# Electrical World

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and Its Practical Applications

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# GENERAL INDEX

## Suggestions for Use of Index

With such exceptions as noted below, articles are indexed under the apparatus to which they chiefly refer. This index is essentially a subject index and not an index of titles. A liberal use of cross references is designed to assist in finding articles.

Central-station companies and their general activities are indexed under the state and city in which they are located. Cities and other communities are indexed under the state in which they are located.

Some related articles have been grouped under such headings as follows:

ASSOCIATIONS AND SOCIETIES (major articles and news items relating to associations are listed under names of individual organizations).
BOOK REVIEWS.
COMMERCIAL ACTIVITIES AND PRACTICES (includes articles on merchandising by central-station companies and dealers).
COMMISSION REGULATIONS AND RULINGS (includes articles pertaining to state public service commissions and their ordinances).
COURT DECISIONS (includes articles on legal rulings).
DISTRIBUTION.
FINANCIAL AND CORPORATE MATTERS.
GENERATING STATIONS, STEAM.
GENERATION.
HYDRO-ELECTRIC DEVELOPMENTS AND PLANTS.
MANUFACTRING AND MARKETS (includes articles on business and trade conditions).
MEASUREMENTS AND MEASURING.
NEW EQUIPMENT (new devices brought out by manufacturers are included under this head).
OWNERSHIP (includes customer, government, municipal and public ownership articles).
PUBLIC RELATIONS.
RATES.
RESEARCH.
RURAL ELECTRIC SERVICE (includes articles on farm electrification).
STATISTICS
TESTING.
TRADE AND INDUSTRY RELATIONS.
TRANSMISSION.
UNITED STATES GOVERNMENT (except articles relating to the Federal Power Commission).

Articles indicated by an asterisk are illustrated, while articles followed by the letter "D" appeared in the Digest of Contemporary Electrical Literature.

Following the main index is an index of authors of signed articles, and following that is an index of men whose names have appeared in the section entitled "News About Men of the Industry."

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# Electrical World

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W. H. ONKEN, JR.
*Editor*

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## *Progress All Along the Line*

GOOD indeed is the promise of 1928 for the electrical industry. The record shows that it is constantly marching on, undaunted by difficulties and undismayed by problems of the future. A slight slackening of pace is discernible, but when streams become wide and deep rapidity of acceleration is no longer their chief characteristic. They are none the less invincible in their onward flow and at the same time are, if anything, more tractable to the needs of commerce and industry.

The credit of the electric light and power industry has improved and will continue to grow better, so that the yearly financial problems of the utilities are no longer of such tremendous concern, however Gargantuan the appetite for funds may be. More than two billion dollars was acquired in 1927 for refunding and other purposes, and to get it entailed less worry than the raising of half a billion dollars five years ago. This augurs well for the other branches of the electrical industry, for with financial and engineering problems well in control greater executive attention can be directed toward enlarging the market for electrical energy and the translating apparatus which goes with it.

The tendency of the times plainly indicates that the most important function of the future will have to do with sales management. In both the manufacturing and the utility branch engineering has brought down the cost of production. Economies have been effected all along the line so that a standardized low unit cost of production may be said to have been attained. It is not so with distribution. While engineers have done their part and have done it well, the commercial man is still groping. Before long he will, he must be up and doing. Money is being spent faster than the actual demands for service justify. Fewer and fewer people now lack the advantages of electric service. The use of energy per capita, however, is still ridiculously low, indicating that both manufacturer and utility have done a mediocre sales job. Fortunately, both realize that this is true and are preparing to meet the issue.

* * * *

## *Dedicated to Service*

DISCUSSIONS of the electrical industry are very apt to put emphasis on size without consideration of the economic fundamentals which underlie the millions and billions so glibly quoted. Size is important only as it makes possible a more effective disposition of the benefits electricity brings to modern civilization. Underlying the splendid growth of the electrical industry are values and services which have made growth inevitable.

During the past year material accomplishments have been recorded, but of far greater importance is the fact that the industry has gained a clearer understanding of its duties and its obligations. Industry consciousness exists that there is a job to be done and that co-operative planning and co-ordinated action are the tools to use for increasing electric service. The manufacturer, the light and power company, the communication interests and the transportation group have a common meeting place and a common opportunity for greater service and consequently better business. The industry is too big and interests are too closely related to permit a haphazard growth arising from the unplanned actions of the separate branches, and the past year has brought about a better conception of the potency of the old phrase "In unity there is strength."

American industry tends toward greater economy in production and marketing, and this results in narrower margins of profit, which are compensated for by a larger volume of output. The electrical industry has kept abreast of this great movement and in addition has furnished the equipments and methods which have made possible the economic developments in other industries. It is dedicated to industrial service as is no other industry.

* * * *

## *Price of Future Growth*

ABOUT 70 per cent of the total construction budget of the power industry this year will go to provide distribution facilities. For it is an accepted principle that a utility company should spend money in sensible proportions to take on additional business. A capital investment is held to be justified if a proposed line extension offers sufficient load. But now the industry faces the question of how much should be invested to secure this business. And this question presses for an answer this year as never before.

It is an astonishing thing to men of other industries, the extent to which the power company in the past has been able to escape the necessity for spending money to develop sales. Manufacturers in other fields are constantly compelled to make courageous appropriations for invading this market or supporting that. Plant investments are also entailed. That is inevitable. But their chief consideration in budgeting must ever be, how much can be spent to create a larger volume of business? The executives of the power industry have never had any trouble with this as a major problem. The wheel is now turning, however, and the financial planning of the future must deal more largely with the apportionment of money to be invested in selling. It will no longer be enough to provide pole lines for taking on new customers. Growth will come from now on increasingly through the development of more sales to present customers—and in the residential field.

The waiting market for electricity in industry and in commercial use is still vast. It is a simple clean-cut selling job that needs much man power, much intelligent sales engineering. But the way is clear. The more complex problem lies in the homes of the 17,590,000 customers now connected and using the service in so pitiably small a way. And here four necessities must be faced and overcome:

1. A public consciousness, a public interest and a public desire for complete electrical equipment must be created. That will require advertising on a scale beyond anything the industry has ever attempted.

2. The present obstacle of inadequate house wiring must be overcome. And this means that wiring must be sold vigorously and persistently that appliances may be conveniently used.

3. The selling of appliances must be organized on a far larger basis so that the standard of household equipment may be rapidly raised. The present progress does not even keep up with the growth in customers.

4. Rates must be made right so that the purchase and use of more appliances will be encouraged.

The power industry stands in the marketplace seeking business in competition with other industries that now hold the public interest. Success in selling will not come for the wishing. The situation calls for intelligent policies, generous financing, courageous leadership and adequate man power. That will be the price of future growth.

* * * *

## Statistics Need Interpretation

FIGURES are dangerous things in unskilled hands. Industry statistics, when used by academic statisticians and by men who do not have an intimate knowledge of the industry whose operations are evaluated in statistical terms, are apt to lead to erroneous deductions. Electrical industry statistics afford enormous totals. These totals are quite accurate, furnish basic measures of industry accomplishment and serve as guides for building a better industry. But the totals involve definitions of such terms as "capitalization," "value of plant and equipment," "generation," "transmission," "distribution," "power," "lighting," "commercial" and other expressions which are understood by men of the industry but may be misinterpreted by the layman. In this issue of the ELECTRICAL WORLD these words are defined, but too frequently the casual statistician or lay reader makes his own definitions, with resultant misapprehensions.

It is unit and average values that give the most erroneous impressions. It is human to generalize. The layman likes to say a steam power station costs so many dollars a kilowatt and a hydro station so many more dollars per kilowatt, and he arrives at these averages by using total industry data. An electrical man smiles at such statements as they are normally applied. Then again average unit rates may be computed and used as generalized figures, or some one may become a financial wizard by using a little arithmetic and total values. Such expositors do not know industry conditions or the proper interpretations to be placed on these values, and it is difficult to explain to them that unit statistics are no better and no worse than total values and serve as the same yardstick for measuring the relative growth or trend of the industry over a period of years.

This country now makes a fetish of statistics and accepts them in large doses from many sources. Many of these statistics have no real father or mother but are never at a loss for foster parents. Official orators and publicists find the soft spots in hard-headed business men through the use of statistics. Figures support the official foolishness so prevalent in American commercial life and are the false as well as the true guides to business prosperity. They should be used intelligently or not at all.

* * * *

## Electrical Budget for Home Owners

AMERICAN homekeepers have adopted the budget. They are beginning to think about their budgets for next year. Shoes, clothes, theaters, the automobile and many other items will find a place in this budget, and plans will be made for the purchase of commodities and services designed to increase the comforts and pleasures of living in 1928. But the electrical industry has not sold to the home owner the electrical item for his budget. The light bill may find a place, but too frequently it will be labeled "incidental expense."

Large plans are in the making in the electrical industry for the sale of its products and services to the American home. Why not make the home budget an objective in this program? The 1928 budgets of homes everywhere in the land should include allocations for the electrical betterment of dwellings as well as for the replacement of furniture, draperies and floor coverings. Such appropriations need not interfere with the later financing of "red seal" and other installations over a longer period, and the habit of including electrical betterments in annual household budgets should be formed and acted upon from this time forward. Innumerable customers of electric service companies have yet to realize that a properly balanced household budget should provide for systematically improving the home along electrical lines, and in the coming months lies a real opportunity for the industry to influence homemakers in a most desirable field.

* * * *

## Profitless Prosperity

INDUSTRY in the United States has for several years tended toward a volume basis. In general, great manufacturing enterprises are conducted on the Ford plan of quantity production and small profit per unit. This is satisfactory as an expedient to overcome localized distribution of products and to meet an economic trend, but it does not lead to anything, ultimately except a "buyers' market"—that business situation in which the purchaser dictates the price and the seller takes what he can get, knowing that if he does not do so his competitor will.

Reports from almost every field indicate that industry is reaching this condition. Buyers are learning that they can get materials at their own price. As a consequence, business is showing little, if any, curtailment in volume, but the poverty of an ungainful trading margin is upon it. Merchandising counselors advise a reduction of distribution costs, but this is only a temporary alleviative in such cases as it may be remediably applied.

A prominent economist says "all the great basic raw-material-producing industries, such as coal, chemicals, agriculture, metal mining and some of those closest to them, like the wool and cotton textiles, leather, and lately iron and steel, have certainly shared little or none of the restless, shifting and selective prosperity which has been so extravagantly hailed. Thanks to the easy-money policy of the Federal Reserve System, the stock market has been doing some fancy aviation, but there has been no real business boom in this country since 1923."

All extremes are untenable. Life and activity tend to intermediation, and conditions must come closer to those of a "sellers' market" than they are now before there can be "good business." It is useless to talk of sales volumes and unbelievably large funds in the banks and invested at absurdly high prices in stocks and bonds. The return on the investment is the only factor that possesses ultimate significance. The solution is simple but exceedingly difficult of achievement. A fair price to the purveyor—he to insist upon it and the buyer to pay it. This requires courage of a high order and unprecedented co-operation on the part of the producers as well as understanding and fairness on the part of the buyer.

* * * *

## *Thrift in Engineering*

ENERGY losses in the systems of the light and power industry of America last year were equal to the total energy generated in 1913. The losses were twice as large as the electric railway load and nearly equal to the total lighting load. These losses—14,000,000,000 kilowatt-hours—represent 20 per cent of the total energy sold. Here is something for the industry to think about. Engineers can reduce these losses. They have done it on several properties, and the economic limit of reduction is easy to fix. But most engineers do not like to tackle the job. They would rather design power houses to gain a fraction of one per cent in efficiency or focus their attention on problems connected with the design of new substations. Big things involving money expenditures are more interesting to most men than little things and money savings. The natural, undisciplined human being is extravagant rather than thrifty.

On every property loss reduction should receive the attention of the best engineering talent. It is not a task for a maintenance man or a construction foreman. The way to reduce losses is to make precision measurements and precision installations and to institute precision operating methods. Each machine, transformer, transmission line and distribution service must be measured, weighed against the service required and revamped to develop its maximum operating economy. Precision housekeeping must go on day after day and week after week. A loss-reduction maintenance crew must go much further than the ordinary maintenance crew.

* * * *

## *Keep the Banker in His Bank*

THE light and power industry has been built by able men. Each large property or group of properties is generally dominated by the personality of the man who has fought to victory on the firing line. He has handled the public, the operations of the system, the finances and the policies, and his strength has made possible the achievements of his company. The industry is fortunate that these men have been behind it during its life of forty years and still control the destinies of most of the properties.

But conditions will change. These men cannot live forever, and very often no qualified subordinate stands ready to step into their shoes. Again, the business has become so big that one-man operation has disadvantages, and the committee type of executive control common to modern business is likely to come into being. Still another factor to be weighed is the fact that enormous amounts of utility securities are now in the hands of bankers. Many of these bankers have developed a practice of directly participating in the control and management of the industries whose securities they hold. Banking activity of this sort started on a small scale, but in some industries it has progressed by leaps and bounds.

Banking control of electric utilities is not desirable. Bankers are ultra-conservative, whereas the light and power industry has succeeded by quickly grasping and using the new and better equipment and methods that have evolved with the rapid development of the science of electricity. Success in the utility business is based on good public relations. Managements must "feel" their public and be responsive to its moods. Only those who actually live among the customers they serve can be fully responsive to the customers' needs. Here again the banker is out of his element. Another element in banking control is that bankers are out to make money first and last. They are cold-blooded business men and may force financing or start projects which will make money but which will not be conducive to better and more economical service to the public. No rightly actuated executive in the light and power business has made money his primary object in building a property.

Weighing these elements in the scales, it is seen that banker control of a public utility business is bad for the business and bad for the public. It is to be hoped that men will be found in the utility industry who have the strength and courage to tell their bankers to remain in their banks.

* * * *

## *The Business Outlook for Electrical Men*

IN THESE pages many leaders have contributed their opinions as to the business outlook confronting the electrical industry at the beginning of this new year. Boiled down, it resolves itself into the consideration of the several favorable and unfavorable economic factors which stand out in the prospect for American business today. These may be taken as follows:

*Favorable Factors*

1. No inflation of prices.
2. Ample supply of credit at low rates.
3. Small inventories and no speculation in commodities.
4. Labor well employed at high wages.
5. Abundant crops.
6. General construction in line with 1927.
7. Prospect of record automobile production.
8. Further federal tax reduction.
9. Foreign trade increasing.
10. European conditions steadily improving.

*Unfavorable Factors*

1. Relatively unsatisfactory earnings in manufacturing industries.
2. Presidential election presents political hazards.
3. Germany's maximum reparations this year may disturb European economics.

As a balance sheet, the favorable influences would seem to so far outweigh the unfavorable as to give every reasonable expectation of what President Coolidge has termed "a comfortable prosperity" in 1928. The forces which make for stability in the business world appear to be in dominant strength. It is safe to say, therefore, that prosperity in the electrical industry this year is going to be largely what electrical men make it. If the four organized branches of the industry are serious in their decision to join hands and go forward enthusiastically with a broad program of market development, we should create our own prosperity. For our era of sales is just beginning and our opportunity lies ahead.

*Courtesy Great Northern Railway and Stone & Webster*

LINE CREW AT WORK ON 110,000-VOLT LINE FOR GREAT NORTHERN RAILWAY AT THE SUMMIT OF THE CASCADES, WESTERN WASHINGTON

# *Light and Power Utilities Will Spend $900,000,000 in 1928 for Additional Facilities*

# 1927 1928

IN 1927 more than 46,000,000,000 kw.-hr. was generated in the fuel-burning stations of the light and power industry and 29,000,000,000 kw.-hr. in the hydroplants. For several years more than 60 per cent of the energy used has been generated from fuel, and this percentage is apt to increase in the future. Economic, political and engineering handicaps to waterpower development become greater each year; because of these handicaps and because of advantages possessed by fuel-burning stations, it becomes increasingly difficult to find economic justification for large water-power and transmission projects in localities distant from load centers.

* * * *

SINCE 1913, the total energy generated in the light and power industry has increased six times. The energy used for lighting has increased six times, that used for power eight times, and that used for railways less than twice. Yet in this period the losses of the systems have increased five times; they are twice the railway load and nearly equal to the lighting load. Here is a big job for utility engineers.

* * * *

THE GROSS revenue of the light and power industry is now $1,783,000,000. Lighting customers pay $1,000,000,000; power customers, $500,000,000; railways, $60,000,000, and intersales among utilities account for $129,000,000. Sales of energy among utilities have doubled since 1921, and this fact affords economic justification for the growth of interconnected transmission systems.

* * * *

THE light and power industry used more than 37,000,000 tons of coal in 1927. Each year for several years the consumption of coal has increased at the rate of about 1,000,000 tons a year. This rate of fuel consumption has been constant despite the rapid increase in generated energy, because major economies in the use of fuel per unit of energy generated have been brought about. In 1927, for example, through these economies the industry saved an amount of fuel equal to the entire industry consumption in 1913 based on the unit fuel consumption in 1913. The 37,000,000 tons used is a small proportion of the 700,000,000 tons of coal mined each year in this country, and the engineers of the utility industry are not conceding that they will not bring about still greater efficiency in fuel consumption.

* * * *

THE Atlantic and North Central States generate nearly 75 per cent of the total energy generated in this country. The South Central states have increased their generation most rapidly since 1922; the Far Western states are second in rate of growth and New England states have grown very slowly in the same period. In no section of the country is there evidence of saturation; markets are yet available equal to those now served.

* * * *

SOME loads attract keen commercial interest. With a use of energy averaging 1 kw.-hr. a day and a monthly revenue of $2.50, there is concrete evidence that electric service can be intensified in American homes. The value of the service is evident; home owners desire the service but it must be sold. The home load should be doubled in 1928.

* * * *

WE ARE now experiencing the most remarkable advance in productive efficiency in the history of modern industry. The first industrial revolution was brought about by the invention of machines and the present revolution is brought about by the application of new processes and methods to the use of machines. It is not electricity in itself nor electrical machines in themselves that make for industrial prosperity; it is the electrical method. Continuous production under precision conditions with a maximum output per unit of capital, space and labor is made possible by the electrical process of production; the automotive industry, for example, is producing three times the number of cars it did in 1914 in the same time with the same workmen. Electricity makes possible a tremendous mechanization of production processes.

* * * *

WITH generating stations aggregating 28,990,000 kva.; with thousands of miles of high-tension transmission lines; with other thousands of miles of distribution circuits, and with hundreds of substations, buildings and other facilities, it might be thought the utility industry was ready to satisfy all service demands. But the demand for electricity is on the increase and the market is not saturated. During 1927 these utilities spent $760,000,000 for additional facilities and their budget for 1928 aggregates over $900,000,000. This is an enormous sum to be spent wisely in one year.

* * * *

IN 1927 the gross revenue of the light and power industry was $1,783,000,000 and the net was $1,017,000,000. This represents the generation of more than 75,000,000,000 kw.-hr. for the service of 21,694,100 customers. More than $8,000,000,000 is now invested in facilities for giving this electrical service to the nation.

* * * *

WITH 6 per cent of the world's population, the United States has about 60 per cent of the world's telephones. Fifty years after the first commercial telephone line finds 18,500,000 telephones in use in this country. Telephony is distinctly an American art.

* * * *

ELECTRICAL manufacturers of heavy equipment did a gross business of about $1,000,000,000 in 1927. Appliance and radio manufacturers did a business of about $2,000,000,000 in this period. These totals are enormous, but the check on prosperity is found in net earnings and in this respect many manufacturers say margins of profit have been very narrow. The electrical industry should have a prosperous group of manufacturers, for they are chiefly responsible for new developments in electrical equipments. Their earnings should support a development program.

AMERICAN industry is only 75 per cent electrified. Much of this electrification has been done crudely and with the idea of substituting electric power for mechanical drives. But industry is awake to a different idea in the use of power. It realizes that electrification is a process and not a group of motors. Production per unit of factory volume can be increased by the use of electric heat, electric controls and electric motors—this use to be fixed by a production process that utilizes the maximum possibilities of the electrical method. There is a big business in industrial electrification.

* * * *

THERE are, as the old year ends, 4,409 light and power systems in this country, and they serve 21,694,100 customers. Investors have spent more than $8,000,000,000 for plant and equipment to give this service. Over $2,000,000,000 of the securities of light and power companies were sold in the money markets during 1927—a quarter of the total securities sold in this country. Investors have faith in the electrical industry because of its honorable record for honesty and service.

* * * *

IN 1907 there were 1,946,979 total customers of electric companies; the lapse of twenty years has multiplied this figure by more than ten and in 1927 domestic customers numbered 17,596,000. About 63 per cent of the people now live in homes served by electricity and during the past few years the net increase in customers each year has been about 1,500,000. New customers will continue to be had, but there is an enormous market for giving more adequate service to existing customers.

* * * *

DURING 1927 all points in Great Britain and the United States were put into touch with one another through transatlantic telephony. Cuba and Canada have also been added to the connection, which gives 10.5 hours of daily communication facilities. Another notable telephone interconnection is the completion of a direct line from the United States to Mexico. World-wide communication is now established on a commercial basis.

### *The Light and Power Industry in 1912 and 1927*

| | 1912 | 1927 |
|---|---|---|
| Number of customers.... | 3,837,518 | 21,694,100 |
| Number of people in homes served by electricity.... | 14,000,000 | 75,500,000 |
| Kilowatt-hours generated. | 11,569,000,000 | 75,116,000,000 |
| Gross revenue ........ | $302,273,000 | $1,783,700,000 |
| Total generating rating, kva. ................ | 6,450,000 | 28,990,000 |
| Value of plant and equipment | $2,175,678,000 | $8,084,000,000 |
| Annual expenditures for new facilities ......... | $100,000,000 | $760,353,000 |

# Executives Optimistic About Industry Conditions

## Interconnection Based on Economic Principles

By Henry I. Harriman

*Vice-Chairman Board of Directors New England Power Association, Boston, Mass.*

ONE of the outstanding features of electrical progress in the last year has been the steady growth of interconnections between large electrical companies throughout the country and the general recognition on the part both of the companies and of the public that there was mutual gain in such interconnections.

H. I. HARRIMAN

These gains may be classified under the following heads:

1. It enables the most efficient plant to carry a substantial part of the load.
2. It decreases the amount of reserve capacity which each separate plant must keep for emergencies.
3. It gives assurance of safety and continuity of service.
4. Through diversity it tends to reduce the total electrical peak of a given area.

The developments in high-tension cables will also be an important factor in extending interconnections between large power stations, as many of them are located in the heart of thickly settled sections where high-tension overhead lines cannot be built. Both New York and Chicago have cables operating successfully at 132,000 volts, and cable makers are now discussing 220,000 volts.

One of the most important factors in the growth of interconnections is the general recognition that they can be carried out by the voluntary action of the various companies without effecting consolidations of companies and without changes in existing laws. In fact, the interconnections of large generating plants may be considered the natural outgrowth of economic principles.

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## All Promises Kept During Past Year

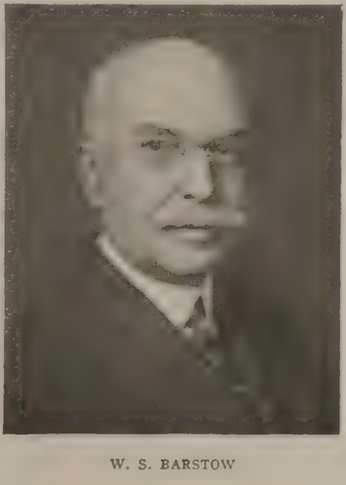
By W. S. Barstow

*President W. S. Barstow & Company*

THE year 1928 opens with the electrical industry established upon a firm foundation and the impetus given by public appreciation will carry it far beyond past accomplishments.

No one could have visualized forty years ago the present state of the art, and no one can visualize today its position forty years hence. It could never have been imagined that the seed sown but a half century ago could blossom into an all important factor in national progress.

The past year of physical and financial expansion has continued to follow strictly economic laws. In the beginning of electric service the kilowatt hour (if this unit had been used) cost the public more than twice what it does today. What is, however, of more importance to general public welfare is that at the present time, due to large interconnected generating plants and expansion of distributing systems, electric service has been made available to almost every section of this country. Great results have been attained in the past and the future promises even more. We speak of progress and prosperity of a nation and yet often do not realize the important part played by electric service in increasing the individual efficiency which results in such progress and prosperity.



W. S. BARSTOW

## Industry Will Grow to Extent It Serves

By J. J. O'Brien

*President Byllesby Engineering & Management Corporation*

AS LONG as electric utilities continue to increase the efficiency and production of individuals and industries they will grow, in my opinion. While at present general business conditions in the territories in which Byllesby companies operate (with some few exceptions) are not so good as a year ago, I do not believe that anything approaching "hard times" is in prospect for 1928. Electric utilities will continue to grow; they will grow more rapidly at one time than another, but even in lean times they possess the ability to show progress and maintain earnings at a point sufficient to secure the inflow of new capital for additions and extensions. Only extremely unwise political action can prevent them from continuing in healthy condition—that is to say, in position to render adequate public service based on a sound financial status.

J. J. O'BRIEN

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## Service Expansion— An Achievement

By Britton I. Budd

*President Public Service Company of Northern Illinois*

DURING 1927 the electrical industry moved steadily forward, its progress being marked by conservative development in many branches rather than by any single outstanding achievement. The extension of adequate utility

B. I. BUDD

service to suburban areas has enabled these areas to enjoy such conveniences as were formerly afforded metropolitan communities. This suburban development now is acting as a magnet, drawing heavily on our congested centers of population and gradually enlarging the scope of rural utility service.

A number of satisfactory experiments in farm electrification were conducted by utility companies during the year, with the result that the application of electrical energy to farm operation has taken a long step forward. Numerous superpower interconnections between neighboring companies were completed during the year, providing additional assurance of uninterrupted service to customers and investment economies to the companies. All of these things have contributed to the sound financial position of the industry as a whole.

## *Southeast Plans $40,000,000 Budget*

By T. W. Martin

*President Southeastern Power & Light Company*

The forecasts of the increased demands that will be made upon the system of the Southeastern Power & Light Company during the next twelve months have now been completed and we are actively going forward with plans to meet these demands. While there has been during the last few months a slight recession in business activity in the territory, this has been overcome and building activities are substantially above those for the corresponding period of 1926. The trend of electric power demands has been constantly upward and we are making our plans to supply a total energy demand of 2,500,000,000 kw.-hr., as compared with 2,100,000,000 kw.-hr. for 1927.

In other words, we are expecting a 20 per cent increase in the output during 1928. The demand for power is now a well-recognized barometer of business conditions, and the demands on our system from present customers and the many new activities being undertaken in the territory served indicate that we must make provision for greater and still greater demands.

To the end of meeting the expected demands, we are making plans for additional generating facilities and distribution lines, requiring an estimated expenditure in 1928 of $40,000,000. This will include part of the cost of an additional steam plant to be erected in Alabama in the Warrior coal fields, recently announced, construction of which has been started, and the first unit of 80,000 hp. capacity should be in operation during the fall of 1928. This new station is designed to permit an ultimate capacity of 270,000 hp. to be developed as demand requires and is in addition to the 100,000 hp. Gorgas plant.

We also expect to bring into operation in the fall of 1928 the Jordan dam, with an initial installation of 144,000 hp., and the Tallassee plant, with an ultimate capacity of 75,000 hp. Plants are also under way for the beginning of construction in the near future on additional power developments on the Savannah River and other streams in Georgia.

T. W. MARTIN

Upon the whole, we look forward with confidence to the year 1928.

## *Expects Expansion Despite Conditions*

By Martin J. Insull

*President Middle West Utilities Company*

Whatever the course of business as a whole during 1928, the electric industry will inevitably continue to expand. And for the same reasons that the industry as a whole will expand, the properties under the direction of so-called "holding" companies will grow relatively more.

The reason lies in the stage of development at which the electric industry now stands—a stage far from saturation. Since the "holding" companies serve chiefly non-metropolitan territories, in which development has not yet progressed as far as in the more densely populated centers, they naturally face a continual and more emphatic growth. The small communities and the farms, mines, oil fields, quarries, irrigation and drainage systems and other such power users spread over the countryside constitute a field of development which is far from completely electrified.

Companies operating in such territories face both an external and internal growth. It is logical to suppose that they will continue to bring into their systems, from time to time, isolated local plants in communities the service requirements of which can be more adequately met by a larger system. In addition to this they must meet a constant growth in the demand for service in territories already served. There are small communities that have no electric service at all to which transmission lines must be extended. Rural electrification is in its infancy. Domestic use of electricity both for lighting and for labor-saving appliances can be made much more general.

This increase in demand for electric service appears simple enough in the homes and industries where it is taking place. The raising of new capital with which to build the necessary generating and transmission facilities to meet the requirements of any one individual is a simple business operation. When, however, each such operation is multiplied by millions—the population of the country—it results in a staggering figure to which "trust" and "octopus" are unthinkingly applied. I think those who react in this way to the growth of the electric industry fail to realize the size of the country, which is the explanation of large figures which seem to cause alarm. The companies whose service is constantly being extended are fully understood by the customers whom they are serving and the investors whose capital they are enlisting in this work. Such opposition as there is is an opposition growing out of fear of size—a size that the development of the country necessarily requires—and is not the feeling, I am confident, of either the customer or the investor toward the electric industry.

MARTIN INSULL

## *Stability and Progress Manifested*

By Charles L. Edgar

*President Edison Electric Illuminating Company of Boston*

THE two most important things that have happened to the light and power industry in New England during the last year are, first, the prominence which was given it by the recent floods in New Hampshire and Vermont, and, second, the publicity given to its affairs through the New England Council.

Both the public and the technical press have very clearly brought out the fact that wherever power companies have improved the rivers of New England, primarily for their own purposes, they have, in fact, controlled the flood problem of these various rivers. One river in particular, the Deerfield, controlled and regulated from its source to its mouth, stands out as a shining example of the effect that this development has had upon the control of its waters during the time of flood. If all of the rivers of New England, as far as commercially possible, had been developed to anything like the extent of the Deerfield River, the damage from flood would have been almost negligible and would have attracted very little attention throughout the country.

Up to within a year or two ago there had been a pronounced feeling in some parts of New England that the power companies were not living up to their opportunities and that their development was lagging behind that in other sections of the country. Through some of the committees initiated by the New England Council a very comprehensive study of the actual facts was made during the last year. It was shown beyond question that, relative to its population, New England, from the standpoint both of investment in its power companies and in their output, is ahead of the rest of the United States and that the proportion of kilowatt-hours manufactured by water power and by steam power in New England alone is almost exactly the same as for the entire United States.

Through these same committees a scheme has been developed by which those companies engaged in interstate transmission of electric power can have their activities regulated to the same extent as if they were engaged only in intrastate transmission. This has been brought about by inserting a clause in interstate contracts, agreeing to abide by the decision of the commissions of the two states sitting jointly, all this, of course, without the intervention of the federal government.

C. L. EDGAR

## *Election Year No Menace*

By B. C. Cobb

*Vice-President Commonwealth Power Corporation*

DURING 1927 public utilities, and especially the electric power and light industry, forged ahead at a remarkable pace. I am inclined to think it will continue to do so in 1928, although new construction budgets for the plant and facility expansions will be somewhat under the 1927 figures. Present indications are for continued prosperity during 1928. There will be ups and downs and declines in certain lines, but in that respect 1928 should differ little from 1927, and surely no one can say that 1927 was not a prosperous year notwithstanding the fact that some lines of business did not maintain their rate of output.

B. C. COBB

The power and light industry is growing rapidly, with tremendous benefit to customers and the public. There is no such thing as an electric trust, about which we hear so much, and any federal investigation that may be made of the industry can do no permanent injury.

While both electric power and gas consumption are expanding rapidly, there is ample room for both, and neither need fear competition from the other.

The electric railway industry is apt to meet more problems than the other branches, as the private automobile has created serious competition. The public is fully alive, however, to the importance of electric railway service, and all communities throughout the country, with the exception of New York City, have recognized that the 5-cent fare is a thing of the past and that if the electric railways are to continue to serve, they must be allowed to earn.

C. W. KELLOGG

Some uncertainty has frequently attended election years and some anticipate business hesitation on this account during 1928. In my opinion, this does not mean as much at the present time as it used to mean, especially if the candidate whom the public wants is nominated and elected to the Presidency, as I think will be the case.

## *Industry's Problems Are Being Met*

By C. W. Kellogg

*President Engineers Public Service Corporation*

THE year 1927 has given renewed proof of the fundamental stability of the light and power industry through the continued upward march of its earnings in the face of a recession of general business activity, which was particularly noticeable in the latter half of the year. Probably the outstanding development of the year has been the realization by home and foreign observers and American labor of the important contribution which the application of electric power to industry has made to the prosperity of the country and the maintenance of high wages. It has been a good year—a year of progress. The continuation of the present favorable trends depends in large measure upon the policy and efforts of the industry in maintaining, improving and extending its service.

I think there is no doubt that 1928 will be a good year for the light and power industry. It will be affected somewhat, though less than other industries, by the general prosperity of the country, the prospects for which are good from the present outlook. In any case, the continuation of vigorous merchandising policies should bring some new business to the industry regardless of general business conditions. With the continuous development of uses for electric service and electric power in many lines, particularly in the American home, I can see nothing but a prosperous future for the industry. We are always confronted with problems; the most important ones now perhaps are the extending of our service to rural territory on a fair basis to the farm population served and to the investor who furnishes the money, the protection of the industry from unwarranted attacks and the maintaining and increasing of public confidence in the industry, both among our customers on the one hand and among our investors on the other. All of these problems are being met intelligently, I believe, and will be worked out to the best interest of all concerned.

## *Commercial Enterprise Is Vital to All*

By Luke C. Bradley

*President Narragansett Electric Company, Providence, R. I.*

IT IS the duty of the power companies to bring to the attention of the people as quickly and completely as possible the comforts and blessings of the varied and manifold uses of electricity. The central station is the best clearing house for this movement, for the art develops rapidly from many sources and the electric shop is the best agency for creating electrical atmosphere in the community. If the utility company admits its responsibility here, it must display and sell appliances. The electrical dealer is not in business for altruistic motives, and the utility is not interested in the sale of appliances *per se* so much as in popularizing electrical service. Of course this means added revenue, but it means increased business for the dealer through a more general community consciousness of electricity and more rapid progress through the greater ability of the central station to keep abreast of the latest advances and make them available to all. Central-station merchandising is the greatest spur to contractor-dealer prosperity ever put to work. If our homes and business houses continue to accept electricity in social and business life, the business of the central station will increase enormously and the extent of the increase will enable the utility to make such rate reductions from time to time as may be economically justified. Thus commercial enterprise is vitally essential to increased prosperity for the electrical industry and the general public.

L. C. BRADLEY

O. H. CALDWELL

## *Radio Broadcasting in 1927 and 1928*

By O. H. Caldwell

*Member Federal Radio Commission*

THE year 1927 made radio history in several important respects. A basic law for radio control and regulation was passed by Congress. Television, or "seeing by radio," was accomplished and widely demonstrated. The lampsocket receiving set became a commercial product, merchandised on a large scale. Adequate radio channels have been cleared reaching into every city, village, rural, farm and remote mountain dwelling in America. And by international agreement among 70 nations, future operations and developments in the whole radio spectrum have been outlined and protected from interference.

Looking forward to 1928, interesting possibilities present themselves. In the short-wave region, we may expect during the year a rush of applications for channels, which in its commercial, industrial and economic reverberations will make the recent episode in the broadcasting band seem mild by comparison. Aside from all other communication demands, it is clear that future aviation progress will depend wholly upon these short waves for communication to airplanes in flight. In the broadcasting band, through various methods of synchronizing the carrier frequencies of stations, we may succeed in multiplying by several times the carrying capacity of existing channels for regional stations. Chain operation on not one but on three or four frequencies (instead of 20 or 30) may further economize our precious channels. Single-side-band transmission may cut the present ten-kilocycle separation nearly in two, further doubling the channels. Meanwhile broadcasting service in cities may during 1928 start on its inevitable transfer to local wire systems (telephone or electric light), leaving space radio to serve the open spaces.

In general, therefore, during 1928, the spotlight of public interest in radio, as of invention and commercial development, will turn upon the long reaches of the radio spectrum *below* the broadcasting band.

## *Utilities Are Conscious of Responsibilities*

By H. T. Sands

*President National Electric Light Association*

THE character of the service rendered by electric light and power companies makes it imperative that plans be made and facilities provided in anticipation of the demands of the public. Whether or not we are to experience a recession in industrial activity during 1928, such as we have witnessed in other presidential years, the electric light and power industry must of necessity continue with its plans for expansion and development. The industry is constructively planning for the future and substantially along lines which have been proven to be sound and in the interest of both the public and the investor.

The outstanding feature in generating equipment is the constantly increasing size of units, with attendant reduction of production costs. The work of interconnection, the soundness of which has already been demonstrated, will doubtless be carried forward in an increasing measure during the coming year. The tying-in of isolated properties into interconnected systems, which are in turn connected with both steam and hydro plants, will make possible the greatest use of the water powers of the country and assure reliable electric service distributed over wide areas.

The extension of electricity to farm homes and farm work promises to continue with accelerated pace during the

H. T. SANDS

R. F. PACK

next twelve months. Out of the coöperative effort now being conducted on experimental farm lines in twenty-one different states, both the industry and the farmer are constantly learning new uses for electricity on the farm.

The important work of improving and maintaining sound public relations is being carried on by some of the ablest executives in the industry. The results of this work are apparent in a more sympathetic understanding of our industry and a larger measure of confidence in its integrity and stability.

The industry looks forward to the twelve months just ahead fully conscious of its responsibility to the public it serves and to the investor whose money makes possible its service.

## *No Fear of Impartial Investigation*

By R. F. Pack

*Vice-President and General Manager Northern States Power Company, Minneapolis, Minn.*

OUR industry must sail through a little squall at Washington, where a number of matters directly affecting the electrical business are under Congressional consideration. Provided we ourselves refrain from becoming panicky, I think there is little or nothing to fear for the following reasons:

1. The people themselves are opposed to the government engaging in the electrical business. This is indicated not only by expressions of opinions of individuals all over the country but by the vote in the only three states where it has been put to a test at the polls. In California state ownership was defeated three times by ever-increasing majorities. It also was defeated in Oregon and in South Dakota.

2. Therefore it is not surprising that a survey shows that 90 per cent of all daily newspapers of more than 5,000 circulation are editorially opposed to government ownership and operation of public utility companies.

3. Of our 435 Congressmen and 96 Senators not more than one or two are avowed socialists, and certainly not more than 25 have any sympathy whatsoever toward the theory of government ownership, and I think we have every reason to believe that whatever comes before this Congress will receive fair and impartial treatment. We have no right to expect anything more.

4. While here and there, there may be something to criticize in our industry, just as there would be in any young industry which has grown to major proportions within a comparatively few years, there is vastly more for which we are entitled to feel justly proud. I believe the people to be inherently fair, and therefore have no fear of an impartial scrutiny of our history.

5. For years we have been building a cordial relationship with our customers on a foundation of good service, fair dealing and courtesy, and the business wisdom of such a policy will make itself manifest now.

We have little to be ashamed of and much to be proud of. It is our business to see that the truth goes before the people. The only thing I have ever feared is ignorance. Congress may readjust our sails a bit, but I am confident we shall emerge from the Congressional squall an even better industry ranking high in public confidence.

R. H. BALLARD

## *"Complete Electric Service" for 1928*

By R. H. Ballard

*Executive Vice-President and General Manager Southern California Edison Company*

IN MY opinion, 1928 will see the eyes of the electrical industry focused on commercial activities and the minds of electrical men concentrated on the problem of increasing our business with existing consumers. The modern six-room house occupied by a family with an income ranging from $3,000 to $5,000 can use from 2,500 to 3,500 kw.-hr. a year—to the great comfort and economic advantage of the entire family. To do this their annual operating budget would not be increased and they would be using an electrical standard only in keeping with their standards of dress, amusement, education and transportation.

We can advocate a greater use of electricity with all sincerity, because it means better food, better eyes, better health and a high degree of general comfort and convenience. Sometimes I think the public has a greater appreciation of the advantages of electricity than have the members of our industry. A well-planned campaign among our own employees is the first step in developing this tremendous latent market. "Complete electric service" would be a good slogan for 1928.

ALEX DOW

SO FAR as I can see, the first few months of 1928 will be months of continued caution. Thereafter the prospects are for steady improvement of business.

By Alex Dow,
*President The Detroit Edison Company*

## *Employees Are Company in the Public Eye*

By A. Emory Wishon

*Vice-President and General Manager San Joaquin Light & Power Corporation and the Great Western Power Company*

THE most valuable medium for promoting the understanding of the utility and its problems is the utility organization itself and with it the first educational work should be undertaken. Ours is not a business merely of the executives; every worker of the rank and file is a part of it, and to customers the meter reader, the service man and the girl behind the cashier's desk are "the power company," rather than the private office men whom they rarely if ever meet. Executives know the story that should be told the public: too often the rank-and-file workers do not know it. Yet each of them makes perhaps as many contacts as do the executives, and because of their number they are an infinitely greater force for publicity. They have opportunity to tell the utility's story in the most effective way it can be told—personally, to friends and acquaintances who know them and like and respect

A. E. WISHON

them. The manager wants the public to have friendly understanding. He depends upon his organization to promote it. His first and most important step toward informing the public, therefore, should be to inform his employees.

## *Farms Like Industry Benefit from Electricity*

By A. W. Leonard

*President Puget Sound Power & Light Company*

NO GREATER service can be rendered by the electrical utilities of the nation than to carry the conveniences and economy of electricity to the farms of America. Electrical utilities of the Pacific Northwest believe that electricity can do for agriculture what it has done for industry. Through intensive cultivation of electrical applications on the farm with a sympathetic understanding of the farmer's problems the Puget Sound Power & Light Company has developed a profitable rural load and at the same time has improved the enonomic status of the farmers of western Washington. During 1927 our company connected more than 5,000 additional rural customers to its lines, and already more than 75 per cent of all homes outside the corporate limits of cities and towns in this territory are enjoying the benefits of electric service. In this electrification program we feel that we are doing our modest part in fulfilling the obligations of the electrical industry to the American farmer and we shall continue to support its worthy purpose.

A. W. LEONARD

# Comment of Manufacturers

## *Sound and Steady Business Expected*

IN THE electrical machinery line there was a moderate decrease in business in the latter part of 1927 as compared with the first half of the year, but it would seem as though we can look forward to the year 1928 with a fair degree of confidence. There is every reason to believe that the requirements of public utility corporations will not decrease. New uses and applications of electricity are constantly being made. The condition of the financial market offers favorable opportunities to provide the capital for necessary extensions. On the whole, it would not appear that the present slackening in business will be of extended duration, and while its immediate effect may be to reduce output and in many cases profits, there would seem to be reason to expect sound and steady business throughout 1928.

Otto H. Falk,  
*President Allis-Chalmers Manufacturing Company.*

## *More Sales Predicted as Result of Surveys*

IN 1926, the year in which the supply department of the Western Electric Company changed its name to Graybar, we realized a total business of $77,000,000, which was by far the largest volume we had ever attained up to that time. Our business this year, while somewhat under that volume, will run close to it. We estimate that business in 1928 will be somewhat better than it has been during 1927, and we look forward to a very satisfactory volume from every standpoint. This estimate is given not as an optimistic guess but rather as a figure which is based on a very close survey of business conditions of the present and future from all parts of the country.

All our sales and expense budgets are based on these estimates, and in the many years since we have adopted this plan of budgeting sales and expense it is very seldom that our estimates and accomplishments vary very much. This survey and statement, therefore, should be of interest to business and financial men of the country who are looking into the future with questioning eyes. It is our belief, based on our estimates, that we need have no fear about the business outcome for the year to come.

A. L. Salt,  
*President Graybar Electric Company, Inc.*

## *Good Promise of Satisfactory Trade*

THE volume of sales for 1927 exceeded our expectations and was very satisfactory indeed. Further, I believe the year in all branches returned a bigger and better business than was generally predicted. The year 1928 gives good promise for a satisfactory volume of trade. I am saying that we look for continued good business, and as mass psychology is most potent, the more people saying that business is good the better the possibility of attaining good business. So let us bury any pessimistic feelings and cry aloud our faith in conditions for the coming year. In doing so we shall all help ourselves.

F. C. Hodkinson,  
*Vice-President and General Manager American Circular Loom Company.*

## *Prosperous Year Ahead for the Progressive*

THE steadily increasing business of utilities at an adequate profit will be favorably reflected in an increased amount of business placed with manufacturers, and if they in turn are well managed and produce good quality at a fair price, they will be rewarded by fair profit. The interests of the utilities and the manufacturers are mutual. One cannot succeed without the other and the most promising feature of today's business is that those who today are not willing to let each branch of the industry prosper represent a constantly diminishing minority. Basing my opinion on the combination of a fair-minded, prosperous utility group, coupled with a natural increasing demand of the public for more and more electric service, I feel the well-managed manufacturing companies, performing a useful function, can look forward to a prosperous 1928.

H. W. Young,  
*President Delta-Star Electric Company.*

## *Indicates Splendid Basic Condition*

A REVIEW of the electrical industry indicates a splendid basic condition which not only gives promise of a continuation of prosperity but also gives promise of a reasonable increase in the volume of electrical business during the year 1928. With many millions of wired homes which are as yet inadequately equipped with labor-saving and convenient electrical appliances, there is a continually broadening market for these devices. During the past year increased sales of all domestic appliances, with the exception of fans, have been recorded throughout the country. Adequate provision should be made for sufficient wiring in new buildings to permit the more liberal use of current-consuming devices.

During the past year there has been only a fair volume of business in the large generating and control apparatus used in the great public utility stations, probably owing to the larger individual units now being installed. The application of electric motors to all kinds of industrial needs has shown progress and has already reached very large dimensions. As this use is becoming almost universal, development of this field should continue at a rapid rate. Progress in the electrification of our railroads has been very much slower than was anticipated some months ago. A considerable increase in the volume of this business is looked for in the near future.

E. M. Herr,
*President Westinghouse Electric & Manufacturing Company.*

## *Good Prospects*

ALTHOUGH competition was exceedingly keen, our 1927 business was highly satisfactory. Barring some abnormal conditions, 1928 should be equally good.

S. A. Burnham,
*President Condit Electrical Manufacturing Corporation.*

## *Expect 1928 Will Be Better Than 1927*

OUR sales in 1927 slightly exceeded those of 1926, but the last half slowed up for two reasons—Ford's delay in getting out the new car and unseasonably warm weather. We expect 1928 to be better than 1927 for the same two causes, among others—Ford will be on the market and the auto trade humming, and second, the late fall helped the farmer, who will have more to spend. Other reasons for expecting 1928 to be a good business year include easy money, good employment at high wages and moderate inventories.

F. W. Jessop,
*President Ohio Electric & Controller Company.*

## *1928—A Buyers' Market With Price Reductions*

OUR 1927 business for eleven months shows a 3 per cent increase over a similar period for 1926. Resale prices average a 5 per cent reduction over 1926, so this figures substantially an 8 per cent increase in commodity sales in 1927 over 1926. The year 1928 will, in my opinion, be a "buyers' market," with price reductions which naturally meet these conditions. The rather general allowance of 5 per cent cash discounts covering invoices paid on the 10th proximo as compared with cash discounts of 2 per cent paid ten days from date of invoice is an unfortunate condition and is to my mind an indication of unsound business conditions which is not as yet reflected by the money market.

G. E. Palmer,
*President Palmer Electric & Manufacturing Company.*

## *Next Year to Equal 1927*

THE business volume in 1928 will be at least the equal of 1927 and possibly equal 1926. While our volume for the year 1927 was considerably greater than 1926, this is largely owing to the manufacture and distribution of new lines of product and not because business generally has been so good. Our business, which is an excellent barometer, does not indicate a "boom" year, as many have predicted. Money and credit conditions will probably remain easy for some months, but we believe will gradually stiffen. Foreign competition, especially in foreign markets, will be more apparent in 1928. Commodity prices have increased slightly, yet there are indications that we are in a gradual but definite declining commodity price cycle.

Living expenses are slowly but surely decreasing and eventually labor wages will follow. Considerable unemployment exists at the present time. Inventories are not large generally, but are large enough for any consumption that exists and we feel that those who claim that stocks must be replenished are not taking this fact into consideration, and also the gradual decline of purchasing power. Our business indicates that prices of raw materials and commodities are working toward a balanced condition—somewhere between 40 and 50 per cent above pre-war prices. The copper metal is a good illustration of this. It has been too low in price as compared with most raw materials. Other metals have been too high and out of balance and are declining in price. Agricultural products have been too low, but are working higher. The prices of most manufactured products have been too low as compared with the cost of raw material and labor. The balance, we believe, however, will be affected by reduction of costs rather than appreciable increase in prices.

E. B. Freeman,
*Vice-President B. F. Sturtevant Company.*

## *Outlook Encouraging*

BUSINESS in 1927 was slightly off in volume as compared with 1926. The outlook for 1928, in my opinion, is very encouraging. The conditions, as I see them, seem to point toward a larger volume of business, and while prices will be very competitive, yet I think the results for the year will be satisfactory.

W. C. Bryant,
*Chairman Bryant Electric Company.*

## *Outlook for Wire Is Fairly Good*

THE electrical wire and cable industry in 1927 has suffered from a somewhat reduced consumption and a highly competitive price situation. The outlook for 1928 business is fairly good and manufacturers should make a better showing than they have during 1927, provided a few of the manufacturers who have operated without reasonable profit in 1927 make a careful analysis of their actual manufacturing and selling costs and base their selling prices upon costs plus a reasonable profit rather than upon lowest competitive price as reported by the salesmen and probably made by some manufacturer without cost knowledge. Copper, rubber and yarn prices would indicate that present selling prices are exceedingly low and that as soon as business shows improvement in the coming year prices should show a reasonable advance.

H. T. Dyett,
*President Rome Wire Company.*

## *Better Sales and Profits Predicted*

BUSINESS was not quite so good in 1927 as it was in 1926. There was much left to be desired, particularly as regards the margin of profit, but business was in fair volume and we look forward to 1928 with a great deal of confidence. I do not believe there will be any particular boom, but we shall have a better year than 1927, and also a better margin of profit.

Louis Larsen,
*General Manager Sundh Electric Company, Inc.*

## *Market for Refrigerators Continually Expanding*

OUR 1927 experiences caused us to appreciate more fully than ever the permanent character of the demand for our products and demonstrate conclusively that 1928 and succeeding years will provide a continually expanding market for automatically operated electrical refrigeration.

A. H. Goss,
*Chairman of the Board Electric Refrigeration Corporation.*

## *Outlook Favorable*

THE outlook for 1928 is, on the whole, favorable. Economic conditions are sound and the satisfaction of the demand of 120,000,000 people should provide ample business activities, with the usual attendant improvement in the art. Earnings of labor have never been so high and with a continuance of good business these earnings should continue and employment become steadier. The electrical manufacturing business for 1927 has, on the whole, been satisfactory, and about the same in volume as the previous year. The use of electric current in homes and factories has increased 7 per cent over 1926, and with the exception of 1921 has shown an increase each year since 1919, when the index was first prepared, and the consumption in 1927 was more than double what it was in 1919. This is becoming one of the best indices of general and industrial conditions in America.

Gerard Swope,
*President General Electric Company.*

## *Sales Will Not Be Less Than in 1927*

OUR business in 1927, while satisfactory, has been slightly under 1926. The first six months showed better sales than the corresponding period of 1926. The third quarter showed a decided slump. We had a fairly good sale during the last quarter, but taken as a whole our total sales for the year will show slightly under last year. We feel that the outlook for 1928, so far as we can judge, is good, at any rate not less than this year. We do not, however, feel that 1928 will be quite so good a year for the electrical business as 1926.

R. C. Lanphier,
*President Sangamo Electric Company.*

## *No Change in Business, Improvement Probable*

IT IS my anticipation that no material change in the business conditions now prevailing will occur until the political situation and the crop situation for 1928 are more definitely determined. This may take the first half of the year. After that, assuming no unfavorable developments in either the political or the crop situations, I look for improvement.

B. Worden,
*President Cutler-Hammer Manufacturing Company.*

## *Business Activity Will Continue*

THE increased volume of business, generally expected by electrical manufacturers for 1927, was reduced, no doubt, on account of the mid-year readjustments of budgets by public utilities and industrials. However, the electrical industry appears to have enjoyed during 1927 a business volume about equal to that of 1926—the industry's greatest previous business year. Indications at this time point to a continuance of the present rate of business activity during the first half of 1928.

N. J. Conrad,
*General Manager Schweitzer & Conrad, Inc.*

## *Stable Market Looked For in 1928*

IN 1927 the volume of business was slightly less than for 1926 and profits were not as satisfactory, owing principally to the unstable market conditions and great caution used by buyers during the last quarter of the year. These same facts obtained in most of the primary industries—that is, low profits and unsatisfactory volume. In the electrical industry the prices of apparatus are lower in proportion to costs than most any other manufactured article. This makes for keen competition and low profits. We look forward to the year 1928 with assurance. We believe prices will be better and volume substantially larger, and we believe in our industry the market will be more stable than it has been during the past two years.

Edmund Lang,
*President Crocker-Wheeler Electric Manufacturing Company.*

## *Fair Demand for Poles Expected*

OUR analysis of business conditions as it pertains to the pole industry is that 1927, from a standpoint of volume, has produced the largest pole business in the history of the industry, but with somewhat of an unsatisfactory price situation, especially for the last six months of the year. For 1928 we are looking for a fair demand, with some shrinkage from that of 1927. There will not be quite as much transmission line building in 1928, but the demand will be equally as heavy for distribution lines.

L. L. Hill.
*President Page & Hill Company.*

## *Large Volume Can be Created in 1928*

WHILE I do not look for business secured during 1928 to equal that which might be the result of a boom period, I now entertain the opinion that business will be good during 1928 for those who will make a definite effort not only to secure their share but to create business where there are so many opportunities existing. Even should the new move to develop the market not get well under way during the next year, There will be a sufficient inspiration so the industry will witness substantial gains in 1928.

R. J. Russell,
*Vice-President and Secretary Century Electric Company.*

## *Profits Discouraging but Prospects Bright*

THE volume of business in 1927 was very satisfactory, but from a profit standpoint it was a most discouraging year. Competition was very severe and apparently it was a "buyers' market" and full advantage was taken of this condition when purchasing materials. Prospects for 1928 do not indicate much change over 1927. This will mean that to make a reasonable profit it will be necessary to increase greatly the efficiency and output per man unless better prices can be secured.

L. R. Lewis,
*President Electric Power Equipment Corporation.*

## *Confidence in 1928*

THE year 1927 has been a good year. The prospects for 1928 are equally good. If business has been a little "off" in some quarters, as it has been in the appliance field, it merely indicates a little fluctuation in the wavy line of business trend, the general level of which continues well above the poor business zone. If, as a result of present trends, we have to manufacture and merchandise more efficiently in order to stay in the race, that will be good both for business and the country. We can look forward to 1928 with confidence. The electrical industry should push forward with enthusiasm. It needs sustained enthusiasm directed by merchandising wisdom. For that industry, the outlook is bright.

G. A. Hughes,
*President Edison Electric Appliance Company, Inc.*

## *Improvement Expected in Business Policies*

THE year 1927 should be a warning to all manufacturers that while declining prices and profits go there must be a limit. The past year should have been a more prosperous one, considering the volume of business. There are some indications in the air that 1928 will not be a repetition of 1927. Many manufacturers are beginning to realize that "mass production" is an economic fact and not a slogan. Like everything else, it can be carried too far

F. R. Fishback,
*President Electric Controller & Manufacturing Company.*

## *Increase Expected*

THE year 1927 showed a very healthy increase in our gross business; in amount, approximately 20 per cent. Prices are very much more satisfactory than previously and on the whole we are thoroughly satisfied with our business for the past year. Every indication points to the same increase in 1928, and the number of pending negotiations indicate that this business will be placed earlier than in the past, so that our customary low spot in production during the first quarter of the year will be to a larger extent filled out.

B. W. Kerr,
*President Railway & Industrial Engineering Company.*

## *Better Year Anticipated*

IT HAS been the almost uniform experience of manufacturers supplying the power plant field that the volume of business for 1927 was not quite so good as that which was experienced in 1926. The falling off in volume, however, has been relatively slight and on the whole 1927 has been what might be called a normal or average year. Competition has been very keen and in some cases destructive. It looks as though 1928 would be better than the year just closed.

Money rates are low, basic commodity prices are down and inventories of every sort are at a low figure due to more careful buying and accurate control of stocks. All factors seem to point to a fine business year.

F. H. Daniels,
*President Riley Stoker Corporation.*

## Improvement Anticipated

THE electrical motor business for 1927 has been much disturbed by changes in sales policy by all of the motor manufacturers and the adoption of a system of discounts for different classes of customers, which has required considerable time on the part of the customers to digest. The new methods are now becoming well understood and complications are disappearing. These factors should lead to a considerable improvement in the business for the year 1928.

James Burke,
*President Burke Electric Company.*

## Expresses Confidence in 1928 Business

WE ARE looking forward with confidence to as good if not better business in 1928 than in the current year. Manufacturers devoting their efforts to quality products and rendering a prompt service should reap an increased business in the next twelve months.

L. G. Kuhlman,
*Treasurer and General Manager*
*Wadsworth Electric Manufacturing Company, Inc.*

## Cross-Arm Sales Will Be in Good Volume

WE CANNOT see much difference between the business of the present time and that of one year ago. The indications as we see them are for sufficient volume during the coming year, but prices are not what they should be for the volume of business handled. The price of fir cross-arms is generally governed by the price of fir lumber. However, the building program indicates an increase and if this actually develops, then we look for somewhat better prices for cross-arms than have prevailed during the present year, which have been on a minimum basis.

B. F. Vreeland,
*President Douglas Fir Cross-Arm Company.*

## Prosperity Dependent on Ourselves

I AM NOT a statistician and know only what the financial agencies tell me—that 1928 will be better than 1927, which was pretty fair, that building will increase, which will help. But I can't get it out of my head that although an increase in general business will react to the advantage of the electrical industry, nevertheless the real extent of our prosperity is dependent upon ourselves. The people of this country have plenty of money. Whether or not they change their habits and give the electrical industry its fair share of what they spend is up to us. They won't do it unless we pound home the electrical idea. So, as far as our prosperity is concerned, we can write our own ticket for 1928.

W. E. Sprackling,
*President Tubular Woven Fabric Company.*

## No Reason to Expect a Falling Off

WHILE naturally data for 1927 are not complete, the business of our company for the past year has run very close to that of 1926. While it will probably be found to be slightly below 1926 business, this falling off will not amount to more than 4 per cent, and as 1926 was by far the best year since the war, we feel that 1927 has been entirely satisfactory. As to the coming year, we see no reason for expecting a decided falling off, although probably there will not be much improvement. In other words, we expect 1928 to be about in line with 1927.

C. R. Durling,
*President Monitor Controller Company.*

## Better Business but Low Profits

GENERAL business in 1928 will be better than in 1927. There is a slight tendency toward increasing prices in raw materials which will counteract the otherwise gradually lowering cost of manufacture, the result probably being a stabilization of price, with a comparatively low margin of profit on standardized articles.

C. H. Roth,
*President Roth Brothers & Company.*

## Indications Good for Early 1928

IT IS a very difficult problem to give you our outlook on the prospects for business for 1928, and it must of necessity be more or less of a guess, but our business has been increasing in volume for the last six weeks and indications for the early part of 1928 seem especially good. We are planning for a considerable increase in volume over 1927.

J. A. Johnson,
*Secretary-Treasurer Kuhlman Electric Co.*

## Keener Competition Is Forecast

THE competitive conditions of 1927 have stimulated manufacturers to improve their product and reduce costs, with the result that those who have been able to do so have maintained a substantial volume and a reasonable margin of profit. The same conditions for 1928 will undoubtedly prevail, with even keener competition and narrower margins, in my opinion. This is not altogether unhealthy, for it puts a premium on ability and a penalty on inefficiency, which is an old law. We must get used to a reasonable volume and make profits by closer attention to business.

H. G. Steele,
*President U. S. Electrical Manufacturing Company.*

## 1927 Corn Crop Encouraging

THE effect of the large 1927 corn crop in the Southwest constitutes the most encouraging factor in current business and in the outlook for the early part of next year. Business for the current year in volume measures up very closely to 1926.

F. M. Bernardin,
*Chairman of the Board*
*Mid-West General Electric Supply Company.*

## Keen Competition but Satisfactory Business

WE LOOK for generally satisfactory business in the coming year, comparable to that we have had over the past two years. Competition is, of course, keen and there is every inducement for more efficient methods in production and distribution.

J. M. Taylor,
*President Diamond State Fibre Company.*

## Expects Larger Volume

THE portion of our business done with the electrical trade was not so good in 1927 as in 1926. The fiscal volume was about 15 per cent less and the price levels about 10 per cent lower, which taken together produced an unsatisfactory result. We have a feeling that 1928 will show a considerable improvement in volume, since we believe the large utilities will soon come into the market with heavier specifications.

N. A. Wolcott,
*President Packard Electric Company.*

## Can Expect Continued Prosperity

WE SEE no reason to expect anything but continued prosperity in the new year for the electrical business in all its activities. We are closing our banner year. The demand for lighting equipment, designed and built with the quality idea, always in mind, continues unabated from all directions.

Augustus D. Curtis,
*President Curtis Lighting, Inc.*

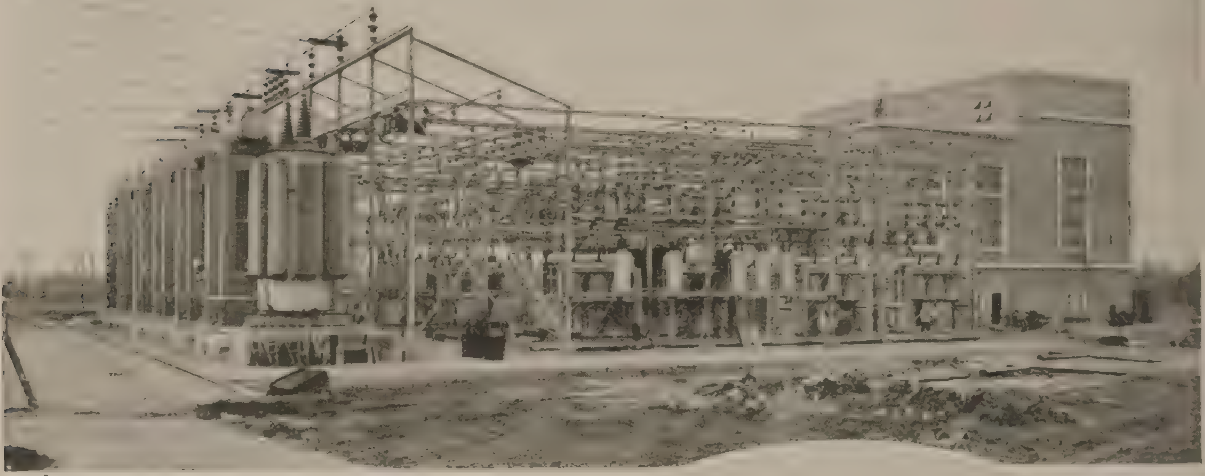
## Prosperity Depends on Disposal of Problems

THE sooner we tackle and dispose of certain industry problems, prominent among them being the grounding problem, the greater will be the prosperity of the electrical industry in 1928 and every year thereafter.

D. H. Murphy,
*President Wiremold Company.*

# Substations of 1927

## Notable Either for Construction or Purpose Used



At top — Walpole, Mass., 110-kv. substation of the Edison Electric Illuminating Company of Boston, containing two 110/14-kv., 15,000-kva. transformers which will ultimately be attached to a transmission ring which has already been built from Edgar station through important centers to the south and west.

At bottom—Jackson 110-kv. substation of the Mississippi Power & Light Co.

In center—Trenton 132-kv. switching station, which connects the New Jersey Electric & Gas Company with the Philadelphia Electric Company.

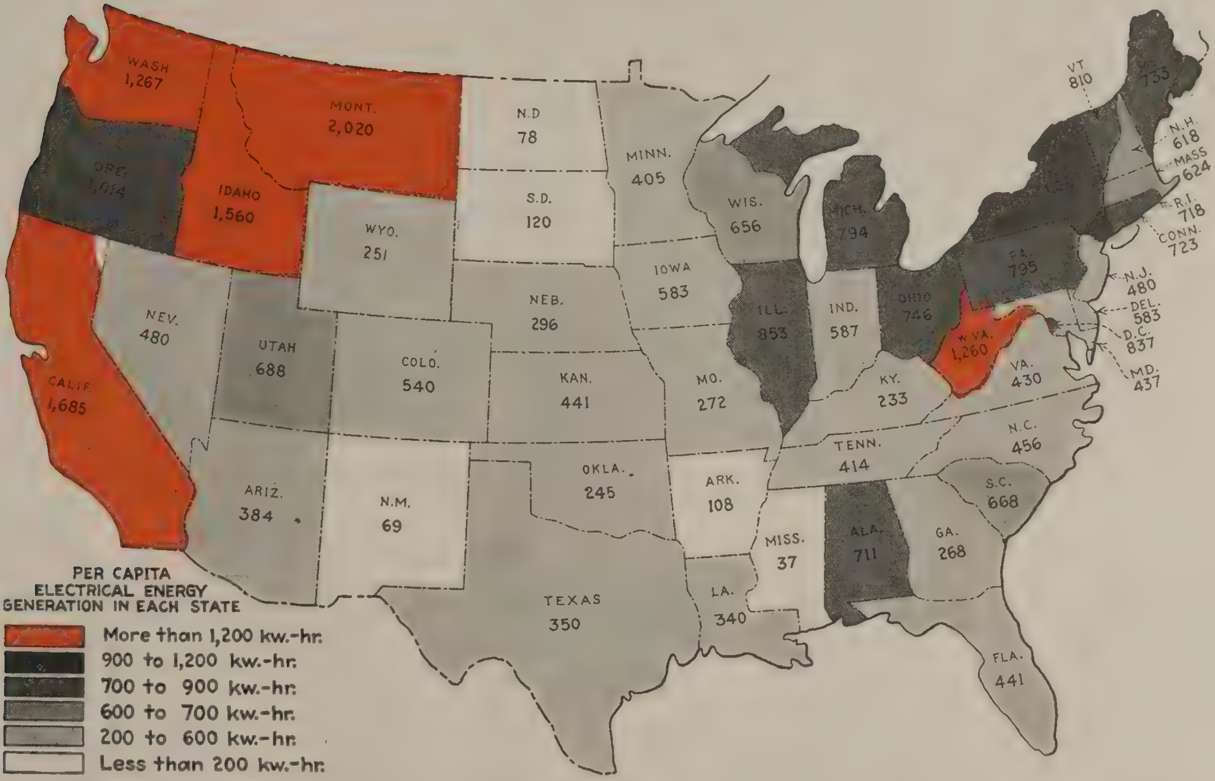
In oval—East Point substation of the Georgia Power Company, tied with Georgia and Alabama system by four 110-kv. lines and with Macon by two 60-kv. lines.

# Light and Power Progress

Serves 21,700,000 customers for a gross revenue of $1,783,000,000. Generation aggregates 75,100,000,000 kw.-hr. Serves 16,000,000 hp. in factories. Résumé of operations

By G. F. Wittig

*Statistical Editor*



THE YEAR 1927 has witnessed a normal growth and development in the light and power industry. Its operations continue to expand, its service continues to supply an increasing demand and its management continues to develop better ways of doing business.

The 4,400 operating properties supply electricity to 21,700,000 customers in the United States. For this service they receive a gross revenue of $1,783,000,000. Operating and maintenance expenses used $767,000,000 of the revenue, taxes to local, state and national governments accounted for a sum estimated to be $150,000,000, and the balance of the revenue took care of incidentals, development expense, depreciation and obsolescence, and the credit requirements of an industry group whose operating and holding company capitalization aggregates $9,500,000,000. In 1927 the light and power utilities raised more than $2,100,000,000 in the money markets which they used for refunding high-rate issues and for additions to service facilities. Of this sum, $240,000,000 was raised by direct sales of securities to customers and employees in 344,000 individual sales. The capital expenditures for these properties aggregated $760,000,000 in 1927, and the budget for 1928 amounts to $900,000,000.

In their normal operations the light and power companies generated 75,100,000,000 kw.-hr., of which 29,000,000,000 kw.-hr. came from waterpower plants and 46,100,000,000 kw.-hr. from fuel-burning stations. The generating capacity of the industry aggregates 29,000,000 kva.; of the prime movers water power operates 11,700,000 hp. This power supplied nearly 16,000,000 of the 35,800,000 hp. driving our factories, to quote 1925 census figures, and it gave to the cities and homes the services and conveniences which only electricity can render.

### Economy Due to Management

But along with these results, many developments occurred in the industry which were of fundamental importance to industry growth. Executives are trying to sell more service. They are attempting to use mass production and consolidated management, to reduce costs so that more and better service may be rendered for the same money. As a consequence, mergers and corporate changes occurred which were more than 800 in number, generating station efficiencies were improved through the display of engineering talent, the cost of money was

### *Table I—Distribution of Central-Station Energy, 1913-1927*

(100 per cent of the industry)

| Year | Energy Generated* (Millions of Kw.-Hr.) | Net Energy Imported‡ (Millions of Kw.-Hr.) | Total Energy Generated and Imported (Millions of Kw.-Hr.) | Estimated Net Consumption by Customers (Millions of Kw.-Hr.) | | | | Line Losses and Intra-Company Business (Millions of Kw.-Hr.) |
|---|---|---|---|---|---|---|---|---|
| | | | | Total | Lighting | Power | Railways | |
| 1913 | 13,000 | 700 | 13,700 | 10,860 | 2,960 | 4,600 | 3,300 | 2,840 |
| 1914 | 14,400 | 773 | 15,173 | 12,030 | 3,100 | 5,580 | 3,350 | 3,143 |
| 1915 | 16,175 | 656 | 16,831 | 13,551 | 3,241 | 6,310 | 4,000 | 3,280 |
| 1916 | 21,230 | 1,022 | 22,252 | 17,897 | 3,807 | 9,990 | 4,100 | 4,355 |
| 1917 | 25,438 | 1,225 | 26,663 | 21,490 | 4,530 | 12,560 | 4,400 | 5,140 |
| 1918 | 29,200 | 1,129 | 30,329 | 24,300 | 5,400 | 14,400 | 4,500 | 6,029 |
| 1919 | 34,900 | 1,143 | 36,043 | 29,000 | 6,460 | 17,890 | 4,650 | 7,043 |
| 1920 | 39,519 | 950 | 40,469 | 32,630 | 7,850 | 19,960 | 4,820 | 7,839 |
| 1921 | 36,971 | 1,020 | 37,991 | 30,700 | 8,700 | 17,400 | 4,600 | 7,291 |
| 1922 | 43,560 | 862 | 44,422 | 35,822 | 9,560 | 20,620 | 5,642 | 8,600 |
| 1923 | 51,133 | 1,055 | 52,188 | 42,220 | 11,410 | 24,810 | 6,000 | 9,968 |
| 1924 | 54,413 | 1,400 | 55,813 | 45,000 | 12,990 | 25,810 | 6,200 | 10,813 |
| 1925 | 61,159 | 1,239 | 62,398 | 50,221 | 13,790 | 30,130 | 6,301 | 12,177 |
| 1926 | 69,158 | 1,506 | 70,664 | 56,964 | 15,000 | 35,154 | 6,810 | 13,700 |
| 1927† | 75,116 | 1,650 | 76,766 | 62,136 | 16,300 | 38,486 | 7,350 | 14,630 |

* 1920-1927 as collected by U. S. Geological Survey.
† Based on ten months' operations. ‡ From Canada Year Book.

### *Table II—Sources of Central-Station Gross Income, 1921 to 1927*

(100 per cent of the industry)

| Year | Total Gross Income | Received from Lighting Customers | Received from Power Customers | Received from Electric Railways | Received from Other Public Utilities |
|---|---|---|---|---|---|
| 1921 | $944,400,000 | $570,500,000 | $267,800,000 | $44,650,000 | $61,450,000 |
| 1922 | 1,072,119,883 | 657,119,883 | 303,200,000 | 50,750,000 | 61,050,000 |
| 1923 | 1,269,550,000 | 795,000,000 | 358,150,000 | 52,200,000 | 64,200,000 |
| 1924 | 1,354,570,000 | 902,670,000 | 321,000,000 | 54,400,000 | 76,500,000 |
| 1925 | 1,480,500,000 | 979,500,000 | 367,540,000 | 53,270,000 | 80,190,000 |
| 1926 | 1,652,300,000 | 1,018,200,000 | 461,000,000 | 58,100,000 | 115,000,000 |
| 1927† | 1,783,700,000 | 1,075,800,000 | 517,900,000 | 60,600,000 | 129,400,000 |

† Based on ten months' operation.

reduced by the use of low-rate money incidental to better utility credit, and operating methods were reorganized to lower costs of doing business. All these developments displayed the initiative and intelligence of industry leaders and lie behind the cold statistical figures, which measure industry progress.

Statistics are of little value unless defined and interpreted. Each user will draw his own inferences regarding details, and only trends need be discussed. One theme runs through all the compilations, and that is the fact that electrical energy, generated in large stations and distributed over wide areas, is being used in increasing amount in the homes, in industry and in the other pursuits incidental to modern civilization. This electrical energy is being produced with progressively higher efficiency, and is sold at a decreasing unit price.

Without attempting to penetrate the remote future, it seems evident that for as long a period as need be considered, in a practical way, the demand for electric service will continue and the turn toward saturation, when it comes, will be very gradual. That rise is predicated upon

### *Table III—Output, Revenue and Expense of the Central-Station Industry by Sections, 1922 to 1927*

(100 per cent of the industry)

| Section | 1922 | 1923 | 1924 | 1925 | 1926 | 1927† |
|---|---|---|---|---|---|---|
| | *Energy Generated, Kilowatt-Hours* +* | | | | | |
| *United States* | 43,559,677,000 | 51,132,883,000 | 54,413,403,000 | 61,158,857,000 | 69,158,114,000 | 75,116,078,000 |
| New England | 3,160,550,000 | 3,664,602,000 | 3,748,536,000 | 4,236,675,000 | 4,612,732,000 | 4,983,173,000 |
| Atlantic | 15,709,032,000 | 18,695,901,000 | 19,694,478,000 | 21,880,778,000 | 25,006,632,000 | 27,086,021,000 |
| North Central | 13,436,664,000 | 15,614,068,000 | 16,644,922,000 | 18,913,784,000 | 21,277,628,000 | 22,606,564,000 |
| South Central | 2,826,224,000 | 3,380,984,000 | 3,791,011,000 | 4,607,650,000 | 5,491,028,000 | 6,713,755,000 |
| Mountain-Pacific | 8,427,207,000 | 9,777,328,000 | 10,534,456,000 | 11,519,970,000 | 12,770,094,000 | 13,726,565,000 |
| | *Gross Revenue from Sale of Energy* | | | | | |
| *United States* | $1,072,119,883 | $1,269,550,000 | $1,354,570,000 | $1,480,500,000 | $1,652,300,000 | $1,783,700,000 |
| New England | 103,885,016 | 120,200,900 | 126,655,000 | 141,200,000 | 153,600,000 | 163,800,000 |
| Atlantic | 387,811,179 | 476,500,000 | 507,155,000 | 557,400,000 | 631,500,000 | 684,000,000 |
| North Central | 358,079,391 | 418,350,000 | 445,150,000 | 470,000,000 | 515,800,000 | 547,000,000 |
| South Central | 76,134,431 | 103,000,000 | 105,610,000 | 128,800,000 | 150,500,000 | 174,200,000 |
| Mountain-Pacific | 146,209,866 | 151,500,000 | 170,000,000 | 183,100,000 | 200,900,000 | 214,700,000 |
| | *Operating and Maintenance Expenses‡* | | | | | |
| *United States* | $481,570,000 | $576,880,000 | $617,980,000 | $650,000,000 | $723,000,000 | $766,700,000 |
| New England | 50,000,000 | 57,600,000 | 58,286,000 | 61,100,000 | 64,000,000 | 71,300,000 |
| Atlantic | 175,800,000 | 219,000,000 | 221,320,000 | 252,500,000 | 266,100,000 | 279,000,000 |
| North Central | 171,300,000 | 202,000,000 | 214,094,000 | 220,300,000 | 247,000,000 | 251,000,000 |
| South Central | 34,200,000 | 46,100,000 | 50,750,000 | 53,000,000 | 72,000,000 | 79,100,000 |
| Mountain-Pacific | 50,270,000 | 52,180,000 | 73,530,000 | 63,100,000 | 73,900,000 | 86,300,000 |

* Data collected by U. S. Geological Survey. † Based on ten months' operations. ‡ Do not include interest, taxes, depreciation or sinking fund. + Does not include imported energy.

### *Table IV—Output of Central-Station Hydro and Fuel Power Plants, 1925-1927**

(100 per cent of the industry)

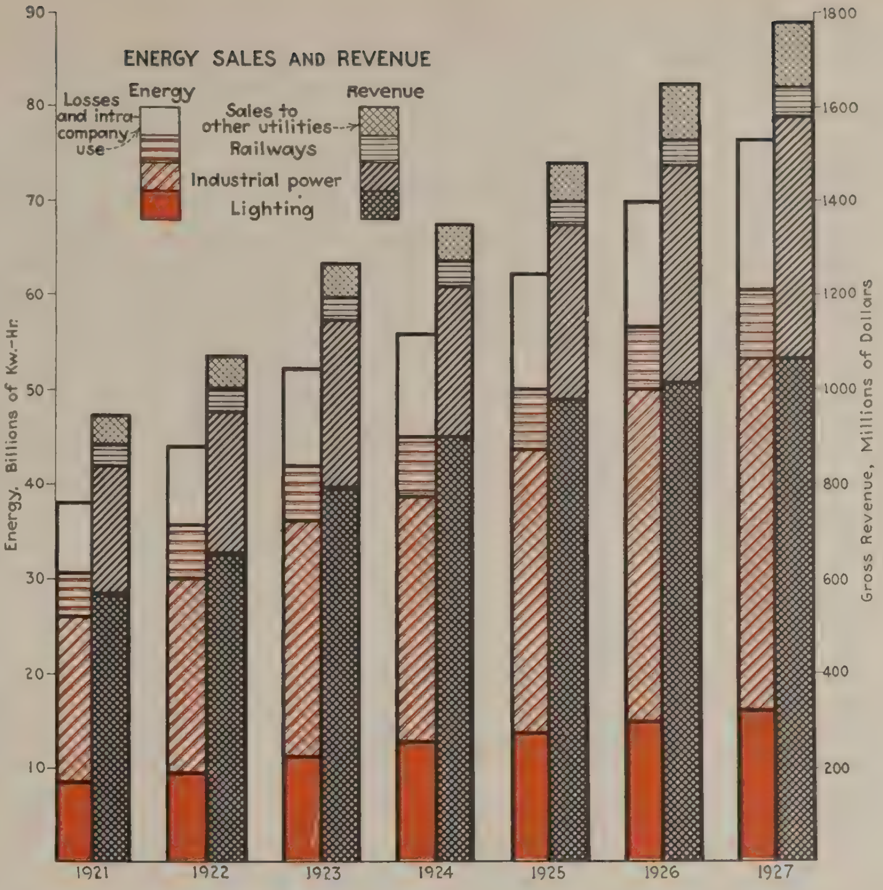
| Section | Energy Generated During 1925 | | | | Energy Generated During 1926 | | | | Energy Generated During 1927† | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hydro Plants | | Fuel Power Plants | | Hydro Plants | | Fuel Power Plants | | Hydro Plants | | Fuel Power Plants | |
| | Thousands of Kw.-Hr. | Per Cent of Total | Thousands of Kw.-Hr. | Per Cent of Total | Thousands of Kw.-Hr. | Per Cent of Total | Thousands of Kw.-Hr. | Per Cent of Total | Thousands of Kw.-Hr. | Per Cent of Total | Thousands of Kw.-Hr. | Per Cent of Total |
| *United States* | 21,996,547 | 35.9 | 39,162,310 | 64.1 | 25,833,603 | 37.4 | 43,324,511 | 62.6 | 29,041,778 | 38.7 | 46,074,300 | 61.3 |
| New England | 1,587,141 | 37.6 | 2,649,534 | 62.4 | 1,668,339 | 36.1 | 2,944,393 | 63.9 | 1,862,739 | 37.4 | 3,120,434 | 62.6 |
| Middle Atlantic | 5,026,384 | 31.9 | 10,734,846 | 68.1 | 5,900,250 | 33.0 | 12,052,611 | 67.0 | 6,021,985 | 32.2 | 12,689,165 | 67.8 |
| South Atlantic | 1,667,075 | 27.2 | 4,452,473 | 72.8 | 2,086,872 | 29.5 | 4,966,899 | 70.5 | 2,575,351 | 30.7 | 5,799,520 | 69.3 |
| East North Central | 1,565,230 | 10.5 | 13,465,147 | 89.5 | 2,000,146 | 11.7 | 15,060,279 | 88.3 | 2,295,462 | 12.7 | 15,766,957 | 87.3 |
| West North Central | 1,276,649 | 32.9 | 2,606,758 | 67.1 | 1,473,634 | 35.0 | 2,743,569 | 65.0 | 1,638,694 | 36.0 | 2,905,451 | 64.0 |
| East South Central | 1,024,437 | 40.1 | 1,517,398 | 59.9 | 1,925,679 | 64.6 | 1,051,829 | 35.4 | 2,302,248 | 67.0 | 1,132,844 | 33.0 |
| West South Central | 30,491 | 1.4 | 2,035,324 | 98.6 | 48,876 | 1.9 | 2,464,644 | 98.1 | 76,252 | 2.4 | 3,202,411 | 98.6 |
| Mountain | 2,548,844 | 84.6 | 460,564 | 15.4 | 2,754,695 | 83.6 | 536,002 | 15.4 | 2,951,944 | 87.2 | 436,453 | 12.8 |
| Pacific | 7,270,296 | 85.4 | 1,240,266 | 14.6 | 7,975,112 | 84.1 | 1,504,285 | 15.9 | 9,317,103 | 90.1 | 1,021,065 | 9.9 |

* Data collected by U. S. Geological Survey. † Based on ten months' operations.

something more substantial than the upward sweep of a curve on a chart. The fundamental difference between life in the twentieth century and in former ages is the general use of mechanical in place of human or animal power. This, probably more than any other one factor, has served to create the wealth that nurtured the other contributions to our well-being and comfort.

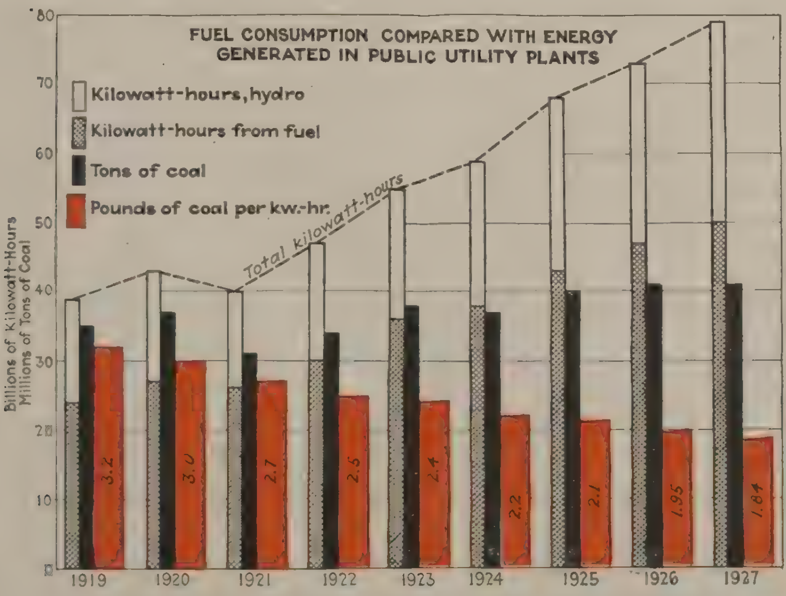
### Electricity Aids Industry

The most convenient and versatile agency thus far discovered for the transmission and application of that mechanical energy is the electrical system. The statement is made in no disparagement or lack of recognition of non-electrical uses of power. The tractor-hauled gang plow and the garden spade each has its place in tilling the soil. Electrical methods will supplant non-electrical wherever they fill a real need and their advantages are adequately presented. On these basic considerations rests the future advance of the electrical industry.



LIGHTING ACCOUNTS FOR $1,100,000,000 OF GROSS REVENUE

Since 1921, the generation of energy in public utility plants has increased at an average rate of nearly 7,000,000,000 kw.-hr. annually. To provide the machinery for generating that increase calls, each year, for a net addition of 2,500,000 to 3,000,000 kva. with the necessary prime movers, plus replacement for what has become obsolete. To send out and apply the added 7,000,000,000 kw.-hr. necessitates transmission and distribution equipment and energy-converting devices with their accessories. To buy and install the power companies' part of all this material calls for about $800,000,000 to $900,000,000, in capital investment annually.



LESS COAL IS USED PER KILOWATT-HOUR EACH YEAR, GIVING DOUBLE THE ENERGY WITH ONE-SIXTH MORE FUEL

Compared with 1926, business in 1927 was slower in the electric as in other industries. But, whereas in many of the others this signifies a recession in operations and in earnings, in the electric power industry it means something very different. The earnings in 1927 were greater than in the year before by more than $131,000,000, or 8 per cent, and the output was greater by 6,000,000,000 kw.-hr., nearly 9 per cent increase. Only the increase, not the operations themselves, was less than in 1926, which showed $168,000,000 rise in the revenue and 8,000,000,000 kw.-hr. increase in energy generated over the preceding year's operations.

It has been suggested that 1928 may show a decline in new construction. The indications are contrary to that view. The summary of prospective budgets, based this year on an exceptionally full response to requests for that information, is higher than

## *Table V—Consumption of Fuel by Central-Station Steam Power Plants, 1925-1927**

(100 per cent of the industry)

| Section | Coal (Short Tons) | | | Fuel Oil (Barrels) | | | Gas (Thousands of Cubic Feet) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1925 | 1926 | 1927† | 1925 | 1926 | 1927† | 1925 | 1926 | 1927† |
| *United States* | 35,321,502 | 36,594,540 | 37,442,120 | 9,742,238 | 8,970,356 | 6,409,635 | 45,479,189 | 52,160,061 | 65,465,314 |
| New England | 2,195,537 | 2,244,611 | 2,283,538 | 916,527 | 908,134 | 875,061 | 0 | 0 | 0 |
| Middle Atlantic | 9,766,271 | 10,408,642 | 10,297,588 | 223,287 | 242,615 | 284,013 | 226,749 | 147,330 | 122,968 |
| South Atlantic | 3,860,880 | 4,052,005 | 4,607,219 | 1,683,005 | 2,253,275 | 1,975,559 | 576,673 | 157,302 | 149,801 |
| East North Central | 13,499,767 | 14,165,281 | 13,887,730 | 55,171 | 47,654 | 54,898 | 6,539,399 | 5,079,733 | 5,938,090 |
| West North Central | 3,116,778 | 3,026,389 | 3,173,067 | 1,113,513 | 963,861 | 792,742 | 5,267,705 | 5,799,649 | 9,725,726 |
| East South Central | 1,641,802 | 1,226,151 | 1,295,606 | 148,255 | 62,703 | 58,481 | 26,400 | 18,261 | 2.410 |
| West South Central | 555,814 | 837,208 | 1,367,899 | 3,019,883 | 1,693,561 | 946,544 | 22,345,800 | 30,430,507 | 41,153,490 |
| Mountain | 623,229 | 620,320 | 522,759 | 210,271 | 239,195 | 219,505 | 146,395 | 160,769 | 523,078 |
| Pacific | 62,424 | 13,933 | 6,714 | 2,372,326 | 2,559,358 | 1,202,832 | 10,350,048 | 10,366,510 | 7,849,751 |

* Data collected by U. S. Geological Survey. † Based on ten months' operations.

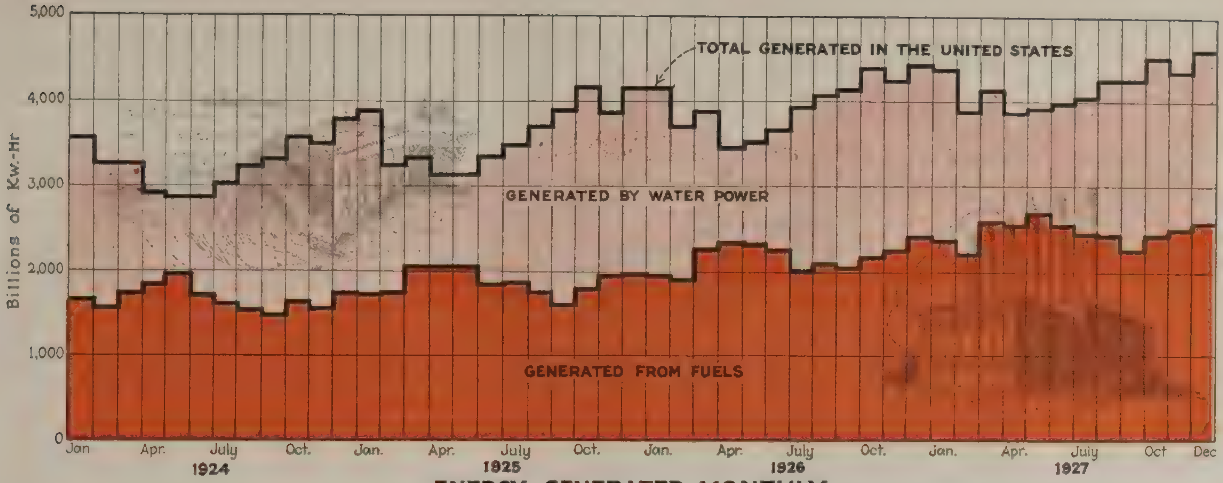
## *Table VI—Electrical Energy Generated in Central Station, Railway and Other Utility Plants*

Figures for 1924, 1925 and 1926 are based on U. S. Geological Survey data, and 1927 figures are based on ten months' operation.

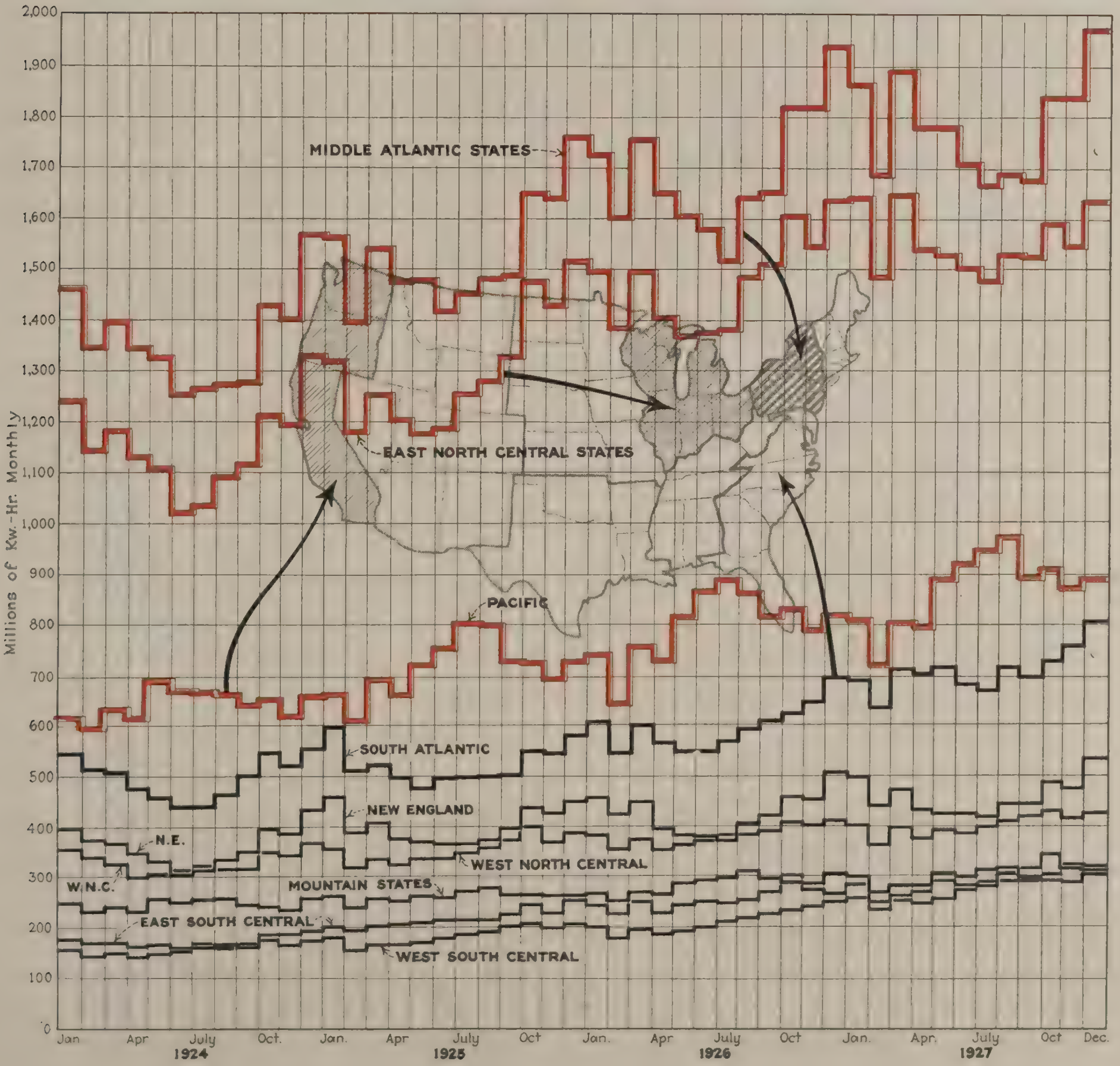
| State and Section | Electrical Energy Generated (Thousands of Kilowatt-Hours) | | | |
|---|---|---|---|---|
| | 1924 | 1925 | 1926 | 1927 |
| *United States* | 59,013,590 | 65,870,306 | 73,791,064 | 79,588,000 |
| New England | 4,334,553 | 4,823,655 | 5,165,955 | 5,499,000 |
| Middle Atlantic | 16,305,735 | 18,298,853 | 20,526,802 | 21,339,000 |
| East North Central | 13,791,109 | 15,714,972 | 17,663,578 | 18,612,000 |
| West North Central | 3,934,166 | 4,253,656 | 4,586,814 | 4,813,000 |
| South Atlantic | 5,949,906 | 6,271,770 | 7,197,294 | 8,542,000 |
| East South Central | 2,063,570 | 2,609,746 | 3,049,199 | 3,512,000 |
| West South Central | 1,923,075 | 2,201,833 | 2,639,520 | 3,342,000 |
| Mountain | 2,963,081 | 3,127,142 | 3,424,715 | 3,534,000 |
| Pacific | 7,748,395 | 8,568,679 | 9,537,187 | 10,395,000 |
| *New England* | | | | |
| Maine | 473,671 | 509,231 | 544,423 | 580,000 |
| New Hampshire | 215,806 | 263,683 | 263,524 | 282,000 |
| Vermont | 223,793 | 257,974 | 264,914 | 285,000 |
| Massachusetts | 2,097,998 | 2,377,649 | 2,498,915 | 2,656,000 |
| Rhode Island | 427,493 | 408,208 | 476,239 | 508,000 |
| Connecticut | 895,792 | 1,006,910 | 1,117,940 | 1,188,000 |
| *Middle Atlantic* | | | | |
| New York | 9,288,569 | 10,266,700 | 11,332,507 | 11,783,000 |
| New Jersey | 1,304,297 | 1,506,155 | 1,736,881 | 1,803,000 |
| Pennsylvania | 5,712,869 | 6,525,998 | 7,457,414 | 7,753,000 |
| *East North Central* | | | | |
| Ohio | 3,701,562 | 4,387,499 | 4,761,028 | 5,018,000 |
| Indiana | 1,297,676 | 1,484,472 | 1,758,435 | 1,850,000 |
| Illinois | 4,665,472 | 5,269,477 | 5,930,399 | 6,247,000 |
| Michigan | 2,696,648 | 3,031,273 | 3,392,813 | 3,578,000 |
| Wisconsin | 1,429,751 | 1,542,251 | 1,820,903 | 1,919,000 |
| *West North Central* | | | | |
| Minnesota | 869,866 | 1,045,684 | 1,040,191 | 1,090,000 |
| Iowa | 1,175,068 | 1,195,315 | 1,344,978 | 1,411,000 |
| Missouri | 888,755 | 865,802 | 912,503 | 957,000 |
| North Dakota | 39,296 | 39,050 | 47,555 | 50,000 |
| South Dakota | 65,909 | 74,875 | 80,342 | 84,000 |
| Nebraska | 337,902 | 366,266 | 394,832 | 414,000 |
| Kansas | 557,370 | 666,664 | 766,413 | 806,000 |
| *South Atlantic* | | | | |
| Delaware | 87,977 | 102,100 | 118,866 | 141,000 |
| Maryland | 482,346 | 572,651 | 587,989 | 699,000 |
| Dist. of Columbja | 315,227 | 349,803 | 381,373 | 454,000 |
| Virginia | 743,668 | 801,568 | 925,882 | 1,099,000 |
| West Virginia | 1,762,737 | 1,642,894 | 1,807,360 | 2,143,000 |
| North Carolina | 647,330 | 942,294 | 1,117,378 | 1,324,000 |
| South Carolina | 943,577 | 881,536 | 1,038,198 | 1,232,000 |
| Georgia | 748,756 | 660,790 | 710,578 | 845,000 |
| Florida | 218,288 | 318,134 | 509,670 | 605,000 |
| *East South Central* | | | | |
| Kentucky | 405,194 | 474,745 | 513,800 | 592,000 |
| Tennessee | 694,073 | 874,973 | 894,015 | 1,030,000 |
| Alabama | 890,087 | 1,169,101 | 1,582,717 | 1,822,000 |
| Mississippi | 74,216 | 90,927 | 58,667 | 67,000 |
| *West South Central* | | | | |
| Arkansas | 154,682 | 189,070 | 163,697 | 207,000 |
| Louisiana | 308,262 | 350,322 | 519,793 | 657,000 |
| Oklahoma | 331,157 | 394,383 | 463,128 | 586,000 |
| Texas | 1,128,974 | 1,268,058 | 1,492,902 | 1,892,000 |
| *Mountain* | | | | |
| Montana | 1,145,285 | 1,262,629 | 1,407,903 | 1,454,000 |
| Idaho | 792,532 | 754,079 | 810,789 | 836,000 |
| Wyoming | 53,556 | 55,544 | 59,381 | 61,000 |
| Colorado | 490,030 | 522,892 | 561,962 | 581,000 |
| New Mexico | 19,913 | 21,787 | 25,993 | 27,000 |
| Arizona | 153,196 | 130,541 | 172,243 | 177,000 |
| Utah | 266,946 | 339,967 | 349,604 | 361,000 |
| Nevada | 41,623 | 39,703 | 36,840 | 37,000 |
| *Pacific* | | | | |
| Washington | 1,503,560 | 1,623,007 | 1,807,792 | 1,980,000 |
| Oregon | 678,395 | 729,859 | 831,135 | 905,000 |
| California | 5,566,440 | 6,215,813 | 6,898,260 | 7,510,000 |

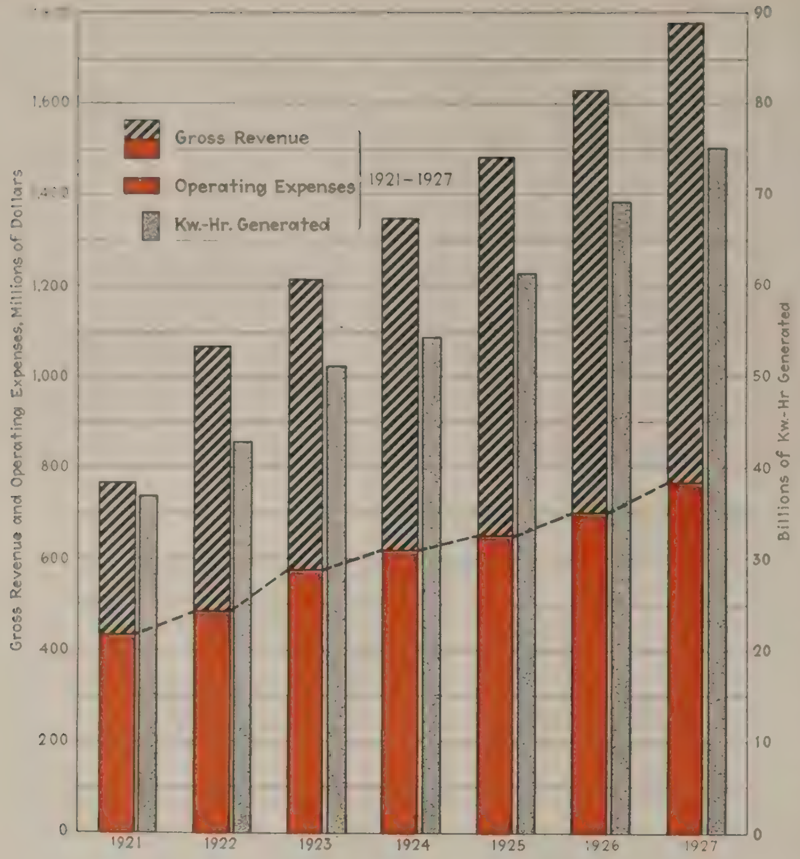
## *Table VII—Number of Central-Station Operating Systems and Installed Generator Rating, Dec. 31, 1927*

| State | Operating Companies | | | Generator Rating Kva. |
|---|---|---|---|---|
| | Total Number | Commercial | Municipal Systems | |
| *United States* | 4,409 | 2,537 | 1,872 | 28,990,000 |
| New England | 330 | 259 | 71 | 2,410,000 |
| Middle Atlantic | 420 | 316 | 104 | 6,930,000 |
| South Atlantic | 529 | 296 | 233 | 3,620,000 |
| East North Central | 926 | 500 | 426 | 7,020,000 |
| West North Central | 1,064 | 420 | 644 | 2,050,000 |
| East South Central | 239 | 150 | 89 | 1,400,000 |
| West South Central | 441 | 271 | 170 | 1,150,000 |
| Mountain | 283 | 190 | 93 | 1,060,000 |
| Pacific | 177 | 135 | 42 | 3,350,000 |
| *New England* | | | | |
| Maine | 65 | 59 | 6 | 250,000 |
| New Hampshire | 42 | 37 | 5 | 123,000 |
| Vermont | 58 | 46 | 12 | 124,000 |
| Massachusetts | 122 | 80 | 42 | 1,170,000 |
| Rhode Island | 9 | 9 | 0 | 222,000 |
| Connecticut | 34 | 28 | 6 | 521,000 |
| *Middle Atlantic* | | | | |
| New York | 185 | 138 | 47 | 3,821,000 |
| New Jersey | 31 | 18 | 13 | 588,000 |
| Pennsylvania | 204 | 160 | 44 | 2,521,000 |
| *South Atlantic* | | | | |
| Delaware | 8 | 3 | 5 | 59,800 |
| Maryland | 35 | 27 | 8 | 296,000 |
| District of Columbia | 3 | 3 | 0 | 192,100 |
| Virginia | 59 | 44 | 15 | 467,000 |
| West Virginia | 46 | 46 | 0 | 907,000 |
| North Carolina | 106 | 58 | 48 | 561,100 |
| South Carolina | 59 | 35 | 24 | 524,000 |
| Georgia | 137 | 44 | 93 | 357,000 |
| Florida | 76 | 36 | 40 | 256,000 |
| *East North Central* | | | | |
| Ohio | 243 | 131 | 112 | 1,893,000 |
| Indiana | 161 | 81 | 80 | 701,000 |
| Illinois | 205 | 124 | 81 | 2,351,000 |
| Michigan | 145 | 73 | 72 | 1,351,000 |
| Wisconsin | 172 | 91 | 81 | 724,000 |
| *West North Central* | | | | |
| Minnesota | 184 | 62 | 122 | 466,000 |
| Iowa | 158 | 68 | 90 | 602,000 |
| Missouri | 148 | 91 | 57 | 407,000 |
| North Dakota | 106 | 75 | 31 | 21,200 |
| South Dakota | 79 | 36 | 43 | 35,800 |
| Nebraska | 193 | 45 | 148 | 176,000 |
| Kansas | 196 | 43 | 153 | 342,000 |
| *East South Central* | | | | |
| Kentucky | 74 | 60 | 14 | 231,000 |
| Tennessee | 62 | 43 | 19 | 412,000 |
| Alabama | 56 | 28 | 24 | 730,000 |
| Mississippi | 47 | 19 | 28 | 27,000 |
| *West South Central* | | | | |
| Arkansas | 58 | 40 | 18 | 71,500 |
| Louisiana | 69 | 30 | 39 | 226,200 |
| Oklahoma | 135 | 62 | 73 | 202,100 |
| Texas | 179 | 139 | 40 | 650,200 |
| *Mountain* | | | | |
| Montana | 37 | 34 | 3 | 431,000 |
| Idaho | 48 | 29 | 19 | 254,000 |
| Wyoming | 33 | 20 | 13 | 17,200 |
| Colorado | 64 | 37 | 27 | 170,000 |
| New Mexico | 23 | 22 | 1 | 7,800 |
| Arizona | 28 | 22 | 6 | 52,500 |
| Utah | 35 | 13 | 22 | 116,300 |
| Nevada | 15 | 13 | 2 | 11,200 |
| *Pacific* | | | | |
| Washington | 66 | 55 | 11 | 636,000 |
| Oregon | 34 | 27 | 7 | 294,000 |
| California | 77 | 53 | 24 | 2,420,000 |



ENERGY GENERATED MONTHLY





ANNUAL INCREASE FOR FIVE YEARS AVERAGES MORE THAN $140,000,000 IN REVENUE AND 6,500,000,000 KW.-HR. IN OUTPUT

the expenditures for any previous year and exceeds any previous budget estimate, except that for 1927. The latter was made at the end of two years of unusual growth. There seemed need of an accelerated pace in providing new plant, and the estimated expenditures were correspondingly high; later developments justified a more conservative policy. The contrary condition exists at the beginning of 1928. The natural tendency is toward moderation in the estimates but the work deferred from 1927 must be made up, and the industry continues to grow.

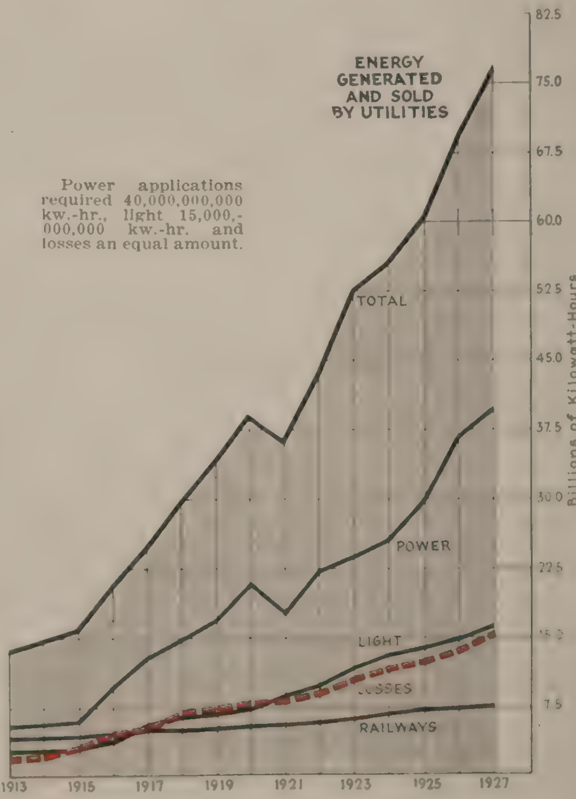
Whatever excess capacity may be indicated by a slightly smaller output per kva. shown in certain reports for 1927, compared with 1926, is at most temporary. Even 1,000,000 kva. represents only a few months' growth, and programs for new plant must be made not for months but years. Undue curtailment would surely result in embarrassment before the deficiency could be overcome.

### Interconnection and Energy Production

The increasing sale of energy between operating companies reflects the effect of interconnections. In amount it constitutes a fifth of the total generated. It has doubled in four years. In 1923 it was about 7,400,000,000 kw.-hr. It rose in successive years by 12, 17, 36 and 12 per cent respectively. In 1927 it reached 14,700,000,000 kw.-hr.

The combined influence of improved utilization of fuel in the modern station, of the complementary use of hydro and steam power, and of the growing network of high-tension lines permitting the most advantageous allocation of loads in a wide area, is made evident by the decrease from 3.2 to 1.85 lb. of coal per kw.-hr. since 1919. The difference is equivalent to a saving, in 1927 alone, in all public utility plants in the United States, of 34,000,000 tons of coal; in the last eight years, the cumulative savings aggregate nearly 140,000,000 tons.

The utilities embody, not only individual savings by far more than a million customer security holders, but the savings of countless others through insurance companies and other forms of trusteeship, the accumulated excess of production over consumption. Those savings are devoted to greater productivity, to the easing of human effort and the providing of comforts. This should not signify merely more material possessions, wider scope for idleness and competitive ostentation; it should carry with it a wholesome growth of those enduring values generally recognized as constituents of a higher civilization, emerging from the initial exhilaration of mere acquisition. There is reason to believe that these things are gradually coming to pass, and that the increasing application of the sources of power in nature, through electrical means, for the benefit and convenience of mankind is a significant factor in a continuing process.



Power applications required 40,000,000,000 kw.-hr., light 15,000,000,000 kw.-hr. and losses an equal amount.

# Twelve Months in Retrospect

Technical triumphs, building, installation and interconnection went steadily on. Despite water-power controversies, politics and floods, 1927 proved full of encouragement

ELECTRICAL engineering achievements of a sufficiently novel character to figure as news of the industry in 1927 were recalled in the ELECTRICAL WORLD for Dec. 3. In the light and power field they included the installation or placing on order of a quantity of equipment of various sorts which in one particular or another was of unprecedented rating and the coming into service almost simultaneously in Chicago and New York of 132-kv. underground cable of Pirelli type. In the allied field of communication television sprang into being and transatlantic telephony became a commercial reality.

Though such engineering advances were fundamentally the most important industry news in the last twelve months, political complications were by their nature the most discussed events and those to which most heed was given by the general public. When the year opened discussions over the disposition of the government property at Muscle Shoals and the proper solution of the triple problem of the Colorado basin—flood prevention, irrigation and generation—were filling many pages in the *Congressional Record* and many columns of the newspapers.

### DEBATE AD INFINITUM

Nineteen-twenty-seven has given way to 1928, the Sixty-ninth Congress has been succeeded by the Seventieth, seven Western governors have met in solemn conclave, disputed and gone home, but the same discussions wax warm again and the identical arguments pro and con are iterated and reiterated in the Capitol lobbies and will soon resound in the upper and lower chambers. If every word spoken on Muscle Shoals were a kilowatt-hour, power from the Tennessee would drug the Southern market. If every oratorical gesture anent Boulder Dam were the upward motion of a piston in an irrigation pump, the deserts of Arizona and Nevada would blossom like the fertilized regions in the Imperial Valley.

Discussion is a dearly bought prerogative of democracy, and it is better that the people through their chosen representatives should reach their own slow decisions on matters inextricably tied in with statecraft and politics than that aspersion should becloud the policies that industrial experts might enforce were the sole responsibility theirs. None the less, it is impossible not to contrast the inertia on the government-embargoed streams with the activity at Conowingo, from which 1928 will in all probability see energy transmitted, and with the beginning already made on the Saluda River in South Carolina. From these two privately owned water-power sites, which figured conspicuously in last year's news and which rival Wilson Dam in potential power, it is safe to predict that industry will receive a great accession of energy long before Muscle Shoals is properly put to work, to say nothing of the eleven sites on the upper reaches of the Tennessee. On the Falls of the Ohio in Kentucky, on the Tallapoosa and Coosa Rivers in Alabama, on Lake Chelan in Washington State, large privately owned hydro plants are rapidly being built. Others of a good size are under way in various states. In both northern and southern California the continuous performance of the largest two companies of that state has maintained its momentum. In July the Melones plant of the Pacific Gas & Electric Company, which is built at an irrigation dam, was dedicated, and November saw the completion of the Mono Bear diversion channel of the Southern California Edison.

### STATE LAW AND REGULATION

Water power continued in 1927 to play a part in state legislatures as well as at Washington. Maine's lawmakers began to realize that, after all, the exportation of power might be a source of gain and not loss to that commonwealth, though no definite step was taken to repeal the law forbidding hydro power to be sent across the boundary. New York argued St. Lawrence development all over again, the Governor failing to convert the Legislature to his views and the Legislature failing to concoct a bill the Governor would sign. West Virginia's legislators left the water powers of that commonwealth where they found them—mainly unused. Wisconsin adopted a policy differing in its recapture provision from the federal water-power law and was at once plunged into litigation over it, the state winning the victory. North and South Dakota officials presented grandiose plans for the Missouri, and in still other states water power played its part on the legislative stage.

The state regulating commissions survived attacks in several legislatures, the assault in Indiana being perhaps the most determined. Chicago defeated a "home rule" bill at the polls, and measures designed to encourage public ownership plans on the Pacific Coast were beaten in San Francisco, Sacramento and Los Angeles.

Many indications point to a fresh struggle in the commissions between opposed valuation methods—"historic cost" and "prudent investment" being again lined up against "reproduction cost new less depreciation." Bugles for battle have been blown in Massachusetts, repeated in Wisconsin and Ohio and echoed from California. The awaited decision in the suit of the St. Louis & O'Fallon Railway against the Interstate Commerce Commission was handed down by a United States court in December. But apparently it settles nothing, and all that has so far been made certain by the Supreme Court of the United States is that the first two methods or either of them cannot be adopted to total exclusion of the third.

### SENATOR WALSH'S RESOLUTION

But the prospective incursion that has aroused the most interest throughout electrical circles is that for which the way has just been paved by the resolution reintroduced at Washington by Senator Walsh of Montana to appoint a committee of five senators to investigate the electric light and power industry and the gas industry. Sent to committee before Christmas by a majority of four votes, the resolution is not likely to be buried there. The utility companies and the recently rejuvenated Joint Committee of National Utility Associations will almost surely have the opportunity to establish the honorable character and public benefit of such companies and to absolve in the public eye the great majority of them from connivance in the wiles of stock jobbers, speculators and promoters. Early in the year the industry came out unscathed from the investigation with similar objects conducted by the Federal Trade Commission.

### GROWTH OF THE SYSTEMS

Water may run idly to the sea without turning a wheel or generating a kilowatt, but steam once created is always put to use, and 1927 saw steam challenge water power in the latter's own territory—in California, in North Carolina and in Alabama, for instance, where respectively fuel-fired stations of the Southern California Edison Company, the Southern Power Company and the Alabama Power Company, built, building or prepared for, figured in last year's news. The coming steam plants of the Insull companies at Pekin, Ill., and elsewhere; new generating units now installed at Pittsburgh, Buffalo, New Orleans, Norfolk, Scranton, Pa.; Springfield, Ohio; Inglis, Fla., and many other places, and a large projected plant on the Delaware opposite Wilmington, Del., formed the subject matter of items in the weekly chronicle.

Texas, with its ever-growing oil production, was the broad theater of incessant building of moderate-sized and small generating plants at strategic points to feed long interconnecting lines. Oklahoma was another especially active state. Transmission lines continued to spring up all over the country, and the now universally accepted policy of interconnection received steady impetus. Because of the completion of links in North Carolina, Tennessee and the Virginias, unbroken interconnection was set up from Chicago south to Mobile and Pensacola. It had previously existed east to Boston, and both of the long right-angled copper arms were successfully operated in parallel, though no power was actually transmitted. The three-company 220-volt tie-in of the Public Service Electric & Gas Company of New Jersey, the Philadelphia Electric Company and the Pennsylvania Power & Light Company was, however, the most important new piece of interconnection to get under way, and it will provide an immense reservoir of power for the north Atlantic seaboard.

In Quebec Province a notable piece of work was finished—the 136-mile, 187-kv. line from the hydro development at Ile Maligne to the city of Quebec. From Canada at large, with her whole industrial structure built up on water power, have come constant reports of the clamor for more. The new Gatineau Power Company took rank at a bound with the great private companies on the continent, and from its plants near Ottawa are soon to be built two lines to serve the Ontario Hydro-Electric Power system—one to eastern Ontario points and one all the way to Toronto. Canada has its own water-power problems, and last year's reports showed that conflict between the provinces and the Dominion over jurisdiction on the Ottawa and St. Lawrence Rivers is waged quite as vigorously as any parallel contest between a state and the federal officials at Washington.

Consolidations, mergers and purchases were probably as numerous in 1927 as they were in 1926 and included at least seven actual changes of financial control affecting large groups of operating companies, among them the taking over of the Fitkin companies by Insull and of three Byllesby companies in California by the Pacific Gas & Electric, the union of seven up-state New York properties, and of the two competing Indianapolis companies, and the consolidation of the Philadelphia Electric with the United Gas Improvement Company. The transactions of the year are listed at length on pages 46 to 54 of this issue.

Rural service, if not forging forward at express speed, may be said, in a sense almost literal, to be striding in seven-league boots. Nebraska, Indiana, Wisconsin, Texas, Georgia, New York and Washington are some of the states from which encouraging reports came.

Besides the always fruitful and successful annual conventions of the National Electric Light Association and the American Institute of Electrical Engineers, several other gatherings of especially interesting character were held in 1927. The Southern Appalachian Power Conference met at Chattanooga in October, and the status of electrical development in the Southern States was well canvassed from many points of view. In the same month the National Association of Railroad and Utilities Commissioners assembled at Dallas. Its most interesting discussion concerned the holding companies. Confidence in conservative, old-time companies of this type was generally expressed, but the speculative, financially weak and overpyramided concerns were the occasion of some emphatic headshaking.

The National Electrical Manufacturers Association held its first annual meeting in June and hit its stride for growth and performance; the Electrical Supply Jobbers Association and the Society for Electrical Development were reorganized for better and completer service, and for the first time in the history of the industry its four major associations—of central-station men, manufacturers, jobbers and contractors—united through their respective heads in a communication to the industry at large designed especially to further commercial progress through closer co-operation.

Another interesting meeting was that of the International Electrotechnical Commission in Italy, at Bellagio and Rome, when the way was paved for the advancement of international standardization and the centenary of Volta's death was commemorated. An occasion of world-wide human interest was the attainment by Thomas A. Edison in February of his eightieth birthday amid universal acclaim.

### FLOODS AND DEATHS

The year, on the whole one of uninterrupted progress, had its leaden lining in the spring flood disasters on the Mississippi and its tributaries and their fall counterpart in Vermont and New Hampshire and in spots elsewhere in New England and in New York. The story of how in both the Southwestern and the Northeastern territory the operating companies maintained service amid discouraging conditions and lived up to the best traditions of light and power production has been duly told.

Death hit the manufacturing branch of the industry hard in removing such men as Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company; Anson W. Burchard, vice-chairman of the General Electric Company's board and chairman of the International General Electric's directors, and Harvey Hubbell. Sigmund Bergmann, the German manufacturer whose early career in America helped him to a great measure of success in his native land, also ceased his labors in the year just past. Among many others mourned by the fraternity were Wigginton E. Creed, president of the Pacific Gas & Electric Company; B. C. Edgar, vice-president and general manager of the Tennessee Electric Power Company, and Admiral W. H. G. Bullard, head of the Federal Radio Commission set up by Congress a few months before his death.

# Telephone Developments—1927

International extension of communication facilities afforded by transatlantic telephony, lines to Mexico, and broadcasting networks. Toll rates reduced. Telephotography and television available. Permalloy helps equipment developments

CLEVELAND OFFICE OF OHIO BELL TELEPHONE COMPANY

AT THE end of 1927, 51 years after the invention of the telephone and 50 years from the installation of the first commercial telephone lines, there are in the United States more than 18,500,000 telephones. To connect these telephones to central offices and to provide for the interconnection of more than 70,000 cities, towns and villages throughout the country, there is a total of more than 63,000,000 miles of exchange and toll wire. Over this network an average of more than 72,000,000 local and toll conversations takes place daily. The growth in number of telephones in 1927 is shown in the accompanying table.

Telephony is distinctively an American art, the principal technical contributions to its improvement having taken place in this country. The intensive commercial development of the telephone in the United States is indicated by the fact that with 6 per cent of the world's population, the United States has about 60 per cent of the world's telephones. Progress in 1927 has taken place not only in the increase in number of telephones and in plant, but in the use made of present facilities and in improvements in the quality of telephone service throughout the country. Furthermore, the range of telephone communication has been increased by extensions to other countries, and important contributions to the future progress of the telephone art have been made. In many items, new ways have been found of reducing cost and improving efficiency, both as regards the elements which go to make up the complex telephone plant and the methods and practices employed in the operation thereof.

With regard to expenditures for new plant in 1927, figures covering the entire telephone industry in the United States are not yet available. It can be said, however, that total expenditures for new plant in the Bell system for 1927 are expected to reach $390,000,000, as compared with $380,000,000 in 1926, which will increase the system's facilities in taking care of additional business and for keeping the facilities of the system at the highest standard. Part of this is for new plant to replace plant retired because of obsolescence, changes to meet requirements of the public, inadequacy, on account of its being worn out or because of destruction by storms or floods. For

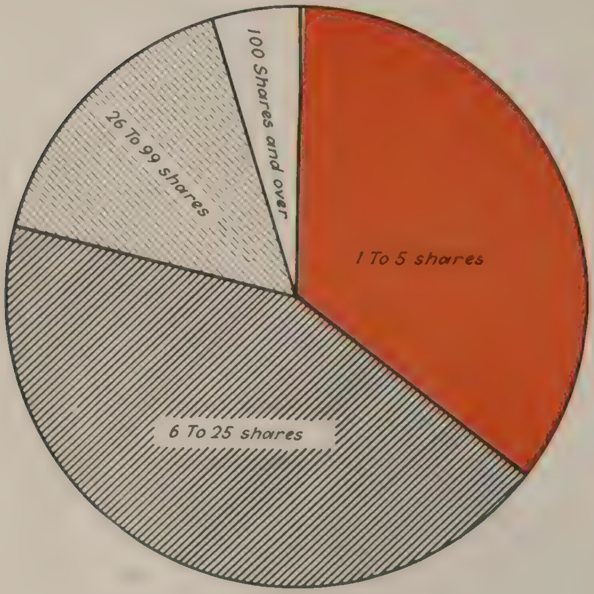
1926 the plant so replaced cost $122,000,000. The investment in plant and equipment in the Bell system devoted to furnishing telephone service at the beginning of 1928 amounts to more than $3,000,000,000.

As of Sept. 30, 1927, the number of employees of telephone companies in the United States was about 378,000. In addition, upwards of 50,000 were employed in telephone manufacturing and many more in the production of the raw materials required.

### Telephone Buildings

The need for a large building program to house telephone equipment and the operating and administrative forces is an indication of the rapid growth of the telephone business. Noteworthy among the telephone buildings recently opened for occupancy is the new building of the Ohio Bell Telephone Company in Cleveland, Ohio, opened in July, 1927. An illustration of this building appears on page 27. This building is 22 stories high and contains about 333,000 sq.ft. of floor space, and houses, in addition to administrative offices and dial central office equipment having capacity to serve about 47,000 stations. Space is provided for the necessary equipment and switchboards to take care of the toll and long distance services. Ultimately, the building can, if necessary be arranged to provide space for dial equipment for, perhaps, 200,000 stations. Another important building recently erected is the new 32-story building of the New York Telephone Company, the first ten stories of which, each having an area equivalent to an entire block, are designed for telephone equipment, and are capable, if desired, of housing dial equipment sufficient to provide for approximately 200,000 telephone stations. In this class should be mentioned the administrative building of the Southwestern Bell Telephone Company in St. Louis, 30 stories high, which also provides for housing central office equipments. A similar building recently erected in San Francisco by the Pacific Telephone & Telegraph Company contains administrative offices only. It has been found that where a many-storied building is necessary in order to utilize valuable land to the best advantage, such a building, even more than the smaller buildings, can be made so architecturally fine that it becomes an object of pride to the community as a whole. Buildings of similar type and more or less comparable in size are now under construction in Newark, Denver, Dallas, Kansas City, Oklahoma City, Detroit and Montreal.

**DISTRIBUTION OF STOCKHOLDERS BY SIZE OF HOLDINGS**
*American Tel. & Tel. Co.*



OVER THREE-QUARTERS OF ALL STOCK IS HELD BY SMALL SHAREHOLDERS

### Transatlantic Telephony

An outstanding accomplishment of the year was the opening of transatlantic radio telephone service on Jan. 7, 1927, between New York and its suburban area and London and its suburban area. This service, handled jointly by the American Telephone & Telegraph Company and the British Post Office, was gradually extended on both sides of the Atlantic until, on March 26, it included all points in the United States and all points in England, Scotland and Wales. On March 11, the service was further extended to Cuba, and on Oct. 3, it was extended to the Canadian cities of Ottawa, Montreal, Quebec, Toronto and Hamilton. At the time the service was opened a total of 4.5 hours of service daily was given. At present 10.5 hours daily are given.

YEAR'S GROWTH IN TELEPHONES

| Bell System and Connecting Companies | Jan. 1, 1928 | Jan. 1, 1927 |
|---|---|---|
| Bell-owned telephones | 13,700,000 | 12,816,000 |
| Bell-connecting telephones | 4,650,000 | 4,758,000 |
| Total | 18,350,000 | 17,574,000 |
| Telephones not connecting with Bell System | 167,000 | 172,000 |
| Total telephones | 18,517,000 | 17,746,000 |

### Opening of Lines to Mexico

On Sept. 29 occurred the formal opening of telephone communication between the United States and Mexico. The establishment of communication between the American and Mexican telephone systems is another significant step in extending the effective range of long distance telephony beyond our national boundaries. The long distance circuit recently completed by the Mexican Telephone & Telegraph Company, an associated company of the International Telephone & Telegraph Corporation, extends from Pueblo to Mexico City and from there to Nuevo Laredo on the Mexican border, with a branch line to Tampico and Victoria. It crosses the border at Laredo, and from there a circuit of the Bell system connects it with the southern transcontinental route.

### New Long Distance Facilities

In addition to the foregoing, there were some notable extensions of long toll lines in 1927. Ten days after the opening of the New York-London telephone service, public service was inaugurated on the newly-completed third transcontinental telephone line following the northern route, which gives direct service between the Pacific Northwest and Chicago and eastern cities. This line provides a direct circuit between Chicago and Seattle 2,240 miles in length. The first transcontinental line to San Francisco, the central route, was opened Jan. 25, 1915. Rapid increase in public demand for long distance communication, however, necessitated a second line, and the southern transcontinental was opened in 1923 from New Orleans to El Paso and Los Angeles.

### New Methods of Handling Toll Calls

Toll service has been greatly improved through the extension of local board handling to an increasingly large portion of the total traffic and the development of better methods for use at toll boards. The short-haul low rate traffic which makes up a considerable majority of the total toll business, particularly in the metropolitan areas, is now largely handled at the local switchboards in about the same manner local calls are handled.

Until recently, the toll board business has been handled by a plan which provided for the ticketing of orders for service by a special group of operators known as "recorders," and the distribution of the tickets to other operators who undertook the work of advancing the calls over the toll lines. Through improvement in operating and supervision, it became possible to combine the recording and line-operating work. A method, taking advantage of this situation, was developed, which results in a large majority of toll-board calls being completed while the subscriber remains at the telephone; certain calls involving difficult switched connections and other special operating requirements continue to be handled by the former practice. This change in toll-board-operating plan has been introduced rapidly throughout the Bell system, the conversion being already complete except for a few cities where major equipment rerrangements, which require some time to effect, are involved.

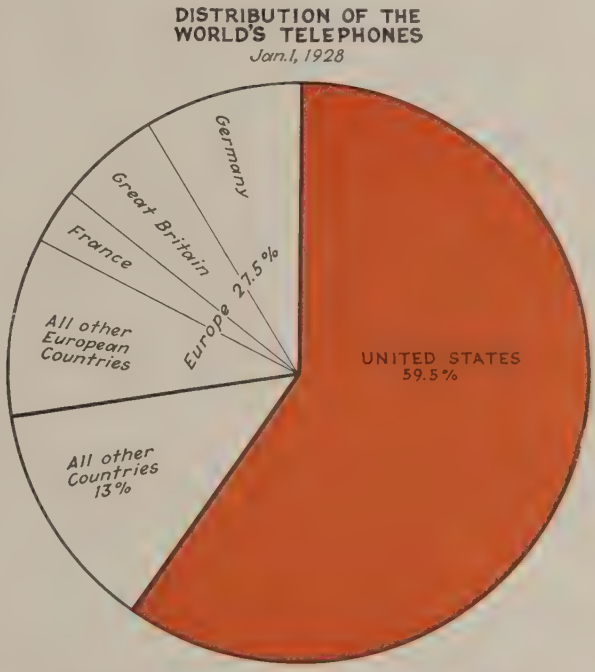
The introduction of this new toll-board method has resulted in improving the speed of service from an average of 6½ minutes in 1925 to an average of about 2½ minutes at present. The "speed of service" is defined as the interval from the time the call is received by the toll operator until the connection is established, or until a report of delay encountered in establishing the connection is given. This speed improvement has been made without unsatisfactory reactions on the efficient use of toll-line plant, which is an obviously important factor in the handling of the longer haul business.

### Reduction in Toll Rates

Coincident with the improvement and extension of long distance service, there has been a further reduction, effective Dec. 1, 1927, in the rates for talking to long distance points over the telephone lines of the Bell system. The last previous change in the rate schedule for interstate long distance service became effective Oct. 1, 1926, and represented an annual saving to the public of about $3,000,000. It is estimated that the schedule which went into effect on Dec. 1 will result in a further annual saving to telephone users of about $1,500,000. This additional reduction in rates is the result of further improved instrumentalities and methods developed by the American Telephone & Telegraph Company and the Bell Telephone Laboratories, Inc., which have effected economies applying especially to the longer circuits. An important factor in this reduction is the steady growth in the country's network of highly efficient and practically storm-proof long distance cables, a description of which appeared in last year's "Statistical Issue" of the Electrical World.

In 1927 the scope of the telephotograph service given for three years between New York, Chicago, San Francisco, and, for a shorter period, to Boston and Cleveland, was materially enlarged by the extension of the network on Jan. 10, 1927, to Atlanta and Los Angeles, and, about a month later, to St. Louis. The usefulness of the telephotograph service for the transmission of commercial documents, news pictures, police information, and for other purposes has been amply demonstrated, and important improvements of this service are under way.

Perhaps the most spectacular accomplishment in communication during the year was the development and demonstration, on April 7, 1927, of television over communication channels of the Bell system. In that demonstration, television was shown both by wire and by radio. The wire demonstration consisted of the transmission of images from Washington to New York, a distance of more than 250 miles, by wires. In the radio demonstration, images were transmitted from the experimental station of the Bell Telephone Laboratories, Inc., at Whippany, N. J., to New York City, a distance of 22 miles Images of speakers in Washington addressing remarks intended for an entire audience, and of singers and other entertainers at Whippany, were seen simultaneously with the reproduction of their voices by loud-speaking equipment. These demonstrations were not based upon any radically new discovery, but rather was it an achievement made possible by the general growth of science and by recent important technical developments, many of them previously used in the telephone service. Among these, for example, are the photoelectric cell, methods of synchronization over long circuits, the distortionless vacuum tube amplifier, and transmission networks of predetermined characteristics. While the question as to what place television will take in our communication system has not been answered, the engineers and executives who have been concerned with its development are confident that, in many ways and in due course of time, television will be found to add substantially to human comfort and happiness.



SIXTY PER CENT OF WORLD'S TELEPHONES IN UNITED STATES

Progress has continued in 1927 in the use of telephone circuits to connect radio-broadcasting stations for the

## *Bell System Statistics*

There are throughout the United States 9,162 telephone companies and in addition 29,595 rural telephone lines operated mainly on a co-operative basis, which have arrangements with the associated Bell companies for the interchange of toll traffic. These are shown in the table as Connecting Companies and Connecting Rural Lines, and their telephones as Bell-Connecting telephones. All other statistics are for the American Telephone & Telegraph Company and its 24 associated companies combined and do not include data for connecting companies or rural lines.

The Bell System includes more than 50,000,000 miles of wire.

| | Dec. 31, 1910 | Dec. 31, 1915 | Dec. 31, 1920 | Dec. 31, 1925 | Dec. 31, 1926 | Increase during 1926* |
|---|---|---|---|---|---|---|
| Number of telephones: | | | | | | |
| Bell companies | 3,933,056 | 5,968,110 | 8,333,979 | 12,035,224 | 12,816,252 | 781,028 |
| Bell connecting companies and lines | 1,949,663 | 3,204,385 | 4,267,956 | 4,685,000 | 4,758,000 | 73,000 |
| Total telephones | 5,882,719 | 9,172,495 | 12,601,935 | 16,720,224 | 17,574,252 | 854,028 |
| Number of Central Offices | 4,933 | 5,300 | 5,702 | 6,017 | 5,998 | *19* |
| Number of connecting companies | 7,396 | 8,735 | 9,231 | 9,227 | 9,162 | *65* |
| Number of connecting rural lines | 10,449 | 19,579 | 26,032 | 28,861 | 29,595 | 734 |
| Miles of pole lines | 282,877 | 330,602 | 358,091 | 386,064 | 385,882 | *182* |
| Miles of exchange wire: | | | | | | |
| Wire in underground cable | 5,630,851 | 9,947,359 | 14,384,135 | 28,425,392 | 31,845,228 | 3,419,836 |
| Wire in aerial cable | 2,800,000 | 4,503,124 | 5,586,531 | 9,462,213 | 10,785,029 | 1,322,816 |
| Open wire | 1,247,367 | 1,601,579 | 1,633,802 | 1,953,235 | 1,933,977 | *19,258* |
| Total exchange wire | 9,678,218 | 16,052,062 | 21,604,468 | 39,840,840 | 44,564,234 | 4,723,394 |
| Miles of toll wire: | | | | | | |
| Wire in underground cable | 386,088 | 625,792 | 1,363,398 | 2,057,196 | 2,323,368 | 266,172 |
| Wire in aerial cable | 70,000 | 98,804 | 299,385 | 1,209,332 | 1,543,358 | 334,026 |
| Open wire | 1,507,906 | 1,728,887 | 2,110,153 | 2,366,172 | 2,430,190 | 64,018 |
| Total toll wire | 1,963,994 | 2,453,483 | 3,772,936 | 5,632,700 | 6,296,916 | 664,216 |
| Total miles of wire | 11,642,212 | 18,505,545 | 25,377,404 | 45,473,540 | 50,861,150 | 5,387,610 |
| Average daily telephone conversations:† | | | | | | |
| Exchange conversations | 21,681,471 | 25,183,799 | 31,835,353 | 46,702,307 | 49,979,855 | 3,277,548 |
| Toll conversations | 602,539 | 819,030 | 1,327,247 | 2,098,163 | 2,374,979 | 276,816 |
| Total conversations | 22,284,010 | 26,002,829 | 33,162,600 | 48,800,470 | 52,354,834 | 3,554,364 |
| Number of employees‡ | 120,311 | 156,294 | 231,316 | 293,095 | 300,628 | 7,533 |

* Decrease shown in italics.
† For year ending Dec. 31.
‡ The employees of the Western Electric Company, Inc., numbering approximately 45,000 on Dec. 31, 1926, are not included.

simultaneous broadcasting of programs through the medium of widely separated stations. An example of this was the broadcasting of the speeches at the Radio Industries Banquet in New York through 75 broadcasting stations scattered throughout the United States and connected by the long distance telephone lines of the Bell system. Such extensive broadcasting could not have been done with present methods without the use of telephone wire facilities.

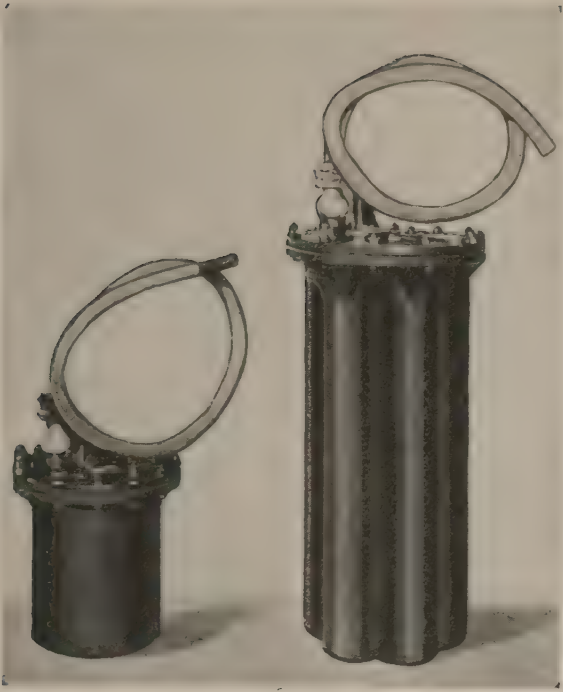
An interesting event of the year was the participation by the Bell system in the Volta Exposition at Como, Italy, held in honor of the centenary of the death of Allesandro Volta, the Italian whose electric pile was the forerunner of modern batteries. In two rooms in the exhibition building were displayed a number of photographs, charts and maps which told the story of the telephone in the United States. In addition, there were models of historical types of telephones and switchboards. A number of papers were presented by American engineers.

Research and development devoted both to physical things and to methods of operation have been perhaps the most important basic factor in the phenomenal growth of the telephone industry in the United States. Many of the results of this work are apparent to the telephone-using public and not infrequently they are spectacular. A very large part of the work is, however, directed to things of which the telephone user is generally quite unaware, the results of such work, though important, appearing only as part of the general improvements in telephone operation.

The development of loading coils, one of the plant items to which important additional contributions have been made in 1927, is an interesting example of the development and research work on all phases of the telephone plant continually carried on by the Bell system.

The commercial application of loading to telephone circuits by means of inductance coils inserted at periodic intervals goes back about 25 years. The principle of "coil loading" was discovered by Professor Pupin of

USE OF PERMALLOY HAS PERMITTED REDUCTION IN SIZE OF LOADING COILS



SMALLER LOADING-COIL CASES PERMITTED BY PERMALLOY

Columbia University and patents were issued to him in 1900. The number of loading coils in the plant of the Bell system on Jan. 1, 1926, was about 1,250,000. By the end of 1927 it is expected this number will be doubled. In order to duplicate, by the use of heavier copper wires, the transmission now obtained by the use of loading in the plant, it would have been necessary to increase the cost of the plant by a vast sum, estimated at $300,000,000. Two-thirds of the saving is in the exchange or local plant as distinguished from the toll or long distance plant.

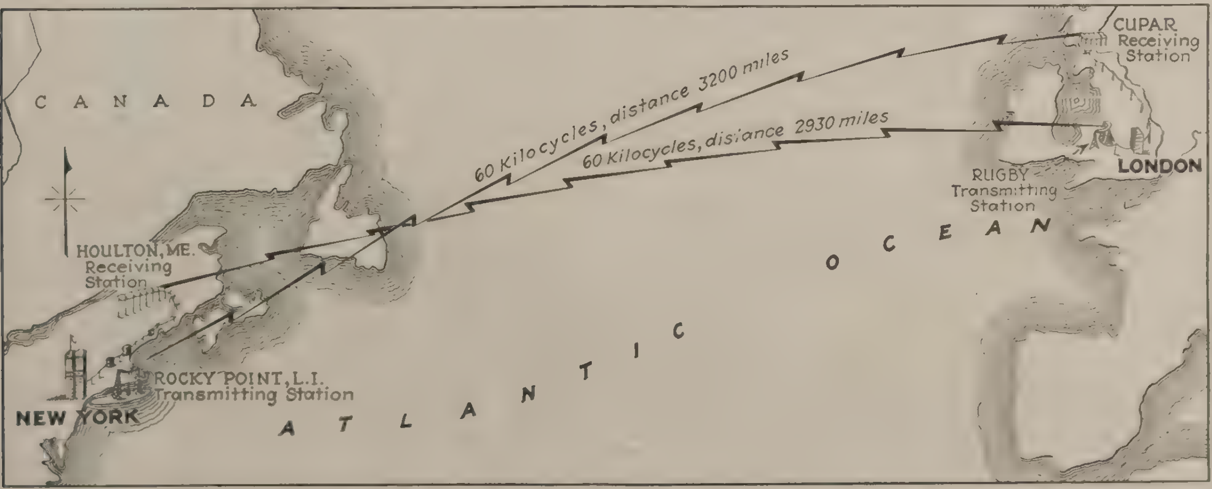
The term "loading" comes from the mechanical analogy of a "loaded" string, the study of which by a French mathematician was made good use of in developing the theory of loading. If one attaches a light cord, say fifteen feet long, to a rigid support at one end, then shakes the free end, waves much like waves on water are set up. These waves die out rapidly along the cord. Now if small weights, small pieces of wire solder, for example, are placed about six inches apart along the cord and it is again shaken at the free end, waves are set up, but their rate of dying out or attenuation is quite different. The cord is analogous to a telephone line, and the weights to loading coils. The effect of loading is to reduce the attenuation of the mechanical waves in one case and the electrical waves in the other. It makes the line a better path for electrical waves.

Loading telephone circuits has another effect, in addition to reducing attenuation. To reproduce speech requires the transmission of a wide "band" of frequencies. Maintaining the integrity of the complex wave shape of speech means transmitting this range of frequencies with substantially equal attenuation. Loading is used in cables to improve the line in this respect and reduce distortion.

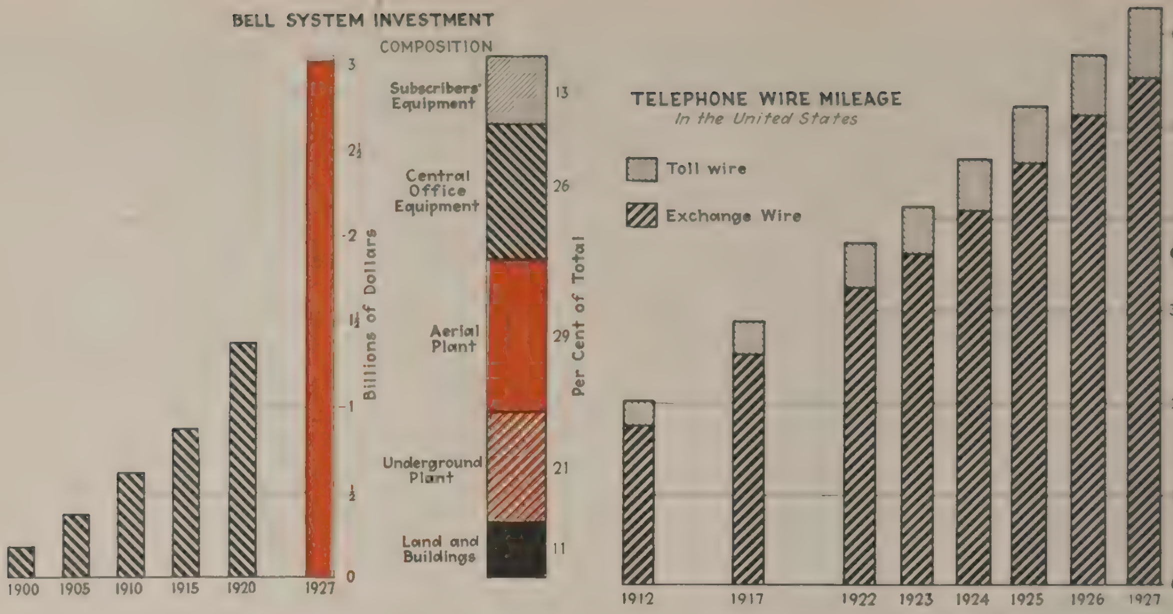
The practical value of loading will be realized from the statement that a loaded circuit in cable may be as good as an unloaded circuit having about eight times as much copper per mile of wire. The development of loading has followed a course much like that of many other inventions. First, there was the application of the principle by extensive design and development work, so that loading coils could be reliably and economically placed in the line. Next, there was the continuous improvement, over a period of nearly 25 years, to better the performance and reduce the cost. The development of the vacuum tube repeater and its application to long circuits brought about the need for extensive changes in loading. For open-wire lines it became evident that, with repeaters, loading coils could be dispensed with, while for cables, new types were required, having a degree of precision and stability not needed before the advent of repeaters.

Of comparable importance with the use of loading coils in the toll cable plant is their increasing application to the local exchange plant. The loading of local trunks has not only resulted in improved service, but has effected large economies by permitting a further extension of the use of small gage cable.

One important phase of the development has been the improvement and reduction in the cost of the core of the loading coil. In an early type of coil, about ten miles of wire no larger than a hair were required for the


CANADA
60 Kilocycles, distance 3200 miles
60 Kilocycles, distance 2930 miles
CUPAR Receiving Station
LONDON
RUGBY Transmitting Station
HOULTON, ME. Receiving Station
ROCKY POINT, L.I. Transmitting Station
NEW YORK
ATLANTIC OCEAN

COMMERCIAL TRANSATLANTIC TELEPHONY WAS AN ACHIEVEMENT OF 1927

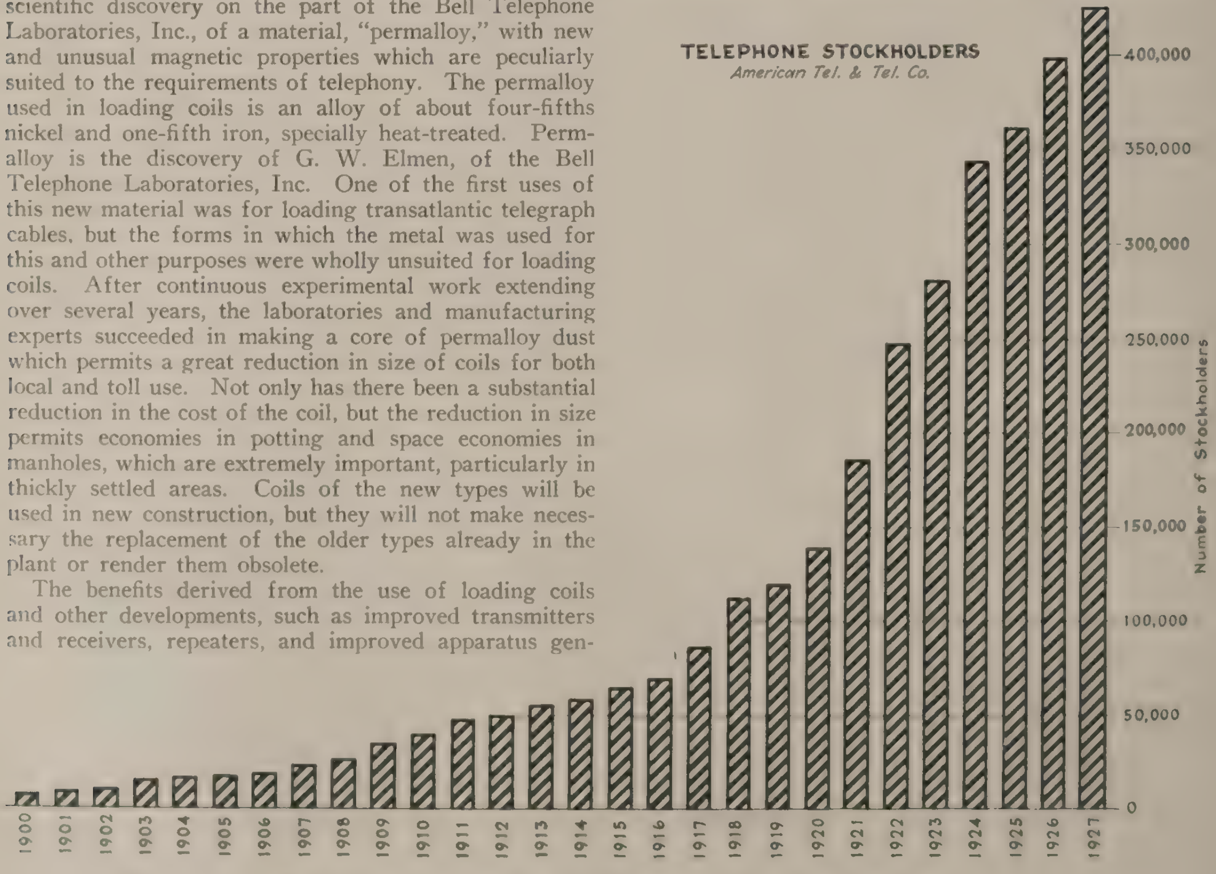


FIFTY PER CENT OF TELEPHONE PLANT INVESTMENT IS IN TRANSMISSION EQUIPMENT INVOLVING 63,000,000 MILES OF EXCHANGE AND TOLL WIRE

core. A later type of core was developed, composed of compressed iron dust, which has many physical advantages over the old and is cheaper.

The latest step forward in the design and construction of loading coils is the direct result of a fundamental scientific discovery on the part of the Bell Telephone Laboratories, Inc., of a material, "permalloy," with new and unusual magnetic properties which are peculiarly suited to the requirements of telephony. The permalloy used in loading coils is an alloy of about four-fifths nickel and one-fifth iron, specially heat-treated. Permalloy is the discovery of G. W. Elmen, of the Bell Telephone Laboratories, Inc. One of the first uses of this new material was for loading transatlantic telegraph cables, but the forms in which the metal was used for this and other purposes were wholly unsuited for loading coils. After continuous experimental work extending over several years, the laboratories and manufacturing experts succeeded in making a core of permalloy dust which permits a great reduction in size of coils for both local and toll use. Not only has there been a substantial reduction in the cost of the coil, but the reduction in size permits economies in potting and space economies in manholes, which are extremely important, particularly in thickly settled areas. Coils of the new types will be used in new construction, but they will not make necessary the replacement of the older types already in the plant or render them obsolete.

The benefits derived from the use of loading coils and other developments, such as improved transmitters and receivers, repeaters, and improved apparatus generally, together with improved cable, are not only permitting the utilization of smaller gage wires than has hitherto been possible, but the economical field for aërial and underground toll cables has been extended into the region which not many years ago it was possible to



MORE THAN 400,000 STOCKHOLDERS ARE INTERESTED IN TELEPHONE BUSINESS

*Telephones in United States*

(Jan. 1, 1926, and Jan. 1, 1927)

| State | No. of Telephones Jan. 1, 1926 | No. of Telephones Jan. 1, 1927 | State | No. of Telephones Jan. 1, 1926 | No. of Telephones Jan. 1, 1927 |
|---|---|---|---|---|---|
| Alabama | 109,512 | 115,451 | Nevada | 11,720 | 12,262 |
| Arizona | 29,728 | 31,727 | New Hampshire | 79,195 | 81,485 |
| Arkansas | 113,667 | 117,414 | New Jersey | 512,048 | 558,211 |
| California | 1,027,552 | 1,126,387 | New Mexico | 19,921 | 20,854 |
| Colorado | 170,575 | 176,906 | New York | 2,292,650 | 2,442,298 |
| Connecticut | 256,813 | 275,169 | North Carolina | 142,738 | 151,455 |
| Delaware | 26,406 | 27,617 | North Dakota | 83,276 | 84,291 |
| Dist. of Columbia | 127,977 | 137,327 | Ohio | 1,054,426 | 1,078,379 |
| Florida | 127,594 | 158,065 | Oklahoma | 256,719 | 270,053 |
| Georgia | 158,440 | 166,421 | Oregon | 169,613 | 178,597 |
| Idaho | 51,617 | 53,748 | Pennsylvania | 1,281,314 | 1,333,219 |
| Illinois | 1,522,959 | 1,603,271 | Rhode Island | 106,706 | 111,775 |
| Indiana | 535,426 | 536,671 | South Carolina | 60,708 | 62,911 |
| Iowa | 566,085 | 564,343 | South Dakota | 110,119 | 110,841 |
| Kansas | 380,509 | 387,772 | Tennessee | 203,289 | 215,813 |
| Kentucky | 223,444 | 220,105 | Texas | 557,889 | 590,106 |
| Louisiana | 118,969 | 130,485 | Utah | 59,423 | 61,060 |
| Maine | 127,030 | 128,622 | Vermont | 58,357 | 59,854 |
| Maryland | 180,826 | 191,752 | Virginia | 170,637 | 177,551 |
| Massachusetts | 808,194 | 843,170 | Washington | 271,453 | 286,135 |
| Michigan | 631,141 | 675,568 | West Virginia | 141,027 | 142,091 |
| Minnesota | 455,451 | 460,394 | Wisconsin | 482,353 | 499,890 |
| Mississippi | 71,543 | 76,502 | Wyoming | 27,471 | 27,410 |
| Missouri | 620,492 | 642,092 | | | |
| Montana | 56,221 | 56,870 | | | |
| Nebraska | 284,695 | 285,778 | United States | 16,935,918 | 17,746,168 |

serve only with some form of open-wire construction. This is of inestimable value from the standpoint of service.

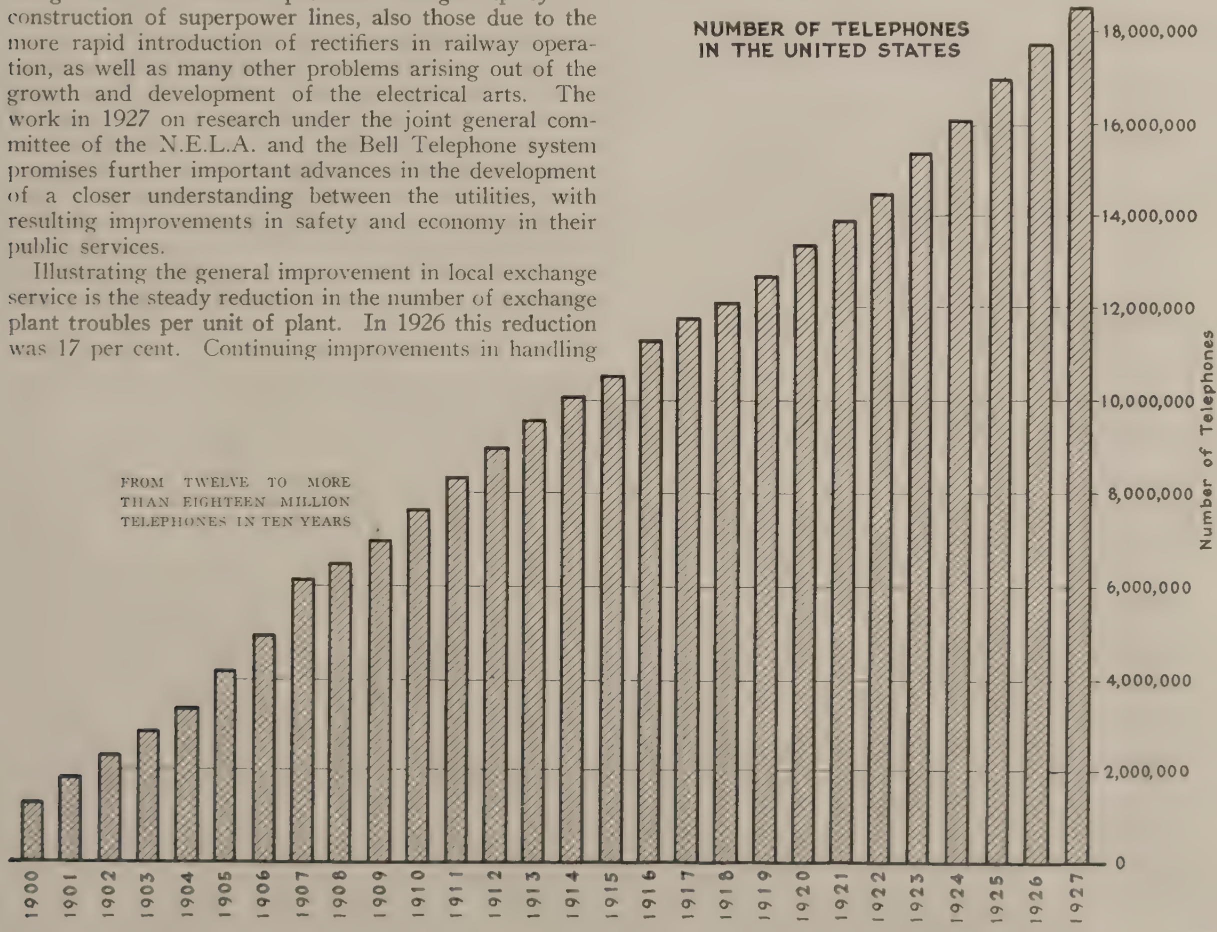
There has been continued progress in the co-operation between communication and electrical supply companies in working out problems common to both, which arise from the proximity of their wire systems. Studies are being made of the new problems brought up by the construction of superpower lines, also those due to the more rapid introduction of rectifiers in railway operation, as well as many other problems arising out of the growth and development of the electrical arts. The work in 1927 on research under the joint general committee of the N.E.L.A. and the Bell Telephone system promises further important advances in the development of a closer understanding between the utilities, with resulting improvements in safety and economy in their public services.

Illustrating the general improvement in local exchange service is the steady reduction in the number of exchange plant troubles per unit of plant. In 1926 this reduction was 17 per cent. Continuing improvements in handling interoffice calls have been made in the last year and the use of such methods as "straightforward trunking" have been extended. The introduction of the dial telephone system continued in 1927, with the result that the number of telephones in the Bell system operated with dial equipment increased during the year from about 2,000,000 stations to over 2,500,000 stations. Dial equipments are being installed where new switchboard equipment is needed and where consideration of the circumstances makes their use advisable.

### Distribution of Telephone Stock

In the last year there has been an increase in the number of those holding securities of the telephone companies. The most widely-held stock, of course, is that of the American Telephone & Telegraph Company. The accompanying charts show the increase in stockholders of this company and bring out the fact that the average holding per stockholder is small. Many of the stockholders of the American Telephone & Telegraph Company are employees and many more, of course, are customers.

It is particularly true of the telephone business that satisfactory service depends in no small measure upon satisfactory relations between the company and its customers. Efforts have been continued in the last year, not only further to improve the technical features of telephone service, but also to maintain a sympathetic understanding between the users of telephone service and those furnishing that service.



# *Statistics on the Operations of the Electric Light and Power Industry Based on Research Studies Made by "Electrical World" and Data Collected by the U. S. Geological Survey and U. S. Census Bureau*

| | 1912* | 1916 | 1917 | 1918 | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928† |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total energy generated (millions of kw.-hr.) | 11,569 | 21,230 | 25,438 | 29,200 | 34,900 | 39,519 | 36,971 | 43,560 | 51,133 | 54,413 | 61,159 | 69,158 | (a) 75,116 | 81,500 |
| Net import of energy (millions of kw.-hr.) | | 1,022 | 1,225 | 1,129 | 1,143 | 950 | 1,020 | 862 | 1,055 | 1,400 | 1,239 | 1,506 | (a) 1,650 | 1,708 |
| Total energy generated and imported (millions of kw.-hr.) | 11,569 | 22,252 | 26,663 | 30,329 | 36,043 | 40,469 | 37,991 | 44,422 | 52,188 | 55,813 | 62,398 | 70,664 | (a) 76,766 | 83,208 |
| Energy sold to lighting customers (millions of kw.-hr.) | 2,752 | 3,807 | 4,530 | 5,400 | 6,460 | 7,850 | 8,700 | 9,560 | 11,410 | 12,990 | 13,790 | 15,000 | (a) 16,300 | 17,808 |
| Energy sold to power customers (millions of kw.-hr.) | 3,254 | 9,990 | 12,560 | 14,400 | 17,890 | 19,960 | 17,400 | 20,620 | 24,810 | 25,810 | 30,130 | 35,154 | (a) 38,486 | 41,300 |
| Energy sold to electric railways (millions of kw.-hr.) | 3,017 | 4,100 | 4,400 | 4,500 | 4,650 | 4,820 | 4,600 | 5,642 | 6,000 | 6,200 | 6,301 | 6,810 | (a) 7,350 | 7,600 |
| Energy lost in transmission (millions of kw.-hr.) | 2,546 | 4,355 | 5,140 | 6,029 | 7,043 | 7,839 | 7,291 | 8,600 | 9,968 | 10,813 | 12,177 | 13,700 | (a) 14,630 | 16,500 |
| Total gross revenue (thousands of dollars) | 302,273 | 436,000 | 526,894 | 664,850 | 773,650 | 882,750 | 944,400 | 1,072,120 | 1,269,550 | 1,354,570 | 1,480,500 | 1,652,300 | (a) 1,783,700 | 1,910,000 |
| Revenue from lighting customers (thousands of dollars) | (e) 271,096 | | (e) 469,370 | | | | 570,500 | 657,120 | 795,000 | 902,670 | 979,500 | 1,018,200 | (a) 1,075,800 | 1,135,000 |
| Revenue from power customers (thousands of dollars) | | | | | | | 267,800 | 303,200 | 358,150 | 321,000 | 367,540 | 461,000 | (a) 517,900 | 580,000 |
| Revenue from electric railways (thousands of dollars) | | | | | | | 44,650 | 50,750 | 52,200 | 54,400 | 53,270 | 58,100 | (a) 60,600 | 60,000 |
| Revenue from other utilities (thousands of dollars) | 31,177 | | 57,524 | | | | 61,450 | 61,050 | 64,200 | 76,500 | 80,190 | 115,000 | (a) 129,400 | 135,000 |
| Total operating expenses (thousands of dollars) | 234,419 | | (g) 426,568 | | | (f) 440,000 | (f) 432,400 | (f) 481,570 | (f) 576,880 | (f) 617,980 | (f) 650,000 | (f) 723,000 | (f) 766,700 | 820,000 |
| Total sale of light and power securities (thousands of dollars) | | | | | | 369,374 | 538,917 | 719,961 | 922,722 | 1,236,438 | 1,279,823 | 1,387,522 | 2,129,000 | 2,100,000 |
| Sales of securities by investment houses (thousands of dollars) | | | | | | 326,374 | 458,917 | 589,961 | 747,722 | 982,421 | 982,223 | 1,150,965 | 1,889,000 | 1,850,000 |
| Sales direct to customers (thousands of dollars) | | | | | | 43,000 | 80,000 | 130,000 | 175,000 | 254,017 | 297,600 | 236,557 | 240,000 | 250,000 |
| Aggregate capitalization thousands of dollars (Dec. 31) | 2,289,622 | | 3,245,185 | 3,600,000 | 4,100,000 | 4,400,000 | 4,600,000 | 4,817,000 | 5,800,000 | 6,600,000 | 7,500,000 | 8,400,000 | 9,500,000 | 10,500,000 |
| Value of plant and equipment thousands of dollars (Dec. 31) | 2,175,678 | | 3,060,392 | | 3,711,924 | 4,212,588 | 4,301,752 | 4,465,016 | 5,080,000 | 5,762,000 | 6,483,000 | 7,325,000 | 8,084,000 | 8,985,000 |
| **Expenditures for additions and extensions (thousands of dollars)** | | | | | | | 222,408 | 324,016 | 602,143 | 692,440 | 721,300 | 841,344 | 760,353 | 900,363 |
| Total number of electric light and power establishments | 5,221 | | 6,542 | | | | | 6,355 | | | 5,235 | 4,827 | 4,409 | 4,100 |
| Total number of commercial establishments (Dec. 31) | 3,659 | | 4,224 | | | | | 3,774 | | | 3,143 | 2,796 | 2,537 | 2,300 |
| Total number of municipal establishments (Dec. 31) | 2,581 | | 2,318 | | | | | 2,581 | | | 2,092 | 2,031 | 1,872 | 1,800 |
| Companies generating all or part of their energy (Dec. 31) | 4,714 | | 5,124 | | | | | 4,380 | | | | | | |
| Companies purchasing all their energy (Dec. 31) | 507 | | 1,418 | | | | | 1,966 | | (j) 1,886 | | | | |
| Number of operating systems, 100,000,000 kw.-hr. output | | | | 5 | 6 | 9 | 5 | 6 | 14 | 106 | 110 | 126 | 135 | 145 |
| Total number of generating plants (Dec. 31) | 5,221 | | 6,542 | | | | | 5,444 | | | | | 4,157 | |
| Total number of commercial plants (Dec. 31) | 3,659 | | 4,224 | | | | | 3,615 | | | | | | |
| Total number of municipal plants (Dec. 31) | 1,562 | | 2,318 | | | | | 1,820 | | | | | | |
| Total generator rating, kva. (Dec. 31) | 6,450,000 | 8,520,000 | 11,230,000 | 12,330,000 | 13,730,000 | 15,860,000 | 16,660,000 | 17,960,000 | 19,900,000 | 22,000,000 | 24,344,000 | 26,813,000 | 28,990,000 | 31,300,000 |
| Total prime mover rating, horsepower (Dec. 31) | 7,530,044 | | 12,936,755 | | | | | 20,296,235 | | | | 32,600,000 | 35,500,000 | 37,900,000 |
| Total steam engines and turbines rating, horsep'r (Dec. 31) | 4,949,778 | | 8,449,076 | | | | | 14,171,222 | | | | 22,240,000 | 24,000,000 | 25,600,000 |
| Total water wheels rating, horsepower (Dec. 31) | 2,469,231 | | 4,277,273 | | | | | 5,822,018 | | | | 9,960,000 | 11,100,000 | 11,900,000 |
| Total internal combustion engine rating, horsepower (Dec. 31) | 111,035 | | 210,406 | | | | | 302,995 | | | | 400,000 | 400,000 | 4,000 |
| Total number of customers (Dec. 31) | 3,837,518 | 6,513,000 | (g) 7,178,703 | 8,505,000 | 9,899,000 | 10,820,000 | 11,700,000 | (g) 12,709,868 | 14,617,158 | 16,768,509 | 18,472,146 | 20,178,531 | 21,694,100 | 22,950,000 |
| Total number of domestic lighting customers (Dec. 31) | 3,100,918 | 5,260,000 | 5,810,300 | 6,900,000 | 8,010,000 | 8,700,000 | 9,430,000 | 10,211,232 | 11,819,100 | 13,567,490 | 14,965,100 | 16,359,279 | 17,596,390 | 18,600,000 |
| Total number of commercial lighting customers (Dec. 31)) | 605,600 | 1,030,000 | 1,125,200 | 1,320,000 | 1,550,000 | 1,740,000 | 1,850,000 | 2,030,324 | 2,287,058 | 2,625,519 | 2,723,046 | 2,963,410 | 3,166,570 | 3,350,000 |
| **Total number of industrial power customers (Dec. 31)** | 131,000 | 223,000 | 243,203 | 285,000 | 339,000 | 380,000 | 420,000 | 468,312 | 511,000 | 575,500 | 784,000 | 855,842 | 931,140 | 1,000,000 |
| Number of people living in electric-lighted dwellings (Dec. 31) | 14,000,000 | 22,800,000 | 25,250,000 | 29,950,000 | 34,700,000 | 37,000,000 | 40,800,000 | 43,100,000 | 51,000,000 | 58,300,000 | 64,400,000 | 70,300,000 | 75,500,000 | 79,800,000 |
| Per cent of total population living in electric-lighted dwellings | 15.9 | 22.2 | 24.3 | 28.7 | 32.8 | 35.1 | 37.5 | 38.9 | 45.7 | 51.4 | 55.7 | 59.5 | 63.0 | 67.0 |
| Total number of employees (Dec. 31) | 79,335 | | 105,541 | | | | | 150,762 | | | | 227,000 | 230,000 | 235,000 |
| Average salary of all employees (dollars) | 771 | | 902 | | | | | 1,409 | | | | | | |
| Average salary of officers (dollars) | 1,760 | | 2,211 | | | | | 3,287 | | | | | | |
| Average salary of superintendents and managers (dollars) | 1,353 | | 1,662 | | | | | 2,415 | | | | | | |
| Average salary of clerks (dollars) | 731 | | 825 | | | | | 1,344 | | | | | | |
| Average pay of wage earners (dollars) | 692 | | 833 | | | | | 1,312 | | | | | | |
| Total consumption of coal (short tons) | | | 21,565,273 | | | | | 26,130,865 | 28,712,580 | 32,556,970 | 35,321,502 | 36,594,540 | (a) 37,442,120 | 38,300,000 |
| Total consumption of oil (barrels) | | | 6,158,219 | | | | | 11,855,969 | 13,915,128 | 16,096,675 | 9,742,238 | 8,970,356 | (a) 6,409,635 | 4,570,000 |
| Total consumption of gas (thousands of cubic feet) | | | 14,199,204 | | | | | 20,174,385 | 29,287,251 | 46,993,070 | 45,479,189 | 52,160,061 | (a) 65,465,314 | 79,000,000 |
| Length of transmission lines, circuit miles (Dec. 31) | | | | | | | | 86,290 | 94,880 | 102,270 | 112,800 | 124,900 | 134,400 | 140,900 |
| Developed water power, horsepower (U. S. Geological survey) March 1 (k) | | | | | | | 7,926,958 | | | 9,086,958 | 10,037,655 | 11,176,596 | 11,720,983 | 12,370,000 |

* Data for 1912 are from U. S. Census Bureau except estimated energy allocation; generator rating converted from kw. to kva. assuming 80 per cent power factor.

† 1928 figures are estimated based on past growth or known plans.

(a)—Estimated, based on ten months' operations.

(e)—Includes all income except from other utilities.

(f)—Does not include interest, taxes, depreciation or sinking fund

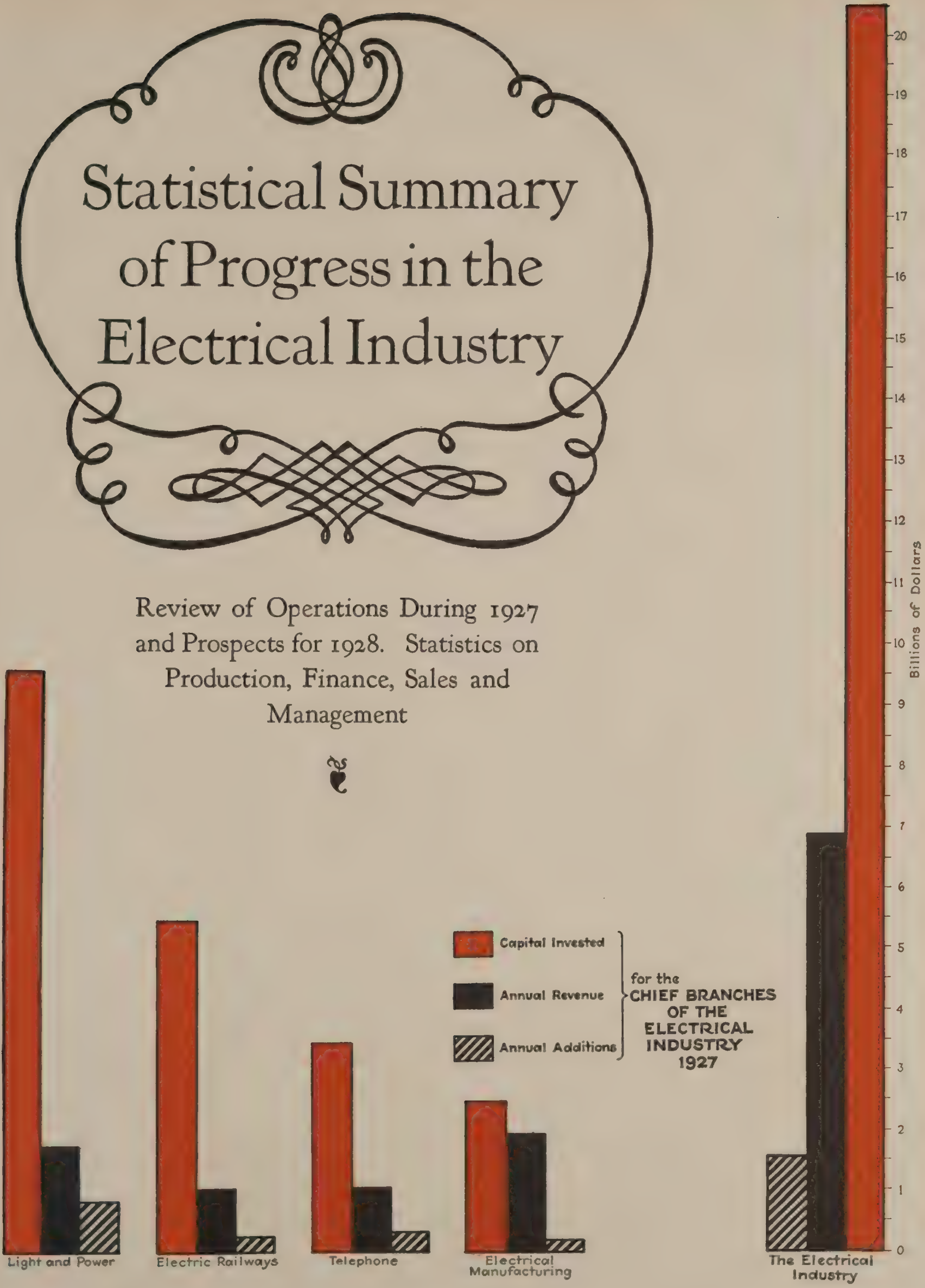
(g)—United States Census Bureau

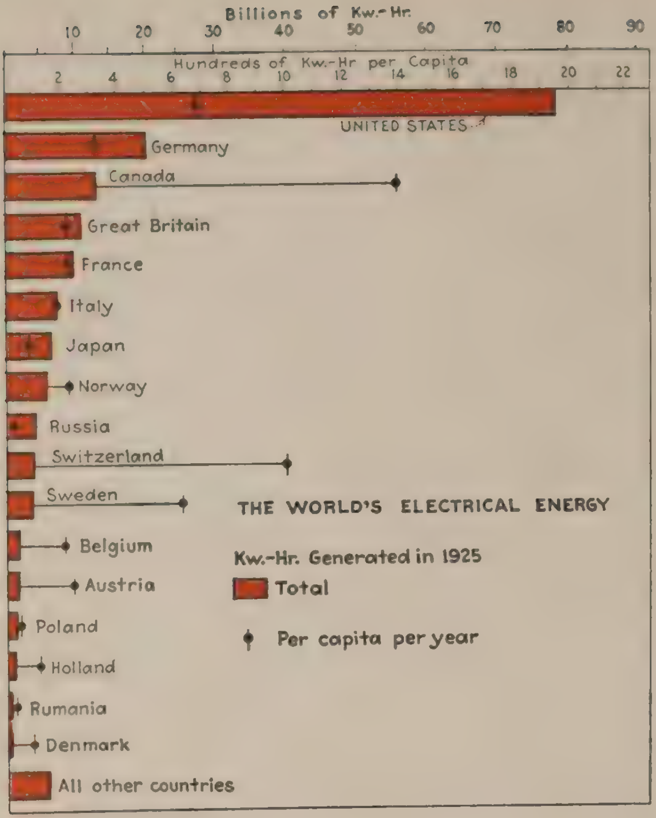
(j)—July 1. (k)—January 1, in 1927.

# Statistical Summary of Progress in the Electrical Industry

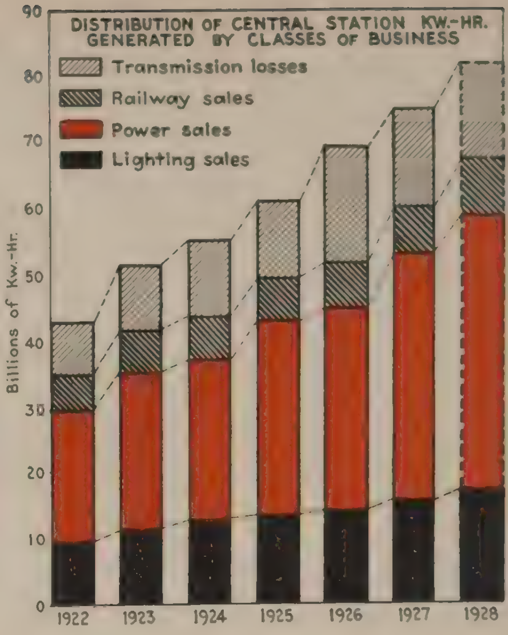
Review of Operations During 1927 and Prospects for 1928. Statistics on Production, Finance, Sales and Management

❦

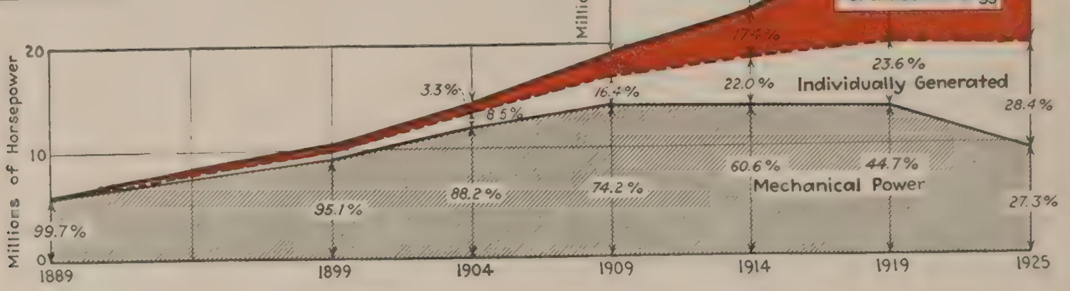




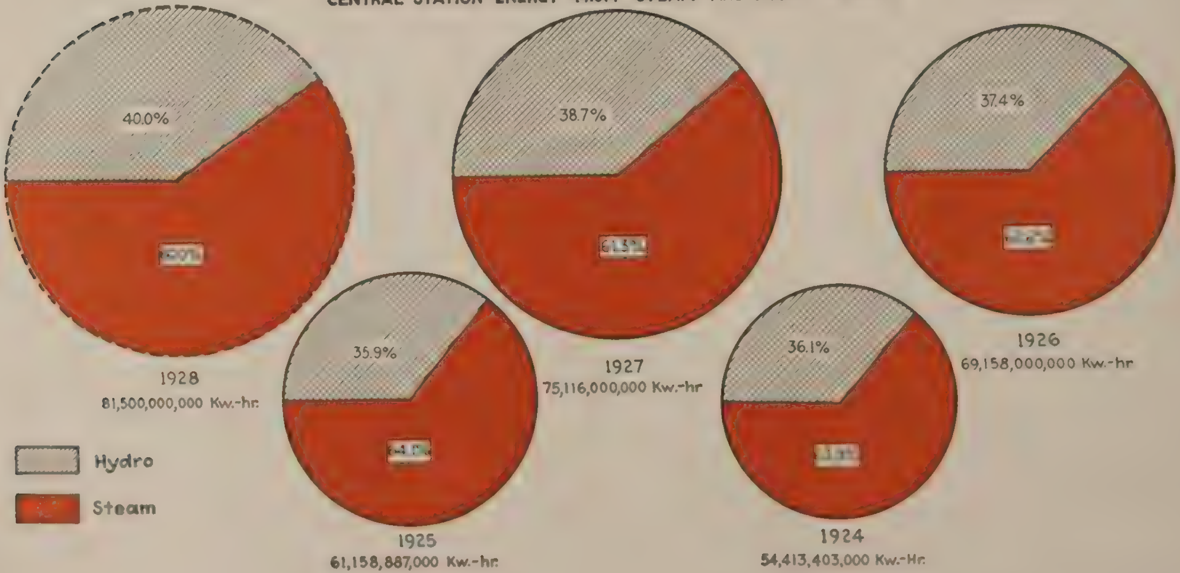
THE WORLD'S ELECTRICAL ENERGY

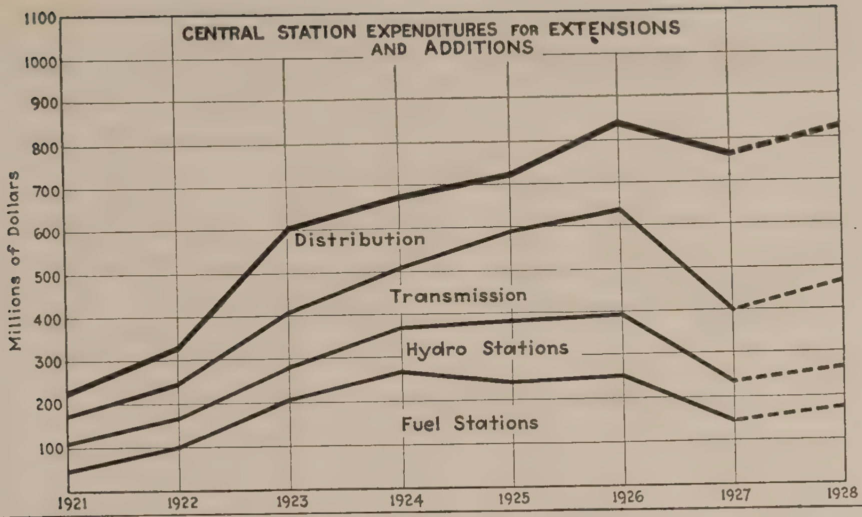


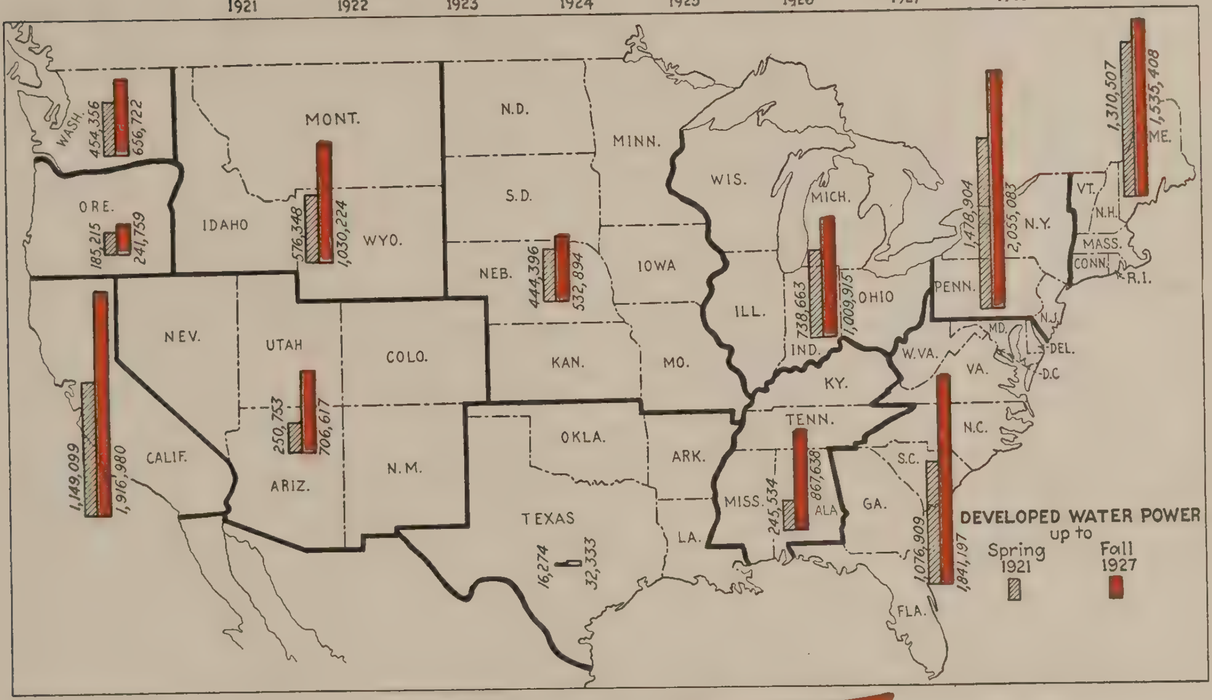
Power in American Industry

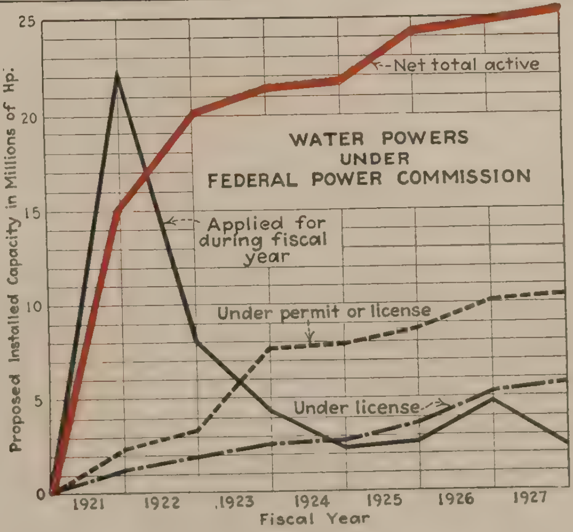


CENTRAL STATION ENERGY FROM STEAM AND HYDRO PLANTS





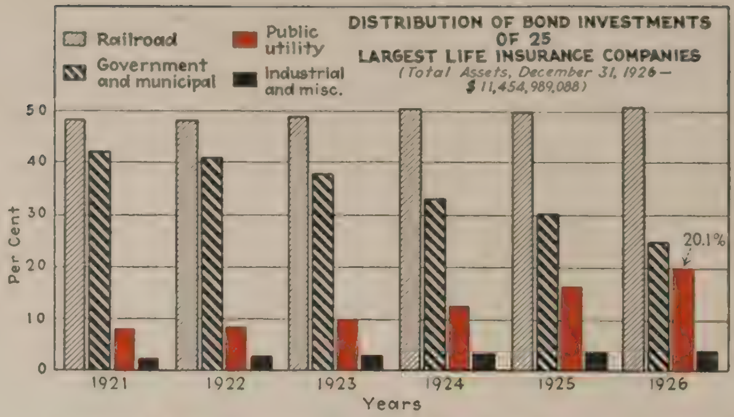


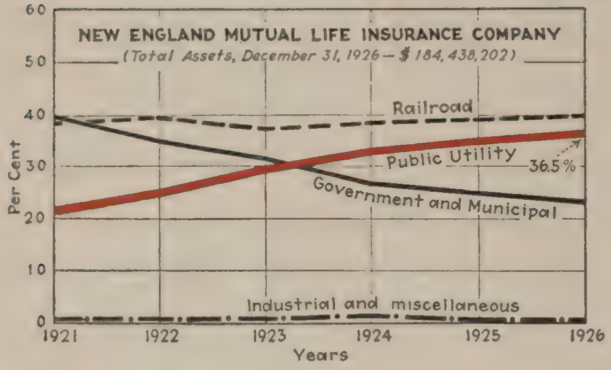


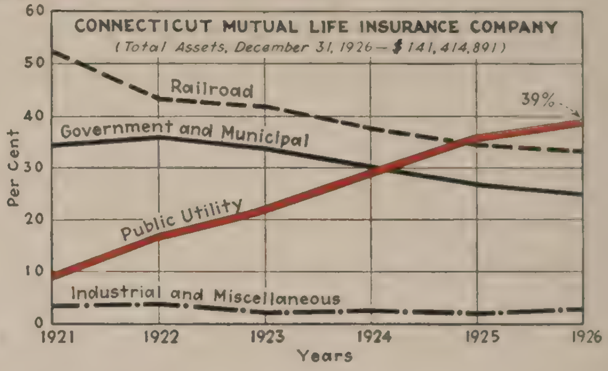
25,000,000 hp.
is being actively
developed under
Federal Power
Commission

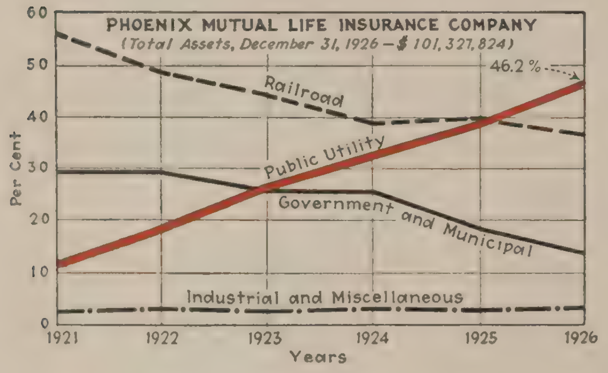
More than
7,000,000 hp.
is developed
east of Mississippi
in hydro plants

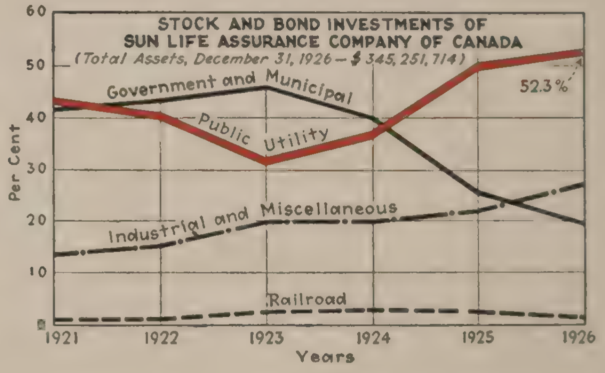
## Utility securities gaining increased acceptance as investments by insurance companies

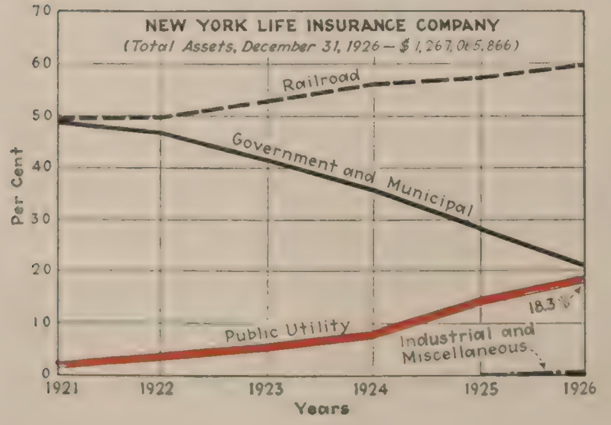


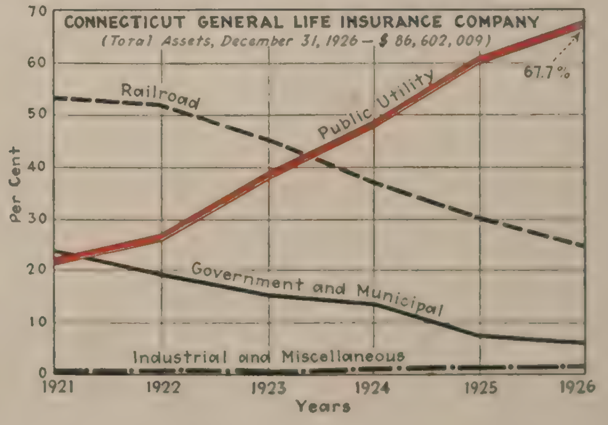


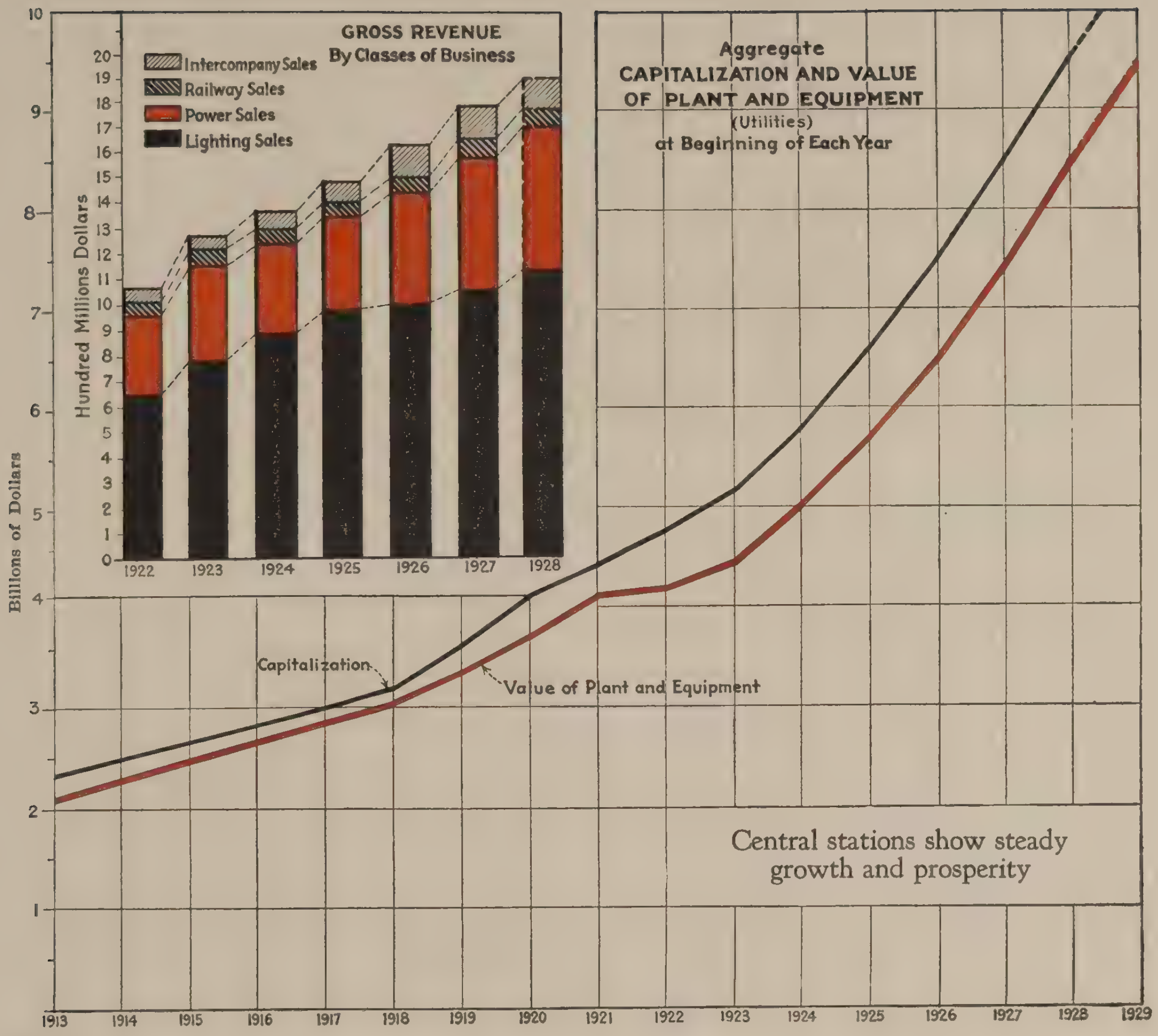




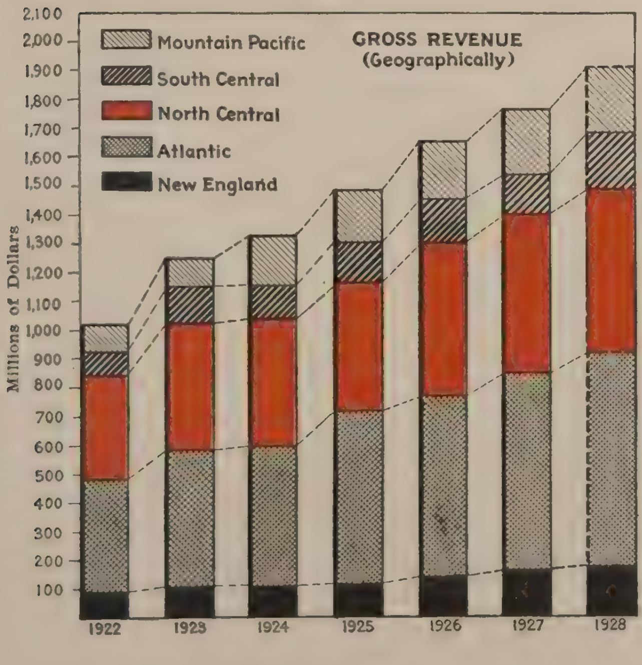


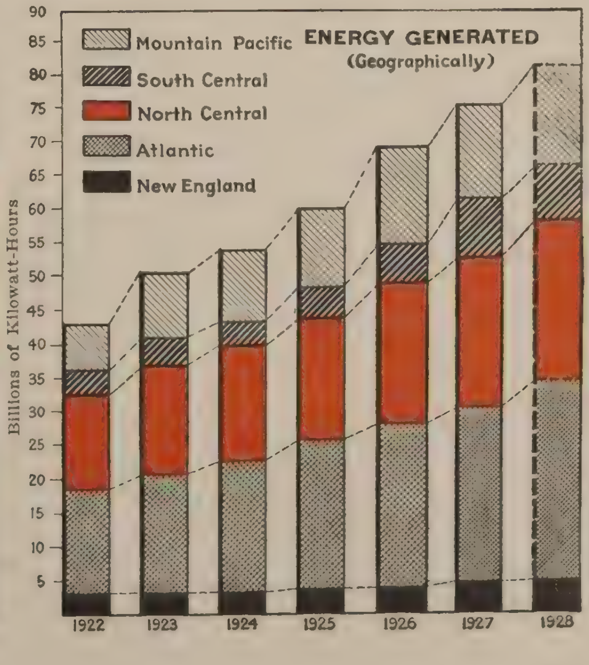


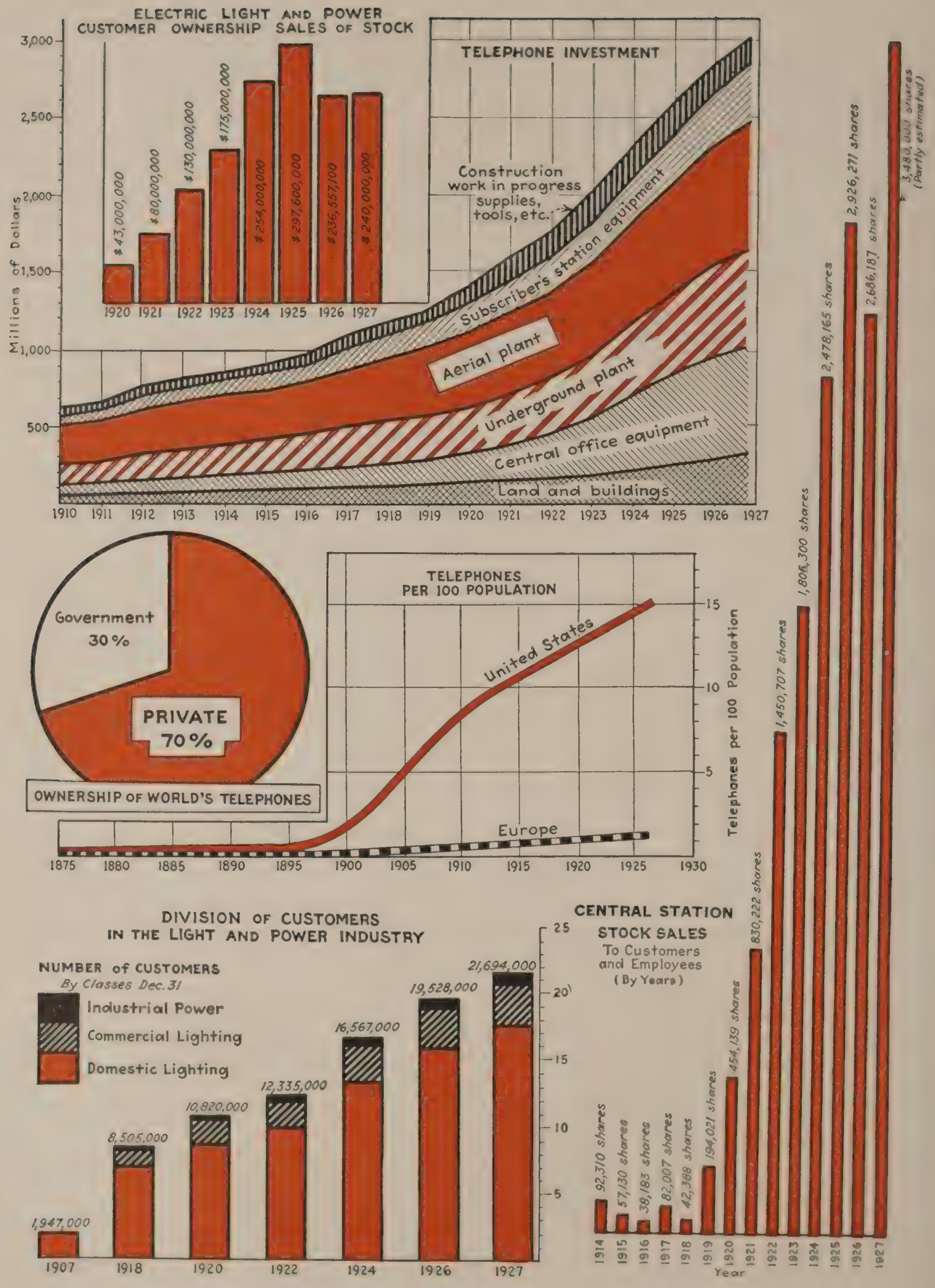


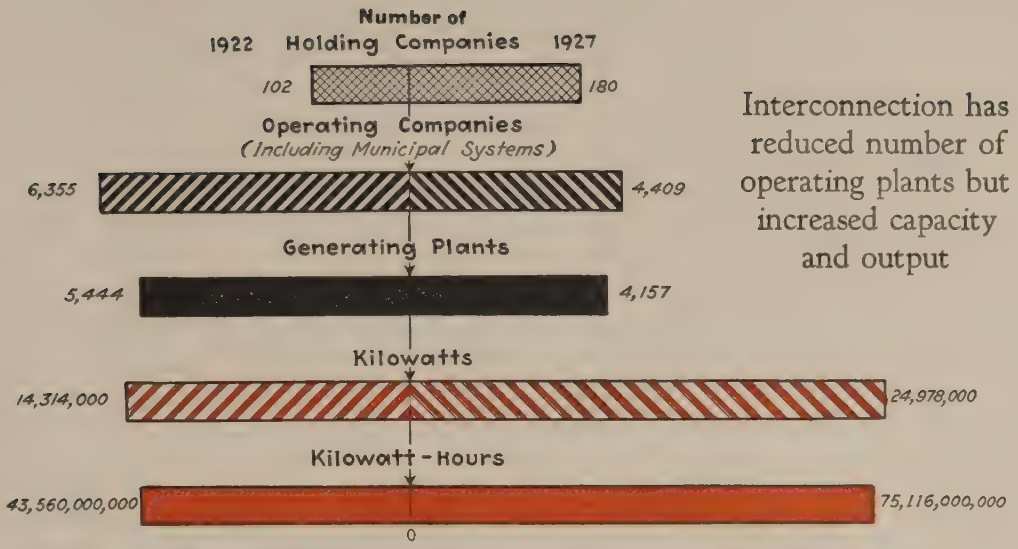


Central stations show steady growth and prosperity

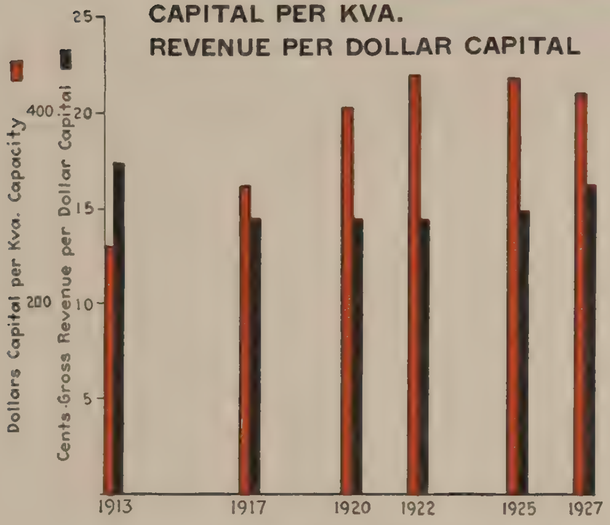


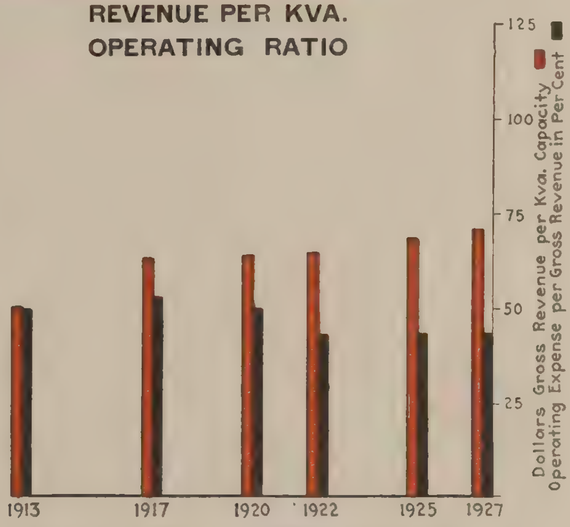


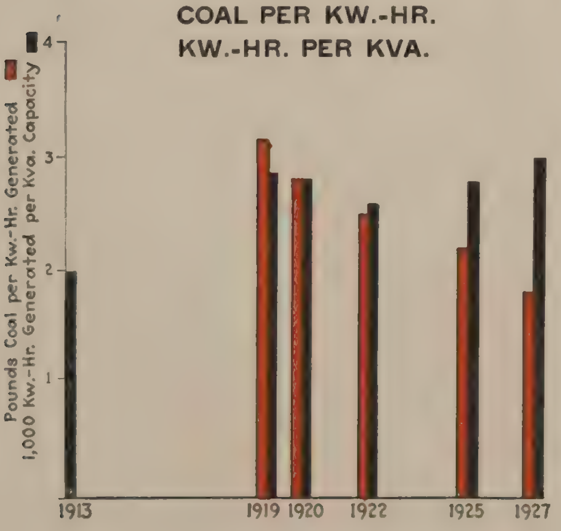

ELECTRIC LIGHT AND POWER CUSTOMER OWNERSHIP SALES OF STOCK
$43,000,000
$80,000,000
$130,000,000
$175,000,000
$254,000,000
$297,600,000
$236,557,100
$240,000,000
1920
1921
1922
1923
1924
1925
1926
1927
TELEPHONE INVESTMENT
Millions of Dollars
3,000
2,500
2,000
1,500
1,000
500
Construction work in progress supplies, tools, etc.
Subscriber's station equipment
Aerial plant
Underground plant
Central office equipment
Land and buildings
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
Government 30%
PRIVATE 70%
OWNERSHIP OF WORLD'S TELEPHONES
TELEPHONES PER 100 POPULATION
United States
Europe
Telephones per 100 Population
15
10
5
1875
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
DIVISION OF CUSTOMERS IN THE LIGHT AND POWER INDUSTRY
NUMBER of CUSTOMERS
By Classes Dec. 31
Industrial Power
Commercial Lighting
Domestic Lighting
1,947,000
8,505,000
10,820,000
12,335,000
16,567,000
19,528,000
21,694,000
25
20
15
10
5
1907
1918
1920
1922
1924
1926
1927
CENTRAL STATION STOCK SALES
To Customers and Employees
(By Years)
92,310 shares
57,130 shares
38,183 shares
82,007 shares
42,388 shares
194,021 shares
454,139 shares
830,222 shares
1,450,707 shares
1,806,300 shares
2,478,165 shares
2,926,271 shares
2,686,187 shares
3,480,000 shares (Partly estimated)
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
Year

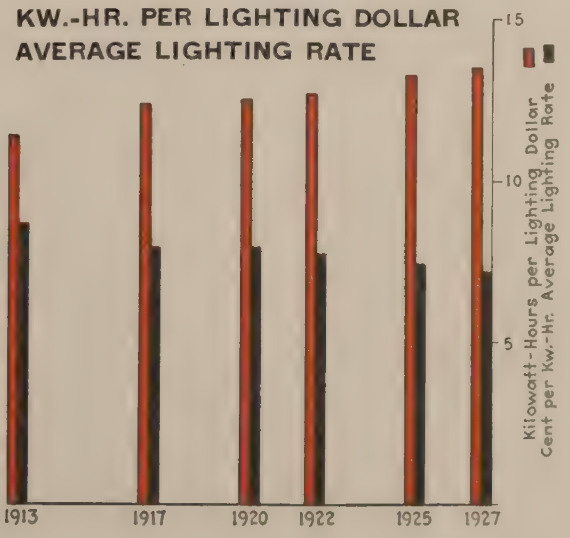


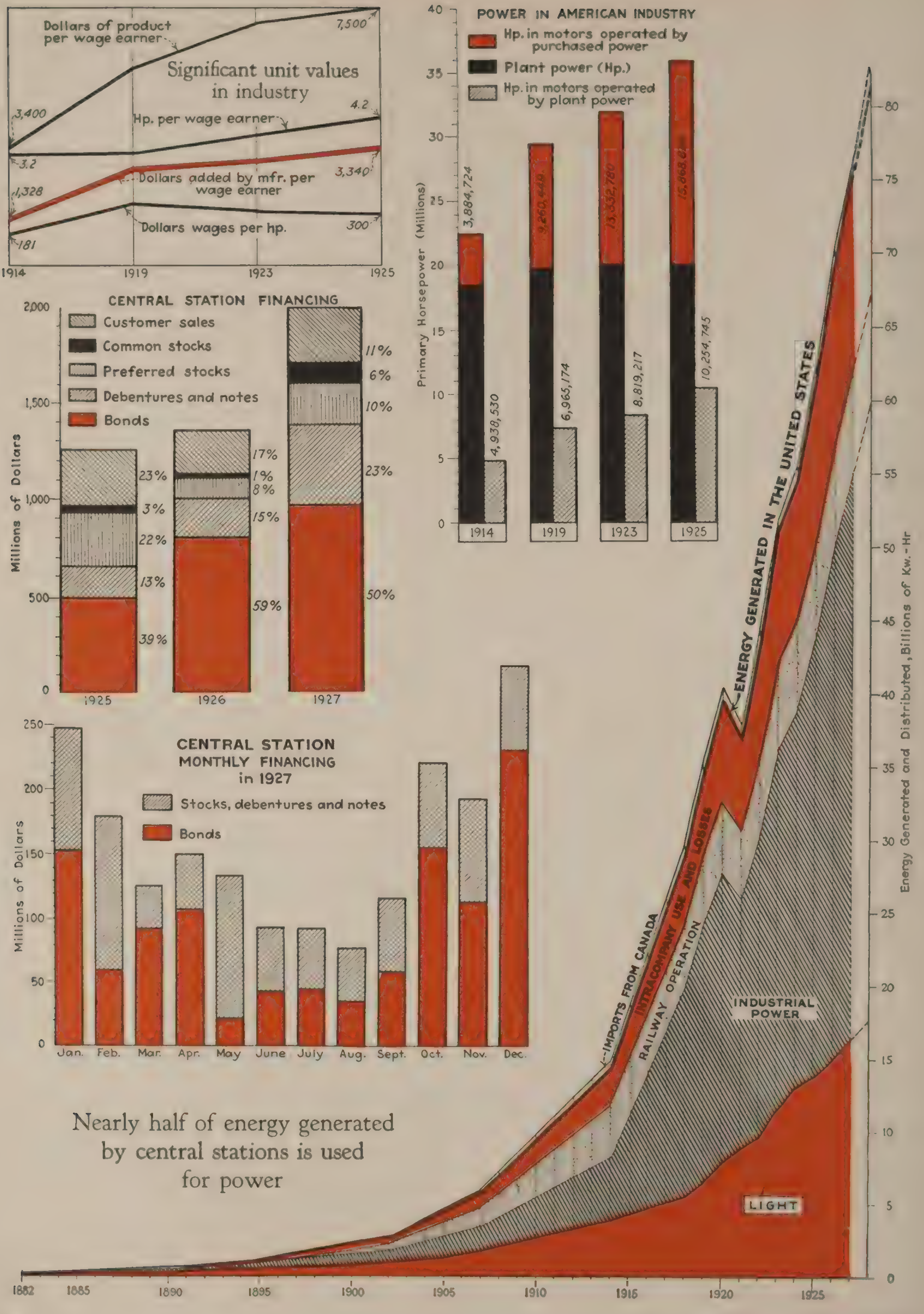
Interconnection has reduced number of operating plants but increased capacity and output


CAPITAL PER KVA.
REVENUE PER DOLLAR CAPITAL


REVENUE PER KVA.
OPERATING RATIO


COAL PER KW.-HR.
KW.-HR. PER KVA.


KW.-HR. PER LIGHTING DOLLAR
AVERAGE LIGHTING RATE



Nearly half of energy generated by central stations is used for power

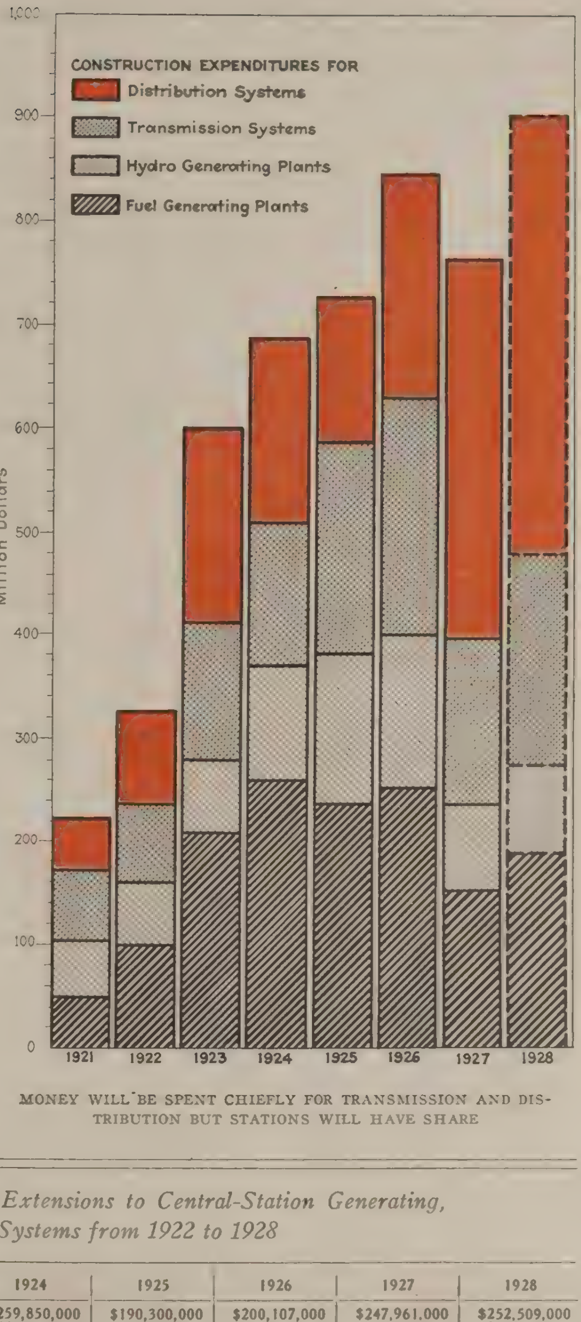
# Utility Budget for 1928 $900,363,000

Revival of building indicated. Expenditures in 1927 aggregate $760,353,000. Distribution expenditures predominate

TELEGRAMS to the ELECTRICAL WORLD from light and power companies indicate a budget of $900,363,000 for 1928. This is the largest expenditure for new facilities indicated in the history of the industry and shows that a decrease in spending for 1927 will be compensated for in 1928.

In every section of the country there are increases in budgets, but the Southern states and North Central states lead in increases. If load densities and age are considered, there is no doubt that the Southern states have embarked upon the largest program of expansion.

For several years the larger proportion of expenditures has been for distribution facilities. During 1927 the sum of $362,316,501 was spent on distribution, and in 1928 this sum aggregates $424,042,695. In 1927 the sum of $163,153,380 was spent for transmission, and in 1928 the budget is $203,396,121. In 1927 the sum



MONEY WILL BE SPENT CHIEFLY FOR TRANSMISSION AND DISTRIBUTION BUT STATIONS WILL HAVE SHARE

*Table I—Total Value of All Additions and Extensions to Central-Station Generating, Transmission and Distribution Systems from 1922 to 1928*

| Section | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 |
|---|---|---|---|---|---|---|---|
| Eastern States | $101,525,000 | $211,196,000 | $259,850,000 | $190,300,000 | $200,107,000 | $247,961,000 | $252,509,000 |
| Southern States | 49,805,000 | 82,105,000 | 104,460,000 | 130,500,000 | 190,500,000 | 191,190,000 | 244,340,000 |
| North Central States | 96,700,000 | 206,180,000 | 218,950,000 | 260,200,000 | 280,605,000 | 213,994,000 | 274,624,000 |
| Western States | 75,986,000 | 102,662,000 | 109,180,000 | 140,300,000 | 170,132,000 | 107,208,000 | 128,890,090 |
| Totals for U. S. | $324,016,000 | $602,143,000 | $692,440,000 | $721,300,000 | $841,344,000 | $760,353,000 | $900,363,000 |

*Table II—Value of Additions and Extensions to Light and Power Company Fuel and Hydro Generating Plants from 1924 to 1928*

| Section | Fuel-Electric Generating Plants | | | | | Hydro-Electric Generating Plants | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Value of Additions | | | | | Value of Additions | | | | |
| | 1924 | 1925 | 1926 | 1927 | 1928 | 1924 | 1925 | 1926 | 1927 | 1928 |
| Eastern States | $94,900,000 | $95,000,000 | $80,107,000 | $53,593,000 | $56,613,000 | $41,760,000 | $15,000,000 | $20,000,000 | $39,436,000 | $27,822,000 |
| Southern States | 34,200,000 | 20,000,000 | 30,000,000 | 35,128,000 | 48,170,000 | 22,600,000 | 50,000,000 | 60,000,000 | 21,913,000 | 29,209,000 |
| North Central States | 127,500,000 | 100,000,000 | 120,000,000 | 43,585,000 | 58,984,000 | 7,200,000 | 20,000,000 | 20,000,000 | 6,020,000 | 8,961,000 |
| Western States | 13,100,000 | 25,000,000 | 25,000,000 | 13,711,000 | 19,142,000 | 37,980,000 | 55,000,000 | 45,000,000 | 21,497,000 | 24,023,000 |
| Totals for U. S. | $269,700,000 | $240,000,000 | $255,107,000 | $146,017,000 | $182,909,000 | $109,540,000 | $140,000,000 | $145,000,000 | $88,866,000 | $90,015,000 |

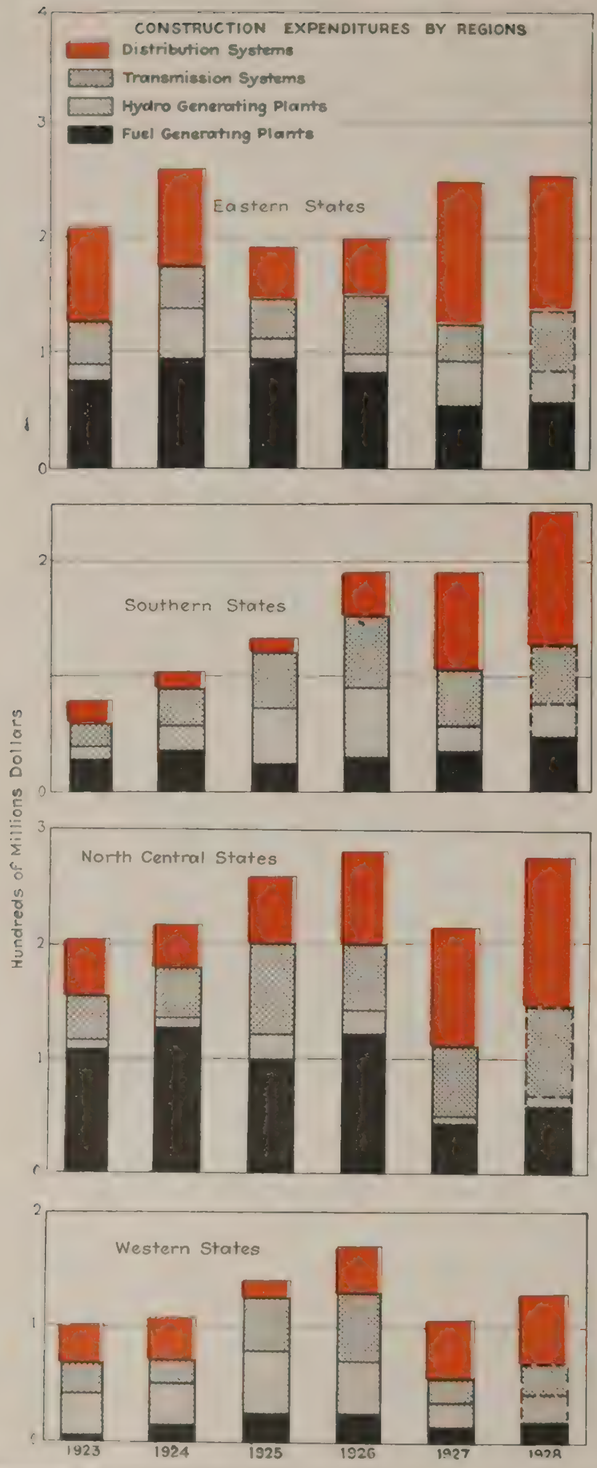


*Table III—Segregation of Central-Station Construction Expenditure for Generation and Transmission*

| Year | Total Central-Station Construction Budgets for Year | Total Expenditures for Electric Generating Plants | Total Expenditures for Transmission and Distribution Systems | Per Cent of Total Spent on Generating Plants | Per Cent of Total Spent on Transmission and Distribution Systems |
|---|---|---|---|---|---|
| 1921... | $222,408,000 | $102,674,000 | $119,734,000 | 46.2 | 53.8 |
| 1922... | 324,016,000 | 164,333,000 | 159,683,000 | 50.8 | 49.2 |
| 1923... | 602,143,000 | 283,813,000 | 318,330,000 | 47.1 | 52.9 |
| 1924... | 692,440,000 | 379,240,000 | 313,200,000 | 54.8 | 45.2 |
| 1925... | 721,300,000 | 380,000,000 | 341,300,000 | 52.7 | 47.3 |
| 1926... | 841,344,000 | 400,107,000 | 441,237,000 | 47.5 | 52.5 |
| 1927... | 760,353,000 | 234,883,000 | 525,470,000 | 30.8 | 69.2 |
| 1928*.. | 900,363,000 | 272,924,000 | 627,439,000 | 30.3 | 69.7 |

*Budget estimates.

of $234,883,000 was spent for generating stations, and the budget for 1928 is $272,924,000.

Expenditures in the utilitiy industry shift in well-recognized cycles. In 1926 expenditures for generating stations and transmission lines reached a peak, and it is logical to expect large expenditures for distribution in 1927 and 1928. When the stations and lines become loaded, another station building period is to be expected that will call for expenditures in excess of those of 1926. But these cycles of building are not extreme, because each year there is a large station building program. Demand for service grows continuously and must be met.

In 1927 a large utility budget was indicated, but many budgets were cut later in the year for divers reasons. Some unsettled political conditions, major efforts to reduce fixed charges, a desire to catch up with the facilities already built and changes in property ownership had an influence to reduce expenditures. But with telegrams from systems sent to the ELECTRICAL WORLD aggregating $800,000,000 for the 1928 budget and with these properties representing only 75 per cent of the generating capacity, it is clearly evident that the light and power industry expects to spend a large sum of money in 1928. Past experience indicates that stopping expenditures during one year merely postpones the day when expenditures commensurate with growth must be made. An example of this is found with one group of properties that spent $44,000,000 in 1927 but has a budget of $106,000,000 for 1928.

In New England the flood damage will result in about $6,000,000 increase in next year's expenditures. In the Middle Atlantic and East-North Central states about $400,000,000 will be spent, with distribution expenditures the largest item. Large expenditures are indicated for the Southern and Southwestern states and between the Mississippi River and the Rocky Mountains. In these regions generating stations will be built in large numbers to supply the needs of these rapidly growing regions.

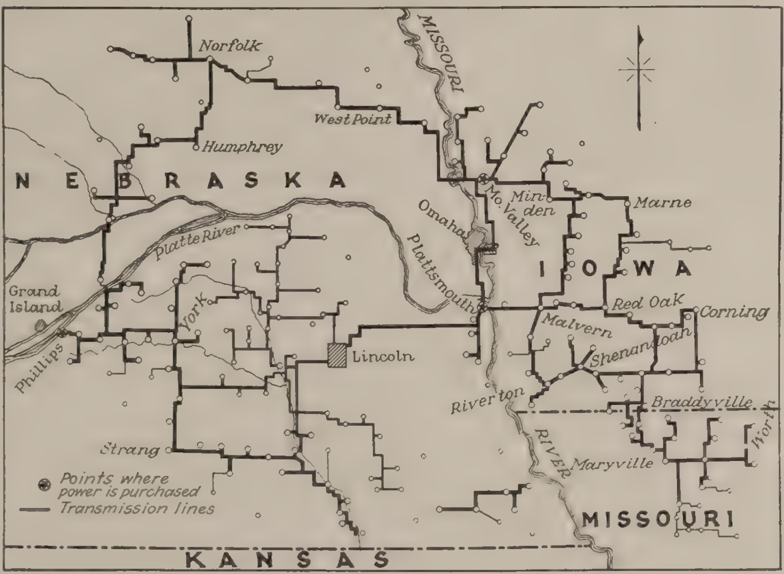
*Table IV—Value of Additions and Extensions to Transmission and Distribution Systems from 1924 to 1928*

| Section | Transmission Systems | | | | | Distribution Systems | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Value of Additions | | | | | Value of Additions | | | | |
| | 1924 | 1925 | 1926 | 1927 | 1928 | 1924 | 1925 | 1926 | 1927 | 1928 |
| Eastern States...... | $37,070,000 | $35,000,000 | $50,000,000 | $32,147,000 | $51,514,000 | $86,120,000 | $45,300,000 | $50,000,000 | $122,785,000 | $116,560,000 |
| Southern States..... | 33,400,000 | 45,200,000 | 60,456,000 | 47,830,000 | 50,298,000 | 14,260,000 | 15,300,000 | 40,044,000 | 86,320,000 | 116,664,000 |
| North Central States | 43,930,000 | 80,200,000 | 60,605,000 | 61,055,000 | 76,816,000 | 40,320,000 | 60,000,000 | 80,000,000 | 103,334,000 | 129,862,000 |
| Western States...... | 19,790,000 | 45,300,000 | 60,000,000 | 22,121,000 | 24,768,000 | 38,310,000 | 15,000,000 | 40,132,000 | 49,878,000 | 60,957,000 |
| Totals for U. S. | $134,190,000 | $205,700,000 | $231,061,000 | $163,153,000 | $203,396,000 | $179,010,000 | $135,600,000 | $210,176,000 | $362,317,000 | $424,043,000 |

# Interconnection Brings Mergers

Consolidation of light and power properties follows the extension
of transmission systems. Trend to group operation
and ownership continues. Record of mergers

THE business of grouping utility properties has developed so greatly that the economic and operating advantages can be measured in tangible savings. As a consequence, the light and power industry has been very active with mergers and the regrouping of properties during the last year. Low money rates, because of good utility credit, have helped to bring about consolidations that will return savings, and experience with past operations has brought about a technique of consolidation whereby less speculation has been involved in merger transactions and fewer speculative or amateur operators have attempted to develop holding organizations.



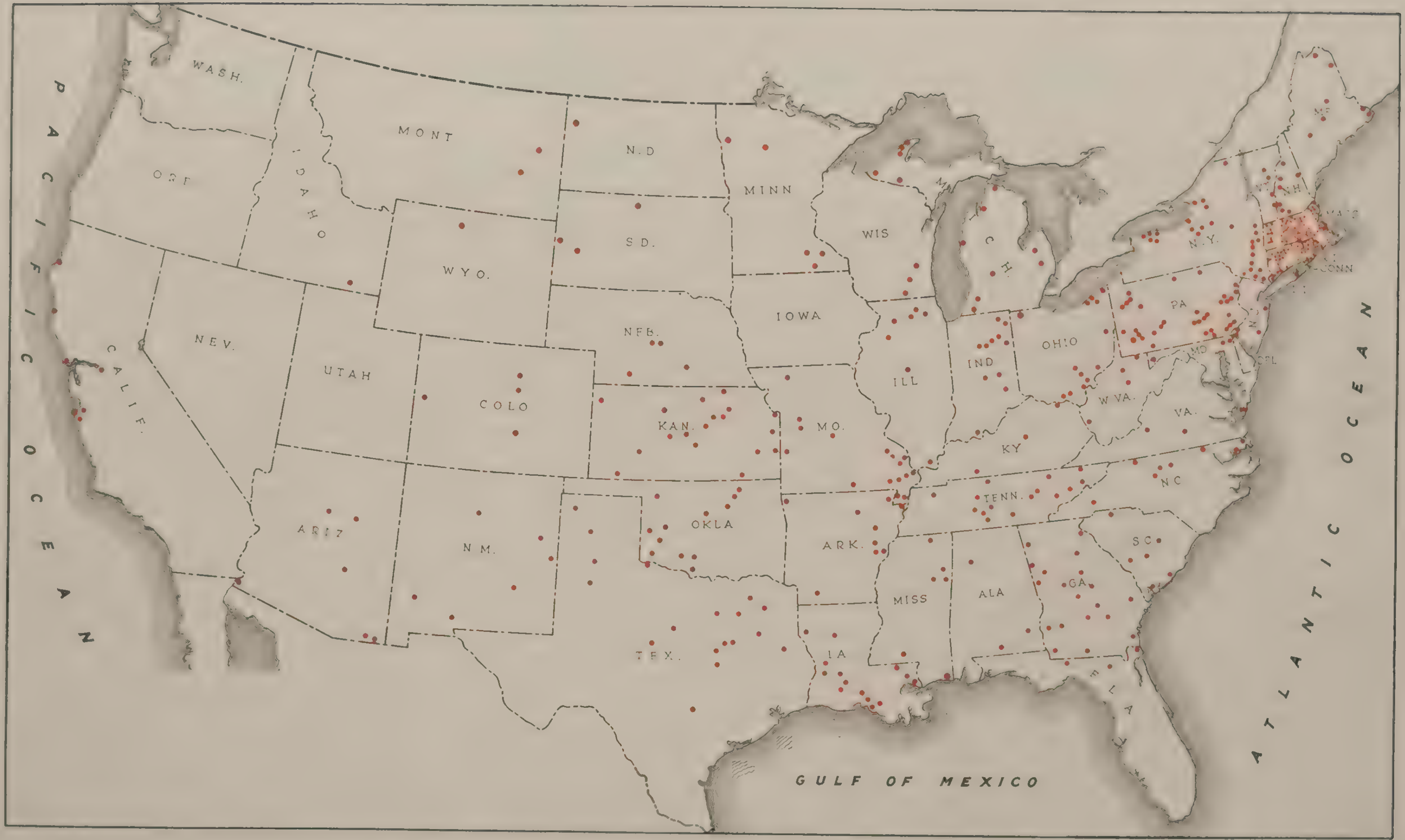
SMALL TOWNS OF IOWA AND NEBRASKA HAVE BENEFITED BY INTERCONNECTIONS

Mergers in the light and power industry are of three or four types. The extension of transmission systems makes it economical to take over small municipal and small private plants adjacent to the extended lines of large utilities. This type of merger has been very active in the South and in the West. Another type of merger is brought about by the purchase of several small properties in different parts of the country. Through consolidated financing and consolidated engineering and management, these properties are tuned up and put on a much more economical basis of operation. Often these properties are later merged into one of the large holding groups. This type of merger has been active in the Southwest and West. Another type of merger has been the formation of a joint control holding company consisting of many small properties, which do not give up their identity or control, but do give to a central organization certain authority for commitments. Massachusetts has developed this type of merger to the greatest extent. There is still another type of merger that has been a recent development and this involves the merging of holding companies themselves and the sale or trade of subsidiary properties, so that each holding company concerned develops a more logical and more profitable grouping of subsidiary properties. During the last year some very large mergers of this type have been made.

During 1927 a total of 828 utility changes occurred. These changes involved direct mergers, change in ownership or change in name and corporate structure. A total of 181 municipal plants were included and these plants were absorbed into large privately owned utilities. This left a total of 647 changes in the corporate name or structure of privately owned properties. States in which municipal plants were taken over to the greatest extent were Georgia, Nebraska, North Carolina and Oklahoma. States in which changes in corporate structures of private plants were carried out to the greatest extent were Massachusetts, New York, North Dakota, Texas, Illinois and Pennsylvania.

There has been great activity in the purchase of small private plants in New England, along the Atlantic seaboard and in the Middle West states. In Georgia, Nebraska, North Carolina and Oklahoma many small municipal plants have been taken over by large transmission systems. The Southeastern Power & Light Company, Middle West Utilities Company, Massachusetts Utilities Investment Trust, Mohawk Hudson Power Corporation and Otter Tail Power Company are holding companies that have been active in purchasing.

The Middle West Utilities Company, through subsidiaries, now serves 1,920 communities in eighteen states with a population estimated at 3,665,000, and, in addition, supplies wholesale energy to 380 other communities with an estimated population of 602,000. It has 204 steam stations and 133 hydro stations to supply energy to a transmission system of 14,454 miles. In Arkansas, Louisiana and Texas, the Southwestern Gas & Electric Company, a subsidiary, has acquired the Gulf States Utilities Company and the East Texas Public Service Company, the eastern Texas properties of the American Public Service Company. In addition, the Southwestern Gas & Electric Company has purchased plants and extended service to Center Point, Cove, DeQueen, Dierks, Foreman, Gillham, Hatfield, Horatio, Locksburg, Mineral Springs, Murfreesboro, Nashville and Winthrop in



## *Where Major Corporate Changes Occurred in Past 18 Months*

The approximate location of each town in which ownership has been changed, or where the utility has been merged with another, or where the holding company has been changed or merged with another is indicated. Towns of less than 2,500 population have not been included. For details the reader is referred to the accompanying tables and the Bonbright survey.

Arkansas. In Oklahoma, the Southwestern Light & Power Co., also a subsidiary, acquired the Elk City and Clinton properties of the Oklahoma Gas & Electric Company and purchased the municipal plants at Bessie, Blair, Fort Cobb, Hinton, Leedy and Martha. The Chickasha Gas & Electric Company has been transferred to this subsidiary.

In Illinois another subsidiary of the Middle West Utilities Company, the Central Illinois Public Service Company, purchased plants at Chesterfield, Hardin and Littleton and the municipal plant at Granville. Other subsidiaries that have been active in extending their systems are the Illinois Northern Utilities, the Interstate Public Service Company in Indiana, the Central Power Company in Nebraska, the Southern New Hampshire Hydro-Electric Company, the New England Public Service Company, the Kentucky Utilities Company, the West Texas Utilities Company, the Central Power & Light Company and the Wisconsin Power & Light Company. The Middle West Utilities Company acts as the financial agent for the subsidiaries and as a consultant in operation and management.

In Oklahoma, the Public Service Company of Oklahoma, a subsidiary of the Middle West Utilities Company, has been active. It has under construction a steam station at Weleetka, which will eventually be connected by a 66,000-volt transmission line with the West Tulsa plant of the Oklahoma Power Company. The Public Service Company sold Guthrie, Mulhall, Langston, Perkins, Coyle and Vinco to the Oklahoma Gas & Electric Company and purchased the Oklahoma Power Company of Okmulgee. These and other changes secured a better arrangement of properties for both the Public Service Company and the Byllesby properties in that state. Interconnections and energy in exchanges between the Public Service Company and the Oklahoma Gas & Electric Company have been arranged that will be advantageous to both properties.

### U.G.I. Expands Greatly

The United Gas Improvement Company greatly extended its utility holdings during the last year, chiefly through purchased control of Day & Zimmermann and the Philadelphia Electric Company. Early in the year, Day & Zimmermann acquired part of the A. E. Fitkin utility interests. The most important properties in the Fitkin group were under the holding of National Public Service Corporation and are the Jersey Central Power & Light Company, Virginia Public Service Company, Tide Water Power Company, Florida Power Corporation, Municipal Service Company, Eastern Shore Gas & Electric Company and numerous subsidiaries. The National Public Service served a population of 1,256,000 in 621 communities. Later the National Public Service was acquired by the Insull interests who thus control all of the Fitkin properties. The U. G. I. Company expanded its holdings in the West, where the Iowa Public Service Company, a subsidiary, acquired the Central Iowa Power & Light Company and the Iowa Light, Heat & Power Company.

In the Philadelphia area, the U. G. I. Company merged the Counties Gas & Electric Company, the Philadelphia Suburban Gas & Electric Company and sixteen smaller units into the Philadelphia Suburban Counties Gas & Electric Company, and recently acquired sufficient stock to control the Philadelphia Electric Company, one of the oldest and largest metropolitan utilities. In Nebraska, the U. G. I. has purchased properties at McCook and Gothenburg. These developments, together with properties already held, place the United Gas Improvement Company in the front rank of large holding organizations.

The Standard Gas & Electric Company sold the Sierra & San Francisco Power Company, the Western States Gas & Electric Company and the Coast Valleys Gas & Electric Company to the Pacific Gas & Electric Company, thus giving the last-named company properties in northern California that will help greatly in making a unified system for further power development. The Oklahoma Gas & Electric Company has co-operated with the Public Service Company of Oklahoma in the rearrangement of holdings in that state. It purchased the Gage and Shattuck plants from the Southwestern Light & Power Company, six plants from the Public Service Company and three municipal plants. This company has added greatly to its generating capacity and transmission system during the year.

MUNICIPAL AND PRIVATE PLANTS SOLD IN 1927

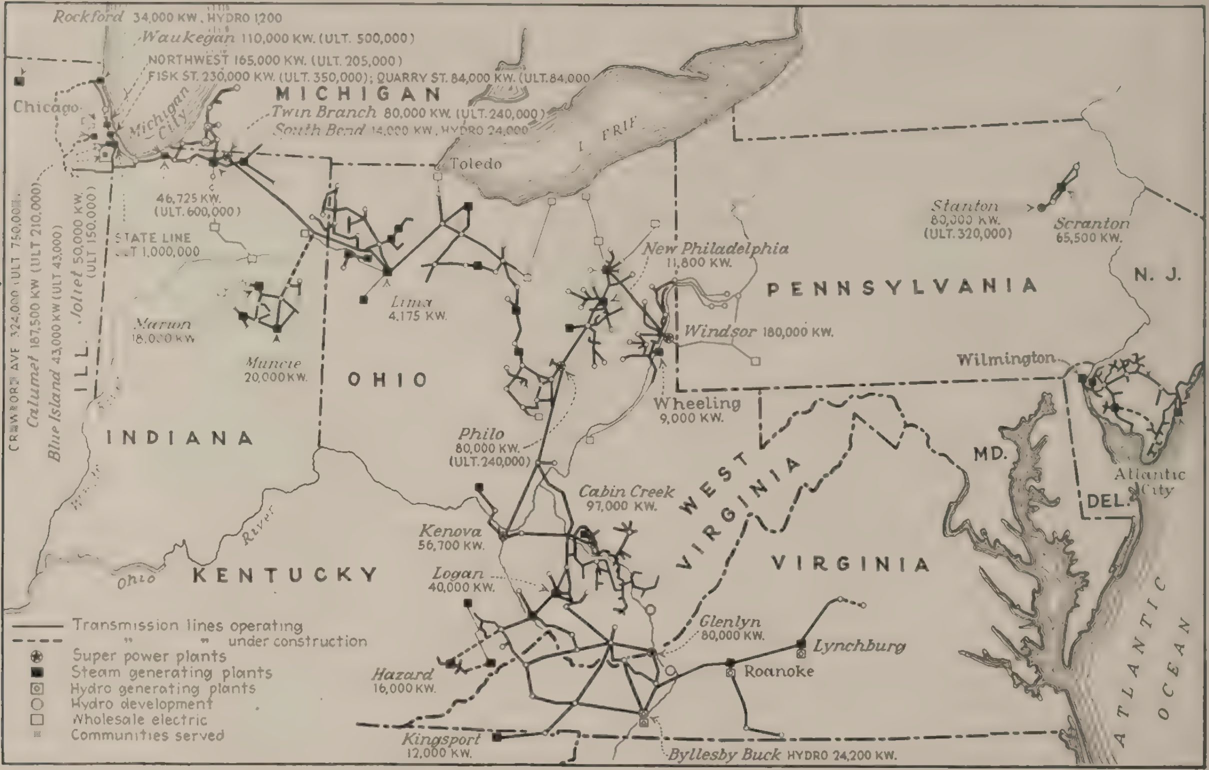
| | Number of Plants | | | Number of Plants | |
|---|---|---|---|---|---|
| State | Private | Municipal | State | Private | Municipal |
| Alabama | 5 | 4 | Nebraska | 23 | 22 |
| Arizona | 5 | ... | New Hampshire | 4 | ... |
| Arkansas | 12 | 3 | New Jersey | 12 | 2 |
| California | 9 | ... | New Mexico | 2 | ... |
| Colorado | 11 | 3 | New York | 52 | 1 |
| Connecticut | 7 | ... | North Carolina | 5 | 18 |
| Delaware | 2 | 5 | North Dakota | 31 | 8 |
| Florida | 4 | 7 | Ohio | 19 | ... |
| Georgia | 19 | 12 | Oklahoma | 11 | 15 |
| Idaho | 7 | ... | Oregon | 10 | 2 |
| Illinois | 28 | 4 | Pennsylvania | 24 | 1 |
| Indiana | 23 | 1 | South Carolina | 3 | 2 |
| Iowa | 13 | 10 | South Dakota | 9 | 8 |
| Kansas | 16 | 10 | Tennessee | 6 | 4 |
| Kentucky | 5 | 2 | Texas | 30 | 7 |
| Louisiana | 4 | 6 | Vermont | 7 | 1 |
| Maryland | 15 | 1 | Virginia | 10 | 4 |
| Massachusetts | 65 | ... | Washington | 4 | 1 |
| Michigan | 19 | 1 | West Virginia | 3 | ... |
| Minnesota | 14 | 5 | Wisconsin | 20 | 3 |
| Mississippi | 2 | 6 | | | |
| Missouri | 20 | 1 | | | |
| Montana | 3 | 1 | Total | 593 | 181 |

In the utility groups associated with the Electric Bond & Share Company, several changes have occurred. The Arkansas Power & Light Company acquired four private plants and three municipal plants, and now serves 107 communities. The Louisiana Power & Light Company acquired the Winnsboro municipal plant, and the Mississippi Power & Light Company took over the municipal plants at Carrollton, Isola and Tupelo. The Nebraska Power Company acquired the electric light and power properties of the Omaha and Lincoln Railway & Light Company. It has taken over several municipal plants, has purchased several properties from the Central West Public Service Company and has extended service to several communities near its transmission lines. The Pacific Power & Light Company, the Texas Power & Light Company, the Houston Lighting & Power Company and the Northwestern Electric Company extended service to private and municipal plants in their respective service areas.

The Southeastern Power & Light Company has been co-ordinating its large system and extending transmission lines into new territory. The Alabama Power Company has purchased a number of properties, including the Gulf Electric Company and the Houston Power Company. The Georgia Power Company acquired Ball Ground, Chamblee-Camp Gordon and eight municipal plants. It merged the properties of the former Georgia Power Company and the Georgia Light, Power & Railways into a co-ordinated unit.

The new company supplies the industrial area of central and northern Georgia, including 89 communities served directly and 48 municipalities that purchase power at wholesale. New transmission lines are being built to interconnect the different Southeastern properties and generating capacity is being added at a rapid rate.

In the American Gas & Electric Company group, the Indiana & Michigan Electric Company of South Bend has bought the Allen County Electric Light & Power Company and the Indiana Power & Light Company. The Atlantic City Electric Company has acquired the Atlantic County Electric Company and the Electric Company of New Jersey, which serves all of southern New Jersey below Camden and Woodbury, and west of the West Jersey & Seashore Railroad.


Rockford 34,000 KW., HYDRO 1,200
Waukegan 110,000 KW. (ULT. 500,000)
NORTHWEST 165,000 KW. (ULT. 205,000)
FISK ST. 230,000 KW. (ULT. 350,000); QUARRY ST. 84,000 KW. (ULT. 84,000
MICHIGAN
Chicago
Michigan City
Twin Branch 80,000 KW. (ULT. 240,000)
South Bend 14,000 KW., HYDRO 24,000
ERIE
Toledo
46,725 KW. (ULT. 600,000)
STATE LINE ULT 1,000,000
CRAWFORD AVE 324,000 (ULT 750,000)
Calumet 187,500 KW (ULT 210,000)
Blue Island 43,000 KW (ULT 43,000)
Joliet 50,000 KW. (ULT 150,000)
ILL.
Marion 18,000 KW
Muncie 20,000 KW.
Lima 4,175 KW.
OHIO
INDIANA
Philo 80,000 KW. (ULT. 240,000)
River
Ohio
KENTUCKY
Kenova 56,700 KW.
Logan 40,000 KW.
Cabin Creek 97,000 KW.
WEST VIRGINIA
VIRGINIA
Hazard 16,000 KW.
Kingsport 12,000 KW.
Byllesby Buck HYDRO 24,200 KW.
Glenlyn 80,000 KW.
Lynchburg
Roanoke
New Philadelphia 11,800 KW.
Windsor 180,000 KW.
Wheeling 9,000 KW.
PENNSYLVANIA
Stanton 80,000 KW. (ULT. 320,000)
Scranton 65,500 KW.
N. J.
Wilmington
MD.
DEL.
Atlantic City
ATLANTIC OCEAN
Transmission lines operating
" " under construction
Super power plants
Steam generating plants
Hydro generating plants
Hydro development
Wholesale electric
Communities served

INTERCONNECTION HAS AFFORDED TERRITORY SOUTH OF THE GREAT LAKES THE BENEFITS OF LARGE MODERN STATIONS

In the East several changes in utility groupings have occurred of major magnitude. The New York Power & Light Corporation was formed by the merger of seven utilities which are subsidiaries of the Mohawk Hudson Power Corporation. The total population served is more than 750,000 and the generating capacity of the system is 230,840 kw. The Massachusetts Utilities Investment Trust was formed by 45 utilities affiliated with the Massachusetts Lighting group and of voluntary associations of groups holding utility shares. The controlled companies serve 94 communities with a population of 600,000. Insull, Son & Company acquired control of the National Electric Power Company, which operates properties in Maine, Pennsylvania, Nebraska, Ohio, Indiana, Michigan, South Dakota, Kansas, Oklahoma and Arkansas, including the Cumberland County Power & Light Company of Portland, Me., the Penn Central Light & Power Company, the Kansas Electric Power Company and others serving a population in excess of 1,125,000 in more than 450 communities. Other important acquisitions of Insull, Son & Company were the Inland Power & Light Corporation, which serves 320 communities in five states and the Western United Gas & Electric Company in southern Illinois. The latest acquisition of the Insulls was the National Public Service Corporation, a former Fitkin property serving 621 communities in Pennsylvania, Florida, Virginia, New Jersey and Georgia and elsewhere with electricity, gas, railway, ice and other services.

Many other changes in utility ownership will be found in the accompanying tables. Some of these changes involve change in ownership, others are mergers under one control and still others represent changes in corporate name and corporate groupings of properties. It is evident that consolidation of utility properties proceeds apace and that the extension of large transmission systems inevitably results in taking over small properties that can be served more economically from large systems.

## *Holding Company Mergers in 1927*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| American Comwealth Pwr. Corp. | American States Sec. Corp..... | 6 | *Jan. |
| American Electric Power Co.... | Pennsylvania Gas & Elec. Corp. | 1 | *Oct. |
| American Power Co. (a)........ | Pennsylvania Gas & Elec. Corp. | 1 | *Oct. |
| Baltimore Corp. of Maryland... | Consolidated Gas Electric Light & Power Co. of Baltimore.... | ..... | *June |
| Central Massachusetts Light & Power Co.................. | Massachusetts Util. Inv. Trust.. | 71-55 | *May |
| Central Public Utility Co....... | Central Public Utilities Corp... | 13 | *Mar. |
| Central West Public Service Co.: Bennington, Elkhorn, Waterloo, Valley, LeShara, Yuban, Elk City & Hooper; wholesale to Mead, Washington, Kennard & Herman, Neb.. | Nebraska Power Co.......... | 5-30 | *Sept. |

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| American Superpower Corp.§ | American Comwlths. Pwr. Corp. | 6 | *Jan. |
| Comwlth. Gas & Elec. Cos | Massachusetts Util. Inv. Trust | 71–55 | *May |
| Commonwealth Power Corp.§ | American Comwlths. Pwr. Corps. | 6 | *Jan. |
| Commonwealth Utilities Corp | Troy, Graham & Co., Chicago | 85 | *April |
| Community Pwr.&Lt. Co. (Del.) | American Comwlths. Pwr. Corp. | 6 | *June |
| Community Pwr. & Lt. Co. (Ill.) | Community Pwr. & Lt. Co. (Del.) | 6 | Feb. |
| Day & Zimmermann, Inc | United Gas Improvement Co | 87 | *June |
| Dierks Lumber & Coal Co.: | | | |
| Arkansas: Center Point, Cove, DeQueen, Dierks, Foreman, Gillham, Hatfield, Horatio, Locksburg, Mineral Springs, Murphreesboro, Nashville and Winthrop | Southwestern Gas & Elec. Co | 56 | *Oct. |
| Oklahoma: Broken Bow, Idabel, Oak Hill, Pine Village, Talihina, Vallient, and Wright City | Public Serv. Co. of Oklahoma | 56 | *Oct. |
| Eastern Shore Gas & Electric Co. (*o e*) | Day & Zimmermann, Inc | 62–42–24–87 | *Mar. |
| Eastern States Utilities Co. (*s*) | American Electric Power Corp. | 1 | *Oct. |
| Electric Public Service Co. (*g*) | Electric Public Utilities Co | 33 | Mar. |
| Electric Securities Co. (*a*) | Pennsylvania Gas & Elec. Corp. | 1 | *Oct. |
| Federated Utilities | Federated Utilities, Inc | 14 | Feb. |
| Gas & Elec. Improvement Co. (*m*) | Massachusetts Util. Inv. Trust | 71–55 | May |
| Georgia Light, Power & Rys | Georgia Power Co | 80 | † |
| Inland Power & Light Corp | Insull Son & Co., Inc | 21–46 | *Oct. |
| Interstate Elec. Corp. (dissolved) | Inland Power & Light Corp | 21–46 | *June |
| Keystone Pub. Serv. Corp. (*o e*) | Day & Zimmermann, Inc | 62–42–24–87 | *Mar. |
| Laclede Gas & Electric Co | Utilities Power & Light Corp | 93 | *May |
| Light, Heat & Power Corp. (*h m*) | Massachusetts Util. Inv. Trust | 71–55 | May |

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Maryland East Coast Util. Co. | East Coast Utilities Co | 27 | *Nov. |
| Maryland Securities Co | Consolidated Gas Electric Light & Power Co. of Baltimore | ..... | Feb. |
| Massachusetts Lighting Cos | Massachusetts Util. Inv. Trust | 71–55 | May |
| Maysville Public Service Co | Kentucky Power Co | ..... | *April |
| Montreal Tramways & Pwr. Co. | Consolidated Securities, Ltd | 90 | † |
| Municipal Service Co. (*e*) | Day & Zimmermann, Inc | 62–42–24–87 | *Mar. |
| National Power & Light Co.§ | American Comwlths. Pwr. Corp. | 6 | *Jan. |
| National Public Service Corp | Day & Zimmermann, Inc | 42–24–87 | *Mar. |
| National Public Service Corp§ | United Gas Improvement Co | 87 | *April |
| National Public Service Corp | Insull, Son & Co., Inc | 21–46 | *Dec |
| New England Power Assn.§ | Massachusetts Util. Inv. Trust | 71–55 | May |
| Northeastern Power Corp | St. Regis Paper Co | 78 | *June |
| Old Colony Lt. & Pwr. Associates | Massachusetts Util. Inv. Trust | 71–55 | *May |
| Penn-Ohio Edison Co | Penn-Ohio Securites Corp | 72 | *Mar. |
| Pennsylvania Gas & Elec. Corp. | American Electric Power Corp. | 1 | *Oct. |
| People's Light & Power Corp | G. L. Ohrstrom & Co | 69 | *April |
| Porto Rico Railways Co., Ltd | Int'l Power Co., Ltd. (Canada). | 49 | *April |
| Power Corp. of New York (*p*) | St. Regis Paper Co | 78 | *June |
| Power & Elec. Sec. Corp. (*p*) | St. Regis Paper Co | 78 | *June |
| Public Utilities Consol. Corp | W. B. Foshay Co | 40 | *June |
| South American Power Co | American & Foreign Power Co., Inc | 2–30 | *Oct. |
| Southern Cities Utilities Co | United Utilities & Service Corp. | 92 | *Mar. |
| Southern Gas & Power Corp | Central Public Service Corp | 14 | *Mar. |
| United Light & Power Co.§ | American Comwlths. Pwr. Corp. | 6 | *Jan. |
| United Public Utilities Co | United Public Service Co | 89 | Feb. |
| United Public Utilities, Inc | Southern Cities Utilities Co | 92 | *Mar. |
| Utilities Shares Corp.§ | American Comwlths. Pwr. Corp | 6 | *Jan. |
| Western United Corp | E. H. Rollins & Sons | 77 | *April |

# Utility Mergers and Purchases in 1927

## *Alabama*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Citizens' Water, Lt. & Pwr. Co. | Alabama Power Co | 80 | *May |
| Gulf Electric Co | Alabama Power Co | 80 | *Nov. |
| Houston Power Co | Alabama Power Co | 80 | *Nov. |
| Monroeville Ice & Power Co | Gulf Utilities Co | ..... | *July |
| Pea River Power Co. (Gov. Chas. Henderson) | Col. C. A. O'Neal | ..... | *Sept. |
| Bay Minette Municipal Lighting Plant & Distribution System | ¶Gulf Electric Co | 80 | *Oct. |
| Geneva Municipal Ltg. Plant | ¶Gulf Electric Co | 80 | *Nov. |
| Gordo Municipal Light & Power Plant | Alabama Power Co | 80 | *Jan. |
| Jackson Municipal System | Alabama Power Co | 80 | *Feb. |

## *Arizona*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Desert Power & Water Co | Public Utilities Consol. Corp | 76–40 | *Aug |
| Miami Water & Power Co | People's Arizona Gas & Elec. Corp. (*t*) | 68 | *Nov. |
| People's Arizona Gas & Elec. Corp (*t*) | G. L. Ohrstrom & Co | 68 | *April |
| Southern Arizona Power Co | Public Utilities Consol. Corp | 76–40 | *April |

## *Arkansas*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Arkansas-Missouri Pwr. Co. (*j*). | Insull Son & Co., Inc | 21–46— | *June |
| Arkansas Public Service Co | Arkansas-Missouri Pwr Co | 21–46 | † |
| Arkansas Utilities Co. (*b*) | American Cmwlths. Pwr. Corp. | 6 | *June |
| Bradford Power Plant | Arkansas Power & Light Co | 32–30 | *Aug. |
| DeQueen Lt. & Pwr. Co. (Dierks Lumber & Coal Co.) | Southwestern Gas & Elec. Co | 56 | *Oct. |
| Dierks Lumber & Coal Co. See Holding Company Mergers under | Southwestern Gas & Elec. Co | 56 | *Oct |
| Foreman Lt. & Pwr. Co. (Dierks Lumber & Coal Co.) | Southwestern Gas & Elec. Co | 56 | *Oct. |
| Gould Electric Plant | Arkansas Power & Light Co | 32–30 | *July |
| Home Lt. & Pwr. Co. (Dierks Lumber & Coal Co.) | Southwestern Gas & Elec. Co | 56 | *Oct. |
| Nashville Ice, Coal & Light Co. (Dierks Lumber & Coal Co.) | Southwestern Gas & Elec. Co | 56 | *Oct. |
| Walnut Lake Electric Plant | Arkansas Power & Light Co | 32–30 | *July |
| Winchester Electric Plant | Arkansas Power & Light Co | 32–30 | *July |
| Batesville Light & Water Improvement District | Arkansas Power & Light Co | 32–30 | *May |
| Dumas Munic. Wtr. & Lt. Plant. | Arkansas Power & Light Co | 32–30 | *July |
| Tillar Municipal Elec. Lt. Plant. | Arkansas Power & Light Co | 32–30 | *July |

## *California*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Central Mendocino Power Co | W. B. Foshay Co., Minneapolis | 40 | *July |
| Coast Valleys Gas & Elec. Co | Pacific Gas & Electric Co | 70 | *May |
| McKinley Bros., Inc. (Middletown) | California Tele. & Lt. Co | 70 | *June |
| People's California Hydro-Electric Corp. (*t*) | G. L. Ohrstrom & Co | 68 | *April |
| Public Utilities California Corp. | Public Utilities Consol. Corp | 76–40 | *Aug. |
| Santa Cruz County Utilities Co. | Public Utilities California Corp. | 76–40 | † |
| Sierra & San Francisco Pwr. Co. | Pacific Gas & Electric Co | 70 | *May |
| Vacaville Water & Power Co | Pacific Gas & Electric Co | 70 | *Oct. |
| Western States Gas & Elec. Co. | Pacific Gas & Electric Co | 70 | *May |

## *Colorado*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Arapahoe Elec. Lt. & Pwr. Co. | Colorado Central Pwr. Co. (*g*) | 33 | *Jan. |
| Arvada Electric Co | Colorado Central Pwr. Co. (*g*) | 33 | *Jan. |
| Buena Vista Elec. Lt. & Pwr. Co. | General Ice & Storage Corp | ..... | *May |
| Castle Creek Water Co | Roaring Fork Water, Light & Power Co | ..... | *Nov. |
| Clear Creek Power & Development Co | Public Service Co. of Colorado. | 19 | *Sept. |
| Colorado Central Power Co | Electric Public Service Co | 33 | *Jan. |
| Colorado Utilities Corp | Central States Pub. Serv. Co | 17–85 | *Feb. |
| Empire Electric Service | Public Serv. Co. of Colorado | 19 | *Sept. |
| Fort Lupton Power & Light Co. | Colorado Central Power Co. (*g*) | 33 | *Jan. |
| Jefferson County Pwr. & Lt. Co. | Colorado Central Power Co. (*g*) | 33 | *Jan. |
| Roaring Fork Electric Light & Power Co | Roaring Fork Water, Light & Power Co | ..... | *Nov. |
| Akron Municipal Light Plant | Comwlth. Utilities Corp., | 23–85 | *April |
| Limon Municipal Light Plant | Comwlth. Utilities Corp., | 23–85 | *April |
| Simla Municipal Electric Light Plant | Comwlth. Utilities Corp., | 23–85 | *Sept. |

## *Connecticut*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Danbury Pwr. & Transp. Co | Danbury & Bethel Gas & Elec. Co | 19 | *Nov. |
| Danielson Light & Power Co | Eastern Connecticut Power Co., Norwich | 87 | *April |
| Lyme Electric Power Co | Eastern Connecticut Power Co., Norwich | 87 | *April |
| Ousatonic Water Power Co | Connecticut Elec. Service Co | 87 | *Jan. |
| Putnam Light & Power Co | Eastern Connecticut Power Co., Nowrich | 87 | *Apri |
| Rockville-Willimantic Ltg. Co | Eastern Gas & Elec. Sec. Corp | 28 | *Feb. |
| Waterbury & Milldale Tramway Co. (Lt. & Pwr. properties) | Connecticut Light & Power Co., Waterbury | 87 | June |

## *Delaware*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| New Castle County Elec. Co. (*a*) | Pennsylvania Gas & Elec. Corp. | 1 | *Oct. |
| Wilmington Lt. & Pwr. Co. (*a*) | Pennsylvania Gas & Elec. Corp. | 1 | *Oct. |
| Dagsboro Municipal Electric Lighting Plant | Eastern Shore Gas & Elec. Co | 62– | *Mar. |
| Frankford Municipal Electric Lighting Plant | Eastern Shore Gas & Elec. Co | 42– | *Mar. |
| Millsboro Municipal Electric Lighting Plant | Eastern Shore Gas & Elec. Co | 24– | *Mar. |
| Selbyville Municipal Electric Lighting Plant | Eastern Shore Gas & Elec. Co | 87– | *Mar. |
| Smyrna Municipal Electric Lighting Plant | Eastern Shore Gas & Elec. Co | | *Mar. |

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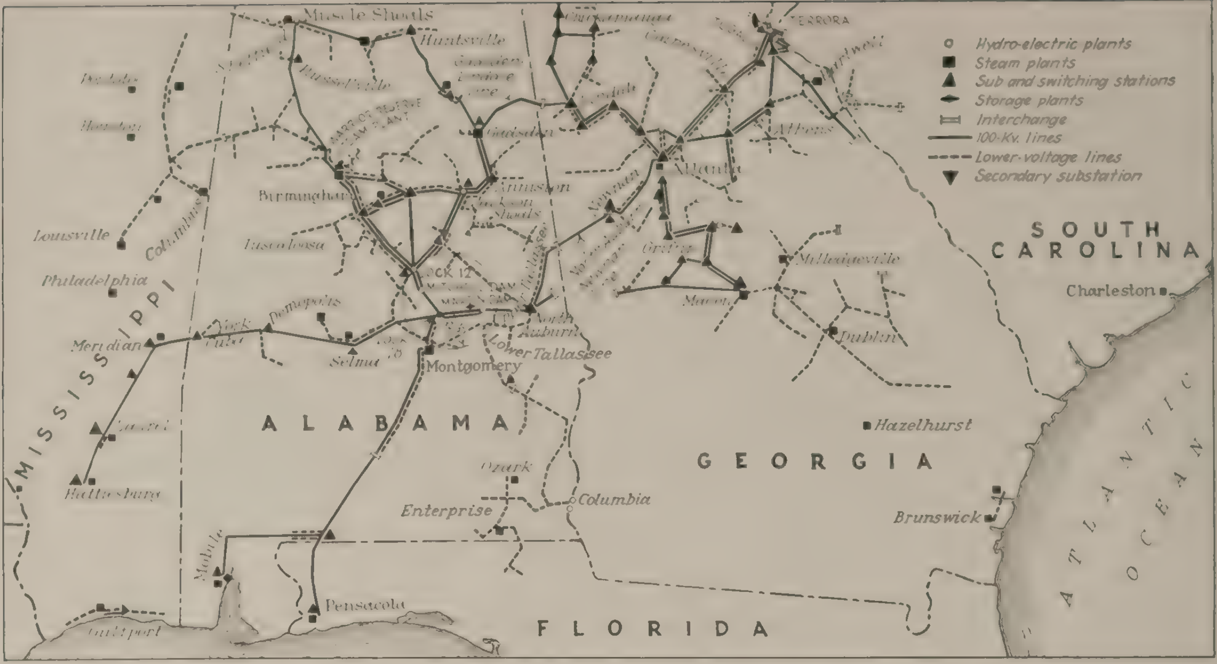
(*a*) Through American Electric Power Co.
(*b*) Through Community Power & Light Co. (Del.)
(*c*) Through Central Massachusetts Lt. & Pwr. Co.
(*d*) Through Commonwealth Gas & Elec. Companies.
(*e*) Through National Public Service Corp.
(*f*) Through Eastern Shore Gas & Elec. Co. (*o*, *e*).
(*g*) Through Electric Public Service Co.
(*h*) Under management of Gas & Electric Improvement Co. (*m*).
(*i*) Through Georgia Light, Power & Railways.
(*j*) Through Inland Power & Light Corp
(*k*) Through Laclede Gas & Electric Co
(*l*) Through Light, Heat & Power Corp. (*m*).
(*m*) Through Massachusetts Lighting Companies.
(*n*) Through Maysville Public Service Co.
(*o*) Through Municipal Service Co. (*e*)
(*p*) Through Northeastern Power Corp.
(*q*) Through Power & Electric Securities Corp. (*p*).
(*r*) Through Old Colony Light & Power Associates
(*s*) Through Pennsylvania Gas & Electric Corp.
(*t*) Through People's Light & Power Corp.
(*u*) Through Porto Rico Railways Co., Ltd.
(*v*) Through United Utilities & Service Corp.
(*w*) Through Western United Corp.
(*x*) Through Southwestern Power & Light Co.
(*y*) Through Wisconsin Valley Electric Co.
(*z*) Through Penn-Ohio Edison Co.



ELECTRICAL DEVELOPMENTS IN THE SOUTH ARE BASED ON INTERCONNECTION

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| | *Florida* | | |
| Central Florida Pwr. & Lt. Co. | Florida Power Corp. (*e*) | 62–42–24–87 | *Mar. |
| Florida Power Corp. (*e*) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Jacksonville Gas Co. | American Comwlths. Pwr. Corp. | 6 | June |
| Pinellas County Power Co. | Florida Power Corp. (*e*) | 62–42–24–87 | *Mar. |
| Fernandina Municipal Electric & Water Utilities & Ice Plant | Southern States Power Co. | ..... | *Mar. |
| Greenville Municipal Elec. Plant<br>Havana Municipal Elec. Plant<br>Jennings Munic. Elec. Plant | West Florida Power Co., Tallahassee | 62–42–24–87 | Feb. |
| Milton Munic. Lt. & Pwr. Plant | Gulf Power Co. | 24–87 | *April |
| White Springs Municipal Electric Light Plant | West Florida Power Co., Tallahassee | 62–42–24–87 | Feb. |
| Winter Park Municipal Light & Water Plant | Florida Pub. Serv. Co., Orlando | 10–43 | *June |
| | *Georgia* | | |
| Athens Railway & Electric Co. | Georgia Power Co | 80 | *Feb. |
| Atlanta Coach Co. | Georgia Power Co | 80 | Feb. |
| Atlanta Northern Railway Co. | Georgia Power Co | 80 | Feb. |
| Ball Ground Distr. Sys. & Wtr. Pwr. Plant | Georgia Power Co. | 80 | *July |
| Butler Light & Power Co. Distribution Systems | South Georgia Power Co. | 82 | *Jan. |
| Central Georgia Power Co. (*i*) | Georgia Power Co. | 80 | *Feb. |
| Central Georgia Transmission Co. (*i*) | Georgia Power Co. | 80 | *Feb. |
| Chamblee-Camp Gordon Water, Light & Power Co. | Georgia Power Co. | 80 | *Oct. |
| Charlton County Power Co. | Kentucky Power Co., Augusta, Ky. | ..... | *April |
| East Georgia Power Co. | Georgia Power Co. | 80 | *Feb. |
| Georgia Public Service Corp. (*i*) | Georgia Power Co. | 80 | *Feb. |
| Georgia Railway & Electric Co. | Georgia Power Co. | 80 | *Feb. |
| Georgia Railway & Power Co. | Georgia Power Co. | 80 | *Feb. |
| Macon Gas Co. (*i*) | Georgia Power Co. | 80 | *Feb. |
| Macon Railway & Light Co. (*i*) | Georgia Power Co. | 80 | *Feb. |
| Mutual Light & Water Co. | Georgia Power Co. | 80 | *Feb. |
| Rome Railway & Light Co. | Georgia Power Co. | 80 | *Feb. |
| Valdosta Lighting Co. (*o e*) | Day & Zimmermann, Inc., | 24–87 | *Mar. |
| Ware County Lt. & Pwr. Co. (*o e*) | Day & Zimmermann, Inc., | 24–87 | *Mar. |
| Camilla Municipal Plant | Baker County Pwr. Co., Newton | ..... | *Mar. |
| Cohutta Munic. Elec. Plant | Georgia Power Co. | 80 | *April |
| McRae Municipal Electric Light, Wtr., Ice & Cold Storage Plant | Central Georgia Power Co. (*i*) | 80 | *May |

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SYMBOLS
||Supervisory or management company.
‡Operating company.
*Items appeared in ELECTRICAL WORLD
†Definite date not known.
¶Has since been absorbed.
§Minority interest.

HOLDING COMPANIES
1 American Electric Power Corp.
2 American & Foreign Power Co., Inc. (30)
3 American Gas & Electric Co.
4 American Light & Traction Co.
5 American Power & Light Co (30)
6 American States Securities Corp.
7 American Utilities Co. (41)
8 American Water Works & Electric Co., Inc.
9 Associated Gas & Electric Co. (95)
10 Atlantic Public Utilities, Inc. (96)
11 W.S. Barstow Management Association, Inc. (43)||
12 Buffalo, Niagara & Eastern Power Corp.
13 Byllesby Engineering & Management Corp. (81)||
14 Central Public Service Co. (A. E. Peirce)
15 Central States Edison Co. (E. A. Shrider)
16 Central States Power & Light Corp.
17 Central States Public Service Co. (85)
18 Chandler & Co., Inc. (50)|
19 Cities Service Co. (Doherty)
20 Columbia Gas & Electric Corp.
21 Commonwealth Light & Power Co. (46)
22 Commonwealth Power Corp. (45)
23 Commonwealth Utilities Corp. (85)
24 Day & Zimmermann, Inc. (87, 62-42)||
25 Drake-Jones Co. or Drake-Jones Investment Co.
26 Duke Power Co.
27 East Coast Utilities Co.
28 Eastern Gas & Electric Securities Corp.
29 Eastern Power Co.
30 Electric Bond & Share Co. (2, 5, 32, 52, 61)||
31 Electric Management & Engineering Corp (60)||
32 Electric Power & Light Corp. (30)
33 Electric Public Utilities Co.
34 Empire Power Corp. (74)
35 Engineers' Public Service Corp. (82)
36 Federal Light & Traction Co.
37 Federal Public Utilities Co.
38 Federal Water Service Co.
39 Foreign Power Securities Corp.
40 W. B. Foshay Co. (76)
41 Gannett, Seelye & Fleming Inc., (7, 86)||
42 General Engrg. & Management Corp. (62, 24)||
43 General Gas & Electric Corp. (11)
44 General Utilities & Operating Corp.||
45 Hodenpyl, Hardy & Co. (22)||
46 Insull Son & Co., Inc. (21)
47 International General Electric Co.
48 International Paper Co.
49 International Power Co., Ltd.
50 International Utilities Corp. (18)
51 A. B. Leach & Co., Inc. (54)||
52 Lehigh Power Securities Corp. (30)
53 Long Island Lighting Co.‡
54 McGraw Electric Co. (51)
55 Massachusetts Utilities Investment Trust (71)
56 Middle West Utilities Co.
57 Minnesota Northern Power Co.
58 Mohawk Hudson Power Corp.
59 Mohawk Valley Co.
60 National Electric Power Co. (31)
61 National Power & Light Co. (30)
62 National Public Service Corp. (42; 24, 87)
63 Nevada California Electric Corp.
64 New England Power Association
65 North American Co. (The)
66 North American Light & Power Co.
67 Northeastern Power Corp. (78)
68 G. L. Ohrstrom & Co.||
69 Otter Tail Power Co. of Delaware
70 Pacific Gas & Electric Co.‡
71 C. D. Parker & Co., Boston (55)||
72 Penn-Ohio Securities Corp.
73 People's Light & Power Corp. (68)
74 E. L. Phillips Interests (34)||
75 Public Service Corporation of New Jersey
76 Public Utilities Consolidated Corp. (40)
77 E. H. Rollins & Sons.||
78 St. Regis Paper Co. (67)
79 Shawinigan Water & Power Co.‡
80 Southeastern Power & Light Co.
81 Standard Gas & Electric Co. (13)
82 Stone & Webster, Inc. (35)||
83 Charles H. Tenney & Co.||
84 Texas-Louisiana Power Co.‡
85 Troy, Graham & Co. (17, 23)||
86 Union Electric & Gas Co. (41)
87 United Gas Improvement Co. (24)
88 United Light & Power Co.
89 United Public Service Co.
90 United Securities, Ltd.
91 United States Electric Power Corp.
92 United Utilities & Service Corp.
93 Utilities Power & Light Corp.
94 Western Massachusetts Companies
95 J. G. White Management Corp. (9)||
96 C. W. Young (10)||
|| Supervisory or management company.
‡ Operating company.

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Metter Municipal Light Plant | Georgia Power Co | 80 | *April |
| Millen Municipal Distr. Sys. | Georgia Power Co | 80 | *July |
| Sale City Municipal Plant | Baker County Pwr. Co., Newton | ..... | *Mar. |
| Statesboro Municipal Elec. Sys. | Georgia Power Co | 80 | *April |
| Stillmore Munic. Elec. Plant | Georgia Power Co | 80 | *April |
| Tennville Municipal Electric Distribution System | Georgia Power Co | 80 | *Jan. |
| Toccoa Municipal Distribution System & Wtr. Pwr. Plant | Georgia Power Co | 80 | *May |
| Twin City Municipal Distribution System | Georgia Power Co | 80 | *June |
| Woodbury Munic. Ltg. Plant | Georgia Power Co | 80 | *Dec. |

### *Idaho*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Canyon Light & Water Co. | Public Utilities Consol. Corp. | 76–40 | *Aug. |
| Mullan Light Co. | Public Utilities Consol. Corp. | 76–40 | *Aug. |
| Northwest Light & Water Co. | Public Utilities Consol. Corp. | 76–40 | *Aug. |
| Pocatello Gas & Power Co. | Public Utilities Consol. Corp. | 76–40 | *Oct. |
| Potlatch Consol. Electric Co. | L. M. Simpson—F. M. Shields, Spokane, Wash. | ..... | *Sept. |
| Potlatch Consol. Electric Co. | Potlatch Power Co. | ..... | *Sept. |
| Potlatch Power Co. | Washington Water Pwr. Co. | ..... | *Oct. |

### *Illinois*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Albion Electric Co. | Illinois Public Utility Co. | 14 | *July |
| Atlanta Elec. Lt. & Pwr. Co. | Illinois Public Utility Co. | 14 | *July |
| Atwood Electric Lt. & Pwr. Co. | Illinois Public Utility Co. | 14 | *July |
| Aurora, Elgin & Fox River Elec. Co. | E. H. Rollins & Sons | 77 | *April |
| Avon Milling Co. | Illinois Power & Light Corp. | 66 | *July |
| Bement Elec. Lt. & Pwr. Co. | Illinois Public Utility Co. | 14 | *July |
| Broadwell Electric Light & Distributing Systems | Illinois Power & Light Corp. | 66 | *Aug. |
| Champaign County Electric Co. | Illinois Power & Light Corp. | 66 | *Jan. |
| Chesterfield Electric Co. | Central Illinois Pub. Serv. Co. | 56 | *Mar. |
| Elizabeth Light & Power Co. | Interstate Light & Power Co. | 12–81 | *Feb. |
| Elkhart Electric Light & Distribution Systems | Illinois Power & Light Corp. | 66 | *Aug. |
| Hardin Elec. Lt. & Pwr. Co. | Central Illinois Pub. Serv. Co. | 56 | *Oct. |
| Homer Electric & Power Co. | Illinois Public Utility Co. | 14 | *July |
| Illinois Public Utility Co. | Central Gas & Electric Co. | 14 | *July |
| Illinois Traction Co. (Venice Power Plant) | Union Electric Light & Power Co. of Illinois | 65 | *Jan. |
| Lincoln Water & Light Co. | Illinois Public Utility Co. | 14 | *July |
| Littleton Electric Light System. | Central Illinois Public Serv. Co. | 56 | *Feb. |
| Mt. Pulaski Elec. Lt. & Pwr. Co. | Illinois Public Utility Co. | 14 | *July |
| Perry Light & Power Co. | Central Illinois Public Serv. Co. | 56 | *Feb. |
| Philo Electric Light & Power Co. | Illinois Public Utility Co. | 14 | *July |
| Rock Island County Power Co. | Sherrard Power Co. | ..... | *Oct. |
| Roscoe Elec. Co. (Stuart Ralston) | Milton Ellis, Rockford | ..... | *April |
| Royal Light & Power Co. | ¶Lincoln Water & Light Co. | 14 | *Feb. |
| Seckman, W. F. (Fowler) | Central Illinois Pub. Serv. Co. | 56 | *April |
| Sherman Elec. Lt. & Distr. Sys. | Illinois Power & Light Corp. | 66 | *Aug. |
| Shirley Light & Power Co. | Illinois Power & Light Corp. | 66 | Oct. |
| Western United Gas & Electric Co. (*w*) | E. H. Rollins & Sons | 77 | *April |
| Williamsville Electric Light & Distribution System | Illinois Power & Light Corp. | 66 | *Aug. |
| Catlin Munic. Elec. Lt. Plant | Gen. Util. Corp. (20-yr. lease) | ..... | *April |
| Grayville Munic. Elec. Ltg. Plant | Central Illinois Pub. Serv. Co. | 56 | *June |
| Rochelle Munic. Ltg. Plant | Illinois North. Util. Co., Dixon. | 56 | *Nov. |
| Waynesville Munic. Lt. Plant | Illinois Pub. Util. Co., Lincoln | 14 | *Aug. |

### *Indiana*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Albany Water Supply Co. | Indiana Water Service Co., Indianapolis | 38 | *May |
| Allen County Elec. Lt. & Pwr. Co. | Indiana & Michigan Elec. Co., South Bend | 3 | *Mar. |
| Brookville Electric Co. | Indiana Light & Power Co. | 10–96 | *Sept. |
| Burnettsville Elec. Lt. & Pwr. Co. | Interstate Pub. Serv. Co. | 56 | *June |
| Citizens' Heat, Lt. & Pwr. Co. | United Public Utilities Co. | 89 | *April |
| Clevenger (H. F.) Elec. Property in Bartholomew County | H. F. Clevenger Elec. Co., Columbus | ..... | *Jan. |
| General Utilities Co. | Indiana Light & Power Co. | 10–96 | *Sept. |
| Indiana Elec. Corp., Indianapolis St. Ry. Co. trans. lines connecting Lennore sta. of I. E. Co. and substas. of I. S. Ry. Co. | Middle West Utilities Co. | 56 | *April |
| Indiana Lt. & Pwr. Co. (see also Ohio) | Atlantic Pub. Util., Inc. | 10–96 | *Sept. |
| Indiana Power & Light Co. | Indiana Water Service Co., Indianapolis | 38 | *May |
| Indiana Power & Light Co. | Indiana & Michigan Elec. Co. | 3 | *Mar. |
| Indianapolis Light & Heat Co. | Indianapolis Pwr. & Lt. Co. | 93 | *Jan. |
| Indianapolis Pwr. & Lt. Co. | Indianapolis Pwr. & Light Corp. | 93 | *Jan. |
| Jonesboro Water Co. | Indiana Water Service Co., Indianapolis | 38 | *May |
| Merchants Heat & Light Co. | Indianapolis Pwr. & Lt. Co. | 93 | *Jan. |
| Montpelier Utilities Co. | Indiana Water Service Co., Indianapolis | 38 | *May |
| People's Utilities Indiana Corp. | Indiana Water Service Co., Indianapolis | 38 | *May |
| Pine Village Light & Power Co. | Interstate Public Service Co., Indianapolis | 56 | *Jan. |
| Shepfer Electrical Co. | Indiana Light & Power Co. | 10–96 | *Sept. |
| Sunman Elec. Lt. & Pwr. Co. | Dearborn-Ripley Lt. & Pwr. Co. | ..... | *May |
| Thompson Electric Co. | Interstate Public Service Co., Indianapolis | 56 | *May |
| Washington Wt., Lt. & Pwr. Co. | Indiana Water Service Co., Indianapolis | 38 | *May |
| Lawrenceburg Town Serv. Co. | Dearborn-Ripley Lt. & Pwr. Co. | ..... | *May |

### *Iowa*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| American Utilities Corp. (Oakville) | People's Gas & Elec. Co., Mason City | 88 | Oct. |
| Central Iowa Power & Light Co. | Iowa Public Service Co. | 87 | *Mar. |
| Denmark Telephone & Elec. Co. | Walsh Bros., Burlington | ..... | *Nov. |
| Dubuque Electric Co. | Interstate Power Co. (Del.) | 93 | † |
| George Elec. Lt. Plant (Iowa Pub. Serv. Co.) | Northwestern Lt. & Pwr. Co., Cedar Rapids | ..... | *Aug. |
| Harmony Light & Power Co. | Iowa Pub. Serv. Co., Ft. Dodge. | 87 | *Sept. |
| Iowa-Nebraska Lt. & Pwr. Co. | Continental Gas & Elec. Corp. | 88 | *Aug. |
| Iowa Lt., Ht. & Pwr. Co. | ¶Central Iowa Pwr. & Lt. Co. | 87 | *Mar. |
| Iowa Light, Heat & Power Co. | Iowa Public Service Co. | 87 | *May |
| Iowa Service Co. | Iowa-Nebraska Lt. & Pwr. Co. | 88 | *Aug. |
| People's Iowa Water Wks. Co. (*t*) | G. L. Ohrstrom & Co. | 68 | *April |
| Salamonia Lt. & Pwr. Co. | Union City Electric Co. | 31–60 | *Oct. |
| Tri-State Utilities Co. | Interstate Power Co. (Del.) | 93 | † |
| Augusta Munic. Elec. & Tel. Plant | People's Gas & Elec. Co., Mason City | 88 | *Oct. |
| Brunsville Munic. Elec. Plant | ¶Iowa Lt., Heat & Power Co. | 87 | *April |
| Denmark Munic. Elec. & Tel. Plant | People's Gas & Elec. Co., Mason City | 88 | *Oct |
| Earlham Munic. Plant | ¶Iowa Lt., Heat & Power Co. | 87 | *April |
| Early Munic. Elec. & Distr. Sys. | Iowa Public Service Co. | 87 | *Aug. |
| Laurens Munic. Lt. & Pwr. Plant | Central States Elec. Co., Cedar Rapids | ..... | *Jan. |
| Luverne Munic. Elec. System | Iowa Public Service Co. | 87 | *Sept |
| Oto Municipal Distr. System | ¶Iowa Light, Heat & Power Co. | 87 | *Mar. |
| Ottosen Munic. System | ¶Central Iowa Pwr. & Lt. Co. | 87 | *Jan. |
| Vincent Munic. Elec. Distr. Sys. | ¶Central Iowa Pwr. & Lt. Co. | 87 | *Jan. |

### *Kansas*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Alma Light & Power Co. | Central States Edison Co., Chicago, Ill. | 15 | *Sept. |
| Chanute Ice & Light Co. (*b*) | American Commonwealths Pwr. Corp. | 6 | Feb. |
| Inland Pwr. & Lt. Corp. (Kansas properties) | Kansas Power Co. (*j*) | 21–46 | *Oct. |
| Kansas City Power & Light Co. | Continental Gas & Elec. Corp. | 88 | *Aug. |
| Kansas City Public Service Co. (Missouri River Power House) | Kansas City Power & Light Co. | 88 | *June |
| Kansas Power Co. (*j*) | Insull Son & Co., Inc. | 46 | *June |
| Kansas Power & Light Corp. (Goodland only) | Public Utilities Kansas Corp. | 76–40 | *Oct. |
| Kansas Public Service Co. (Plant at Second St. & Grand Ave.) | Kansas Pwr. & Lt. Co., Topeka. | 66 | *May |
| Kansas Utilities Co. (*b*) | American Commonwealths Pwr. Corp. | 6 | *June |
| Public Utilities Kansas Corp. | Public Util. Consol. Corp. | 76–40 | *June |
| Rossville Elec. Lt., Ice & Elev. Co. | Kansas Pwr. & Lt. Co., Topeka. | 66 | *April |
| Rural Light & Power Co. | Kansas City Power & Light Co. | 88 | *Mar |
| Topeka Edison Co. | Kansas Pwr. & Lt. Co, Topeka. | 66 | *Apr. |
| Topeka Railway Co | Kansas Pwr. & Lt. Co., Topeka. | 66 | *April |
| Tri-County Light & Power Co. | Western Lt. & Pwr. Co., Salina. | ..... | Oct. |
| Union Power Co | Kansas Pwr. & Lt. Co., Topeka. | 66 | *April |
| Bern Municipal Ltg. System | United Pwr. & Lt. Corp., Abilene | 66 | *April |
| Cedar Vale Munic. Generating Station & Distribution System | Inland Util. Co., Kansas C., Mo. | ..... | *Feb. |
| Delphos Municipal Light Plant | United Pwr. & Lt. Corp., Abilene | 66 | *Oct |
| Fairview Municipal Plant & Distribution System | Kansas Pwr. & Lt. Co., Topeka | 66 | *Mar |
| Kiowa Elec. Lt. & Pwr. Plant | Western Light & Power Co. | .... | *Dec. |
| Moran Munic. Plant & Distr. Sys. | J. E. Houdashelt | ..... | *Feb. |
| Ness City Municipal Light & Power Plant | Western Lt. & Pwr. Co., Salina. | ..... | *Feb. |
| Nickerson Munic. Lt. Plant | United Power & Light Corp. | 66 | *Nov. |
| Plains Munic. Electric Plant | United Power & Light Corp. | 66 | *Mar |
| Wetmore Munic. Pwr. & Lt. Plant | United Power & Light Corp. | 66 | *Apr. |

### *Kentucky*

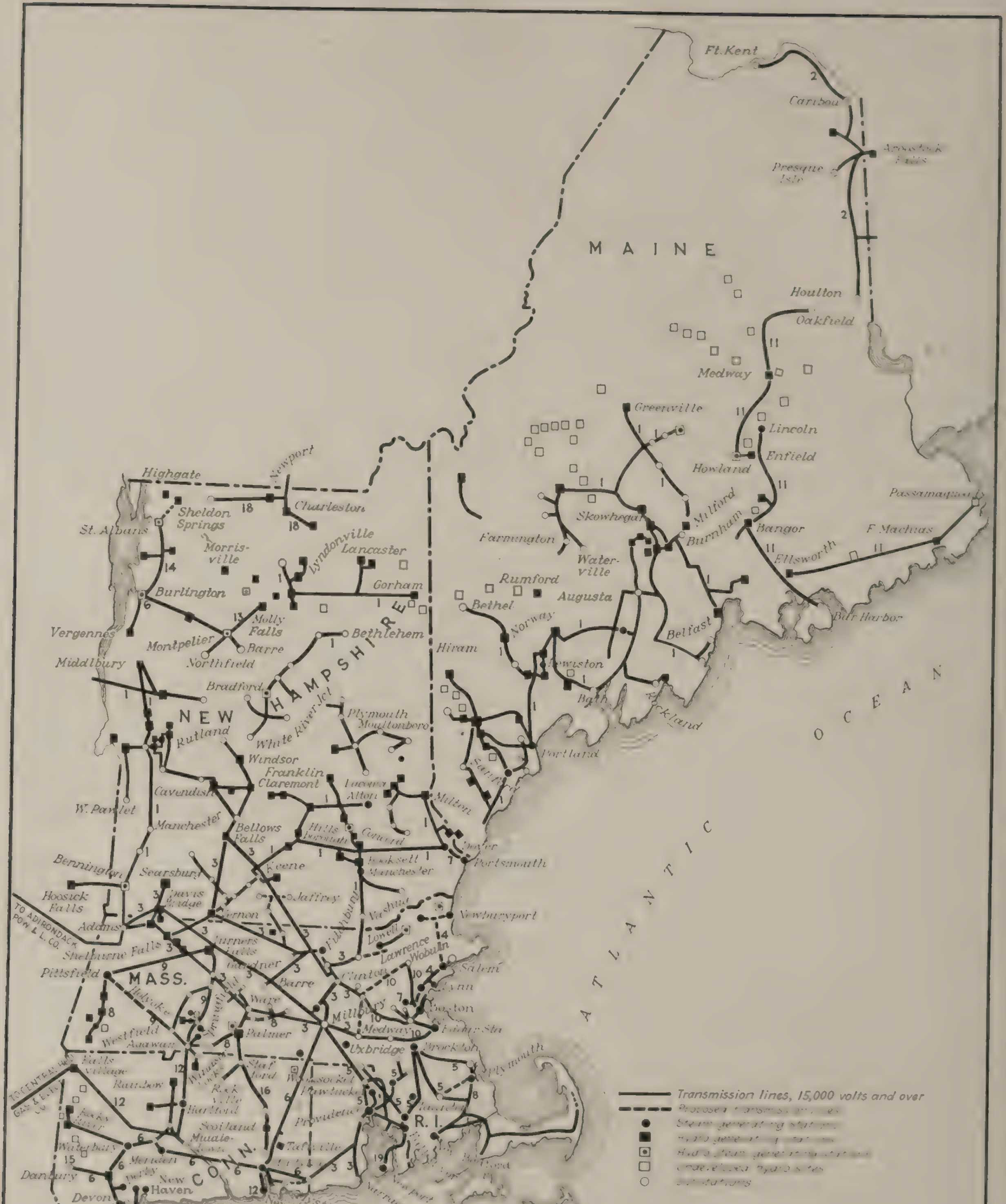
| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Caneyville Light Co. | Kentucky Utilities Co. | 56 | *Sept. |
| Cumberland Light Co. | Kentucky Utilities Co. | 56 | *June |
| Interstate Utilities Co. | Kentucky Utilities Co. | 56 | *Jan. |
| Maysville & Flemingsburg Light & Power Co. (*n*) | Kentucky Power Co., Augusta. | ..... | *April |
| Maysville Gas & Elec. Co. (*n*) | Kentucky Power Co., Augusta. | ..... | *April |
| Benton Munic. Lt. & Pwr. Plant | Federal Public Utilities Co. | 37 | *Oct |
| Russellville Municipal Light & Power Plant | Kentucky-Tennessee Lt. & Pwr. Co. | 9–95 | *Sept. |

### *Louisiana*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Gulf States Utilities Co. | Southwestern Gas & Elec. Co. | 56 | *April |
| Louisiana Ice & Utilities Co. | Commonwealth Utilities Corp. | 23–85 | April |
| Mansfield Light & Power Co. | American Utilities Co. | 7–41 | *Aug. |
| Sulphur Light & Power Co. | Gulf States Utilities Co. | 35–82 | *Oct. |
| Church Point Municipal Plant | Federal Pub. Util. Co., Chicago | 37 | *Nov. |
| Crowley Munic. Elec. Plant | Gulf Pub. Serv. Co. | 24–87 | *May |
| Lecompte Munic. Elec. Plant | Louisiana Ice & Utilities, Inc. | 23–85 | *Jan. |
| Marksville Municipal Electric Light & Water Works | Federal Pub. Util. Co., Chicago. | 37 | *Nov. |
| Washington Municipal System | Gulf Public Service Co., Jacksonville, Tex | 24–87 | *Mar. |
| Winnsboro Municipal Light & Power Plant | Louisiana Power & Light Co. | 32–30 | *April |

### *Maryland*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Annapolis & Chesapeake Bay Power Co | Consolidated Gas Elec. Lt. & Pwr. Co. of Baltimore through Baltimore Corp. of Maryland. | ..... | *June |
| Baltimore Electric Co. | Consolidated Gas Elec. Lt. & Pwr. Co. of Baltimore | | *June |
| Citizens' Lt., Ht. & Pwr. Co. | Associated Maryland Elec. Pwr. Corp. | ..... | *Nov. |
| Clear Spring Elec. Lt. & Pwr. Co. | Potomac Edison Co., Hagerstown | 8 | *Sept. |
| Consumers Ice. Co. (*e, f*) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Deal Island Electric Co. | Maryland East Coast Utilities | 27 | *Nov. |
| Delmarvia Utilities Co. (*o, e, f*). | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Electric & Ice Manufacturing Co. | Maryland East Coast Util. Co. | 27 | *Nov |
| Elkton Electric Co. | Northern Maryland Pwr. Co. | 29 | *April |
| Exmore Lt. & Pwr. Co. (*e, f*) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Havre de Grace Electric Co. | Northern Maryland Pwr. Co. | 29 | *April |
| Home Mfg. Lt. & Pwr. Co. | Northern Maryland Pwr. Co. | 29 | *April |
| Kent County Elec. Co. (*o, e, f*) | Day & Zimmermann, Inc. | 24–87 | *Mar |
| North Baltimore Service Co. (*g*). | Electric Public Utilities Co. | 33 | Mar. |



*New England has been the scene of many mergers and interconnections during 1927*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Northern Maryland Electric Co. | Northern Maryland Power Co. | 29 | *April |
| Washington, Baltimore & Annapolis Elec. Railroad Co. | Consolidated Gas, Elec. Lt. & Pwr. Co. of Baltimore, through Baltimore Corp. of Maryland. | ..... | *June |
| Snow Hill Municipal Electric Light & Power Co. | Eastern Shore Gas & Electric Co. (*o*, *e*) | 62–42<br>24–87 | *July |

## *Massachusetts*

| | | | |
|---|---|---|---|
| Adams Gas Light Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Agawam Electric Co. | Western Massachusetts Cos. | ..... | *Jan. |
| Amesbury Electric Light Co. | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| Amherst Gas Co. | Western Massachusetts Cos. | ..... | *Jan. |
| Arlington Gas Light Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Athol Gas & Elec. Co. (*d*) | Massachusetts Util. Inv. Trust. | 71-55 | May |
| Ayer Electric Light Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71-55 | May |
| Blackstone Elec. Light Co. (*c*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Cambridge Electric Light Co. | New England Gas & Elec. Assn. | 9–95 | *May |
| Cambridge Gas Light Co. | New England Gas & Elec. Assn. | 9–95 | *May |
| Cape & Vineyard Electric Co. | New England Gas & Elec. Assn. | 9–95 | *July |
| Central Massachusetts Electric Co. (*c*) | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| Central Massachusetts Power Co | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| Clinton Gas Light Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Easthampton Gas Co. | Western Massachusetts Cos. | 94 | *Jan. |
| Edison Elec. Illg. Co. of Boston § | Massachusetts Util. Inv. Trust. | 71–55 | † |
| Franklin County Power Co. | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| Gardner Gas, Fuel & Light Co. | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Gloucester Gas Light Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Greenfield Elec. Lt. & Pwr Co. | Western Massachusetts Cos. | 94 | *Jan. |
| Harvard Gas & Elec. Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Lee Electric Co. | Western Massachusetts Cos. | 94 | *Sept. |
| Leominster Electric Light & Power Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Leominster Gas Light Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Lexington Gas Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Marlborough Electric Co. | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Marlboro-Hudson Gas Co. (*d*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Merrimac V'l'y Pwr. & Bldg. Co. | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| Milford Electric Light & Power Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Milford Gas Light Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Mill River Electric Lt. Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| North Adams Gas Lt. Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71-55 | May |
| Northampton Elec. Ltg. Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71-55 | May |
| Northampton Gas Lt. Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Norton Power & Elec. Co. (*c*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Norwood Gas Co. | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Palmer Gas Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Plymouth Electric Lt. Co. (*r*) | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| Plymouth Gas Light Co. | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Randolph & Holbrook Power & Electric Co. | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| Southeastern Massachusetts Power & Electric Co. | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| So. Berkshire Pwr. & Elec. Co. | Massachusetts Util. Inv. Trust. | 71–55 | *May |
| Spencer Gas Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Turners Falls Pwr. & Elec. Co. | Western Massachusetts Cos. | 94 | *Jan. |
| Union Light & Power Co. (*c*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Ware Electric Co. (*c*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Webster & Southbridge Gas & Electric Co. | New England Power Assn. | 64 | *July |
| Westborough Gas & Electric Co. | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Weymouth Light & Power Co. | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Waymouth Water Power Co. | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Williamstown Gas Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Winchendon Elec. Lt. & Pwr. Co. | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Woburn Gas Light Co. (*h*, *m*) | Massachusetts Util. Inv. Trust. | 71–55 | May |
| Worcester Gas Light Co. | New England Gas & Elec. Assn. | 9–95 | *May |
| Worcester Suburban Elec. Co. | Massachusetts Util. Inv. Trust. | 71–55 | *May |

## *Michigan*

| | | | |
|---|---|---|---|
| Alpha Lighting Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Amasa Lighting Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Boyne City Electric Co. | Michigan Public Service Co. (*j*). | 21-46 | *June |
| Boyne Falls Light & Power Co. | Michigan Public Service Co. (*j*). | 21-46 | *June |
| Boyne River Power Co. | Michigan Public Service Co. (*j*). | 21-46 | *June |
| Dickinson County Pub. Serv. Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Elk Electric Co | Michigan Public Service Co. (*j*). | 21-46 | *June |
| Grayling Electric Co. | Michigan Public Service Co. (*j*). | 21-46 | *July |
| Iron Mountain Electric Light & Power Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Loretto Light & Power Co. | Wisconsin Michigan Pwr. Co. | 65 | *July |
| Michigan Public Service Co. (*j*). | Insull Son & Co., Inc. | 21-46 | *June |
| Michigan United Lt. & Pwr. Co. | Michigan Public Service Co. (*j*). | 21-46 | *June |
| Michigan Water Power Co. | Central Public Utility Corp. | 14 | Mar. |
| Peninsular Power Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Powers-Spaulding Light Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Southern Michigan Paver Co. (Quincy plant) | Consumers Pwr. Co., Jackson. | 22-45 | Sept. |
| Twin Falls Light Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Walloon Lake Pwr. & Lt. Co. | Michigan Public Service Co. (*j*). | 21-46 | *June |
| Wisconsin Michigan Power Co. | The North American Co. | 65 | *July |
| Shepherd Municipal Electric Light & Power System | Consumers Pwr. Co., Jackson. | 22-45 | *June |

## *Minnesota*

| | | | |
|---|---|---|---|
| Atwater Light & Power Co. | Northern States Power Co. | 13-81 | *May |
| Bemidji Elec. & Mfg. Co. | Interstate Power Co. (Del.) | 93 | † |
| Edgerton Elec. Distr. Plant | Northern States Power Co. | 13–81 | *Oct. |
| Farmington Elec. Lt. & Pwr. Co. | Drake-Jones Inv. Co., Minn. | 25 | *May |
| Lake Shore Electric Co. | Successor not known | ..... | Oct. |
| Littlefork Light & Power Co. | City of Littlefork | ..... | *Sept. |
| Milan Light & Power Co. | Western Pwr. & Lt. Co., Waconia | ..... | *Jan. |
| Minnesota Elec. Distr. Co. | Interstate Power Co. (Del.) | 93 | *Mar. |
| Minnesota Power Co. | Northern States Power Co. | 13-81 | *Mar. |
| New Richland Lt. & Pwr. Co. | Northern States Power Co. | 13–81 | *Sept. |
| People's Light & Power Co. | Interstate Power Co. (Del.) | 93 | † |
| People's Minnesota Gas & Elec. Corp. (*t*) | G. L. Ohrstrom & Co. | 68 | *April |
| Red River Valley Power Co. | Interstate Power Co. (Del.) | 93 | † |
| Bellingham Municipal Plant | Western Pwr. & Lt. Co., Waconia | ..... | *Jan. |
| Champlin Munic. Elec. Ltg. Sys. | Minneapolis Gen. Elec. Co. | 13–81 | *June |
| Louisburg Munic. Electric Distr. System | Western Power & Light Co. | ..... | *June |
| Spring Grove Munic. System | Root River Pwr. & Light Co., Preston | ..... | Oct. |
| Wood Lake Munic. Elec. Distr. System | Northern States Power Co. | 13–81 | *Oct. |

## *Mississippi*

| | | | |
|---|---|---|---|
| Leakesville Lt. & Ice Plant | Federal Public Utilities Co. | 37 | *Aug. |
| Waynesboro Ice & Light Co. | Federal Public Utilities Co. | 37 | *Aug. |
| Carrollton Munic. Lt. & Power Plant | Mississippi Pwr. & Lt. Co. | 32–30 | *Jan. |
| Corinth Munic. Wtr., Lt. & Pwr. Utility | Mississippi Power Co. | 80 | *Oct. |
| Isola Munic. Light Plant | Mississippi Power & Light Co. | 32–30 | *Jan. |
| Lucedale Munic. Lt. & Pwr. Co. | Federal Pub. Util. Co., Chicago | 37 | *Nov. |
| Port Gibson Munic. Light & Wtr. Plant | Mississippi Pub. Service Co. | ..... | *July |
| Tupelo Munic. Elec. Lt. Plant. | Mississippi Pwr. & Light Co. | 32–30 | Feb. |

## *Missouri*

| | | | |
|---|---|---|---|
| Arkansas-Missouri Pwr. Co. (*j*). | Insull Son & Co., Inc. | 21–46 | *June |
| Browning-Purdin Elec. Co. | Consumers Pub. Service Co., Brookfield | ..... | Oct. |
| East Missouri Power Co. | Inland Pwr. & Light Corp. | 21-46 | *June |
| Galena Electric Plant | Electric Utilities Co., Joplin | 19 | *Mar. |
| Gilliam Elec. Lt. & Pwr. Co. | Kansas Power & Light Co. | 66 | † |
| Kansas City Pwr. & Light Co. | Continental Gas & Elec. Corp. | 88 | *Aug. |
| Kansas City Pub. Serv. Co. | Kansas City Pwr. & Light Co. | 88 | *June |
| King City Elec. & Mfg. Co. | Maryville Elec. Lt. & Pwr. Co. | 88 | *Oct. |
| Laclede Electric Light Co. | Consumers' Public Service Co., Brookfield | ..... | Oct. |
| Laclede Gas Light Co (*k*) | Laclede Gas & Electric Co. | 93 | *May |
| Laclede Pwr. & Lt. Co. (*k*) | Utilities Pwr. & Light Corp. | 93 | *May |
| Maryville Elec. Lt. & Pwr. Co. | Iowa-Nebr. Lt. & Pwr. Co. | 88 | *Aug. |
| Missouri Public Service Co. (*j*). | Insull Son & Co., Inc. | 46 | *June |
| Missouri Utilities Co. (*b*) | American Commonwealths Pwr. Corp. | 6 | *June |
| New Hampton Electric Co. | Missouri Public Service Co. (*j*). | 46 | *Nov. |
| Powersville Light Plant | Missouri Power & Light Co. | 66 | *Aug. |
| Rothville-Sumner Electric Co. | Consumers' Public Service Co., Brookfield | ..... | Oct. |
| Springfield Traction Co. | Springfield Gas & Elec. Co. | 36 | *May |
| Stover Light Co. | Missouri Utilities Co. | 6 | Oct. |
| Windsor Light & Power Co. | Missouri Public Service Co. (*j*). | 46 | Oct. |
| Ridgeway Municipal Power Co. | Missouri Public Service Co. (*j*). | 46 | *Aug. |

## *Montana*

| | | | |
|---|---|---|---|
| Flathead Valley Electric Co. | Pub. Util. Consolidated Corp. | 76–40 | *Aug. |
| Helena Light & Railway Co. (Electric properties only) | Helena Gas & Electric Co. | 95 | Nov. |
| Mission Range Power Co. | Pub. Util. Consolidated Corp. | 76–40 | *Aug. |
| Miles City Munic. Ltg. Plant. | Montana-Dakota Power Co. | 57 | *May |

## *Nebraska*

| | | | |
|---|---|---|---|
| Beatrice Power Co. | Central States Elec. Co. of Nebr. | ..... | *April |
| Central West Public Serv. Co. (properties formerly operated by Platte Valley Power Co.) | Nebraska Power Co. | 5–30 | *Sept. |
| Consumers Electric Serv. Co. | Northwestern Public Serv. Co. | 31–60 | † |
| Eagle Light Plant | Nebraska Power Co. | 5–30 | *April |
| Erickson Hydro-Electric Plant | Nebr. Elec. Pwr. Co., Omaha | 35–82 | *June |
| Interstate Power Co. (Del.): (Nebraska properties) | Interstate Pwr. Co. of Nebr. | 93 | *Mar. |
| Iowa-Nebraska Lt. & Pwr. Co. | Continental Gas & Elec. Corp. | 88 | *Aug. |
| Krug Light & Power Co. | Central States Edison Co., Chic. | 15 | *April |
| Lincoln Public Service Co. | Iowa-Nebr. Light & Pwr. Co. | 88 | *Aug. |
| Lincoln Traction Co. | Iowa-Nebr. Light & Pwr. Co. | 88 | *Aug. |
| Minnesota Elec. Distr. Co.: (Northeastern Nebraska properties) | Interstate Pwr. Co. of Nebr. | 93 | *Mar. |
| Nebraska City Wtr. & Lt. Co. | Central Pwr. Co., Grand Island | 56 | *June |
| Nebraska Electric Power Co. | Eastern Texas Electric Co. | 35–82 | *Jan. |
| Nebraska Gas & Electric Co. | Iowa-Nebr. Lt. & Pwer Co. | 88 | *Aug. |
| Nebraska Light & Power Co. | United Gas Improvement Co. | 87 | *Aug. |
| Omaha & Lincoln Ry. & Lt. Co.: Electric light properties, including power development on Platte River at Ashland) | Nebraska Power Co. | 5–30 | *Mar. |
| Platte Center Light & Pwr. Co. | Northwestern Public Serv. Co. | 31-60 | *June |
| ¶Platte Valley Power Co. | Dakota Public Service Co. | 51–54 | *Feb. |
| Rogge, J. H. (Elmwood) | Nebraska Power Co. | 5–30 | *April |
| Steinauer Distr. Sys. & Trans. Line to Pawnee City | Iowa-Nebr. Light & Pwr Co. | 88 | *Nov. |
| Tri-States Utilities Co. (Nebraska properties) | Interstate Pwr. Co. of Nebraska | 93 | *Mar. |
| Western Pub. Serv. Co. (Gering only) | City of Gering | ..... | *Sept. |
| Winnebago Light & Pwr. Co. | Central States Electric Co. of Nebraska, Omaha | ..... | *Mar. |
| Alvo Munic. Lighting System | Nebraska Power Co. | 5–30 | *April |
| Arapahoe Munic. Lt. & Wtr. Pl. | Nebraska Electric Power Co. | 35–82 | *April |
| Big Springs Munic. Distr. Sys. | Western Public Service Co. | 35–82 | *Oct. |
| Bruning Munic. Distr. System. | Nebraska Power Co. | 5–30 | Oct. |
| Burchard Munic. Plant & Lines. | Iowa-Nebr. Lt. & Pwr. Co. | 88 | *Nov. |
| Colon Municipal System | Nebraska Power Co. | 5–30 | Oct. |
| Dorchester Municipal Plant | ¶Nebr. Gas & Electric Co. | 88 | *Aug. |
| Eagle Municipal Plant | Nebraska Power Co. | 5–30 | *April |
| Edison Municipal System | Nebraska Electric Power Co. | 35–82 | *April |
| Homer Munic. Elec. Lt. Plant. | Central States Elec. Co. of Nebraska | ..... | *Mar. |
| Millard Municipal Plant | Nebraska Power Co. | 5-30 | *July |
| Monroe Munic. Lt. & Pwr. Plant & Distribution System | Northwestern Public Serv. Co. | 31-60 | *April |
| Murdock Municipal Plant | Nebraska Power Co. | 5-30 | *April |
| North Loup Munic. Plant & Sys. | Nebraska Power Co. | 5-30 | *Feb. |

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Orleans Munic. Distr. Sys. & Transmission Line to Alma | Western Public Service Co. | 35-82 | *Feb. |
| Pilger Munic. Distr. System | Iowa-Nebr. Lt. & Power Co. | 88 | *Oct. |
| Pleasant Dale Munic. Plant | ¶Nebraska Gas & Electric Co. | 88 | *Aug. |
| Richland Munic. Electric Plant | Northwestern Pub. Serv. Co. | 31-60 | *July |
| Seward Munic. Elec. Ltg. Plant | Town of Madison | ..... | *April |
| Sterling Munic. Elec. Plant | ¶Nebraska Gas & Electric Co. | 88 | *Dec. |
| Walthill Munic. Elec. Lt. Plant | Central States Elec. Co. of Nebr. | ..... | *Mar. |
| Weeping Water Munic. Ltg. Pl. | Nebraska Power Co. | 5-30 | *June |

### New Hampshire

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Allen & Co., William F. | Southern New Hampshire Hydro-Electric Co., Colebrook | 56 | *Jan. |
| Portsmouth Power Co. | New England Gas & Elec. Assn. | 9-95 | *July |
| Rust, Henry B. (Warren) | Baker River Lt. & Power Co., Warren | ..... | *Jan. |
| Salmon Falls Mfg. Co. | New England Pub. Serv. Co. | 56 | *July |

### New Jersey

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Atlantic County Electric Co. | Atlantic City Electric Co. | 3 | Aug. |
| East Brunswick Mutual Light & Power Co. | Pub. Serv. Elec. & Gas Co. | 75 | May |
| Electric Co. of New Jersey | Atlantic City Electric Co. | 3 | Aug. |
| Essex & Hudson County Gas Co | Public Service Elec. & Gas Co. | 75 | *May |
| Gas & Elec. Co. of Bergen Cty. | Public Service Elec. & Gas Co. | 75 | *May |
| Hudson County Gas Co. | Public Service Elec. & Gas Co. | 75 | *May |
| Jersey Central Pwr. & Lt. Co.(*e*) | Day & Zimmermann, Inc. | 24-87 | *Mar. |
| New Brunswick Light, Heat & Power Co. | Public Service Elec. & Gas Co. | 75 | *May |
| Newark Consolidated Gas Co. | Public Service Elec. & Gas Co. | 75 | *May |
| Paterson & Passaic Gas & Elec-Co. | Public Service Elec. & Gas Co. | 75 | *May |
| Sayreville Elec. Lt. & Pwr. Co. | Eastern New Jersey Pwr. Co. | 93 | *April |
| Somerset, Union & Middlesex Lighting Co. | Public Service Elec. & Gas Co. | 75 | *May |
| Pompton Lakes Munic. Hydro-Electric Plant | Jersey Central Pwr. & Lt. Co. | 62-42 | *Jan. |
| Sea Side Park Munic. Elec. Plant | Jersey Central Pwr. & Lt. Co. | 24-87 | Jan. |

### New Mexico

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Belen Water & Light Co. | New Mexico Pwr. Co., Santa Fe | 36 | Mar. |
| New Mexico Utilities Co. (*b*) | American Comwlths. Pwr. Corp. | 6 | *June |

### New York

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Adirondack Electric Pwr. Corp. | New York Pwr. & Light Corp. | 58 | *Oct. |
| Adirondack Pwr. & Light Corp. | New York Pwr. & Light Corp. | 58 | *Oct. |
| American Woolen Mills (Power & Water rights) | Oswego Falls Corp., Fulton | ..... | *Jan. |
| Barber, Fenton W. (Lewis) | Plattsburg Gas & Electric Co. | 9-95 | *Nov. |
| Bergen Rural Electric Co. | Niagara, Lockport & Ontario Power Co. | 12 | *Mar. |
| Blooming Grove Elec. Distr. Sys. | Orange & Rockland Elec. Co. | ..... | *Feb. |
| Cohoes Power & Light Corp. | New York Pwr. & Light Corp. | 58 | *Oct. |
| Consolidated Electric Co. | ¶Adirondack Pwr. & Lt. Corp. | 58 | *April |
| Eastern New York Util. Corp. | New York Pwr. & Light Corp. | 58 | *Oct. |
| Fort Covington Light, Heat & Power Co. (*p, q*) | St. Regis Paper Co. | 67-78 | *June |
| Fulton County Gas & Elec. Co. | New York Pwr. & Light Corp. | 58 | *Oct. |
| Fulton Light, Heat & Pwr. Co. | Eastern Gas & Elec. Securities Corp. (Conn.) | 28 | *Feb. |
| Georgetown Elec. Ltg. Co., Inc. | New York State Gas & Electric Corp. | 9-95 | *June |
| Grand Island Lt. & Pwr. Corp. | Tonawanda Power Co. | 12 | Jan. |
| La Salle Electric Corp. | Niagara Electric Service Corp. | 12 | *Sept. |
| Lamoka Power Corp. | Lake Ontario Power Corp. | ..... | *July |
| Ledyard Lighting Co. | Empire Gas & Elec. Co., Geneva | 34-74 | *April |
| Lewiston Power Corp. | Niagara Electric Service Corp. | 12 | *Sept. |
| Long Beach Power Co. | Queens Borough Gas & Elec. Co. | 53 | *July |
| Long Island Lighting Co.§ | American Comwlths Pwr. Corp. | 6 | *Jan. |
| M. B. Light & Power Co., Inc. | New York State Gas & Electric Corp. | 9-95 | *Sept. |
| Malone Light & Pwr. Co. (*p, q*) | St. Regis Paper Co. | 67-78 | *June |
| Marion Power Corp. | Lake Ontario Power Corp. | ..... | *July |
| Mexico Electric Co. | Seneca River Pwr. Co., Baldwinsville | 58 | *Jan. |
| Milo Paper Mills (incl. water power on Kenka Lake) | Empire Power Co. | 34-74 | *Oct. |
| Milling & Ltg. Co., Inc., of Brasher Falls (*p, q*) | St. Regis Paper Co. | 67-78 | *June |
| Munic. Gas Co. of the City of Albany | New York Pwr. & Light Corp. | 58 | *Oct. |
| New York Pwr. & Light Corp. | Mohawk Hudson Power Corp. | 58 | *Aug. |
| Niagara, Lockport & Ontario Power Co. (Orangeville & Wethersville) | ¶Western New York Util., Inc. | 12 | *Oct |
| Northern Cayuga Lt. & Pwr. Corp. | Lake Ontario Power Corp. | ..... | *July |
| Northern New York Util., Inc. (*p, q*) | St. Regis Paper Co. | 67-78 | *June |
| Northern Wayne Elec. Lt. & Pwr. Co. | Rochester Gas & Elec. Corp. | 59 | *Sept |
| Oakland Power Co., Inc. | Rockland Lt. & Pwr. Co., Nyack | 83 | *May |
| Oswego River Power Corp. (*p*) | St. Regis Paper Co. | 67-78 | *June |
| People's Gas & Elec. Co. (*p*) | St. Regis Paper Co. | 67-78 | *June |
| Phelps, Harley R. (Vienna) | Niagara Lockport & Ontario Power Co. | 12 | *Oct. |
| Preston Power Corp. | Lake Ontario Power Corp. | ..... | *July |
| Raquette River Pwr. Co. (*p*) | St. Regis Paper Co. | 67-78 | *June |
| Sanborn-Pekin Power Co., Inc. | Niagara, Lockport & Ontario Power Co. | 12 | *Mar. |
| Seneca River Power Co. | Syracuse Lighting Co. | 58 | *July |
| Sodus Gas & Elec. Light Co. | Lake Ontario Power Corp. | ..... | *July |
| Souve, Emory (Vienna only) | Niagara, Lockport & Ontario Power Co. | 12 | *May |
| Staten Island Edison Corp. | New York State Gas & Elec. Corp. | 9-95 | *Mar. |
| Tracy Development Co. | Empire Power Corp. | 34-74 | *June |
| Troy Gas Co. | New York Power & Lt. Corp. | 58 | *Oct. |
| Tusten Light & Power Co. | New York State Gas & Electric Corp. | 9-95 | *April |
| Union Springs Lt. & Pwr. Co. | Empire Gas & Elec. Co., Geneva | 34-74 | *April |
| Western New York Util., Inc. | Buffalo, Niagara & Eastern Pwr. Corp. | 12 | *Mar. |
| Western New York Util., Inc. | Niagara, Lockport & Ontario Power Co. | 12 | *Nov. |
| Windham Valley Electric Co. | New York State Gas & Electric Corp. | 9-95 | *Sept. |
| Wynantskill Hydro-Elec. Co. | Harlem Val. Elec. Corp., Pawling | 9-95 | *April |
| Long Beach Munic. Elec. Plant & Distribution System | Long Beach Power Co. | ..... | *Nov. |

### North Carolina

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Blue Ridge Power Co. | Southern Power Co. | 26 | *June |
| Moravian Power Co. | Southern Public Utilities Co. | 26 | † |
| North Carolina Pub. Serv. Co. | Southern Power Co. | 26 | *June |
| Tide Water Power Co. (*e*) | Day & Zimmermann, Inc. | 24-87 | *Mar. |
| Troutman Light & Power Co. | Southern Public Utilties Co. | 26 | *Oct. |
| Ahoskie Municipal Distr. Sys. | Virginia Electric & Pwr. Co. | 35-82 | *May |
| Coleraine Munic. Distr. Sys. | Virginia Electric & Pwr. Co. | 35-82 | *May |
| Conover Munic. Elec. Lt. Plant. | Southern Pub. Utilities Co. | 26 | *Oct. |
| Edenton Municipal System | Virginia Electric & Pwr. Co. | 35-82 | *Mar. |
| Elkin Municipal Plant | Southern Pub. Utilities Co. | 26 | *Feb. |
| Harrelsville Munic. Distr. Sys. | Virginia Electric & Pwr. Co. | 35-82 | *May |
| Kernersville Municipal Plant | Southern Pub. Utilities Co. | 26 | *Feb. |
| Madison Municipal Plant | Southern Pub. Utilities Co. | 26 | *Jan. |
| Marshville Municipal Plant | Southern Pub. Utilities Co. | 26 | *Feb. |
| Mount Airy Municipal Plant | Southern Pub. Utilities Co. | 26 | *Feb. |
| New London Munic. Elec. Light Plant | Southern Pub. Utilities Co. | 26 | *June |
| North Wilkesboro Munic. Elec. Distribution System | Southern Pub. Utilities Co. | 26 | *Feb. |
| Powellsville Munic. Distr. Sys. | Virginia Electric & Pwr. Co. | 35-82 | *May |
| Spray Munic. Distr. System | Leaksville Lt. & Power Co. | ..... | Oct. |
| Stoneville Municipal Plant | Southern Pub. Utilties Co. | 26 | *Feb. |
| Tarboro Munic. Elec. Lt. Plant. | Virginia Electric & Pwr. Co. | 35-82 | *Jan. |
| Wingate Municipal Plant | Southern Public Utilities Co. | 26 | *Feb. |
| Winton Munic. Distr. System | Virginia Electric & Pwr. Co. | 35-82 | *May |

### North Dakota

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Bisbee Elec. Lt. & Power Co. | Otter Tail Power Co., Fergus Falls, Minn. | 69 | *Jan. |
| Bucyrus Electric Plant | Hettinger Elec. Lt. & Pwr. Co. | ..... | *Nov |
| Carson Elec. Co. (Duncan Noyes) | Hughes Electric Co. | ..... | *May |
| Churches Ferry Elec. Lt. Plant | Otter Tail Power Co. | 69 | Sept. |
| Drake-Jones Inv. Co. (Rolla & Cando) | ¶Pub. Serv. Corp. of N. Dakota | 69 | Sept. |
| Edinburg Motor Co. | Otter Tail Power Co. | 69 | *Sept. |
| Egeland Lt., Heat & Pwr. Co. | Otter Tail Power Co. | 69 | *Jan. |
| Ellendale Electric Co. | United Public Utilities Co. | 89 | *April |
| Forman Elec. Lt. & Pwr. Plant. | Otter Tail Power Co. | 69 | *June |
| Foss & Astrup (Grenora) | Montana-Dakota Power Co. | 57 | *Aug. |
| Hanks Hrdwe. Co. (Elec. Dept.) | Montana-Dakota Pwr. Co. | 57 | *Aug. |
| Hughes & Deiters Elec. Co. | Hughes Electric Co. | ..... | July |
| International Pub. Serv. Corp. | Interstate Pwr. Co. of N. Dakota | 93 | *July |
| Kelly Electric Co. | George Crook | ..... | *June |
| Lakota Lt. & Pwr. Plant | Pub. Serv. Corp. of Lakota | ..... | *Mar |
| Lean, A. H. (Rock Lake) | Otter Tail Power Co. | 69 | *Jan |
| Leeds Electric Lt. & Pwr. Co. | Otter Tail Power Co. | 69 | Sept |
| Napoleon Light & Power Co. | Northern Power & Light Co., Mobridge, S. D. | ..... | *Jan |
| New Leipzig Electric Co. | Hughes Electric Co. | ..... | *Sept. |
| Northern Power & Light Co. | United Public Utilities Co. | 89 | *April |
| Otter Tail Power Co. (Grafton) | City Council | ..... | *Sept. |
| Otter Tail Pwr. Co. (Harvey pl.) | Central Lt. & Pwr. Co. of North Dakota | 16 | Feb |
| Public Service Corp. of North Dakota (Rolla plant) | Otter Tail Power Co. | 69 | *Sept |
| ¶Rolla Mill & Power Plant | Drake-Jones Co., Minneapolis, Minn. | 25 | *May |
| Rollette Light & Power Co. | Otter Tail Power Co. | 69 | *June |
| Rugby Light & Power Co. | Otter Tail Power Co. | 69 | *June |
| Sherwood Electric Co. | Montana-Dakota Power Co. | 57 | Oct. |
| Stewart Milling Co., S. (Mott) | Hughes Electric Co. | ..... | *Sept |
| Woodward, F. M. (Botineau) | Otter Tail Power Co. | 69 | *Jan. |
| York Electric System | Otter Tail Power Co. | 69 | *June |
| Zerrull, I. W. (Orr) | Otter Tail Power Co. | 69 | *April |
| Cando Utilities (Municipal) | Drake-Jones Inv. Co., Minneapolis, Minn. | 25 | *May |
| Cleveland Municipal Plant | Northern Util. Corp., Jamestown | 51-54 | *Nov. |
| Dunseith Municipal Plant | Otter Tail Power Co. | 69 | *Mar. |
| Marmarth Munic. Light Plant | ¶W. H. Thomas, Bowman | ..... | *May |
| Marmarth Munic. Light, Heat, Water & Power Plant | Montana-Dakota Power Co. | 57 | June |
|  | Northern Power & Light Co., Mobridge, S. D. | ..... | *July |
| Milton Municipal Plant | Otter Tail Power Co. | 69 | *June |
| Munich Municipal Plant | Otter Tail Power Co. | 69 | *June |
| Pisek Munic. Plant (formerly Dvorack Bros.) | Otter Tail Power Co. | 69 | Sept. |
| St. Thomas Municipal Plant | Otter Tail Power Co. | 69 | *Sept. |

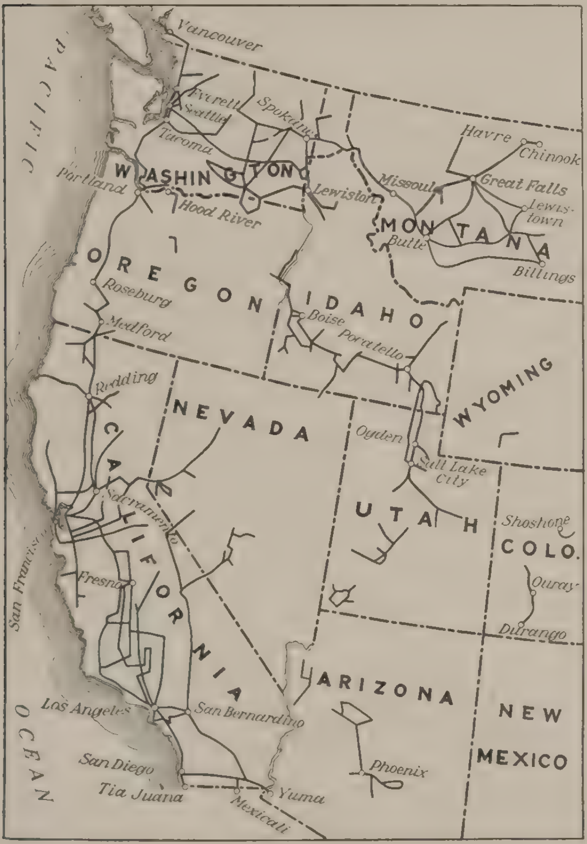
### Ohio

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Brookville-Lewisburg Ltg. Co. | United Public Utilities Co. | 89 | *April |
| Buckeye Light & Power Co. | United Public Utilities Co. | 89 | *April |
| Cincinnati Suburban Power Co. | Union Gas & Electric Co. | 20 | *June |
| Columbus Ry., Power & Lt. Co. | Continental Gas & Elec. Corp. | 88 | *Aug. |
| Dayton, Covington & Piqua Traction Co. | United Public Utilities Co. | 89 | *April |
| Farmington Light & Pwr. Co. | Ohio Public Service Co. | 19 | June |
| Greenville Elec. Lt. & Pwr. Co. | United Public Utilities Co. | 89 | *April |
| Indiana Lt. & Pwr. Co.: Allen, Defiance, Hancock, Henry Putnam & Wood Counties; (see also Indiana) | Atlantic Pub. Utilities, Inc. | 10-96 | *Sept. |
| Lake Shore Electric Ry. Co. | F. W. Coen, Cleveland & Assos. | ..... | May |
| London Light & Power Co. | Ohio Edison Co. | 22-45 | *May |
| Lytle Light & Power Co. | Northern Power & Light Co., Mobridge, S. D. | ..... | *Sept. |
| North Fairfield Lt. & Pwr. Co. | Lake Shore Elec. Ry. Co., through Lake Erie Pwr. & Lt. Co., Sandusky | ..... | Oct. |

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Ohio Pub. Serv. Co. (Gas holdings) | Columbia Gas & Elec. Co. of New York | ..... | *Oct. |
| Ohio River Edison Co. (z) | Penn-Ohio Securities Corp. | 72 | *Mar. |
| Ohio River Trans. Co. (z) | Penn-Ohio Securities Corp. | 72 | *Mar. |
| Penn-Ohio Electric Co. (z) | Penn-Ohio Securities Corp. | 72 | *Mar. |
| Stark Elec. R.R. (Elec. business) | Alliance Electric Co. | ..... | *Aug. |
| Wooster Electric Co. | Electric Public Utilities Co. | 33 | *July |

### *Oklahoma*

| | | | |
|---|---|---|---|
| Chicasha Gas & Elec. Co. | Southwestern Light & Pwr. Co. | 56 | *Mar. |
| Choctaw Lumber Co. (Dierks Lumber & Coal Co.) | Public Service Co. of Oklahoma | 56 | *Oct. |
| Dierks Lumber & Coal Co.: (See under Holding Companies acquired) | Public Service Co. of Oklahoma | 56 | *Oct. |
| McCurtain County Lt. & Pwr. Co. (Dierks Lumber & Coal Co.) | Public Service Co. of Oklahoma | 56 | *Oct. |
| Oklahoma Gas & Elec. Co. (Clinton & Elk City) | Southwestern Light & Pwr. Co. | 56 | *Jan. |
| Oklahoma Power Co. | Public Service Co. of Oklahoma | 56 | *April |
| Oklahoma Utilities Co. (g) | Electric Public Utilities Co | 33 | Mar. |
| Public Serv. Co. of Oklahoma: Plants in Coyle, Guthrie, Langston, Mulhall, Perkins & Vinco | Oklahoma Gas & Elec. Co. | 13–81 | *Feb. |
| Southwestern Light & Pwr. Co. (Gage only) | Oklahoma Gas & Elec. Co. | 13–81 | *Feb. |
| Southwestern Lt. & Pwr. Co. (Shattuck only) | Oklahoma Gas & Elec. Co. | 13–81 | *Jan. |
| Wright City Elec. Lt. Co. (Dierks Lumber & Coal Co.) | Public Service Co. of Oklahoma. | 56 | *Oct. |
| Bessie Municipal Plant | Southwestern Lt. & Pwr. Co. | 56 | *July |
| Blair Municipal Elec. Ltg. Plant | Southwestern Lt. & Pwr. Co. | 56 | *Jan. |
| Boise City Municipal Light & Power Plant | Cimarron Utilities Co. | ..... | *May |
| Burbank Municipal Distribution & Transmission System | Oklahoma Utilities Co. | 33 | *April |
| Fairland Municipal Distr. Sys. | Empire District Electric Co. | 19 | *July |
| Fort Cobb Municipal Electric System & H-T Line | Southwestern Lt. & Pwr. Co. | 56 | *Sept. |
| Grove Municipal Plant | Public Service Co. of Oklahoma | 56 | *Dec. |
| Guyamon Municipal Light & Power Plant | Industrial Utilities Co. | ..... | *Feb. |
| Hinton Municipal Elec. Plant | Southwestern Lt. & Pwr. Co. | 56 | *April |
| Leedey Municipal Plant | Southwestern Lt. & Pwr. Co. | 56 | *July |
| Marshall Municipal Light & Power Plant | Oklahoma Gas & Electric Co. | 13–81 | *Oct. |
| Martha Municipal Plant | Southwestern Lt. & Pwr. Co. | 56 | *Jan. |
| Shattuck Municipal Elec. Plant | Oklahoma Gas & Electric Co. | 13–81 | April |
| Stratford Municipal Plant | United Power & Light Co. | ..... | *July |
| Tishomingo Munic. Elec. Plant | Oklahoma Gas & Electric Co. | 13–81 | *July |



THE PACIFIC COAST IS NOW INTERCONNECTED FROM MONTANA TO MEXICO

### *Oregon*

| | | | |
|---|---|---|---|
| Bandon Electric Co. | W. A. Hattrem, Portland & J. C. Rowland, Tacoma, Wash. | .... | *May |
| Condon Electric Co. | ¶Sherman Electric Co., Moro | 5–30 | *Feb. |
| Consolidated Electric Light Co. | People's West Coast Hydro-Electric Corp. | 73–68 | *June |
| Heppner Water, Lt. & Pwr. Co. | ¶Sherman Electric Co., Moro | 5–30 | *Feb. |
| Jensen Light & Power Co. | People's West Coast Hydro-Electric Corp. | 73–68 | *June |
| Keno Power Co. | California-Oregon Power Co. | 13–81 | *April |
| Molalla Electric Co. | Portland Electric Power Co. | ..... | *May |
| People's West Coast Hydro-Electric Corp. (t) | G. L. Ohrstrom & Co. | 68 | *April |
| Prairie Power Co. | People's West Coast Hydro-Electric Corp. | 73–68 | *June |
| Sherman Electric Co. | Pacific Power & Light Co. | 5–30 | *Feb. |
| Arlington Municipal Plant | ¶Sherman Electric Co | 5–30 | *Feb. |
| Fossil Municipal Electric Distributing System | Pacific Power & Light Co. | 5–30 | *Nov. |

### *Pennsylvania*

| | | | |
|---|---|---|---|
| Bechtelsville Lt. & Pwr. Co. | Boyertown Electric Co. | 11–43 | *April |
| Bryn Athyn Electric Co. | Philadelphia Suburban Counties Gas & Electric Co. | 87 | *May |
| Chester Valley Electric Co. (o e) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Chester County Light & Power Co. (a) | Pennsylvania Gas & Elec. Corp. | 1 | *Oct. |
| Citizens Light & Pwr. Co. (o e) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Counties Gas & Electric Co. | Philadelphia Suburban Counties Gas & Electric Co. | 87 | *Mar. |
| Edison Lt. & Pwr. Co. (o e) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Elwood City Hydro-Elec. Co. (z) | Penn-Ohio Securities Corp. | 72 | *Mar. |
| Garrett Electric Light, Heat & Power Co. | Penn Public Service Corp., Johnston | 9–95 | *Oct. |
| Glen Rock Electric Light & Power Co. (o e) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Holtwood Power Co. | Pennsylvania Wtr. & Pwr. Co. | ..... | *Aug. |
| Keystone Power Corp | West Penn Electric Co. | 8 | *Nov. |
| Langhorne Elec. Lt. & Pwr. Co. | Philadelphia Suburban Counties Gas & Electric Co. | 87 | *May |
| Mahoning County Lt. Co. (z) | Penn-Ohio Securities Corp. | 72 | *Mar. |
| New Hope Electric Co. | Philadelphia Suburban Counties Gas & Electric Co. | 87 | *May |
| Pennsylvania Power Co. (z) | Penn-Ohio Securities Corp. | 72 | *Mar. |
| Philadelphia Suburban Gas & Electric Co. | Philadelphia Suburban Counties Gas & Electric Co. | 87 | *May |
| Plymouth District Power Co. | Philadelphia Electric Co. | ..... | *May |
| Rogersford Electric Co. | Philadelphia Suburban Counties Gas & Electric Co. | 87 | *May |
| Sheffield Elec. Lt. & Pwr. Co. | Penn Public Service Corp. | 9–95 | *Oct |
| South Coventry Township Electric Co. | Philadelphia Suburban Counties Gas & Electric Co. | 87 | *May |
| Spring City Electric Co. | Philadelphia Suburban Counties Gas & Electric Co. | 87 | *May |
| Titusville Lt. & Pwr. Co. (o e) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| United Electric Light Co. | Duquesne Light Co. | 13–81 | *April |
| Whitpain Power Co. | Philadelphia Electric Co. | ..... | *May |
| Worcester Power Co. | Philadelphia Electric Co. | ..... | *May |
| Coraopolis Municipal Plant | Duquesne Light Co. | 13–81 | *April |

### *South Carolina*

| | | | |
|---|---|---|---|
| Laurens Road Light & Pwr. Co. | Southern Public Utilities Co. | 26 | Oct. |
| Pendleton Electric Light Co. | Southern Public Utilities Co. | 26 | *June |
| South Carolina Gas & Elec. Co. | Southern Power Co. | 26 | *June |
| St. Matthews Municipal Electric Light Plant | Broad River Power Co. | 11–43 | *April |
| Walterboro Municipal System | Edisto Public Service Co., Denmark | 10–96 | *Jan. |

### *South Dakota*

| | | | |
|---|---|---|---|
| Consumers Electric Service Co. | Northwestern Public Service Co. | 31–60 | *April |
| Florence Light Co. | Northwestern Public Service Co. | 31–60 | *June |
| Garretson Electric Service Co. | Northern States Power Co. | 13–81 | *Oct. |
| Hieb Electric Service Co. | Northern States Power Co. | 13–81 | *April |
| Hitchock Light & Power Co. | Northwestern Public Service Co. | 31–60 | *June |
| Northern Power & Light Co. | United Public Utilities Co. | 89 | *April |
| Thompson Electric Light Plant, | Otter Tail Power Co., Fergus Falls, Minn. | 69 | *June |
| Wallace Electric Plant | Northwestern Public Service Co. | 31–60 | *June |
| Wessington Electric Plant | Northwestern Public Service Co. | 31–60 | *June |
| Alexandria Municipal Plant | Northern States Power Co. | 13–81 | *April |
| Frederick Municipal Electric Light & Power Plant | United Public Utilities Co. for Northern Power & Light Co. | 89 | *April |
| Java Municipal Plant | Northern Power & Light Co. | 89 | *May |
| Redfield Municipal Electric Light & Power Plant | Northwestern Public Service Co. | 31–60 | *June |
| St. Lawrence Municipal Light & Power Plant | Northwestern Public Service Co. | 31–60 | *May |
| Wessington Springs Municipal Electric Plant | Northwestern Public Service Co. | 31–60 | *May |
| White River Municipal Hydro-Electric Plant | Dakota Public Service Co. | 51–54 | *Feb. |
| Willow Lake Municipal Plant | Northwestern Public Service Co. | 31–60 | *Feb. |

### *Tennessee*

| | | | |
|---|---|---|---|
| Bristol Gas & Electric Co. | Tennessee Central Service Co. | 19 | Feb. |
| Public Light & Power Co. (r) | United Utilities & Service Corp | 92 | *Mar |
| Public Service Co. | Tennessee Electric Power Co. | 19 | *July |
| Southern Cities Power Co. (t) | United Utilities & Service Corp | 92 | *Mar |
| Tiptonville Electric Plant | Union Electric & Gas Co. for Southern Utilities Co. | 86–41 | *Mar. |
| Watauga Power Co. | Tennessee Central Service Co. | 19 | Feb. |

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Gallatin Municipal Light & Water Plant | Kentucky-Tennessee Light & Power Co. | 9–95 | *Aug. |
| Puryear Municipal Elec. Plant | Kentucky-Tennessee Light & Power Co. | 9–95 | *April |
| Ridgley Municipal Electric & Water Plant | Union Electric & Gas Co. for Southern Utilities Co. | 86–41 | *Mar. |
| Trezevant Munic. Ltg. Plant | Kentucky-Tenn. Lt. & Pwr. Co. | 9-95 | *Dec. |

## *Texas*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Angleton Light & Ice Co. | Texas Gulf Power Co. | 84 | *May |
| Athens Light & Power Co. | Texas Pwr. & Lt. Co., Dallas (*x*) | 5–30 | *June |
| Big Lake Utilities Co. | West Texas Utilities Co. | 56 | *April |
| Central Power & Light Co.: Childress, Clarendon, Esterline, Kirkland, Memphis, Shamrock, Verna & Wellington | West Texas Utilities Co. | 56 | *Oct. |
| Citizens Utilities Co. | Central Texas Light & Power Co., San Antonio | ..... | *April |
| Community Power & Light Co. of Texas (*b*) | American Comwlth. Pwr. Corp. | 6 | *June |
| Dalhart Ice & Electric Co. | Dalhart Public Service Co. (*j*) | 46 | May |
| Dalhart Public Service Co. (*j*) | Insull Son & Co , Inc. | 46 | *Oct. |
| Dickinson Electric Co. | Texas Gulf Power Co. | 84 | *May |
| East Texas Public Service Co. | Southwestern Gas & Electric Co. | 56 | *June |
| Freeport Lt. Wtr. & Gas Co.: Tallbut, Bryan & Hoskins Mounds plants | Houston Lighting & Power Co. | 61–30 | *June |
| Henderson Light & Ice Co. | ¶East Texas Public Service Co. | 56 | *Jan. |
| League City Light & Power Co. | Texas Gulf Power Co. | 84 | † |
| Leander Elec Lt. & Pwr. Plant | Texas Pwr. & Lt. Co., Dallas (*x*) | 5–30 | Oct. |
| Lone Star State Power Co. | San Antonio Pub. Serv. Co. | 4 | *July |
| Lone Star State Power Co. | Texas Pwr. & Lt. Co., Dallas (*x*) | 5–30 | *Oct. |
| McCarney Light & Power Co. | West Texas Utilities Co. | 56 | *May |
| Midland Light Co. | Texas Pwr. & Lt. Co., Dallas (*x*) | 5–30 | *Mar. |
| Pearson & Johnson | Central Texas Light & Power Co., San Antonio | ..... | *Apr. |
| Pelly Light Co.: Addison, Barbers Hill, Cedar Bayou, Crosby, Pringle & Wooster | Houston Lighting & Power Co. | 61–30 | *Nov. |
| Quanah Ice & Light Co. | West Texas Utilities Co. | 56 | *Sept. |
| San Angelo Water, Light & Power Co. | West Texas Utilities Co. | 56 | Oct. |
| Spur Light & Power Co. | West Texas Utilities Co. | 56 | *Feb. |
| Texas City Elec. Lt. & Wtr. Co. | Texas Gulf Power Co. | 84 | Oct. |
| Texas Utilities Co. (*b*) | American Comwlth. Pwr. Corp. | 6 | *June |
| Twin City Ice & Electric Co. | West Texas Util. Co., Abilene | 56 | *Nov. |
| Venus Lighting & Water Co. | Texas Pwr. & Lt. Co., Dallas (*x*) | 5–30 | *Mar. |
| West Columbia Lt. & Pwr. Co. | Texas Gulf Power Co. | 84 | † |
| Yoakum Light & Power Co. | Texas–Louisiana Power Co. | 84 | *April |
| Clifton Municipal System | Texas–Louisiana Power Co. | 84 | Jan. |
| Eldora Municipal Plant | West Texas Utilities Co. | 56 | *April |
| McLean Municipal Plant | Southwestern Public Service Co | 24–87 | Jan. |
| Nacogdoches Municipal Power Plant | Texas Power & Light Co. (*x*) | 5–30 | *July |
| Perryton Municipal Electric Light Plant | Inland Utilities Co. | ..... | *Jan. |
| Shamrock Municipal Electric Light & Power Plant | Central Power & Light Co. | 56 | *May |
| Sonora Municipal System | West Texas Utilities Co. | 56 | *April |

## *Vermont*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Clyde River Power Co. | Public Utilities Vermont Corp. | 76–40 | *May |
| Eastern Vermont Public Utilities Corp. | D. L. McDaniel of New York | ..... | *Nov. |
| Ottauguechee Woolen Co. (water rights at Evarts) | New England Power Co. | 64 | *April |
| People's Hydro Electric Vermont Corp. (*t*) | G. L. Ohstrom & Co. | 68 | *April |
| Public Utilities Vermont Corp. | Public Util. Consolidated Corp. | 76–40 | *June |
| Stamford Light, Heat & Power Co. (*k*, *l*) | Massachusetts Utilities Investment Trust | 71–55 | May |
| West Enosburg Elec. Plant Corp. | Municipality of Enosburg Falls | ..... | Oct. |
| Readsboro Munic. Ltg. System | New England Power Co. | 64 | Jan. |

## *Virginia*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Citizens Gas & Electric Co. | Consumers' Util. Co., Staunton | ..... | *Feb. |
| East Coast Utilities Co. (Hopewell only) | Virginia Electric & Power Co. | 35–82 | *April |
| Eastern Shore Gas & Electric Co. of Virginia (*o e f*) | Eastern Shore Gas & Electric Co | 62–42–<br>24–87 | Mar. |
| Prince George Electric Light & Power Co. | Virginia Electric & Power Co. | 35–82 | *April |
| Roanoke Fibre Board Co. (Riparian rights at Roanoke Rapids) | Virginia Electric & Power Co. | 35–82 | *June |
| Rocky Mount Lt. & Pwr. Co. (*a*) | Pennsylvania Gas & Elec. Corp. | 1 | *Oct. |
| Shenandoah River Power Co. | Atlantic Public Utilities, Inc. | 10–96 | *April |
| Virginia East Coast Utilities Co. | East Coast Utiiities Co. | 27 | † |
| Virginia Public Service Co. (*e*) | Day & Zimmermann, Inc. | 24–87 | *Mar. |
| Winchester Gas & Electric Co. | Consumers' Util. Co., Staunton | ..... | *Feb. |
| Cape Charles Municipal Plant & Distribution System | Eastern Shore Gas & Electric Co. (*e*) for Exmore Pwr. & Lt. Co. | 62–42<br>24–87 | *Sept. |
| Clarksville Municipal Electric Power Plant | Virginia Public Service Co. | 62–42<br>24–87 | *Sept. |
| Shenandoah Municipal Electric & Water Works Plants | Page Power Co. | ..... | *Nov. |
| South Hill Municipal Plant | Virginia Public Service Co. | 62–42<br>24–87 | *Aug. |

## *Washington*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Clark County Water, Light & Power Co. | Ridgefield Light & Power Co., which leased property to Northwestern Electric Co. | 5–30 | *Nov. |
| Longview Public Service Co. | Washington Gas & Electric Co. | 91 | *Jan. |
| Mountain States Power Co.: Monroe, Snohomish & Cherry Valley District in Snohomish County | Puget Sound Power & Light Co. | 82 | *Oct. |
| Northwest Light & Power Co. | Public Util. Consol. Corp. | 76–40 | *Aug. |
| Skykomish Municipal Light & Power Plant | Puget Sound Power & Light Co. | 82 | *Sept. |

## *West Virginia*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| West Virginia Utilities Co. (properties at Morgantown & Cameron) | West Virginia Public Service Co. | 8 | *June |
| West Virginia Utilities Co. (*s*) | United Util. & Service Corp. | 92 | *Mar. |
| Wheeling Public Service Co. (*s*) | United Util. & Service Corp. | 92 | *Mar. |

## *Wisconsin*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Aurora Elec. Lt. & Pwr. Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Badger Utility Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Kekoskee Light & Power Co. | Northwestern Light & Power Co., Cedar Rapids, Iowa | ..... | *Jan. |
| Lindsay Light & Power Co. | Wisconsin Power & Light Co. | 56 | *July |
| Niagara Light & Power Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Northern Wisconsin Hydro-Elec. Power Co. (Bayfield only) | Municipality of Bayfield | ..... | *June |
| Peninsular Power Co. | Wisconsin Michigan Power Co. | 65 | *July |
| People's Wisconsin Hudro-Electric Corp. (*t*) | G. L. Ohrstrom & Co. | 68 | *April |
| Sauk County Utilities Co. | Wisconsin Power & Light Co. | 56 | *Mar. |
| Southern Wisconsin Power Co. | Wisconsin Power & Light Co. | 56 | *Jan. |
| Star Electric Light, Heat & Power Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Trenton Power & Light Co. | Wisconsin Power & Light Co. | 56 | *Feb. |
| Waupaca Electric Service & Railway Co. | Wisconsin Valley Electric Co. | 13–81 | *Oct. |
| Weyauwega Electric Light Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Wisconsin Michigan Power Co. | The North American Co. | 65 | *July |
| Wisconsin Northern Light, heat & Power Co. (Electric lines in vicinity of Mosinee) | Wisconsin Valley Electric Co. | 13–81 | *June |
| Wisconsin Northern Light & Power Co. | Wisconsin Michigan Pwr. Co. | 65 | *July |
| Wisconsin River Power Co. | Wisconsin Power & Light Co. | 56 | *Jan. |
| Wisconsin Traction, Light, Heat & Power Co. | Wisconsin Michigan Power Co. | 65 | *July |
| Wisconsin Valley Electric Co. | Standard Gas & Electric Co. | 13–81 | *Oct. |
| Wisconsin Valley Power Co. | Standard Gas & Electric Co. through Wisconsin Valley Electric Co. (*y*) | 13–81 | *Oct. |
| Granton Municipal Transmission Line & Distribution System | Northern States Power Co. | 13–81 | *Feb. |
| Rice Lake Municipal Plant | Northern States Power Co. | 13–81 | *Feb. |
| Wausau Municipal Distribution System | Wisconsin Valley Electric Co. | 13–81 | Oct. |

## *Canada*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Bonhomme Electric Plant | Gatineau Power Co. | 48 | *Feb. |
| Canadian Light & Power Co. | Shawinigan Water & Power Co. | 79 | *Aug. |
| Compagnie Electrique de Bellechasse | Quebec Power Co. | 79 | *Aug. |
| Compagnie d'Energie Electrique de Montmagny | Quebec Power Co. | 79 | *Aug. |
| Donat Hydro-Electric Plant | ¶Quebec Southern Power Co. | 48 | *May |
| Eastern Canada Power Co. | Shawinigan Water & Power Co. | 79 | *Jan. |
| Eastern Electric & Development Co. | Canada Electric Co., Amherst, N. S. | ..... | *Oct. |
| Fort William Paper Co. | Abitibi Power & Paper Co., Ltd. | ..... | *Oct. |
| Gatineau River Power Co., Ltd. | Gatineau Power Co. | 48 | June |
| La Compagnie Hydro-Electrique de L'Annonciation | ¶Quebec Southern Power Corp. | 48 | *Mar. |
| Manitoba Paper Newsprint Plant | Abitioi Power & Paper Co., Ltd. | ..... | *Oct. |
| Maniwaki Pwr. & Tel. Co. | Gatineau Power Co. | 48 | *Mar. |
| Montreal Hydro-Elec. Co., Ltd. | Consolidated Securities, Ltd. | 90 | † |
| Ottawa & Hull Power Co., Ltd. | Gatineau Power Co. | 48 | *June |
| Ottawa-Montreal Power Co.: (Developed power sites at Van Kleek Hill, Vaudreuil, Coteau Jct., Rockland, etc) | Gatineau Power Co. | 48 | *June |
| Papineauville Electric Co. | Gatineau Power Co. | 48 | *Feb. |
| Quebec Southern Power Corp. | Gatineau Power Co. | 48 | *July |
| Rosetown Electric Light & Power Co., Ltd. | International Utilities Corp. | 50–18 | *June |
| Spanish River Newsprint Plant | Abitibi Power & Paper Co., Ltd. | ..... | *Oct. |
| Valleyfield Electric Co. | Shawinigan Water & Power Co., through and for Beauharnois Electric Co. | 79 | *Aug. |
| Watrus Elec. Lt. & Pwr. Co. | International Utilities Corp. | 50-18 | *June |
| Laurenburg (N.S.) Municipal System | Laurenburg Gas Co., Ltd. | ..... | † |

## *Foreign*

| Company Involved | Acquiring Company | Holding Company | Date of Merger |
|---|---|---|---|
| Companhia Brasileira de Energia Electrica | International General Elec. Co. | 47 | *April |
| Companhia Linha Circular de Carros da Bahia | International General Elec. Co. | 47 | *April |
| Companhia Trilhos Centraes | International General Elec. Co. | 47 | *April |
| L'Energie Industrielle | Foreign Power Securities Corp. | 39 | Mar |
| L'Union Hydro-Electrique Armoricaine | Foreign Power Securities Corp. | 39 | Mar. |
| Macoris Light & Power Co. | Islands Edison Co. | 44 | *Oct. |
| Panama-Colon Gas Co. | American & Foreign Power Co., Inc. | 2–30 | *June |
| Porto Rico Railways, Light & Power Co. (*u*) | International Power Co., Ltd. | 49 | *April |
| Societe Hydro-Electrique du Sud-Est | Foreign Power Securities Corp. | 39 | Mar. |

# Utilities Raise $2,128,000,000

### Low money rates and increased budget demands create unprecedented volume of financing. More than billion added to capitalization. Refunding operations active

By H. M. Cameron

*Financial Editor*

BREAKING the highest previous record in financing by nearly 50 per cent, the power and light industry last year absorbed the stupendous total of well over two billion dollars. Such a program has never been exceeded by any single industry in a corresponding space of time. This large sum represented one-fourth of all the financing done in the public money markets of this country. About half of it represented refinancing at lower rates of interest and the balance was required for expenditures in the properties.

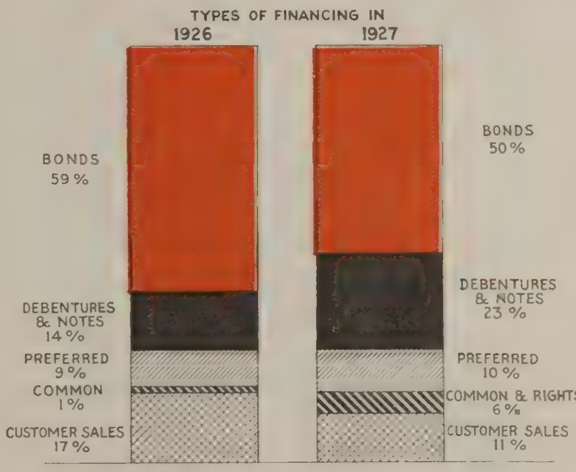
The industry's refinancing program called for $879,000,000. Not only have such operations brought about a huge saving in interest charges—probably ten to fifteen millions annually—but they have also promoted simplification and strengthening of capital structures in a large way. Scores of corporate issues bearing higher interest rates than those now ruling have been retired and replaced by lower-priced obligations. The saving frequently has been as high as 1½ to 2 per cent. Economies of this nature are comparable, in so far as their benefits to the industry are concerned, to lower construction or operating costs; they place the companies in a position to show better earnings on their junior securities. Public utility companies incidentally are able to reap greater benefit from refinancing than most industrial concerns, since a larger proportion of their capital normally is in the form of interest-bearing obligations.

*Electric Light and Power Securities in 1927*

Public Sales by Investment Houses

| | Amount of Issue | |
|---|---|---|
| Mortgage Bonds (average yield 5.00 per cent) | | |
| 12 issues yielding from 4.55 to 4.75 per cent... | $266,200,000 | |
| 14 issues yielding from 4.78 to 4.95 per cent... | 234,052,000 | |
| 17 issues yielding from 5.00 to 5.10 per cent... | 162,562,000 | |
| 18 issues yielding from 5.11 to 5.18 per cent... | 254,136,000 | |
| 17 issues yielding from 5.20 to 5.25 per cent... | 86,372,000 | |
| 11 issues yielding from 5.27 to 5.54 per cent... | 34,850,000 | |
| 13 issues yielding from 5.60 to 5.95 per cent... | 36,764,000 | |
| 12 issues yielding from 6.00 to 6.20 per cent... | 15,209,000 | |
| 8 issues yielding from 6.25 to 6.60 per cent... | 17,525,000 | |
| 122 issues.......... | | $1,107,670,000 |
| Debentures (average yield 5.69 per cent): | | |
| 5 issues yielding from 5.00 to 5.20 per cent... | 104,500,000 | |
| 7 issues yielding from 5.28 to 5.53 per cent... | 73,500,000 | |
| 5 issues yielding from 5.65 to 5.75 per cent... | 103,500,000 | |
| 6 issues yielding from 6.00 to 6.25 per cent... | 67,000,000 | |
| 6 issues yielding from 6.32 to 6.88 per cent... | 9,650,000 | |
| 29 issues.......... | | 358,150,000 |
| Notes (average yield 4.09 per cent) | | |
| 4 issues yielding from 4.25 to 5.25 per cent... | 42,300,000 | |
| 8 issues yielding from 5.75 to 6.00 per cent... | 13,062,500 | |
| 3 issues yielding from 6.15 to 6.75 per cent... | 3,250,000 | |
| 1 issue.......... | 4,200,000 | |
| 16 issues.......... | | 62,812,500 |
| Preferred Stock (average yield 6.16 per cent) | | |
| 7 issues yielding from 5.12 to 5.88 per cent... | 56,610,000 | |
| 9 issues yielding from 6.00 to 6.09 per cent... | 58,320,700 | |
| 8 issues yielding from 6.10 to 6.47 per cent... | 33,832,500 | |
| 11 issues yielding from 6.63 to 7.00 per cent... | 45,689,000 | |
| 5 issues yielding from 7.07 to 7.25 per cent... | 7,140,000 | |
| 5 issues yielding from 7.29 to 7.37 per cent... | 7,210,000 | |
| 45 issues.......... | | 208,802,200 |
| Common Stock | | |
| 2 issues.......... | | 6,200,000 |
| Rights and warrants.......... | | 145,274,564 |
| Total of all issues of year.......... | | $1,888,909,264 |
| Estimated local sales to customers.......... | | 240,000,000 |
| | | $2,128,909,264 |

In comparison with the past few years all classes of financing show the downward trend of money rates. Mortgage bonds were marketed at an average rate of 5.00 per cent, against an average of 5.40 per cent in 1926 and of 6 per cent in 1924. A substantial number of large issues were floated during the year on a 4½ per cent basis—a situation until recently without precedent during the present decade. There is little in the current situation to indicate any change in the present downward trend of rates within the near future.



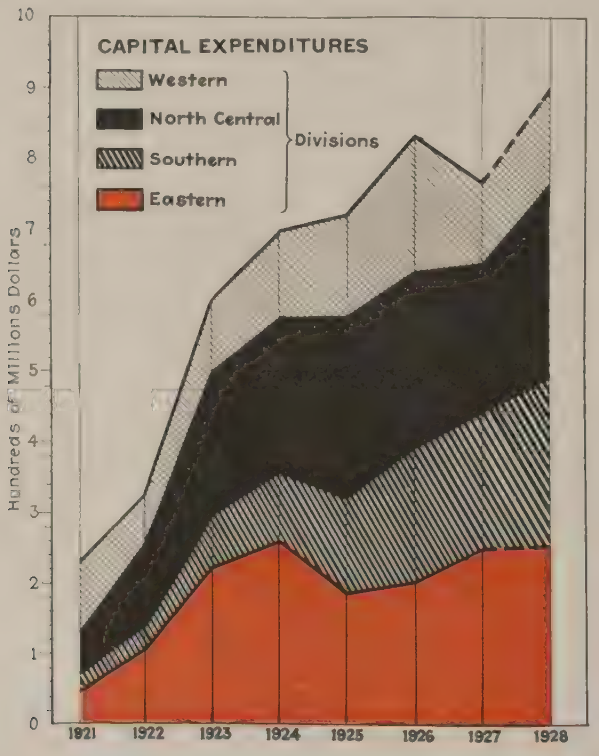
FIFTY PER CENT OF LIGHT AND POWER FINANCING IN 1927 WAS IN BONDS

Debentures were sold at an average yield of 5.69 per cent, against 6.20 per cent in 1926. The average on notes was 4.09, against 5.50 per cent, and on preferred stock 6.16, against 6.84 in 1926.

Despite the unusually favorable bond market that has existed throughout 1927, with the exception of a few weeks in summer when there was a temporary oversupply, bond financing constituted a smaller proportion of the total than in 1926. The percentage of publicly sold issues was 52, against 59. The aggregate dollar value of bonds sold, however, exceeded the 1926 total by $294,000,000. There was only a slight change from the previous year in debenture and note financing, which constituted 17 per cent of the total, against 15 per cent in 1926. Preferred stock sold publicly accounted for 10 per cent of the total, against 8, and the volume of customer sales, as discussed in detail elsewhere, fell off to 11 per cent of the total, against 17 per cent in 1926.

For some years it has been the practice of certain of the power and light companies, as well as leading industrial corporations, to raise a portion of their capital requirements directly from their shareholders by issuing rights or option warrants for the purchase of stock. Although there has been no attempt in our previous annual summaries to compute and include totals for such financing, account of it has been taken during 1927. The aggregate of rights and warrants presumed to have been exercised, or in any event underwritten, was $145,274,564. For purposes of convenience the date of offering is taken as the date of the financing in view of the impossibility of tracing the actual raising of the funds through the execution of the rights. Obviously comparisons with totals for previous years are inaccurate unless account be taken of this item not previously included.

Although much effort has been expended during 1927 toward securing legalization of utility securities for savings bank and trust investment, little of a tangible nature has yet been accomplished. Savings bank and trust company funds available for investment have multiplied rapidly during the past decade, whereas there has been virtually no extension in the volume of securities authorized for such investment. Few would dispute the safety and suitability of power and light company bonds for this purpose, but the general public, and legislators in particular, appear to need much more education along these lines. Institutional buying, however, on the part of insurance companies, investment trusts and other financial and fiduciary institutions has expanded materially during the year.



NORTH CENTRAL AND SOUTHERN UTILITIES PLAN LARGEST INCREASE IN CAPITAL EXPENDITURES, WHILE EAST AND WEST CONTINUE AT PRESENT RATE

*Revenue and Expenses During 1927*

| | Gross Revenue | Operating Costs | Net Revenue |
|---|---|---|---|
| January | $162,000,000 | $63,900,000 | $98,100,000 |
| February | 162,300,000 | 61,300,000 | 91,000,000 |
| March | 146,200,000 | 63,000,000 | 83,200,000 |
| April | 145,700,000 | 62,100,000 | 83,600,000 |
| May | 140,600,000 | 62,200,000 | 78,400,000 |
| June | 138,700,000 | 62,600,000 | 76,100,000 |
| July | 134,300,000 | 62,400,000 | 71,900,000 |
| August | 135,600,000 | 63,000,000 | 72,600,000 |
| September | 145,300,000 | 63,700,000 | 81,600,000 |
| October | 154,000,000 | 67,400,000 | 86,600,000 |
| November | 159,000,000 | 65,600,000 | 93,400,000 |
| December | 170,000,000 | 69,500,000 | 100,500,000 |
| | $1,783,700,000 | $766,700,000 | $1,017,000,000 |

Supplementing the normal growth of the industry, aggressive business promotion during 1927 produced an 8 per cent rise in gross revenues over 1926. At the same time operating costs increased only 6 per cent, allowing for a growth of almost 10 per cent in net revenues. Gross and net revenue and operating cost figures for the year by months are given in the accompanying table.

A significant trend evident in statistics of the power and light industry over a period is the steady reduction in the operating ratio. During the period covered in the attached statistical analysis, the ratio has been gradually reduced from 50 per cent in 1920 to 43 in 1927. This, in the face of stable if not lowered rates to consumers, may be regarded as an achievement in the administration of the utility industry. It is due in no small part to the economics resulting from merger and interconnection developments. The analysis of revenue received in relation to power generated and customers served shows the earning position of the industry during the period since 1920.

*Six-Year Record of Financing*

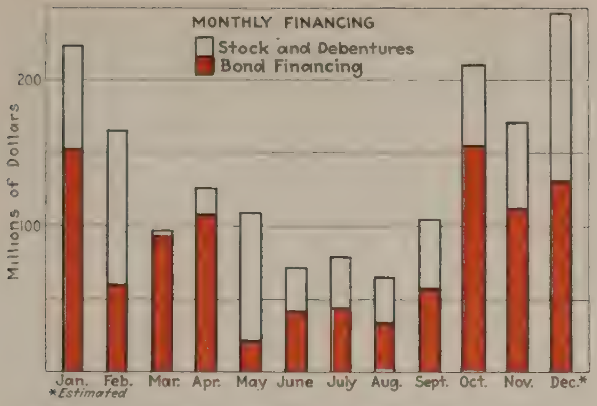
| | |
|---|---|
| 1922 | $589,960,000 |
| 1923 | 997,722,000 |
| 1924 | 1,175,121,000 |
| 1925 | 1,278,223,000 |
| 1926 | 1,384,665,000 |
| 1927 | 2,128,909,000 |
| Total | $7,554,600,000 |

The total capitalization, as defined by the ELECTRICAL WORLD, of the light and power industry at the end of 1927 amounted to $9,500,000,000. This sum is the

*Eight Years' Progress of the Power Industry*

| | Gross Revenue | Over Previous Year, Per Cent | Net Revenue | Over Previous Year, Per Cent | Operating Ratio, Per Cent | Gross per Kilowatt-Hour Generated (Cents) | Kilowatt-Hour Generated per Customer* | Gross Revenue per Customer (Electric) |
|---|---|---|---|---|---|---|---|---|
| 1920 | $882,750,000 | 14 | $442,750,000 | .. | 50 | 2.5 | 3,810 | $85.3 |
| 1921 | 944,400,000 | 7 | 512,000,000 | 16 | 46 | 2.5 | 3,280 | 84.0 |
| 1922 | 1,072,120,000 | 14 | 590,550,000 | 15 | 45 | 2.5 | 3,570 | 87.9 |
| 1923 | 1,269,550,000 | 18 | 692,670,000 | 17 | 45 | 2.5 | 3,750 | 92.7 |
| 1924 | 1,354,570,000 | 7 | 736,590,000 | 6 | 46 | 2.5 | 3,480 | 86.4 |
| 1925 | 1,480,500,000 | 9 | 830,500,000 | 13 | 44 | 2.5 | 3,470 | 84.0 |
| 1926 | 1,652,300,000 | 12 | 929,300,000 | 13 | 44 | 2.5 | 3,580 | 85.4 |
| 1927 | 1,783,700,000 | 8 | 1,017,000,000 | 9 | 43 | 2.3 | 3,590 | 85.1 |

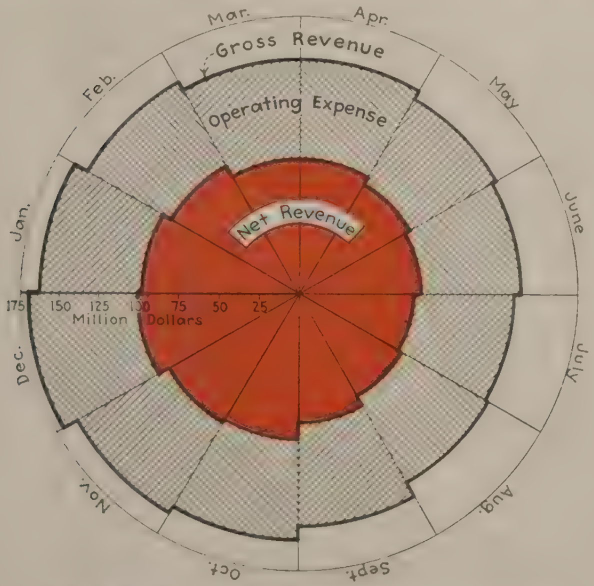
*Average number of customers at beginning and end of year.



VOLUME OF FINANCING REACHED UNPRECEDENTED LEVELS AT END OF 1927

aggregate capitalization of the operating companies and the holding companies. It contains duplication in that the common stock of an operating company is held by a holding company and, in theory at least, the capitalization of the holding company should equal the aggregate amount of the common stocks of operating companies which it holds. Thus this duplication involves the common stock. Another complication occurs in that many holding companies own stocks of industrials, gas companies, water companies and railroads in addition to utilities, so that their capitalization is based on a total stock holding in excess of their operating light and power company stocks. Further, it may be noted that the capitalization used represents face value of securities when issued.

In computing the capitalization figure the census of 1922 was taken as a basis, and for each year since that time annual totals of securities sold are added after that portion used for refunding purposes is deducted. Since many holding companies finance for their operating companies and since many inter-company security holdings exist, it is very difficult to make a tabulation that separates the capitalization of operating and holding companies. The census of this year will make available the capitalization of the operating companies and with those data it will be possible to subdivide the capitalization figure used in this issue. But as an industry statistical fact the total capitalization should be given to show relative changes each year.



OPERATING COSTS ARE PRACTICALLY UNIFORM, WHILE NET REVENUE IS HIGHEST IN WINTER MONTHS

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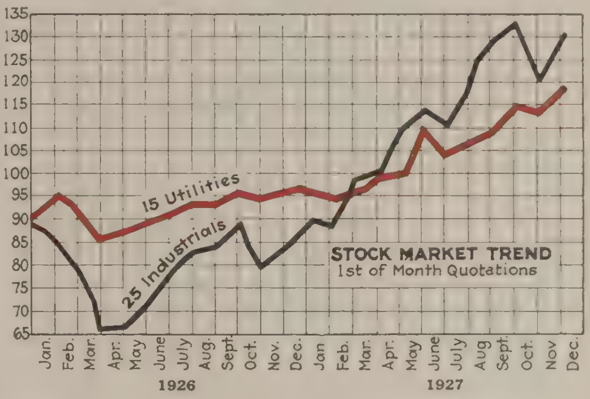
# Markets Forge Upward to New Levels in 1927

### Disregarding threatened market break and possible effect of federal investigation, investors accumulate utility stocks in unprecedented volume

HEAVY investment accumulation of utility stocks in unprecedented volume, forcing averages to new high levels, is the story of the utility markets during 1927. With one or two exceptions, prices reached new high averages every month of the year. Disregarding such factors as a threatened break in stock exchange prices and the possible psychological effect of a federal investigation, investors have shown implicit confidence in the future of the power and light industry and in the soundness of its securities.



UTILITY STOCKS FLUCTUATE WITHIN NARROWER RANGE THAN INDUSTRIALS

Illustrating the action of the markets more specifically, the accompanying graph of the average of fifteen power and light common stocks registers a net advance of 35 points since the beginning of the present movement in April, 1926. Of this advance, approximately 25 points were made during 1927. Collectively, the companies included constitute more than one-third of the industry in gross revenue and may, therefore, be regarded as representative. The importance of this advance, in dollar values, is shown by a study of the change in aggregate market value of these stocks during the period. The total value at the beginning of the period was $1,658,000,000 and at the end $2,136,000,000, showing a net appreciation of $478,000,000, or 29 per cent.

Preferred stocks have shown a steady and consistent appreciation during the year. Levels are now several points above those of last January and investment buying in these issues has shown a definite expansion.

Bond values also registered a steady advance during 1927. Demand for high-grade power and light issues, both for private and for institutional investment, has increased steadily. Under this influence, yields have been steadily reduced until financing has recently been carried on by some of the leading companies on a 4½ per cent basis—the lowest level in nearly twenty years.

# Customers Invest in Industry

## Customer ownership sales approach $240,000,000. Light and power securities widely held. 343,000 transactions in twelve months. Average sale about $700

Despite money market conditions which favored utility financing by the floating of securities in financial centers, the practice of selling stock locally to customers and employees was continued in 1927 at virtually the same pace as in the preceding year. In the twelve months beginning with November, 1926, the total sales, as indicated by monthly reports to the Electrical World, aggregated $248,325,000; the number of transactions was 376,400, and 3,516,000 shares were sold. For the calendar year 1927 it is estimated that sales will amount to $240,000,000 or slightly more in value and that about 3,480,000 shares will have been sold in 343,000 transactions. The average is close to $700 per transaction. The odd average of $69 per share is due to the influence of a considerable number of shares at other than $100 par, notably the large sales of $25 shares by one prominent company.

*Security Sales 1920-1927, Inclusive*

| | Sales by Investment Houses | Sales Direct to Customers | Per Cent Direct to Customers |
|---|---|---|---|
| 1920 | $326,374,000 | $43,000,000 | 11.7 |
| 1921 | 458,917,000 | 80,000,000 | 14.8 |
| 1922 | 589,961,000 | 130,000,000 | 18.1 |
| 1923 | 747,722,000 | 175,000,000 | 19.0 |
| 1924 | 982,421,000 | 254,000,000 | 20.6 |
| 1925 | 982,223,000 | 297,561,800 | 23.2 |
| 1926 | 1,150,965,000 | 236,557,100 | 17.1 |
| 1927 | 1,888,909,000 | 240,000,000† | 11.3 |
| Total 1920–1927 | $7,127,492,000 | $1,456,118,900 | 17.0 |

† November and December estimated.

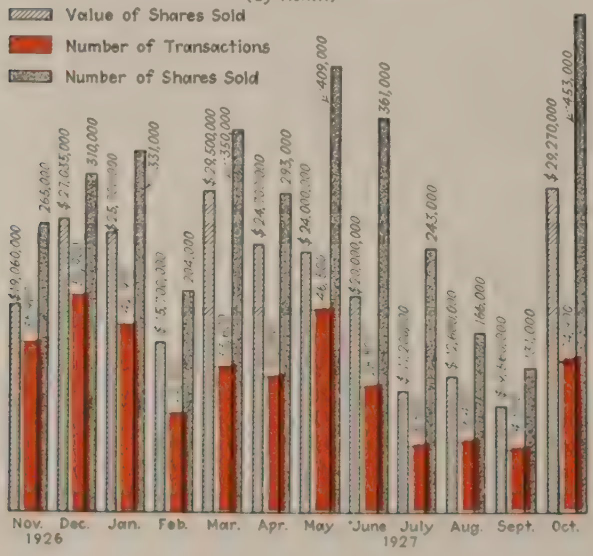
Comparison with 1926 indicates that the money value of securities sold was about the same in both years, but there was a wider distribution of sales. In the earlier year, according to the report of the customer-ownership committee of the National Electric Light Association, companies reporting sold 2,686,187 shares, valued at $236,557,100 in 248,867 transactions. The shares, therefore, increased by 30 per cent and the number of transactions by 37 per cent.

From the data at hand, a segregation of repeated sales to the same purchaser is impossible. The report previously mentioned gives the number of customer and employee stockholders at the end of 1926 as 1,432,277. Whether these are all different individuals or whether the figure is the sum of the number of sales is not clear. In either case, it indicates broad dissemination of the securities in the territory served.

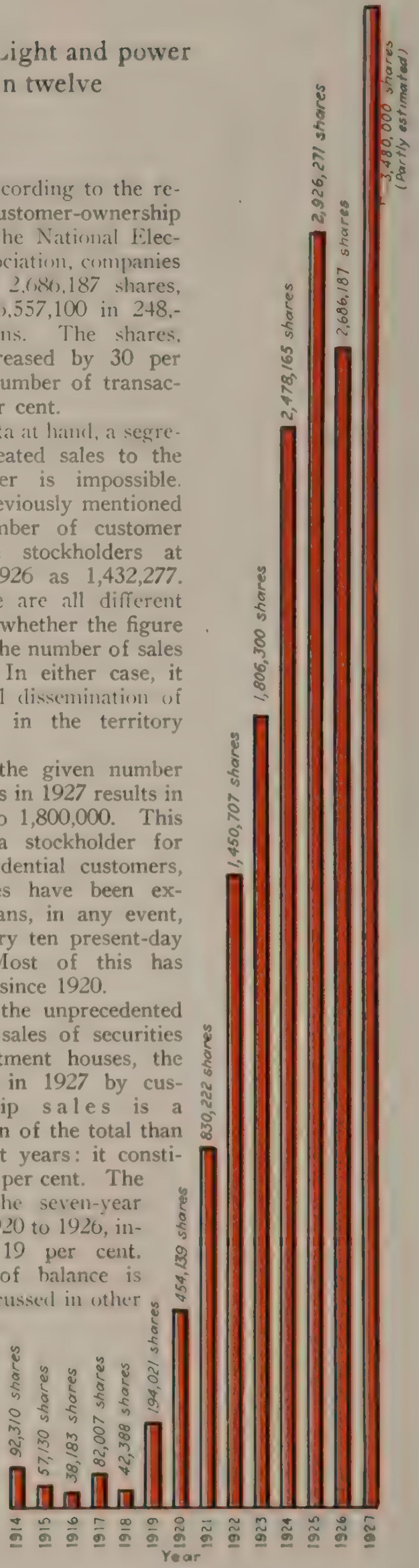
Adding to the given number the transactions in 1927 results in a total close to 1,800,000. This would mean a stockholder for every ten residential customers, if repeat sales have been excluded; it means, in any event, a sale for every ten present-day customers. Most of this has been achieved since 1920.

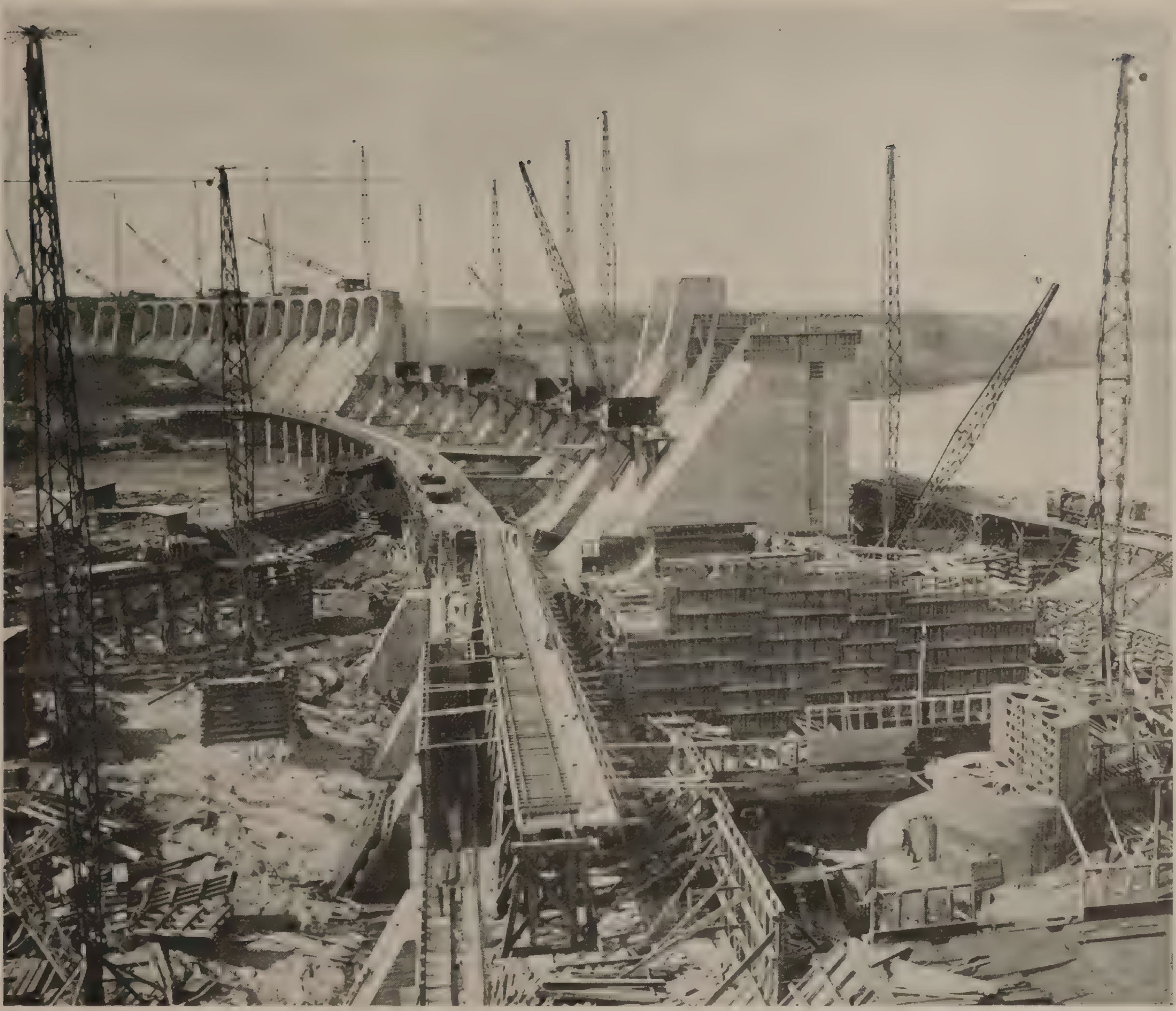
Because of the unprecedented magnitude of sales of securities through investment houses, the money raised in 1927 by customer-ownership sales is a smaller fraction of the total than in other recent years: it constitutes about 11 per cent. The average for the seven-year period from 1920 to 1926, inclusive, was 19 per cent. This change of balance is more fully discussed in other articles in this issue, relating to public utility financing.

SECURITY SALES TO CUSTOMERS
(By Month)



STOCK SALES
To Customers and Employees
(By Years)





JORDAN DAM (ALA.) PLANT TO CONTAIN FOUR 29,000-KVA. UNITS

# $273,000,000 for 1928 Stations

About 3,000,000 kva. to be added to utility generating capacity. Building of plants to occur in all regions. West coast goes to steam stations.

SERVICE demands in the light and power industry increase at a rate that calls for the addition of more than a million kilovolt-amperes to generating stations each year. Budget reports indicate an expenditure in 1928 for power stations aggregating $273,000,000, as compared with $235,000,000 in 1927. The 1928 expenditure will be $183,000,000 for steam plants and $90,000,000 for hydro plants.

Power-plant building occurs in all areas. In several large metropolitan systems the program for 1928 calls for additions to existing stations. In regions of heavy load density new stations are contemplated and in areas where transmission-line building has been active large stations are built to supply the system. With the extension of transmission systems small and inefficient stations in small towns become stand-by or peak-load plants and the bulk of the energy is supplied from large, efficient plants. A striking development for 1928 is the program for building many steam stations on the Pacific Coast and in the South—regions noted for waterpower resources. Two reasons exist for this trend, the chief one being costs and the other being the need for a local power supply to insure reliable service to metropolitan communities served by transmission systems.

Under federal waterpower license a total of 680,826 hp. is scheduled to go into operation in 1928, as compared with 91,194 hp. in 1927. Other large hydro projects are contemplated for the South, and the Conowingo development should start operations. Waterpowers which can be developed economically continue to be in favor, and several large projects await development only because of political or other restrictions.

The accompanying tables give a detailed analysis of power-station building programs for each location, but does not contain certain large stations for which preliminary plans are made and which will be started in 1928. Evidence is available to show that 1928 and 1929 will be very active in power-plant building.

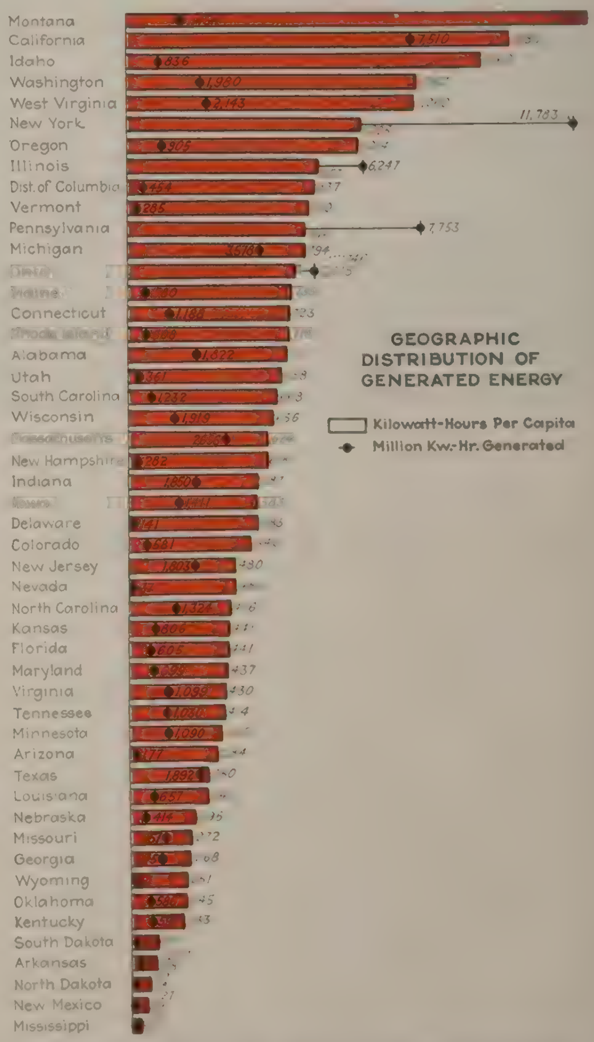
*Table I—New Installations Completed During 1927*

| Division | Hydro Hp. | Hydro Estimated Kva. | Steam Estimated Kva. | Total Estimated Kva. |
|---|---|---|---|---|
| New England | 98,000 | 91,600 | 60,000 | 151,600 |
| Middle Atlantic | 156,000 | 145,800 | 727,500 | 873,300 |
| South Atlantic | 108,000 | 100,900 | 270,900 | 371,800 |
| East North Central | 2,000 | 1,900 | 940,000 | 941,900 |
| East South Central | 108,000 | 100,900 | 38,700 | 139,600 |
| West North Central | 28,000 | 26,200 | 82,300 | 108,500 |
| West South Central | 105,200 | 98,300 | 199,200 | 297,500 |
| Mountain | 143,200 | 133,800 | 7,200 | 141,000 |
| Pacific | 420,200 | 392,700 | 308,800 | 701,500 |
| Total | 1,168,600 | 1,092,100 | 2,634,600 | 3,726,700 |

*Table II—Steam-Electric Generating Plants Completed in 1927, Now Under Construction, or Definitely Planned for an Early Start, Including Additions to Existing Installations*

| Company | Station | Initial or Added Capacity, Kw. | Scheduled Date of Operation | Ultimate Capacity, Kw. |
|---|---|---|---|---|
| *New England States* | | | | |
| Edison Elec. Illuminating Co. | Edgar | *60,000 | 1927 | ......... |
| United Illuminating Co. | English | 32,500 | 1928 | 32,500 |
| *Middle Atlantic States* | | | | |
| American Gas & Electric Co.<br>Pennsylvania Pwr. & Lt. Co. | Stanton, Pa. | 100,000 | 1927 | 400,000 |
| Binghamton Lt., Ht. & Pwr. Co. | Westover | 35,000 | 1928 | ......... |
| Buffalo General Electric Co. | Charles R. Huntley | 60,000 | 1927 | ......... |
| Buffalo General Electric Co. | Charles R. Huntley | 75,000 | 1928 | ......... |
| Duquesne Light Co. | Colfax | 188,500 | 1927 | 500,000 |
| Duquesne Light Co. | Shippingport | *70,000 | 1928 | ......... |
| Elmira Water, Light & R.R. Co. | Elmira | 6,000 | 1927 | ......... |
| Jersey Central Pwr. & Lt. Co. | Whippany | *20,000 | 1927 | ......... |
| New Jersey Power & Light Co. | Holland | 40,000 | 1928 | 250,000 |
| New York Edison Co. | East River | *130,000 | 1927 | *750,000 |
| New York Edison Co. | Hell Gate | *130,000 | 1927 | ......... |
| Rockland Light & Power Co. | Hillburn | 5,000 | 1927 | ......... |
| *South Atlantic States* | | | | |
| Appalachian Electric Power Co. | Cabin Creek, W. Va. | 31,500 | 1927 | ......... |
| Appalacian Electric Power Co. | Glenlyn, Va. | 25,000 | 1927 | ......... |
| Appalachian Electric Power Co. | Kenova, W. Va. | 25,000 | 1927 | ......... |
| Appalachian Electric Power Co. | Roanoke, Va. | *7,500 | 1927 | ......... |
| Delmarvia Power Co. | Vienna, Md. | 12,000 | 1927 | ......... |
| Eastern Shore Public Serv. Co. | Vienna, Md. | 12,000 | 1928 | ......... |
| Florida Power & Light Co. | Lauderdale | 25,000 | 1927 | 150,000 |
| Jacksonville, Fla.—Municipal | Jacksonville | *30,000 | 1927 | ......... |
| Potomac Electric Power Co. | Benninge | *35,000 | 1927 | ......... |
| South Carolina Power Co. | Charleston | 10,000 | 1927 | ......... |
| Virginia Electric & Power Co. | Norfolk | 30,000 | 1927 | ......... |
| *East North Central States* | | | | |
| Central Illinois Pub. Serv. Co.<br>Commonwealth Edison Co.<br>Illinois Power & Light Corp.<br>Public Serv. Co. of No. Illinois | Powerton | 52,000 | 1928 | ......... |
| Commonwealth Edison Co. | Crawford Ave. | *200,000 | 1927 | ......... |
| Commonwealth Edison Co. | Crawford Ave. | 100,000 | 1928 | ......... |
| Consumers Power Co. | Kalamazoo | 20,000 | 1927 | ......... |
| Detroit Dept. of Public Lighting | Morrell St. | 60,000 | 1927 | ......... |
| Detroit Edison Co. | Delray No. 3 | 100,000 | 1928 | 400,000 |
| Detroit Edison Co. | Marysville | 30,000 | 1927 | 110,000 |
| Detroit Edison Co. | Trenton Channel | 125,000 | 1926-7 | 300,000 |
| Detroit Ediston Co. | Trenton Channel | 50,000 | 1927 | |
| Illinois Power & Light Corp. | Danville | 10,000 | 1927 | ......... |
| Indiana & Michigan Elec. Co. | Twin Branch | *40,000 | 1927 | ......... |
| Lansing, Mich.—Municipal | Lansing | 21,500 | 1927 | ......... |
| Ohio Edison Co. | Mad River | 20,000 | 1927 | 60,000 |
| Ohio Power Co. | Philo | 165,000 | 1928 | ......... |
| Ohio Public Service Co. | Ashland | *70,000 | 1927 | ......... |
| Ohio River Edison Co. | Toronto | 37,500 | 1927 | ......... |
| Ohio River Edison Co. | Toronto | 37,500 | 1928 | ......... |
| Public Serv. Co. of No. Illinois | Waukegan | 50,000 | 1927 | 160,000 |
| Richmond, Ind.—Municipal | Richmond | 10,000 | 1927 | ......... |
| State Line Generating Co. | State Line | *220,000 | 1929 | *1,000,000 |
| Union Elec. Lt. & Pwr. Co. of Ill. | Venice | 145,000 | 1927 | 350,000 |
| Union Elec. Lt. & Pwr. Co. of Ill. | Cahokia | 50,000 | 1927 | 350,000 |
| *East South Central States* | | | | |
| Nashville Railway & Light Co. | Nashville | *20,000 | 1927 | ......... |
| Southern Cities Utilities Co. | Estill Springs | †20,000 | 1927 | 20,000 |
| *West North Central States* | | | | |
| Central States Electric Co. | Iowa Falls | 3,500 | 1928 | ......... |
| Empire District Electric Co. | Riverton | *30,000 | 1927 | ......... |
| Kansas Gas & Electric Co. | Neosho | 25,000 | 1927 | 40,000 |
| Kansas Power & Light Co. | Tecumseh | †22,500 | 1927 | ......... |
| Oklahoma Gas & Electric Co. | Horseshoe Lake | 25,000 | 1928 | ......... |
| Otter Tail Power Co. | Mapleton, N. D. | 4,000 | .... | 16,000 |
| Sioux City Gas & Electric Co. | Big Sioux | 10,000 | 1928 | ......... |
| *West South Central States* | | | | |
| Arkansas Utilities Co. | Helena | *4,270 | 1928 | ......... |
| Louisiana Power Co. | Sterlington | 98,400 | 1927 | ......... |
| New Orleans Public Serv., Inc. | New Orleans | 30,000 | 1927 | ......... |
| Public Service Co. of Oklahoma | Welectka | 15,000 | 1927 | 45,000 |
| Southwestern Public Serv. Co. | Amarillo | 5,000 | 1927 | 50,000 |
| Texas Electric Service Co. | Odessa | 3,750 | 1927 | 5,000 |
| Texas-Louisiana Power Co. | Alamogordo | ......... | 1927 | ......... |
| West Texas Utilities Co. | Spur | †800 | 1927 | ......... |
| West Texas Utilities Co. | San Angelo | 5,000 | 1927 | 20,000 |
| *Mountain States* | | | | |
| Albuquerque Gas & Electric Co. | Bernalillo | 3,000 | 1927 | ..... |
| Colorado Public Utilities Corp. | McGregor | 2,750 | 1927 | ..... |
| *Pacific States* | | | | |
| Los Angeles—Bureau of Power & Light | Los Angeles | *30,000 | 1927 | ..... |
| Pasadena, Calif.—Municipal | Pasadena | 15,000 | 1927 | ..... |
| Southern California Edison Co. | Los Angeles | *200,000 | 1927 | ..... |
| Southern California Edison Co. | Long Beach | *60,000 | 1927 | *300,000 |
| Southern California Edison Co. | Long Beach No. 3 | 100,000 | 1928 | ......... |

* = Kva. † = Hp.



NEW YORK LEADS IN TOTAL, MONTANA IN ENERGY PER CAPITA

Energy generated in central light and power, railway, Bureau of Reclamation and other public utility plants.

## *Table III—Hydro-Electric Generating Plants Completed in 1927, Now Under Construction, or Planned for an Early Start, Including Additions to Existing Installations*

| Company | Station | Initial or Added Capacity, Hp. | Scheduled Date of Operation | Ultimate Capacity, Hp. |
|---|---|---|---|---|
| *New England States* | | | | |
| Central Maine Power Co. | Gulf Island | 27,000 | 1927 | ........ |
| Connecticut Light & Power Co. | Rocky River | 32,000 | 1928 | 32,000 |
| New England Power Association | Ridge | 10,000 | 1927 | 10,000 |
| New England Power Association | Bellows Falls, Vt. | 60,000 | 1927 | 536,250 |
| Norwich, Conn.—Municipal | Norwich | 1,000 | 1927 | ........ |
| United Electric Light Co. | Indian Orchard, Mass. | 5,000 | 1928 | ........ |
| *Middle Atlantic States* | | | | |
| Northern Adirondack Power Co. | Ausable Chasm | *4,500 | 1927 | ........ |
| Philadelphia Electric Co. | Conowingo | 350,000 | 1928 | 700,000 |
| Rochester Gas & Electric Corp. | Genesee River | 28,000 | 1927 | 60,000 |
| Rochester Gas & Electric Corp. | Mount Morris | 60,000 | 1927 | ........ |
| Rochester Gas & Electric Corp. | Lower Falls | 20,000 | 1927 | ........ |
| *South Atlantic States* | | | | |
| Carolina Power & Light Co. | Norwood | 83,000 | 1928 | 245,000 |
| Carolina Power & Light Co. | Waterville | 90,000 | 1929 | |
| Carolina Power & Light Co. | Swift Island | 50,000 | 1927 | 100,000 |
| Columbus Electric & Power Co. | Bartlett's Ferry, Ga. | †15,000 | 1928 | ........ |
| Georgia Power Co. | Burton | 9,000 | 1927 | 12,000 |
| Georgia Power Co. | Nacooche | 7,000 | 1927 | ........ |
| Lexington Water Power Co. | Saluda River | †130,000 | 1930 | 200,000 |
| Page Power Co. | Shenandoah River | 2,000 | 1927 | ........ |
| Potomac River Corp. | Great Falls | †180,000 | 1932<br>= 1935 | + 225,000 |
| Southern Power Co. | Claremont | .... | 1928 | 56,000 |
| Tallassee Power Co. | Badin | 40,000 | 1927 | ........ |
| Toccoa Power Co. | Toccoa, Ga. | 22,000 | 1929 | ........ |
| *East North Central States* | | | | |
| Northern States Power Co. | Chippewa River | ...... | 1928 | 30,000 |
| People's Wisconsin Hydro-Electric Co. | Namekagon River | 2,000 | 1927 | ........ |
| *East South Central States* | | | | |
| Alabama Power Co. | Upper Tallassee | *50,000<br>41,500 | 1928<br>1928 | 75,000 |
| Alabama Power Co. | Lock 18 | 144,000 | 1928 | 216,000 |
| Louisville Hydro-Electric Co. | Ohio River | 108,000 | 1927 | 135,000 |
| *West North Central States* | | | | |
| Interstate Power Co. | Delhi, Iowa | 18,000 | 1927 | ........ |
| Mississippi River Power Co. | Keokuk, Iowa | †40,000 | 1929 | ........ |
| Northern Electric Co. | Menominee River | 10,000 | 1927 | ........ |
| *West South Central States* | | | | |
| Central Power & Light Co. | Del Rio | ........ | .... | 6,000 |
| Houston Lighting & Power Co. | Deepwater | †65,000 | 1927 | †180,000 |
| Pecos Valley Power & Light Co. | Pecos River | †12,000 | 1927 | †24,000 |
| James F. Robinson, Oklahoma | Grand River | 140,000 | 1931 | ........ |
| F. H. Willmont & Associates | Guadalupe River | ........ | 1928 | ........ |
| *Mountain States* | | | | |
| Colorado Utilities Corp. | .................. | 10,000 | 1927 | . |
| Great Falls Power Co. | Black Eagle Falls | 24,000 | 1927 | ........ |
| Idaho Power Co. | American Falls | †12,000 | 1927 | .... |
| Inland Power & Light Co. | Clearwater River | 12,000 | 1927 | 12,000 |
| Montana Power Co. | Black Eagle Falls | 25,000 | 1927 | ........ |
| Pacific Power & Light Co. | Lewiston | †10,000 | 1927 | †10,000 |
| Salt River Valley Water Users' Association | Horse Mesa | *33,000 | 1927 | *33,000 |
| U. S. Bureau of Reclamation | Guernsey, Wyo. | 3,500 | 1927 | ........ |
| U. S. Bureau of Reclamation | Minidoka | *3,000 | 1927 | *10,000 |
| Western States Utilities Co. | Birch Creek, Idaho | 275 | 1927 | ........ |
| *Pacific States* | | | | |
| Aberdeen, Wash.—Municipal | Wynooche | 16,000 | 1928 | 30,000 |
| American River Wtr. & Pwr. Co. | American River No. 1 | †20,000 | 1928 | †20,000 |
| American River Wtr. & Pwr. Co. | American River No. 2 | †20,000 | 1928 | †20,000 |
| California-Oregon Power Co. | Prospect No. 2 | 44,000 | 1927 | 66,000 |
| Cascade Power Co. | Chiwaucum | 60,000 | 1931 | 73,000 |
| Feather River Power Co. | Bucks Creek | 60,000 | 1927 | 300,000 |
| Grays Harbor Railway & Lt. Co. | Cowlitz River | 60,000 | 1928 | ..... |
| Los Angeles, Bureau of Pwr. & Lt. | Haiwee | *7,000 | 1927 | ..... |
| Los Angeles, Bureau of Pwr. & Lt. | Owens River | 47,000 | 1928 | ..... |
| Northwestern Power & Light Co. | Elwha River | 17,500 | 1927 | ..... |
| Pacific Gas & Electric Co. | Drum | 17,000 | 1927 | ..... |
| Pacific Gas & Electric Co. | Electra | 18,000 | 1928 | ..... |
| Pacific Gas & Electric Co. | Melones | 36,000 | 1927 | 36,000 |
| Pacific Gas & Electric Co. | Spaulding No. 1 | *8,000 | 1927 | ..... |
| Pacific Gas & Electric Co. | Spaulding No. 2 | *3,750 | 1928 | .. |
| Pacific Gas & Electric Co. | Spaulding No. 3 | *7,000 | 1928 | *7,000 |
| Pacific Gas & Electric Co. | Tiger Creek | 44,000 | 1928 | 44,000 |
| Pacific Gas & Electric Co. | Mokelumne | 60,000 | 1927 | ..... |
| Puget Sound Power & Light Co. | Baker River Dam | 8,000 | 1927 | .... |
| San Joaquin Light & Power Corp. | Kings River | 40,000 | 1927 | 500,000 |
| Seattle, Wash.—Municipal | Diablo Canyon | 120,000 | 1928 | ....... |
| Seattle, Wash.—Municipal | Cedar Falls | †3,500 | 1927 | ..... |
| Shasta Power Corp. | Pitt No. 4 | *100,000 | 1928 | .... |
| Southern California Edison Co. | Big Creek No. 2.A | 112,000 | 1928 | 112,000 |
| Tacoma, Wash.—Municipal | Cushman No. 2 | 50,000 | 1927 | 140,000 |
| Turlock Irrigation District | Don Pedro | †15,000 | 1927 | †30,000 |
| Washington Pulp & Paper Co. | Glines Canyon | *13,333 | 1927 | *13,333 |
| Washington Water Power Co. | Lake Chelan | 32,200 | 1927 | 128,000 |
| Washington Water Power Co. | Lake Chelan | 32,200 | 1928 | |

† = Kw. * = Kva.

GREAT FALLS (TENN.) HYDRO STATION TAPS TWO WATER SHEDS

# *List of Power Projects Completed in 1927 or Under Construction Under License from Federal Power Commission as of November 1, 1927.*

| Project No. | Name | Stream | State | Proposed Ultimate Installation, Hp. | Estimated Cost | Scheduled Date of Completion | Hp. Scheduled to Be Put in Operation or Placed in Operation 1927 | 1928 | 1929 |
|---|---|---|---|---|---|---|---|---|---|
| 15 | Hydraulic Race Co. et al | Eighteen-Mile Cr. | New York | 13,240 | $1,068,000 | 12-13-28 | ...... | (a) 6,965 | ...... |
| 67 | Southern California Edison Co. | San Joaquin | California | 545,000 | 61,152,000 | 7-1-35 | ...... | ...... | (b) 107,000 |
| 70 | Rock Creek Power Co. | Rock Creek | Montana | 11,860 | 200,000 | 8-1-28 | ...... | 1,880 | ...... |
| 77 | Snow Mountain Water & Power Co. | South Eel | California | 14,400 | (c) 6,665,000 | 7-1-29 | (c) 4,000 | ...... | ...... |
| 120 | Southern California Edison Co. | San Joaquin | California | 195,000 | 13,890,000 | 12-31-29 | ...... | ...... | (d) 90,000 |
| 137 | Pacific Gas & Electric Co. | No. Fk. Mokelumne | California | 42,000 | (e) 8,291,000 | 12-1-30 | ...... | ...... | ...... |
| 155 | Southern Sierras Power Co | Snow Creek | California | 3,750 | (f) 656,300 | 12-31-27 | 3,750 | ...... | ...... |
| 175 | San Joaquin Light & Power Corp. | San Joaquin | California | 556,000 | 50,970,000 | 7-1-36 | 38,000 | ...... | ...... |
| 176 | Escondido Mutual Water Co. | San Luis Rey | California | 1,000 | 260,000 | 9-1-26 | (g) 360 | ...... | ...... |
| 184 | El Dorado Power Co. | So. Fk. American | California | (h) 112,000 | 8,922,319 | 12-31-35 | ...... | ...... | ...... |
| 185 | Southern Sierras Power Co. | Lost Creek et al | California | 4,000 | 630,000 | 12-31-27 | 4,000 | ...... | ...... |
| 201 | Town of Petersburg | Crystal Lake | Alaska | 1,240 | (i) 103,500 | 12-31-25 | ...... | ...... | 620 |
| 233 | Mount Shasta Power Corp. | Pit River | California | 120,000 | 14,924,000 | 12-31-31 | ...... | ...... | ...... |
| 271 | Arkansas Power & Light Co. | Ouachita | Arkansas | (j) 96,000 | 8,055,000 | 7-1-36 | ...... | ...... | ...... |
| 289 | Louisville Hydro-Electric Co. | Ohio | Kentucky | 135,000 | 7,500,000 | 12-31-29 | ...... | 108,000 | ...... |
| 309 | Clarion River Power Co | Clarion | Pennsylvania | 42,500 | 6,460,000 | 9-1-27 | (k) 20,500 | ...... | ...... |
| 312 | Molybdenum Corp. of America | Red River | New Mexico | 530 | 67,000 | 7-1-27 | ...... | ...... | (l) 430 |
| 338 | Nevada Irrigation District | Middle Fork Yuba & Canyon Creek | California | 150,000 | 5,100,000 | 7-1-34 | ...... | ...... | ...... |
| 353 | Home Power Co. | Skagway River | Alaska | 250 | 49,000 | 1-1-31 | ...... | ...... | ...... |
| 404 | Carvey, L. H. | Lagoon Creek | Alaska | 160 | (m) 32,000 | 12-31-27 | 160 | ...... | ...... |
| 405 | The Susquehanna Power and Philadelphia Electric Power Co. | Susquehanna | Md. and Pa. | 594,000 | 52,200,000 | 12-31-35 | ...... | 378,000 | ...... |
| 432 | Carolina Power & Light Co. | Big Pigeon | North Carolina | 139,500 | 11,900,000 | 12-31-33 | ...... | ...... | 46,500 |
| 451 | Humphreys, A. E. | Goose Creek | Colorado | 650 | 157,900 | 11-1-27 | 400 | ...... | ...... |
| 459 | Cravens, Walter | Osage River | Missouri | 135,000 | 14,100,000 | 12-31-29 | ...... | ...... | 135,000 |
| 485 | Columbus Electric & Power Co. | Chattahoochee | Ala. and Ga. | 80,000 | 7,500,000 | 12-31-26 | ...... | (n) 22,000 | ...... |
| 516 | Lexington Water Power Co. | Saluda | So. Carolina | 260,000 | 24,000,000 | 12-31-30 | ...... | ...... | ...... |
| 533 | Horning, Fred A. | Flat Creek | Montana | 80 | 17,900 | 1-1-27 | 80 | ...... | ...... |
| 539 | Kentucky Hydro Electric Co. | Kentucky | Kentucky | 3,000 | 404,000 | 12-31-27 | 3,000 | ...... | ...... |
| 567 | East Bay Municipal Utility District | Mokelumne | California | 10,000 | (o) 7,922,000 | 12-31-31 | ...... | ...... | ...... |
| 588 | Northwestern Power & Light Co. | Elwha | Washington | 16,500 | 1,300,000 | 12-31-27 | 16,500 | ...... | ...... |
| 590 | Snow Storm Silver Lead Co. | Callahan Creek | Montana | 600 | 60,000 | 1-1-29 | ...... | 600 | ...... |
| 615 | Muncy, W. G. | Kelly's Gulch | California | 20 | (m) 4,000 | 1-1-29 | ...... | 15 | ...... |
| 618 | Alabama Power Co. | Coosa River | Alabama | 180,000 | 13,250,000 | 12-31-28 | ...... | 72,000 | ...... |
| 619 | Feather River Power Co. | Bucks Creek et al | California | 60,000 | 7,700,000 | 6-30-28 | ...... | 60,000 | ...... |
| 621 | Inland Power & Light Co. | Clearwater River | Idaho | 10,880 | 2,000,000 | 12-31-31 | ...... | 5,440 | ...... |
| 637 | Chelan Electric Co. | Chelan River | Washington | 125,000 | 11,344,000 | 12-31-34 | ...... | 25,000 | ...... |
| 682 | West Florida Power Co. | Ochlockonee | Florida | 12,000 | 2,100,000 | 8-23-29 | ...... | ...... | 12,000 |
| 693 | Town of Highlands | Cullasagee | North Carolina | 300 | 66,000 | 6-30-27 | 300 | ...... | ...... |
| 710 | Wisconsin Power & Light Co. | Wolf River | Wisconsin | 920 | 240,000 | 12-31-28 | ...... | 920 | ...... |
| 714 | Price and Galt | Eau Claire Creek | California | 34 | (m) 6,800 | 1-5-30 | ...... | ...... | 34 |
| 719 | Royal Development Co. | James and Phelps Creek | Washington | 440 | 105,000 | 12-1-29 | ...... | ...... | (p) 270 |
| 727 | Saint Paul's Mission | Little Peoples Creek | Montana | 6 | (m) 1,200 | 1-1-29 | ...... | 6 | ...... |
| 735 | Duncan, Abe | Forni Creek | California | 4 | 700 | 9-27-27 | 4 | ...... | ...... |
| 750 | Galt, E. G. | Eau Claire Creek | California | 20 | (m) 4,000 | 1-5-30 | ...... | ...... | 20 |
| 787 | Richel, Marion I. | Black Fk. of Rock Creek | Montana | 10 | 800 | 12-1-27 | 10 | ...... | ...... |
| 807 | Gorman Packing Corp. | Unnamed Creek on Knight Island | Alaska | 100 | 8,000 | 12-31-27 | 100 | ...... | ...... |
| 822 | Gold Basis Mining & Milling Co. | East Fk. of North Fk. of North Fk. of Yuba | California | 270 | 43,000 | 11-30-29 | ...... | ...... | 270 |
| | Totals | | | 3,663,284 | $351,250,419 | | 91,194 | 680,826 | 392,144 |

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(a) 6,275 hp. previously constructed or remodeled.
(b) 30,000 hp. previously installed.
(c) Cost includes about 110 miles transmission line; 10,400 hp. previously installed.
(d) 105,000 hp. previously installed.
(e) Includes 14.5 miles of transmission line.
(f) Cost includes 4.2 miles transmission line.
(g) 640 hp. previously installed.
(h) 28,000 hp. previously installed.
(i) Cost includes 16 miles of transmission line.
(j) 12,000 hp. previously installed.
(k) 22,000 hp. previously installed.
(l) 100 hp. previously installed.
(m) Assumed cost based on $200 per hp.
(n) 44,000 hp. previously installed.
(o) For power and water supply.
(p) 170 hp. previously installed.

OUTDOOR COMPARTMENTS AT CHICAGO CONTAIN 12,000-VOLT BUSES AND CIRCUIT BREAKERS

# What of the Future

## *In Producing Electrical Energy from Heat Sources*

By J. C. Parker
*Vice-President Brooklyn Edison Company*

J. C. PARKER

IN ATTEMPTING to forecast improvements in the cost of production of electrical energy from heat sources, a person is tempted first to think about new and weird cycles. While not discounting the opportunity for improvement in these spectacular ways, I am convinced that the big improvements in the next few years will come through more pedestrian enterprise.

Progressively the last ten years have seen stage bleeding, air preheating, economizers and intelligent uses of auxiliary steam come into their own. Water walls and preheat cycles have progressively advanced the economy of steam-power production. We don't hold our breath now when one talks of steam pressures of 1,500 lb., and evaporation at the critical point is just around the corner—reduced to practice on the continent of Europe. At Hartford the mercury cycle has shown itself to be operatively feasible and the use of diphenol oxide has alluring possibilities with all the evidence of being probably practicable.

Strangely enough, most engineering effort has been devoted to the top of the cycle with but little attention to the low temperature end except for sporadic attempts at the use of exhaust steam in certain evaporation processes. I say strangely enough, because the present lost latent heat of vaporization represents by far the biggest part of the heat taken from the boiler room. There is in my mind no question that intelligent economic research will sooner or later find a balanced process wherein this latent heat can be salvaged and our large generating plants correspondingly operated noncondensing.

Engineers who view the significant improvement in combustion brought about during the past few years must recognize that, brilliant as are the developments that have taken place, they shine only by comparison with the work of previous years. The present status of the combustion art is a long way from the ultimate. As an extreme possibility in this connection it may be pointed out that there is a sister industry which buys fuel in large quantities, prepares it for gaseous distribution and has huge quantities of solid byproducts. Clearly, from the combustion viewpoint, there should be considerable and significant possibilities of economy in the cooperative development of gas works, electric supply stations and exhaust steam utilization.

These are things to dream about, or, better, actively to study. Close at hand, however, we have the possibility of design and management improvement following our present basic methods of energy production.

The cost of energy delivered on to the bus depends on three things—investment cost, over-all efficiency and operation management. Great strides have been made with the second of these, so far as concerns the individual unit. I seriously question whether the same skill has been devoted to the development of system efficiency. Most of us, for example, consider the beautifully efficient base-load unit as a thing which has its place on the big interconnected system. What could be accomplished were the companies which operate detached from such systems definitely to design peak-load units primarily with reference to low first costs almost irrespective of operating efficiency with the idea that other units might be operated at load factors approximating 100 per cent and correspondingly designed for the maximum efficiency attainable? Could not the total cost of production significantly be lowered? We have habitually devoted most of our attention to our newer constructions with but little thought to the problem of complete utilization of our older stations as spare or emergency capacity, in spite of the fact that such treatment of the older equipment would enable at once the preponderance of generation by the more modern and efficient equipment and the saving of new construction expenditure.

In spite of the appearance that engineers and operators display when on dress parade, the substantial fact is that we are woefully ignorant of the things that we can do operatively with our equipment, once installed. For example, to obtain a high system economy it is absolutely essential that the least economical equipment be held available for emergency purposes only, yet there is absolutely no quantitative knowledge in the industry or fundamental understanding even of the sequence of events ensuing on the sudden throwing of load on to such stand-by equipment. Operating management is then necessarily curtailed in most fully realizing the best that can be had from the equipment installed. A fraction of

*Total Energy and Fuel-Generated Energy in Public Utility Plants in the U. S. 1919-1927*

Including electric light and power, electric railway, Bureau of Reclamation and certain other plants generating energy for public consumption:

| Year | Kw.-Hr. Generated in all Public Utility Plants (Millions) | Kw.-Hr. Generated from Fuel (Millions) | Coal Consumed (Thousands of Tons) | Coal Equivalent of all Fuel† (Thousands of Tons) Total | Pounds of Coal per Kw.-Hr. |
|---|---|---|---|---|---|
| 1919 | 38,921 | 24,176 | 35.10 | 38.88 | 3.2 |
| 1920 | 43,555 | 27,248 | 37.13 | 41.43 | 3.0 |
| 1921 | 40,976 | 25,863 | 31.59 | 35.25 | 2.7 |
| 1922 | 47,659 | 30,240 | 34.18 | 38.01 | 2.5 |
| 1923 | 55,674 | 36,092 | 38.96 | 43.53 | 2.4 |
| 1924 | 59,014 | 38,808 | 37.56 | 43.14 | 2.2 |
| 1925 | 65,870 | 43,264 | 40.23 | 44.79 | 2.1 |
| 1926 | 73,791 | 47,274 | 41.32 | 45.87 | 1.95 |
| 1927 | 79,588* | 50,141* | 41.75* | 46.22* | 1.84* |

*Estimate based on ten months' operations.
†Includes oil and natural gas.

the effort which has gone into design development if devoted to operating management research would produce most significant improvements in the steam-generating art.

Granted the most advanced cycle, system design for high efficiency and fundamentally sound operating management, there still remains room for improvement in capital costs. We cannot expect any enormous reductions in the first cost of our turbine equipment or in the boiler equipment per unit of capacity. However, we are learning to use the installed boiler room capacity for duties which a few years ago would have been undreamed. Only yesterday one heard of a boiler being operated at 700 per cent of nominal rating, and the question naturally arises as to when we will throw nominal ratings overboard entirely. Such developments as the result of water-cooled walls and powdered fuel are in the spectacular class, but there is even more significant improvement of capital cost to be had in the detail layout.

Designers have exercised a fiendish ingenuity in pyramiding valves and piping systems, switches and relays and academically exquisite schemes to obtain efficiencies which no routine operation ever could attain because the technical complications have jeopardized reliability.

All great art has distinguished itself through simplicity and straightforwardness of conception and boldness of execution. Admirable as have been the engineering advances in power plant design, it is questionable whether they have been distinguished in this sense. Complication of design not only causes excessive initial cost, but demands labor crews and supervisory effort that may easily be way out of proportion to the paper gains expected. In his entire professional career the writer has never yet discovered that thoughtful simplification did not result in greater dependability and higher economy of operation.

In attempting to predict the immediate future of the steam-generating art, one would be bold, if not foolish, to attempt to say which element will produce signal improvements and to what extent. Could that be done to any degree of certainty, the future would already have become present. However, it is hoped that the foregoing may indicate that the production of electrical energy from the heat of combustion has not attained anything approaching full development but rather that the ensuing few years will produce not only more kilowatt-hours per pound of fuel but even more significantly more kilowatt-hours per dollar expended. The unique attainment of the electrical industry—pushing down the price of its commodity in the face of increased costs for all other elements in living—is going to continue almost without limit into the future.

### *Conowingo Interconnection*

*Right*—The 400,000-kw. Conowingo hydro station of the Philadelphia Electric Company.

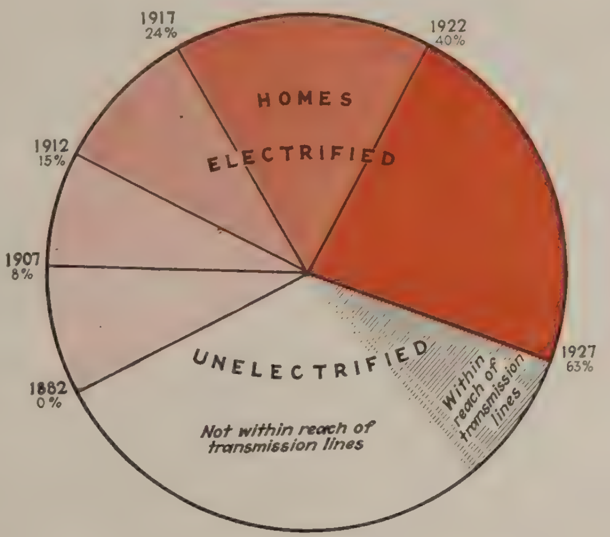
*Below*—Plymouth Meeting substation will interconnect 220-kv. lines of the Pennsylvania Power & Light Company, Public Service Electric & Gas Company and Philadelphia Electric Company.

*Lower Right*—Two lines of these towers carry 220-kv. circuits from Conowingo to Philadelphia.

# 21,694,000 Customers

More than 1,500,000 added in 1927. Residential customers increase by 1,237,000 to nearly 17,600,000. 63 per cent of American homes now served. Rate of growth 7.5 per cent. Peak of increase has been passed

THE beginning of 1928 finds the electric light and power industry serving 21,694,100 customers, classified into 17,596,400 residential, 3,166,570 commercial and 931,140 industrial power users and others. The last-named group includes some miscellaneous customers not listed by companies reporting under any one of the three major classes, but their number is relatively small.



SIXTY-THREE PER CENT OF HOMES ARE ELECTRIFIED. 23 PER CENT SINCE 1922

The net increase during the year 1927 is estimated at 1,515,569, divided into 1,237,111 residential, 203,160 commercial lighting and 75,298 others. The rate of increase was approximately 7.5 per cent; slightly lower if all classes are considered together; a trifle higher for domestic customers alone.

Although individual companies reported gains far in excess of the national average, the greatest regional gains, both numerically and in per cent, occurred in the Middle Atlantic group of states; the rate of growth in that section was 9.4 per cent, rising to nearly 10 per cent in New York and somewhat higher in New Jersey. As in previous years, the influence of the metropolitan area is marked.

The table of customers on page 66 has been critically revised, in the light of all available sources of information. It embodies the results of special surveys, of data collected throughout the year and of much correspondence with all authorities in the various states from whom authentic data might be had.

The returns for 1927 corroborate the inference drawn from similar statistics in recent years: the period of maximum increase in number of customers has been passed; growth from now on will probably be more and more gradual. Residential customers constitute by far the largest group numerically—about four-fifths of the total—and since the number of those using electricity is approaching two-thirds of all the homes in the country, it is reasonable to suppose that the rapid increase observed a few years ago could not long continue.

It might be urged that the data are not entirely homogeneous; customers, consumers, number of meters and number of open accounts are variously reported when an effort is made to ascertain the number of light and power customers. These terms are not equivalent, but the data thus gathered are the best to be had at this time; while the differences would no doubt preclude a fair comparison of the operations of certain individual companies, the effect on state and national totals is not great. Some of the errors tend to balance out, and the resulting figures represent the number of families, of business places and of power-consuming establishments with reasonable accuracy for practical purposes.

Assuming, then, that a residential customer is substantially equivalent to a family electrically served, and basing the estimated number of families on census statistics for the year in question, it appears that nearly 64 per cent of our national population now have central-station service in their homes. This excludes isolated plants not classed as public utilities, in particular farm-lighting sets which are estimated at 350,000.

In the past the net increase in customers has far outrun the growth in population. The turning point appears to have been reached in 1924; the gain that year was about 2,000,000 customers of all kinds. In the next three years it was successively, in round numbers, 1,700,000, 1,700,000 and 1,500,000. The residential growth presents the same picture, only the figures are a little smaller — namely, 1,600,000, 13,500,000, 13,500,000 and 12,400,000, respectively, again in round numbers.

The accompanying table summarizes the changes that have taken place in twenty years. The electrical industry was by no means insignificant in 1907, but in retrospect the figures of that day look small. In two decades the increase in customers has been more than tenfold. The number has trebled in a decade.

Data for the earlier years are reprinted from the United States Census of Central Electric Light and Power Stations. Those subsequent to 1922 have been critically revised in the light of the best available information. In addition to statistics received directly through the co-operation of the companies themselves, generous assist-

## (Central Station Customers by States (1907-1927) and Classes (1926-1927)

| | U. S. Central Station Census | | | | | | | | | Domestic Lighting Customers | | | Commercial Lighting Customers | | | Power and Miscellaneous Customers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1907 | 1912 | 1917 | 1922 | 1924 | 1925 | 1926 | 1927 | Increase During 1927 | 1926 | 1927 | Increase During 1927 | 1926 | 1927 | Increase During 1927 | 1926 | 1927 | Increase During 1927 |
| *United States* | 1,946,979 | 3,837,518 | 7,178,703 | 12,709,868 | 16,768,509 | 18,472,146 | 20,178,531 | 21,694,100 | 1,515,569 | 16,359,279 | 17,596,390 | 1,237,111 | 2,963,410 | 3,166,570 | 203,160 | 855,842 | 931,140 | 75,298 |
| New England | 162,875 | 313,227 | 647,289 | 1,143,697 | 1,525,125 | 1,689,255 | 1,804,276 | 1,931,210 | 126,934 | 1,472,896 | 1,585,800 | 112,904 | 260,010 | 269,270 | 9,260 | 71,370 | 76,140 | 4,770 |
| Middle Atlantic | 419,837 | 822,906 | 1,523,862 | 3,242,775 | 4,260,962 | 4,814,550 | 5,392,703 | 5,952,800 | 560,097 | 4,304,103 | 4,764,700 | 460,597 | 909,000 | 987,600 | 78,600 | 179,600 | 200,500 | 20,900 |
| South Atlantic | 93,471 | 193,909 | 357,577 | 679,081 | 1,072,467 | 1,198,211 | 1,349,844 | 1,454,500 | 104,656 | 1,081,125 | 1,168,830 | 87,705 | 211,410 | 222,980 | 11,570 | 57,309 | 62,690 | 5,381 |
| East North Central | 485,534 | 940,883 | 1,884,042 | 3,311,010 | 4,316,179 | 4,682,661 | 5,106,361 | 5,418,400 | 312,039 | 4,249,038 | 4,515,040 | 266,002 | 668,700 | 702,490 | 33,790 | 188,623 | 200,870 | 12,247 |
| West North Central | 236,622 | 451,386 | 988,104 | 1,560,698 | 1,913,965 | 1,995,822 | 2,113,050 | 2,222,050 | 109,000 | 1,709,300 | 1,798,350 | 89,050 | 303,800 | 318,100 | 14,300 | 99,950 | 105,600 | 5,650 |
| East South Central | 70,798 | 107,106 | 184,126 | 351,899 | 529,545 | 552,987 | 615,300 | 671,300 | 56,000 | 488,300 | 530,450 | 42,150 | 104,300 | 115,600 | 11,300 | 22,700 | 25,250 | 2,550 |
| West South Central | 117,055 | 223,283 | 373,180 | 605,331 | 930,217 | 1,015,162 | 1,082,200 | 1,167,900 | 85,700 | 826,300 | 880,250 | 53,950 | 198,050 | 225,150 | 27,100 | 57,850 | 62,500 | 4,650 |
| Mountain | 107,831 | 182,108 | 337,087 | 445,270 | 522,028 | 544,572 | 585,697 | 611,740 | 26,043 | 485,817 | 506,390 | 20,573 | 77,070 | 81,090 | 4,020 | 22,810 | 24,260 | 1,450 |
| Pacific | 252,956 | 491,730 | 791,276 | 1,357,372 | 1,698,021 | 1,978,926 | 2,129,100 | 2,264,200 | 135,100 | 1,742,400 | 1,846,580 | 104,180 | 231,070 | 244,290 | 13,220 | 155,650 | 173,330 | 17,700 |
| ***New England:*** | | | | | | | | | | | | | | | | | | |
| Maine | 19,614 | 28,511 | 51,213 | 92,733 | 137,018 | 150,418 | (a) 158,278 | 166,400 | 8,122 | 123,278 | 129,500 | 6,222 | 26,300 | 27,600 | 1,300 | 8,700 | 9,300 | 600 |
| New Hampshire | 14,082 | 22,752 | 38,280 | 64,158 | (a) 89,055 | (a) 96,147 | (b) 102,400 | 113,500 | 11,100 | 80,800 | 89,700 | 8,900 | 17,550 | 19,300 | 1,750 | 4,050 | 4,500 | 450 |
| Vermont | 15,361 | 22,380 | 33,147 | 48,320 | 57,570 | 62,220 | 68,820 | 72,610 | 3,790 | 57,430 | 59,500 | 2,070 | 8,080 | 8,220 | 140 | 3,310 | 4,890 | 1,580 |
| Massachusetts | 80,713 | 163,993 | 344,437 | 607,563 | (a) 812,058 | (a) 906,606 | (a) 960,148 | 1,031,400 | 71,252 | 784,648 | 851,200 | 66,552 | 137,200 | 140,000 | 2,800 | 38,300 | 40,200 | 1,900 |
| Rhode Island | 11,591 | 19,088 | 43,817 | 86,271 | 120,074 | 130,889 | 144,730 | 155,350 | 10,620 | 120,540 | 130,100 | 9,560 | 20,180 | 21,050 | 870 | 4,010 | 4,200 | 190 |
| Connecticut | 21,514 | 56,503 | 136,395 | 244,652 | (a) 309,341 | 342,975 | (a) 369,900 | 391,950 | 22,050 | 306,200 | 325,800 | 19,600 | 50,700 | 53,100 | 2,400 | 13,000 | 13,050 | 50 |
| ***Middle Atlantic:*** | | | | | | | | | | | | | | | | | | |
| **New York** | 201,701 | 434,110 | 794,516 | 1,760,418 | (a) 2,296,482 | 2,548,833 | (a) 2,915,073 | 3,234,800 | 319,727 | 2,297,173 | 2,549,900 | 252,727 | 529,000 | 584,000 | 55,000 | 88,900 | 100,900 | 12,000 |
| **New Jersey** | 57,179 | 105,785 | 202,030 | 428,934 | (a) 644,112 | 749,347 | (a) 854,100 | 953,500 | 99,400 | 697,700 | 777,300 | 79,600 | 122,000 | 134,500 | 12,500 | 34,400 | 41,700 | 7,300 |
| **Pennsylvania** | 160,957 | 283,011 | 527,316 | 1,053,423 | (a) 1,320,368 | 1,516,370 | 1,623,530 | 1,764,500 | 140,970 | 1,309,230 | 1,437,500 | 128,270 | 258,000 | 269,100 | 11,100 | 56,300 | 57,900 | 1,600 |
| ***South Atlantic:*** | | | | | | | | | | | | | | | | | | |
| Delaware | *11,165 | ...... | ...... | ...... | 21,112 | 28,750 | 31,900 | 33,600 | 1,700 | 25,100 | 26,430 | 1,330 | 5,900 | 6,210 | 310 | 900 | 960 | 60 |
| Maryland | 22,168 | †66,465 | †108,178 | †209,947 | (a) 191,181 | (a) 220,104 | (a) 250,791 | 274,500 | 23,709 | 215,500 | 236,400 | 20,900 | 30,900 | 33,250 | 2,350 | 4,391 | 4,850 | 459 |
| Dist. of Columbia | ...... | ...... | ...... | ...... | (a) 77,057 | (a) 91,179 | (a) 107,375 | 119,800 | 12,425 | 86,575 | 97,700 | 11,125 | 15,700 | 16,600 | 900 | 5,100 | 5,500 | 400 |
| Virginia | 6,969 | 14,948 | 35,705 | 61,182 | 134,965 | 153,455 | (a) 182,450 | 199,900 | 17,450 | 152,700 | 167,200 | 14,500 | 19,800 | 21,800 | 2,000 | 9,950 | 10,900 | 950 |
| West Virginia | 9,404 | 18,165 | 32,520 | 74,069 | (a) 118,553 | (a) 131,088 | (b) 141,528 | 152,500 | 10,972 | 111,200 | 121,000 | 9,800 | 25,300 | 26,400 | 1,100 | 5,028 | 5,100 | 72 |
| North Carolina | 9,719 | 25,676 | 51,603 | 106,392 | 164,439 | 180,059 | (b) 195,600 | 209,500 | 13,900 | 149,400 | 161,100 | 11,700 | 37,780 | 38,900 | 1,120 | 8,420 | 9,500 | 1,080 |
| South Carolina | 8,054 | 17,602 | 32,226 | 61,685 | 94,291 | 98,641 | (b) 106,000 | 114,200 | 8,200 | 83,250 | 89,700 | 6,450 | 19,330 | 20,820 | 1,490 | 3,420 | 3,680 | 260 |
| **Georgia** | 15,452 | 29,109 | 47,235 | 73,957 | 127,193 | 138,135 | 154,200 | 168,700 | 14,500 | 123,900 | 135,600 | 11,700 | 24,200 | 26,400 | 2,200 | 6,100 | 6,700 | 600 |
| **Florida** | 10,540 | 21,944 | 50,110 | 91,849 | 143,676 | 156,800 | 180,000 | 181,800 | 1,800 | 133,500 | 133,700 | 200 | 32,500 | 32,600 | 100 | 14,000 | 15,500 | 1,500 |
| ***East North Central:*** | | | | | | | | | | | | | | | | | | |
| Ohio | 100,071 | 174,467 | 353,183 | 774,605 | (d) 1,096,793 | (d) 1,205,844 | ( ) 1,365.000 | 1,447,000 | 82,000 | 1,152,000 | 1,228,000 | 76,000 | 174,000 | 177,000 | 3,000 | 39,000 | 42,000 | 3,000 |
| Indiana | 86,237 | 156,603 | 267,628 | 405,240 | 502,351 | 538,571 | ( ) 579,300 | 611,200 | 31,900 | 490,000 | 515,600 | 25,600 | 69,400 | 74,000 | 4,600 | 19,900 | 21,600 | 1,700 |
| Illinois | 167,645 | 364,046 | 682,260 | 1,127,830 | 1,457,261 | 1,565,473 | (b) 1,683,800 | 1,779,000 | 95,200 | 1,393,100 | 1,470,740 | 77,640 | 223,500 | 237,290 | 13,790 | 67,200 | 70,970 | 3,770 |
| Michigan | 87,500 | 187,545 | 421,692 | 659,233 | 850,140 | 909,841 | (b) 955,000 | 1,016,300 | 61,300 | 803,400 | 856,800 | 53,400 | 126,200 | 132,800 | 6,600 | 25,400 | 26,700 | 1,300 |
| Wisconsin | 44,081 | 90,242 | 194,402 | 345,241 | (a) 409,634 | (a) 462,932 | (b) 523,261 | 564,900 | 41,639 | 410,538 | 443,900 | 33,362 | 75,600 | 81,400 | 5,800 | 37,123 | 39,600 | 2,477 |
| ***West North Central*** | | | | | | | | | | | | | | | | | | |
| Minnesota | 54,214 | 104,504 | 219,045 | 342,171 | 409,212 | 429,262 | 450,400 | 476,300 | 25,900 | 363,700 | 384,750 | 21,050 | 67,800 | 71,750 | 3,950 | 18,900 | 19,800 | 900 |
| Iowa | 48,516 | 90,299 | 198,119 | 298,911 | 355,535 | 366,965 | 386,900 | 407,000 | 20,100 | 310,500 | 328,200 | 17,700 | 54,000 | 55,500 | 1,500 | 22,400 | 23,300 | 900 |
| Missouri | 61,575 | 143,997 | 276,463 | 410,650 | 563,715 | (c) 597,813 | 645,800 | 676,500 | 30,700 | 517,700 | 541,500 | 23,800 | 101,000 | 105,700 | 4,700 | 27,100 | 29,300 | 2,200 |
| North Dakota | 7,999 | 15,618 | 35,378 | 47,047 | 53,920 | 54,547 | 56,600 | 59,400 | 2,800 | 44,100 | 46,400 | 2,300 | 10,200 | 10,600 | 400 | 2,300 | 2,400 | 100 |
| South Dakota | 7,940 | 20,391 | 42,184 | 60,254 | 64,206 | 64,625 | 66,350 | 69,150 | 2,800 | 51,700 | 53,900 | 2,200 | 10,800 | 11,250 | 450 | 3,850 | 4,000 | 150 |
| Nebraska | 27,086 | 61,814 | 116,970 | 165,976 | 183,450 | 186,770 | 195,600 | 206,600 | 11,000 | 160,000 | 169,000 | 9,000 | 27,400 | 28,900 | 1,500 | 8,200 | 8,700 | 500 |
| Kansas | 29,292 | 68,396 | 137,018 | 236,202 | 283,927 | 295,840 | 311,400 | 327,100 | 15,700 | 261,600 | 274,600 | 13,000 | 32,600 | 34,400 | 1,800 | 17,200 | 18,100 | 900 |
| ***East South Central:*** | | | | | | | | | | | | | | | | | | |
| Kentucky | 24,282 | 51,204 | 91,738 | 149,682 | 191,998 | 200,510 | 212,100 | 230,700 | 18,600 | 167,900 | 181,300 | 13,400 | 35,100 | 39,200 | 4,100 | 9,100 | 10,200 | 1,100 |
| Tennessee | 16,426 | 35,326 | 52,078 | 114,534 | 167,050 | 180,704 | 192,000 | 206,900 | 14,900 | 153,300 | 164,100 | 10,800 | 31,300 | 34,700 | 3,400 | 7,400 | 8,100 | 700 |
| Alabama | 16,261 | 23,890 | 34,669 | 54,549 | 103,149 | 131,450 | 150,900 | 168,400 | 17,500 | 119,800 | 133,900 | 14,100 | 27,400 | 30,300 | 2,900 | 3,700 | 4,200 | 500 |
| Mississippi | 13,829 | 22,013 | 25,605 | 44,217 | 55,158 | 56,830 | 60,300 | 65,300 | 5,000 | 47,300 | 51,150 | 3,850 | 10,500 | 11,400 | 900 | 2,500 | 2,750 | 250 |
| ***West South Central*** | | | | | | | | | | | | | | | | | | |
| Arkansas | 12,071 | 20,500 | 42,449 | 56,096 | 100,696 | 111,697 | 120,800 | 131,200 | 10,400 | 98,500 | 107,100 | 8,600 | 18,700 | 20,100 | 1,400 | 3,600 | 4,000 | 400 |
| Louisiana | 15,972 | 27,838 | 47,536 | 58,901 | 117,669 | 127,210 | 131,400 | 136,100 | 4,700 | 101,000 | 104,300 | 3,300 | 24,900 | 25,950 | 1,050 | 5,500 | 5,850 | 350 |
| Oklahoma | 20,565 | 46,860 | 88,047 | 154,669 | 191,884 | 199,755 | (b) 213,100 | 232,800 | 19,700 | 165,100 | 176,950 | 11,850 | 36,250 | 41,400 | 5,150 | 11,750 | 14,450 | 2,700 |
| Texas | 68,447 | 128,085 | 195,148 | 335,665 | 519,968 | 576,500 | 616,900 | 667,800 | 50,900 | 461,700 | 491,900 | 30,200 | 118,200 | 137,700 | 19,500 | 37,000 | 38,200 | 1,200 |
| ***Mountain:*** | | | | | | | | | | | | | | | | | | |
| Montana | 17,630 | 32,312 | 59,176 | 62,646 | 75,988 | 78,522 | (a) 80,880 | 84,670 | 3,790 | 64,200 | 67,120 | 2,920 | 12,900 | 13,400 | 500 | 3,780 | 4,150 | 370 |
| Idaho | 12,656 | ...... | ...... | ...... | 69,700 | 72,690 | 77,300 | 79,900 | 2,600 | 61,360 | 63,500 | 2,140 | 13,590 | 13,950 | 360 | 2,350 | 2,450 | 100 |
| Wyoming | 5,116 | 8,437 | 19,590 | 25,395 | 31,848 | 32,040 | 33,600 | 35,240 | 1,640 | 28,800 | 30,200 | 1,400 | 3,400 | 3,570 | 170 | 1,400 | 1,470 | 70 |
| Colorado | 46,911 | 68,046 | 92,242 | 132,708 | 175,218 | 182,820 | 194,700 | 204,500 | 9,800 | 161,700 | 169,000 | 7,300 | 24,350 | 26,250 | 1,900 | 8,650 | 9,250 | 600 |
| New Mexico | 4,494 | 8,551 | 13,988 | 18,834 | 22,780 | 24,050 | 25,700 | 27,050 | 1,350 | 21,400 | 22,540 | 1,140 | 3,250 | 3,410 | 160 | 1,050 | 1,100 | 50 |
| Arizona | 5,854 | 12,668 | 24,320 | 38,552 | 40,059 | 40,348 | 41,900 | 43,480 | 1,580 | 34,400 | 35,700 | 1,300 | 5,460 | 5,660 | 200 | 2,040 | 2,120 | 80 |
| Utah | 11,212 | ‡45,965 | ‡116,276 | ‡156,127 | 100,910 | 109,320 | (b) 114,700 | 119,300 | 4,600 | 100,800 | 104,600 | 3,800 | 10,800 | 11,450 | 650 | 3,100 | 3,250 | 150 |
| Nevada | 3,958 | 6,129 | 11,495 | 11,008 | 13,042 | (a) 13,179 | (a) 16,917 | 17,600 | 683 | 13,157 | 13,730 | 573 | 3,320 | 3,400 | 80 | 440 | 470 | 30 |
| ***Pacific:*** | | | | | | | | | | | | | | | | | | |
| Washington | 46,452 | 73,421 | 115,488 | 260,610 | 331,321 | 365,221 | (b) 366,400 | 382,700 | 16,300 | 316,200 | 330,080 | 13,880 | 41,120 | 42,790 | 1,670 | 9,080 | 9,830 | 750 |
| Oregon | 33,475 | 33,627 | 55,985 | 78,534 | (b) 178,112 | (b) 182,664 | 197,900 | 209,400 | 11,500 | 170,200 | 180,600 | 10,400 | 18,950 | 19,650 | 700 | 8,750 | 9,150 | 400 |
| California | 173,029 | 384,682 | 619,803 | 1,018,228 | (b) 1,188,588 | (b) 1,431,041 | (b) 1,564,800 | 1,672,100 | 107,300 | 1,256,000 | 1,335,900 | 79,900 | 171,000 | 181,850 | 10,850 | 137,800 | 154,350 | 16,550 |

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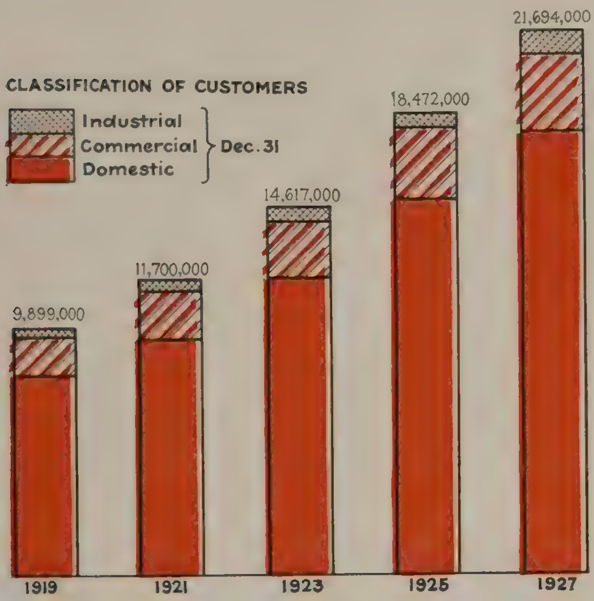
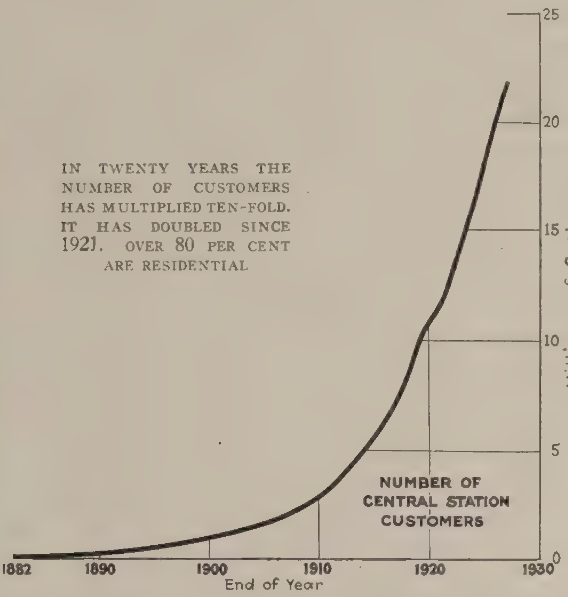
*Includes District of Columbia. †Includes Delaware and District of Columbia ance has been rendered by the public utility commissions of many of the states and by committees on public utility information. Credit for new figures is indicated in the table. Where official figures were obtainable, they have been substituted for the ELECTRICAL WORLD estimates previously published, except where they were known to be incomplete. A number of state commissions were able to give data for private companies, but had no jurisdiction over municipal operations, so that data had to be combined.

In most instances the changes thus introduced were surprisingly small. The net result was an upward revision of about 2 per cent, evidence of the successful operation of the policy of estimating as accurately as possible, but of leaning toward the conservative side wherever judgment had to be exercised in interpreting data. The diminishing margin between the number of potential and of actual customers, particularly in the residential field, shows the growing need of developing greater use per customer, if growth is to continue.





# Water Power of the World

THE DEVELOPED water power of the world, according to estimates made by the United States Department of the Interior through the Geological Survey, was about 33,000,000 hp. at the end of 1926, an increase of 43 per cent in six years. It was 23,000,000 hp. in 1920 and 29,000,000 hp. at the end of 1923. About three-fourths of the increase for the last three years has been in the English-speaking section of North America. Europe made a brief spurt during and after the World War but has now slowed down appreciably in its construction of hydro-electric power plants.

It is difficult to co-ordinate estimates of water power for the several countries, particularly estimates of potential water power, because of differences in their elements and character and in the completeness and accuracy of the data on which they are based; but the estimates here given are considered sufficiently accurate to afford a rough idea of the potential water-power resources of the world and the extent of their development. The figures for the developed water power represent the rated capacity of water wheels or turbines installed, and the figures for the potential power represent the total power that could be obtained at ordinary low water, including the power already developed. The installed capacity usually amounts to from two or three times the power available at low water.

In the accompanying tables the potential power for the United States represents the power available 90 per cent of the time at 70 per cent efficiency.

TABLE I—SUMMARY OF POTENTIAL AND DEVELOPED WATER POWER IN NORTH AMERICA BY COUNTRIES (1926)

| Country | Horsepower | |
|---|---|---|
| | Developed | Potential |
| Mexico | 300,000 | 6,000,000 |
| United States | 11,721,000 | 35,000,000 |
| Alaska | 43,000 | 1,000,000 |
| Newfoundland | 160,000 | 400,000 |
| Canada | 4,556,000 | 18,250,000 |
| Costa Rica | 15,000 | 1,000,000 |
| Guatemala | 4,000 | 1,500,000 |
| Honduras | 3,000 | 1,000,000 |
| Nicaragua | 400 | 800,000 |
| Salvador | 2,700 | 200,000 |
| Panama | 13,300 | 500,000 |
| West India | 19,350 | 150,000 |
| Total | 16,837,750 | 65,800,000 |

TABLE II—WATER POWER RESOURCES OF CONTINENTS

| | Developed Hp. | Potential Hp. |
|---|---|---|
| North America | 16,800,000 | 66,000,000 |
| South America | 750,000 | 54,000,000 |
| Europe | 13,100,000 | 58,000,000 |
| Asia | 2,100,000 | 69,000,000 |
| Africa | 14,000 | 190,000,000 |
| Oceanica | 240,000 | 17,000,000 |
| Total | 33,004,000 | 454,000,000 |

# News of the Industry

## State Commissions to Oppose Walsh

### Their Representatives Expected to Object to Federal Investigation of Companies Regulated by Them—How Muscle Shoals Bills Shape Up

By Paul Wooton
*Washington Correspondent of the* Electrical World

BEFORE considering the action it will take on the Walsh resolution, which proposes a minute inquiry by a special committee of the Senate into virtually every phase of the public utility business, the committee on interstate commerce, as already reported, plans to hold public hearings, to begin Jan. 16. Apparently it will be developed at these hearings that the state public service commissions will not be in accord with the Walsh proposal. The feeling among the state utility commissions, it was stated at the headquarters of their association in Washington, is that there is no need for additional regulative machinery. They look upon the utilities as essentially local enterprises. To have the federal government concerning itself with electric power and gas, of which only a small proportion of the total moves interstate, seems to them an instance of the tail wagging the dog.

At the hearing it is expected that witnesses representing the state commissions will emphasize the position that the matter is one of state rather than federal concern. It will be pointed out that the utilities, including the holding companies and their earnings and securities, are subject to the plenary power of the states, which is being exercised effectively. It will be emphasized that the states have not sought the proposed investigation and that no reason exists for the transfer to Washington of complaints which in the usual course would be taken up by the state commissions. It is expected also that some of the executives and other officers of the power companies will answer Senator Walsh's charge of overcapitalization of the industry and exorbitant rates to consumers.

One of the points which will be brought out at the hearing is the almost unlimited scope of the proposed investigation. It would include banks, insurance companies, educational institutions and other concerns affiliated with companies owning public utility stocks. Engineering and construction companies, as well as financial concerns, are specifically included in the resolution, as are non-utility companies that have even remote connections with a utility.

While the committee has taken no action on the resolution so far other than to fix a time for its consideration and the probable beginning of hearings, there is no disposition on the part of any members, so far as is known, to delay a report to the Senate beyond the time necessary for proper consideration of the resolution. Under the procedure the committee may report the resolution favorably or unfavorably, or may report it recommending its passage in an amended form. If the committee should accept the view taken by the representatives of the state commissioners as indicated at the offices of the association of commissioners here, the tendency undoubtedly would be to restrict the proposed inquiry to the interstate business engaged in by the utilities.

One of the principal points expected to be brought out at the hearing is that the state commissions and the courts, in dealing with valuations to be made the basis of rate fixing, pay no attention whatever to the amount of capitalization of the companies or the outstanding securities. It is expected that the representatives of the power companies will categorically deny the charge of overcapitalization and will present figures sustaining their denial. At the same time it will probably be shown that the question of overcapitalization is one which affects investors rather than consumers of power, inasmuch as the commissions and the courts nowadays totally disregard such questions in fixing rates.

Judging from the language of the Walsh resolution its proponents are not willing to accept the determinations of the state authorities. This is a factor in the proposed investigation that is sure to claim the attention of the leaders of an administration pledged to economy. The cost of checking the underlying data of capital issues aggregating $9,500,000,000, of evaluating the even larger and more intricate property accounts, to say nothing of the analysis of the corporate structure of more than a hundred holding companies, would be great. In view of all of this it is not thought likely that the committee will approve the resolution in its present form.

The fact that the Potomac Electric Power Company has reduced its rates 41 per cent in the last three years in the city which is the residence of national legislators during the sessions of Congress should have an important bearing on the proposed investigation of the electric industry, officials of the Potomac company think. They feel that the conduct of the electric utility in the national capital has been of such a character as to create a good impression among members of Congress, and it is pointed out that the household rate in Washington is among the lowest in the country and is lower than that in Buffalo, where hydro-electric power is available. The low rates prevailing in Washington are in spite of the stringent local regulations, which require the almost exclusive use of underground conduits.

#### Three Muscle Shoals Bills

To bring up to date the Muscle Shoals situation as it presents itself to Congress, it may be still of interest to make it clear that a bill is being prepared to put into legislative form the recommendations of the President and of the Secretary of Agriculture for the disposition of Muscle Shoals. While the exact provisions of the bill have not been announced, it is understood that they will call for the sale of the power at a reasonable price and the use of the funds thus received in conducting experiments in the production, distribution and use of concentrated fertilizers.

Two propositions are now pending in Congress. One, by Senator Norris, is before the Senate committee on agriculture. It is essentially a government operation and ownership plan both with respect to fertilizer production and generation, distribution and sales of power. It authorizes appropriations for additional power equipment that would cost perhaps $15,000,000. Pending before the military committee of the House is a bill by Congressman Madden authorizing the execution of a contract with the American Cyanamid Company for a fifty-year lease of the Muscle Shoals properties on condition that the United States expend an additional sixty-five or seventy million dollars for building two additional power plants, one at dam site No. 3 and the other at the Cove Creek site near Knoxville, Tenn. The contract proposes that the lessee shall engage in fertilizer production on various stipulated conditions. Mr. Madden has just issued a statement calling attention to the fact that no less than 63 "improvements" have been incorporated in the bill by agreement between the committee and the American Cyanamid Company and declaring: "As the legislation is now drawn it is my judgment that it represents a most effective instrument for securing to the country those benefits to national defense and agriculture which we sought to secure when we passed the national defense act in 1916."

Each of these measures—the Norris bill and the Madden bill—will provoke strong opposition in both houses.

# Governor Smith Reiterates Power Views

### But Suggests that His Desired Power Authority Prove the Economic Soundness of Its Plan Before Legislative Sanction Is Given

GOVERNOR SMITH in his eighth annual message to the New York State Legislature, submitted on Wednesday of this week, renews his request for the establishment of a New York State Power Authority, but he has again shifted his position somewhat in that he suggests that such authority when created prepare a comprehensive plan dealing with the production and distribution of hydro-electric energy which before any development would be undertaken would be written into the statutes by the Legislature in the same manner that a comprehensive plan for the development of the port of New York was enacted in detail in the law giving that body power to function.

In respect to power development the message says in part:

> In 1921 the Legislature saw no obstacle to the setting up of the Port of New York Authority, and to the approval of a comprehensive plan for the development of that port which, when carried into effect, will cost upward of three hundred million dollars. Even more recently the Legislature did not oppose amending that plan and conferring upon the Port Authority the power to issue its bonds for the construction of bridges between New York and New Jersey, to cost more than one hundred million dollars. All of the bonds sold for the progress of this great public work have been offered to the public upon the basis of the ability of these improvements to earn interest and sinking fund charges.
>
> What is the difference between a joint undertaking like the development of the Port of New York and the construction of these bridges and the development of water power at sites now in possession of the people of the state? I see none. In fact, I am convinced that the economic worth of such development can be as easily demonstrated to prospective bondholders as can the economic worth of the developments at the Port of New York. Moreover, I have such confidence in this method of financing that I believe that unless and until such economic proof is forthcoming, no move should be made by any authority set up by the state to offer its bonds to the public.
>
> Following, therefore, the charted path and taking a lesson from actual experience, why should we not set up in this state a New York State Power Authority which would be a public corporation, municipal in character, having no stockholders, deriving its powers from the state and having duties specifically imposed upon it to take over and develop the power resources of the state? Such a corporation should be given the power to issue bonds exempt from state taxation and secured by the revenues to be derived from the improvements when made.
>
> The Power Authority should be directed in the first instance to prepare a comprehensive plan for the development of our water-power resources and submit it, with the economic proof of its soundness, to the Legislature just as the Port Authority submitted its proposals to develop the Port of New York. . . . Should it develop that they were unable to prove the economic soundness of any plan they may propose, it will remain within the power of the Legislature to reject the plan and the question will be definitely settled for all time. But, before the fact is established, to alienate the resources, to lease them to private control for a lifetime, would be a deliberate and willful waste of a great God-given resource that should be developed in the interest of the people.
>
> The question of water-power development at the present time is receiving nation-wide attention. Giant power combines naturally will stand against the proposal of a public authority, but it is difficult to be in sympathy with their viewpoint because it is purely selfish. On the other hand, there is today an insistent and growing demand for the development of these power resources by the rightful owners—the public themselves. . . .
>
> There is one sure way to get the full benefit of hydro-electric energy for the small storekeeper, the small home-owner and the people on the farm, and that is to have the state retain the ownership not only of the source of the power but of the development works. The comprehensive plan prepared by the Power Authority can deal with the distribution after study and research. It will have to be a part of the plan, which in turn will have to receive legislative approval before it can be effective. No harm can come to the state by a trial along the same lines already adopted for other great public developments by means of such an authority. Nobody can honestly and conscientiously oppose it unless they belong to that reactionary Bourbon group who are against public ownership or public development of any resource.

After referring to the two state-owned hydro-electric plants on the Barge Canal, the Governor concludes:

> There are but two roads upon which we can travel. There is no middle course. We must either take a chance and lease these properties for a term of years, which really means giving them away with the possible right of recapture after we are all dead and gone, with all the consequent litigation attendant thereon, or declare for ourselves at once, retaining not only our full and complete ownership of these properties but the right to make contracts at rates favorable to the real owners of the power—the people of the state.

### PUBLIC UTILITY REGULATION

Upon the subject of public utilities the message repeats recommendations of former years, saying:

> All along I have stood for the right of a locality to regulate a public utility operating wholly within its borders upon the theory that the service is being rendered to the people of a single city and the elected officials of the city are held responsible in the first instance. The people look to them and not to the state. Further, local officials have been prone to blame the state when service and rates are not what the people believe they should be.
>
> There is also no reason why the state should not delegate its police power for the regulation of public utilities to the properly elected officials of a municipality. There are many cities in the state which may not desire that power. In order not to infringe upon their home-rule prerogatives, it might be well to frame a statute in such a form that it would require the municipality to take an affirmative stand and by resolution of its local common council seek permission to exercise the state's authority over public utility corporations entirely within its corporate limits. In the absence of a specific request, the control should remain with the state.

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# New York State Mayors Ask for State Hydro Power

The New York State Conference of Mayors, sometimes called the "third house" of the Legislature, meeting last week, recommended that the Legislature provide for the state development of undeveloped hydro-electric power. It will supplement the Governor's message by sending to the Legislature its recommendations. Regarding utility legislation, the conference says:

"We urge the Legislature to enact legislation of a permissive character which will give to the municipalities the right to acquire, construct, own, lease and operate within or without their corporate limits any public utility, product or service which is or is to be supplied to the municipality or its inhabitants, or to enter into contract for such product or service."

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# High Bridge Plant at St. Paul Meets with Accident

Referring to press reports of an explosion in the plant of the Northern States Power Company in St. Paul on the afternoon of Jan. 3, Robert F. Pack, vice-president and general manager, made the following statement:

"Shortly before 3 o'clock in the afternoon of Jan. 3 there was a flashover in generator No. 2 at the High Bridge station, putting this unit out of commission. With the exception of very minor injury to two employees, no persons were injured and no damage was done to any property other than the company's. The plant was slightly damaged by fire, and there was an interruption in some sections of St. Paul for approximately half an hour. Speedy resumption of the service was made possible owing to the interconnection of different plants of the Northern States Power system into the power loop that surrounds the Twin Cities. There is ample generating capacity to supply all requirements until repairs to the damaged generator can be made."

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# Central Maine Power Reports Excellent Outlook

Further expansion of the Central Maine Power Company system is now under way after the best year in the history of this utility. In a statement made on Jan. 1 President Walter S. Wyman said that work has begun on the 5,500-hp. hydro-electric station to be built on the Androscoggin River at Deer Rips. It is expected that the new Deer Rips plant will be completed next fall.

During 1926 the company supplied service to more than 600 additional rural homes and also established a new schedule of rates in several districts which will save its customers substantial amounts. Work is being pushed at top speed in the construction of a 110-kv. line, the first in the state, from Lewiston to Windsor and from Rockport to Thomaston, principally for supplying power to a new cement plant in the latter town. Mr. Wyman says that the chief regret of 1927 is that favorable action upon the exportation of surplus power from the state was withheld by the Legislature.

## Purchases and Mergers

*H. C. Orton of Interstate Power Explains Further the Coming Transfer of Federal Public Utilities to Utilities Power & Light*

PLANS for the purchase (alluded to under this heading last week) by the Utilities Power & Light Company and other interests of the holdings of the Federal Public Utilities Company, which include the Northeastern Iowa Power Company, formerly owned by Davenport interests, have been explained by H. C. Orton, Dubuque, vice-president and general manager of the Interstate Power Company, a subsidiary of the Utilities Power & Light. Mr. Orton said that the transaction has been pending for some time and that its consummation is now only a matter of time. That the purchase will include the merging of the Northeastern Iowa Power Company with the Interstate Power Company was denied by Mr. Orton, who stated that the plan is to operate all of the Federal Public Utilities Company's holdings as a separate unit. Mr. Orton will continue as vice-president and manager of the Interstate company, and the administrative offices of the new chain of utilities will also be in Dubuque under his direction.

The properties involved, which, as previously announced, have a valuation of approximately $15,000,000, include, besides the Northeastern Iowa Power Company, the Central Light & Power Company of North Dakota, the Southeastern Missouri Public Service Company, the Missouri Power & Development Company, the Arkansas Public Service Company and utility companies in Oklahoma, Texas, Alabama, Louisiana, Michigan, Minnesota and New Brunswick, Canada.

The United Gas Improvement-Philadelphia Electric Company merger will become effective Feb. 14, according to announcement by the special committee of stockholders.

Interests usually associated with Charles H. Tenney & Company, Boston, have made an offer of $125 per share for the stock of the Gloucester Electric Company, serving the Cape Ann district of Massachusetts. Outstanding shares total 20,500 of $25 par value. About 35,000 in population is served by the company. The Tenney interests quite recently enlarged the sphere of their operations by acquiring the Newburyport company and merging it with the Haverhill Electric Company.

The Pennsylvania Edison Company of Easton, Pa., has acquired the Saylorsburg (Pa.) Light & Power Company. Both are General Gas & Electric properties. The Monongahela-West Penn Public Service Company, Fairmont, W. Va., is negotiating for the purchase of the Webster Springs (W. Va.) Electric Light Company.

A certificate merging the Portville Utility Company with the Niagara, Lockport & Ontario Power Company has been filed at Albany, N. Y.

A certificate has been filed in the office of the Secretary of State at Albany merging the Lebanon Valley Lighting Company, Katonah Lighting Company, Amenia Electric Light & Power Company and Morgan Valley Electric Light & Power Company with the Harlem Valley Electric Corporation.

Taxpayers of Yuma, Colo., at a special election on Dec. 27 voted 141 to 53 against the selling of its municipally owned electric light plant to the Commonwealth Utilities Corporation for $90,000.

Application of the Otter Tail Power Company to purchase the electric property at Great Bend, N. D., from the Great Bend Light & Power Company has been approved by the North Dakota commission. The General Service Company has been authorized to buy the electric property at Sanish from J. E. Brusel.

Purchase of the light and power plant at West Fork, Ark., is announced by officials of the Southwest Power Company, McAlester, Okla. The plant will be connected with a transmission line from Fayetteville.

The Southern Indiana Light & Power Company, of which Henry F. Clevenger of Columbus, Ind., is president, has bought the Winterrowd Electric Company holdings at Flatrock.

The Inland Utilities Company is reported negotiating for purchase of the municipal electric light plant and waterworks at New Albany, Miss.

An offer to pay $3,500,000 for the power and distribution plant and the railway at Saskatoon, Saskatchewan, and to divide net profits from their operation with the city has been made by the Dominion Electric Light & Power Company, New York.

Indorsation of the Public Utilities Board of Nova Scotia for a merger of four Annapolis Valley light and power companies into one, to be known as the Annapolis Valley Electric Company, Limited, is being sought. The companies are the Lawrencetown Light, Heat & Power Company, Paradise West Electric Company Bridgetown Electric Light, Heat & Power Company and the Bear River & Digby Electric Light, Heating & Power Company.

## Philadelphia Electric's New Building Illuminated

From his home in West Orange, N. J., Thomas A. Edison on New Year's Eve, by tapping a telegraph key, sent an impulse over 90 miles of Western Union wire that inaugurated the floodlighting of the Edison Building, at Ninth and Sansom Streets, Philadelphia—the Philadelphia Electric Company's just completed office building. The upper nine floors of the 22 that the building contains were painted all the colors of the rainbow.

This floodlighting is to continue daily. It is unusual in that moving colors have been used. The spectacle on New Year's Eve showed two of the primary colors in use, red and green, in honor of the Yuletide season. These two colors were shot along the nine upper floors. Green was used along the lower floors and red on the top. White lights were thrown against these, and during the cycle of a half minute every shade in red and green, from a delicate violet to a rose pink, was seen.

## Furnace Uses a Million Kw.-Hr. Monthly

*Milwaukee Electric Railway & Light Makes Installation for Its Largest Industrial Customer to Serve Heat-Treating Unit of Great Size*

WHAT is asserted to be the largest resistance-type electric heat-treating furnace yet manufactured has just been placed in operation by the A. O. Smith Corporation, the Milwaukee Electric Railway & Light Company's largest industrial power customer. The furnace is rated at 3,000 kw. and will use in the neighborhood of 1,000,000 kw.-hr. per month under normal operating conditions. Large oil-refinery stills or vessels weighing as much as 175 tons each will be heat-treated or annealed in the furnace, where the temperature will be maintained at a maximum of 1,650 deg. Fahr. The oil stills are charged into the furnace on special sand-sealed-type furnace cars 12 ft. wide and 70 ft. long.

The furnace is heated by means of heavy cast-nickel-chrome-alloy T-grid heating elements in the side walls of the furnace chamber. The heating elements are divided into six separate circuits, each of which is separately and automatically controlled. Provision has been made by means of special transformers to vary the rate of power or heat input into the equipment over a wide range. The complete furnace installation takes up a floor space approximately 20 ft. wide and 250 ft. long. The heating chamber, car transfer pit and cooling chamber are each 80 ft. in length.

Three 1,000-kw. single-phase transformers connected in closed delta for taking energy at 26,000 volts, three-phase, are used for supplying energy to the furnace. These transformers are contained in an outdoor-type substation which is 12 ft. wide and 60 ft. long. The substation was designed by the distribution engineering division of the Milwaukee company and installed by the installation division of the electric distribution department. The underground division of the same department installed the 26,000-volt underground cables and conduits to the substation. The furnace was designed by and erected under the supervision of the Electric Furnace Company of Salem, Ohio, which also furnished the complete electrical equipment and material necessary for constructing the furnace or heating chamber. The A. O. Smith Corporation designed and built the cooling chamber and the cars and car transfer mechanism.

# Briefer News

COLUMBUS, OHIO, WILL ADD 16,000 STREET LAMPS TO ITS SYSTEM.—To improve the city's street lighting system in the coming year, the Columbus (Ohio) City Council has authorized the purchase of 16,192 additional electric lamps.

SAND SPRINGS (OKLA.) POWER COMPANY HAS PROGRAM OF EXPANSION.—A program for expansion, in which $2,500,000 will be expended by the Sand Springs (Okla.) Power, Light & Water Company, has been announced by E. M. Monsell, vice-president. "While the time for the announcement may be somewhat premature," he is quoted as saying, "the $2,500,000 will be ultimately spent."

INCREASED VOLTAGE HELPS BUFFALO SUPPLY OF ENERGY.—Substation No. 2 of the Buffalo General Electric Company has been changed over to handle power at higher voltage. Formerly receiving its power supply from Terminal B at 11,000 volts, it now is supplied from Terminal D at 22,000 volts. The change has enabled the station to serve an increasing industrial area without any interruption of power service.

UTILITY COMPANY'S PROTEST BRINGS BIG TAX REDUCTION. — Suits brought by the Northern Ohio Power & Light Company, Akron, Ohio, in the federal court at Cleveland enjoining the collection of the 1925-26 utility taxes in Summit and other counties of Ohio have been settled out of court. Under the settlement the company saves about $125,000 on its Summit County taxes for the two-year period involved. The Northern Ohio contended that its property was listed for taxation at virtually its full value, while other property was listed on a basis of 40 to 50 per cent. The utility company made it plain that it had no desire to evade its taxes, but maintained that the valuation of its property should be reduced or the valuation of other property be raised.

NEW HYDRO PLANTS ON UPPER NEW YORK STREAMS.—The Northern New York Utilities, Inc., will have a market this year for 24,500 additional horsepower, according to General Manager H. G. Davis. The company owns power houses on the Raquette, Beaver, Black and Oswegatchie Rivers. A total of 17,000 of the extra horsepower was taken on Jan. 1 by the St. Regis Paper Company for operation of its mills at Norfolk, Norwood and Raymondsville, all on the Raquette. The rest will be used by the Rome Brass & Copper Company in the operation of a new plant. Jan. 15 will see the completion of power plants at Raymondsville and Norfolk, the former to develop 3,000 hp. and the latter 5,000 hp. A 5,000-hp. plant at Norwood will be finished about Feb. 1, and a plant at East Norfolk of 7,000 hp. some time later.

OLD CINCINNATI RATES SUSTAINED IN LOCAL COURT.—The dispute over rates in Cincinnati has brought a decision in the Common Pleas Court overturning that of a master commissioner and directing the company to re-establish the 1925 rate which the city had endeavored to supersede by new ones designed to save consumers $750,000 a year. (See ELECTRICAL WORLD for Oct. 29, page 904). The Common Pleas Court found a referendum petition on the 1925 rates illegal and the Council's action void. The company charges confiscation and has a suit pending in the federal courts. The city will appeal from the local court's decision just noted.

BOSTON EDISON TALKS WITH, NOT AGAINST, TIME.—By adding a motorgraph talking sign to an illuminated electric clock which has occupied a conspicuous place in the Back Bay district for many years, the Edison Electric Illuminating Company of Boston has enhanced popular interest in its service. The message of the sign can be read for over a half-mile, and the installation now contains 6,300 15-watt and 2,260 25-watt lamps, the larger size being used in the motorgraph message. This clock weighs 17 tons, is 58 ft. high x 54 ft. wide, has numerals 5 ft. high and minute and hour hands 18 ft. and 14 ft. long respectively.

DETAILS OF NEW COLUMBIA RIVER PROJECT. — Preparatory steps for the seven-million-dollar development projected for the generation of 50,700 electrical horsepower for mining and manufacturing purposes have just been taken in Washington State by the Pend Oreille Lead & Zinc Company of Spokane. An appropriation of 7,000 sec.-ft. of water from the flow of Clark's Fork of the Columbia River is asked for this development, which would be located within the town limits of Metaline Falls, in the northeast corner of the state just below the Canadian border, and be known as the Metaline Falls project. The development would further require 70,000 acre-feet of water storage, providing a total fall for power uses of 80 ft. The diversion dam, to rest upon solid rock formation, will be of rock-filled concrete, 110 ft. high with a top length of 400 ft. and a bottom length of 100 ft. The Clark's Fork River, draining the Pend Oreille lakes in Idaho, would be one of the chief contributory streams to the proposed gigantic Columbia River irrigation project, and because of this proposed future federal undertaking, consent of the United States government as well as of the state must be secured.

KANSAS CITY HAS NEW "WHITE WAY."—Twelfth Street, Kansas City, Mo., has just added to the nation's "great white ways" by installing 80 lamps rated at 120,000 cp. in the area between Wyandotte and McGee Streets. The old lamps had a total of only 19,800 cp. The new ones are set 19 ft. above the sidewalk. They will burn each night from sunset until 1 a.m. and will be turned on again a little before dawn.

LIVELY ELECTRICAL TIMES IN A SMALL COMMUNITY.—Roland, Iowa, a town of only a thousand souls, has held five elections in six months on franchise issues. In the latest a proposal to continue to purchase power from the municipal plant at Story City was defeated by fifteen votes. Two weeks previously a franchise was awarded to the Iowa Railway & Light Corporation by one vote. Litigation threatens to upset this arrangement, although the company immediately cut in its service.

PHILADELPHIA UTILITY OFFICIALS GATHER.—With Arthur W. Thompson, president of the United Gas Improvement Company; Samuel T. Bodine, chairman of the board; Edward T. Stotesbury, Thomas N. McCarter and about twenty other directors acting as hosts, the U.G.I. gave a reception and luncheon on Dec. 30 to the officials of Day & Zimmermann, Inc., and the Philadelphia Electric Company, both now allied with the company first named. Almost every officer and director of the three companies was present, including Walter H. Johnson, president Philadelphia Electric, and John E. Zimmermann. Better mutual acquaintance was the object of the gathering, which may become an annual affair.

TWO NEBRASKA PROJECTS.—The Niobrara Power Company, composed largely of the same group that recently developed the Northern Nebraska Power hydro-electric plant near Spencer, Neb., has been organized for the purpose of constructing a plant on the Niobrara River several miles distant. The company has not yet incorporated, but has made surveys and estimates of cost.—— Power companies serving Nebraska have named a committee of engineers to investigate the feasibility of what is known as the Tri-County project in Adams, Gosper and Frontier Counties. This development, initiated as a public ownership proposition by land owners and business men in the district, who sought to place the credit of the state behind the necessary thirty-million-dollar bond issue, failed in the Legislature. It is now proposed to carry out the plan with private capital if the project is declared feasible and a market for the energy can be found.

Rating of Iowa Falls Plant Goes to 30,000 Kw. — The Central States Electric Company has started work upon an extension of its steam turbine plant at Iowa Falls, Iowa, to cost $300,000. The first unit to be installed will be of Westinghouse make with a rating of about 3,000 kw. The plant is designed for an eventual capacity of 30,000 kw.

New Dam for the Ouachita.—Its second dam across the Ouachita River in Montgomery County, Ark., to be known as the "Couch Dam," is to be constructed by the Arkansas Power & Light Company at Ola. Soundings have been made, and the company is ready to begin construction as soon as all the necessary land is acquired.

New Orleans to Have Electrical Show.—The Electrical League of New Orleans announces that it is preparing to sponsor a Louisiana Electrical Exposition, to be held at the Delgado Trades School. It is the intention to organize the exposition on a large scale, and it will have the backing of the New Orleans Public Service, Inc. Dates set are March 5 to March 10.

Growth of Montana-Dakota Power Company. — Completion of its high-tension-line construction program for the year 1927 reveals that the Montana-Dakota Power Company has added thirteen towns to the number previously served and has built 103 miles of line. This company now furnishes electrical energy to 70 cities and towns in western North Dakota and eastern Montana through 700 miles of line. It has constructed a power plant at Glendive, Mont., and is building one south of Columbia, N. D.

New Public Service Building at Portland, Ore.—On Jan. 3 there was a public dedication of the new Public Service Building at Portland, Ore., which has been occupied since Dec. 19 by the three affiliated companies for which it was built. All but six floors of the sixteen-story tower structure flanked by three-story wings are occupied by the Portland Gas & Coke Company, the Northwestern Electric Company and the Pacific Power & Light Company. The building is faced with white stone and has a colonnade course around the top floors. The Northwestern company and the Pacific Power & Light occupy the fourth, fifth and sixth floors respectively; the treasury departments of the three companies are on the seventh and eighth floors, and the presidents' offices and those of the legal department and the directors' room are on the fifteenth. Special attention was given to the lighting of the offices and salesrooms, both of which have a higher intensity than other commercial establishments of their kind in the city.

Decatur (Ill.) Service Improved. —The Illinois Power & Light Corporation last year expended $500,000 in improvement of its electric service in Decatur, Ill., the completion of two new transmission lines, making three interconnecting lines into the city, being the outstanding development. Seventy miles of lines were added to the distribution system, and a new substation, housing a 5,000-kw. synchronous condenser, was another improvement.

Riverside (Cal.) Municipal Plant Lowers Rates.—A reduction in lighting rates that is calculated to save city consumers $25,795 annually has been adopted by the City Council of Riverside, Cal. This saving is based on a reduction from 8 cents to 7 cents per kilowatt-hour. Accumulation of funds in the light and water department has been the cause for much dissatisfaction among consumers who believed rates should be reduced even if taxes were raised in consequence.

Samuel Ferguson on Floods and Interconnection. — Samuel Ferguson, president of the Hartford Electric Light Company, in speaking of the unprecedented November floods in New England, said recently: "The floods in New England have proved beyond question the value of interconnecting electric systems in maintaining service under conditions which must have incapacitated isolated generating plants. A few years ago the flooding of the great Vernon plant of the New England Power Company would have been a disaster to thousands. When it was flooded recently it made no difference at all to the company's customers owing to its interconnection with other plants in New England, New York and elsewhere, which enabled it to keep the service going."

## Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published on page 80 of this issue.]

American Engineering Council—Washington, D. C., Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington.

Empire State Gas and Electric Association—Electric Section, Niagara Hotel, Niagara Falls, N. Y., Jan. 12 and 13. C. H. B. Chapin, Grand Central Terminal, New York.

Electrical League Conference — 30 North Dearborn Street, Chicago, Jan. 16 and 17. Society of Electrical Development, 420 Lexington Avenue, New Yprk.

New England Electrical Credit Association—Boston, Jan. 17. C. A. Kane, 176 Federal St., Boston.

N.E.L.A. Commercial Section—Edgewater Beach Hotel, Chicago, Jan. 18-20. A. J. Marshall, 420 Lexington Avenue, New York.

National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 23-27. S. N. Clarkson, 420 Lexington Ave., New York.

Artistic Lighting Equipment Association—Winton Hotel, Cleveland, Jan. 25-28. G. P. Rogers, 711 Graybar Bldg., New York.

Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21. J. C. Plankington, Northwestern Electric Company, Portland, Ore.

Texarkana (Ark.) Plant to Be Doubled. — Material improvements in the power plant of the Southwestern Gas & Electric Company at Texarkana are under way. They include an addition to the boiler house and the installation of two boilers with a total rating of 1,520 hp.; a concrete stack 200 ft. high, an addition to the turbine room, where a 5,000-kw. turbo-generator will be installed, and various auxiliary equipment. The total capacity of the plant will be more than doubled.

Bureau of Mines Will Lend Electrical Films.—From the Pittsburgh experiment station or any distributing center the Bureau of Mines of the United States Department of Commerce will lend freely motion-picture films produced under the bureau's direction and showing mining and manufacturing processes. Several are of interest to electrical men, including three covering the "Story of Coal," three on the "Story of an Electric Meter," two on "Water Power," and two on the "Story of a Storage Battery."

St. Lawrence Rapids Development Is Broached.—Notice has been filed at Ottawa by the Montreal & Western Canada Company that the company will apply at the forthcoming session of the Canadian Parliament for authority to develop the rapids in the St. Lawrence River below Cornwall, Ontario. The proposed scheme is a very ambitious one. The company would build a 30-ft. waterway between Cornwall and Montreal and exploit the power incidental thereto. Those connected with the company are not mentioned in the notice.

New Braunfels (Tex.) Plant's Generating Capacity Will Be Doubled.—Plans already hinted at have been finally adopted for doubling the capacity of the electric power plant at New Braunfels, Tex., of the Comal Power Company, subsidiary of the San Antonio Public Service Company, at a cost of $1,500,000, according to E. H. Kifer, general manager. In addition to its own service, the Comal Power Company sells power to the Texas Power & Light Company and the Central Power & Light Company. The San Antonio company will also spend in its home city $750,000 for laying underground cables and construction of substations. The South Texas Public Service Company, another subsidiary, will spend $150,000 for constructing rural transmission lines and connections.

# News About Men of the Industry

L. P. Hite has been appointed manager of the Paducah district of the Kentucky Utilities Company to succeed R. A. Becker, who resigned because of ill health. Mr. Hite has been superintendent of production in charge of western Kentucky power plants, with headquarters at Earlington since last spring, and for a year previous to that connection he was manager of the Morganfield district. He affiliated himself with the company in March, 1926, after being in charge of the municipal electric plant at Henderson, Ky. W. C. Shields has been selected to succeed Mr. Hite as superintendent of production for Western Kentucky.

Andrew C. Erwin, president of the Athens Publishing Company, has been elected director of the Georgia Power Company to succeed the late J. Billups Phinizy. A native of Athens and a graduate of the University of Georgia, Mr. Erwin became prominent when he re-organized the Citizens Bank of Athens and later was made president of the Commercial National Bank. He has served the city of Athens as mayor and also as president of the Chamber of Commerce.

K. T. Kone has been appointed sales manager of the Panhandle Power & Light Company, Borger, Tex., which is controlled by the United Light & Power Company. Mr. Kone has engaged in sales work for the United companies since 1922.

George Barber has been named sales manager for the southern district of the Puget Sound Power & Light Company, with headquarters in Chehalis, Wash. He is succeeded as sales manager in the northern district by R. W. Lindley.

J. Paul Clayton, vice-president of the Central Illinois Public Service Company, Springfield, Ill., has been appointed chairman of the industrial development committee of the Illinois Chamber of Commerce. Mr. Clayton was formerly a director and vice-president of that same organization.

Horace B. Stout, counsel for the Railroad and Public Utilities Commission of the State of Tennessee for the past three years, has resigned. Mr. Stout has recently formed a law partnership and is leaving the commission to devote his time to private practice.

W. G. Gay, formerly industrial sales engineer of the Baton Rouge Electric Company, has been appointed sales manager to succeed H. P. Geisler, Jr. Mr. Gay started with the Stone & Webster organization in 1910 at the Boston office. He began power station work in Minneapolis and subsequently became chief engineer at New London, Conn., in 1916. Later he removed to Pawtucket, but he was transferred to Baton Rouge in 1919, where he served as chief engineer until he was made industrial sales engineer in 1926.

## *J. C. Guild Succeeds Edgar in Chattanooga*

J. C. Guild, Jr., has been appointed general manager of the Tennessee Electric Power Company to succeed the late B. C. Edgar, according to an announcement made by President B. C. Cobb. A native of Chattanooga and a graduate of Vanderbilt University, Mr. Guild has been serving as vice-president of the company for several years.

R. L. Kirk has been appointed assistant to the system development manager of the Duquesne Light Company, Pittsburgh. A graduate of the Carnegie Institute of Technology, Mr. Kirk was first employed by the Duquesne organization prior to the United States' participation in the World War. In 1922 he returned to the company, where he has occupied successively the positions of designer, section engineer, general engineer, assistant to the vice-president and work progress engineer.

James W. Reed, for three years manager for the Kentucky Utilities Company at Carlisle, has been transferred to Clinton in the capacity of manager. F. J. Hardesty of the Fulton staff of the company has removed to Carlisle as manager.

C. I. Isley, formerly local manager at Florence, S. C., for the Carolina Power & Light Company, has been transferred to the Asheville (N. C.) division of the company in the capacity of appliance sales manager.

L. H. Knapp, formerly connected with the industrial electric heating department of the General Electric Company, Schenectady, N. Y., has been appointed industrial electric heating engineer of the Hartford (Conn.) Electric Light Company.

H. S. Chandler, who has been connected with the Georgia Power Company at various times for the past 20 years, has been appointed sales manager for the Illinois Power Company at Decatur.

Bond P. Geddes of Washington, D. C., has been appointed executive vice-president of the Radio Manufacturers' Association to succeed L. S. Baker, resigned. Mr. Geddes brings to his new position a background of seventeen years of experience in press and public relations work in and outside of Washington. In addition to his newspaper, press association and public relations experience, Mr. Geddes has had legal training and is a member of the bar of the District of Columbia and a graduate of Columbia University. He assumed his new duties Nov. 1 at the Eastern headquarters of the Radio Manufacturers' Association in New York.

Herman Mezger has recently joined Stone & Webster, Inc., as an engineer in the electrical division. He was formerly with the Brazilian section of the Foreign Department of the Allgemeine Elektrizitäts Gesellschaft of Berlin. Since coming to this country he has been with the Westinghouse Electric & Manufacturing Company at East Pittsburgh.

Wallace S. Wick of Des Moines has been named as manager of the Oskaloosa properties of the Iowa Power & Light Company, succeeding J. H. Porter, resigned.

Earl Utley has been appointed local manager for the Kentucky Utilities Company at Clay, Ky., to succeed C. E. Utley, his father, who resigned Dec. 1 to enter other business.

W. R. Jessup is the new superintendent of the Lake Andes (S. D.) division of the Northwestern Public Service Company.

W. M. Flook, chairman of the board of the American Brown Boveri Electric Corporation, has been elected its president.

A. W. Atwater, for the past two years a partner in the engineering contracting firm of the Martin & Warlick Company, Chattanooga, Tenn., and formerly in the power-plant engineering field at Columbus, Ohio, has joined the mechanical engineering division of Stone & Webster, Inc., at Boston.

Edward Dickson has been appointed manager of the Trezevant plant of the Kentucky-Tennessee Light & Power Company.

## Obituary

Harry E. Hayes, for many years assistant engineer on the electrical staff of Charles H. Tenney & Company, Boston, Mass., died Dec. 30 at his home in Stoneham at the age of 62. He was a native of Madbury, N. H., was educated at Harvard College and the Massachusetts Institute of Technology, and in recent years had specialized in underground construction work for the North Boston Lighting Properties.

W. F. Harvey, president of the Porcelain Insulator Corporation, Lima, New York, died suddenly Jan. 4 at his home in Lima.

# Financial and Statistical News

## December Breaks All Financing Records with $303,332,500 Total

WITH A total of well over $300,000,000, December broke all previous records of monthly financing by power and light companies. In line with the relative proportions of refunding and new money existing during the previous eleven months, approximately half of this was for refunding purposes. December's figure constituted more than 14 per cent of the year's total.

The cost of money continued its downward trend during the year so that by December, financing could be carried out on a very favorable basis. Six of the sixteen bond (or note) issues sold were on a 4½ per cent basis, and on eight of these the yield was less than 5 per cent.

Among the largest issues of the month were two $40,000,000 issues, one sold by Alabama Power Company and the other by Duke Power Company, and a $60,000,000 issue sold by Philadelphia Company. Each of these three has a life of 40 years. Most of the month's financing was relatively long term.

An analysis of the year's financing will be found elsewhere in this issue.

AMERICAN WATER WORKS ISSUES DEBENTURES.—During the first week of January, 5 per cent gold debentures of the American Water Works & Electric Company were offered in the amount of $3,000,000, the price being 95 and interest. These debentures, dated Dec. 1, 1927, and maturing Dec. 1, 1975, will be direct obligations of the company. Proceeds will be used to reimburse the company in part for expenditures in connection with the acquisition of additional properties, for additional working capital and for corporate purposes.

## British Energy Consumption Up 57 per Cent in Five Years

The latest available figures for consumption of electricity in Great Britain are given in the annual report of the Electricity Commissioners for the period April 1, 1926, to March 31, 1927, which has just been issued. They show that the sales of energy by authorized undertakings to consumers amounted in 1926 to 5,723,000,000 kw.-hr. and represented an increase of about 57 per cent on the sales in 1922. This was an average consumption of about 130 kw.-hr. per head of the estimated population of the United Kingdom in 1926. The sales of electricity for power purposes increased during five years from 2,499,000,000 kw.-hr. to 3,760,000,000 kw.-hr., or by 50 per cent. Sales for lighting and other domestic purposes increased from 582,000,000 kw.-hr. to 1,244,000,000 kw.-hr., or by over 113 per cent. Those figures do not take into account the supply for traction purposes and the supply con-

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN DECEMBER

| Name of Company | Amount of Issue (Par Value) | Period Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Louisiana Power & Light Co. | $8,000,000 | 30 | First mortgage gold bonds | Construction | 5 | 97¾ | 5.15 |
| Connecticut Light & Power Co. | 6,500,000 | .. | Cumulative preferred stock | To provide funds for construction purposes | 5½ | 100 | 5.50 |
| United Public Service Co. | 1,000,000 | .. | Preferred stock | Construction, new property acquisition and for other corporate purposes | 7 | 100 | 7 |
| El Paso Electric Co. | 1,000,000 | 23 | First mortgage gold bonds, series A | To retire indebtedness incurred by the company in its construction program | 5 | 101 | 4.92 |
| Alabama Power Co. | 40,000,000 | 40 | First and refunding mortgage gold bonds | To retire bonds, to purchase additional equipment and for other corporate purposes | 4½ | 94¾ | 4.80 |
| Wisconsin-Hydro Electric Co. | 800,000 | .. | Cumulative preferred stock | Acquisition of properties | 6 | 95 | 6.32 |
| Central Public Service Corp. | 4,500,000 | 13 | Collateral trust gold bonds, series A | To pay for the acquisition of properties, to retire indebtedness and for other corporate purposes | 6 | 97½ | 6.30 |
| Duke Power Co. | 40,000,000 | 40 | First and refunding mortgage gold bonds | To reimburse for expenditures on additions, to retire floating debt and for other corporate purposes | 4½ | 98 | 4.61 |
| Philadelphia Co. | 60,000,000 | 40 | Secured gold bonds | To retire all present mortgage indebtedness, to purchase additional stock and for other corporate purposes | 5 | 98 | 5.11 |
| Central Maine Power Co. | 2,000,000 | 30 | First and general mortgage gold bonds, series E | To reimburse for cost of additions and for the acquisition of new properties | 4½ | 98 | 4.62 |
| Binghamton Light, Heat & Pwr. Co. | 1,020,000 | .. | Cumulative preferred stock | To reimburse treasury in part for the cost of additions and betterments to property | 6 | 102 | 5.88 |
| Duquesne Light Co. | 20,000,000 | .. | Cumulative first preferred stock | To retire stock and for other corporate purposes. | 5 | 97½ | 5.12 |
| Associated Electric Co. | 20,000,000 | 25 | Gold bonds | To acquire or retire securities of subsidiaries | 4½ | 94¼ | 4.90 |
| Central Illinois Public Service Co. | 4,200,000 | 1–3 | Serial gold notes | Refunding | 4½ | 100 | 4.50 |
| | 29,000,000 | 40 | First mortgage gold bonds, series F | ........ | 4½ | 94¾ | 4.80 |
| Wisconsin Power & Light Co. | 6,350,000 | 29 | First lien and refunding mortgage gold bonds, series E | ........ | 5 | 101½ | 4.90 |
| Central Gas & Electric Co. | 7,000,000 | 20 | First lien collateral trust sinking fund gold bonds | Acquisition of new properties, to retire indebtedness and for other corporate purposes or to reimburse company | 5½ | 98½ | 5.62 |
| | 2,362,500 | .. | Preferred stock | To acquire new properties, to retire indebtedness and for other corporate purposes | 6½ | 94½ | 6.87 |
| | 3,500,000 | 3 | Gold notes | ........ | 5½ | 99¾ | 5.75 |
| Florida Power & Light Co. | 10,000,000 | 27 | First mortgage gold bonds | To reimburse for extensive additions to property and for other corporate purposes | 5 | 97½ | 5.15 |
| Central States Power & Light Corp. | 8,500,000 | 25 | First mortgage and first lien gold bonds | To retire securities of corporation and of subsidiaries, to pay for acquisition of properties and for other corporate purposes | 5½ | 98½ | 5.60 |
| | 3,000,000 | .. | Preferred stock | ........ | 7 | 100 | 7 |
| American European Securities Co. | 2,000,000 | 30 | Collateral trust sinking fund bonds | ........ | 5 | 99 | 5.07 |
| Indiana Electric Corp. | 2,600,000 | 24 | First mortgage and refunding gold bonds | ........ | 5 | 98½ | 5.10 |
| Central States Electric Corp. | 20,000,000 | 20 | Convertible debentures | To liquidate indebtedness, to acquire additional investments and to redeem outstanding debentures | 5 | 96½ | 5.28 |

Total ........ $303,332,500
Total amount actually realized ........ $293,415,102

Rights ........ $41,100,325
Total financing for December ........ $334,515,427

sumed in manufacturing and trading operations derived from privately owned generating plants. At the beginning of 1920 the number of bulk supplies which had been taken or arranged for was 120—namely, 70 by local authorities and 50 by companies. On March 31, 1927, the number of such supplies actually taken or arranged for had increased to 351—199 by local authorities and 152 by companies.

## Northern States Power Shareholders Offered Rights

ADDITIONAL capital is being secured by Northern States Power Company through the issue of rights to shareholders. Holders of class A and class B common stock have been offered the privilege of subscribing for the new stock to the extent of one-quarter of their present holdings.

To make provision for the new issue, the directors have authorized the sale of additional class A stock to the extent of one-quarter of the aggregate amount outstanding at the close of business Jan. 3. Additional B stock is being issued on a similar basis. The proceeds of the issue will be used for extensions and additions to the company's property. The offering, it is announced, has been underwritten without cost to the company.

Common stock class A now outstanding amounts to $17,967,600. The addition of one-quarter this amount would bring the total up to more than $22,000,000. Class B stock outstanding totals $5,000,000 and the addition of one-fourth this amount would bring the total to $6,250,000.

## Electricity Supply in Roumania

According to a recent official return, there are now 146 electric power stations in operation in Roumania. Of the total, 31 plants, or about 21 per cent, are hydro-electric; 44, or 28 per cent, are steam-operated, while 71, or approximately 50 per cent, utilize internal-combustion engines for the generation of power. The total installed capacity is about 174,300 kw. There are 86 plants with a combined capacity of 26,500 kw. producing continuous current, three single-phase alternating-current plants totaling 5,200 kw., two two-phase stations producing 10,000 kw. and 55 three-phase stations with an aggregate of 132,600 kw.

BIGGEST JAPANESE ELECTRIC COMPANIES UNITE.—The terms for consolidating the Tokio Electric Light and the Tokio Electric Power companies are now practically complete, according to the latest Japanese announcement. The companies constitute 15 per cent of the total capital of the electrical industry of Japan, and 19 per cent of the generating capacity.

Prolonged rate-cutting in the Tokio area prompted financial interests to exert their influence in effecting this amalgamation. Another important factor in negotiating the merger was the consideration that further foreign capital, which the industry requires, would be difficult unless competition was eliminated. The basis of the fusion is nine shares of the light company to ten of the power company.

IDAHO POWER SELLS PREFERRED.—The sale in thirty days of an entire new issue of 10,000 shares of preferred stock, mainly to customers, was an accomplishment of the Idaho Power Company, Boise, in the latter part of last year. The stock, which was a $6 cumulative no par stock, offered at $100, brought $1,000,000 into the company treasury for improvements and additions and other corporate purposes. It was absorbed locally, principally in small blocks sold by employees. The issue was authorized by the former stockholders and given the same position in the financial structure with respect to rights and privileges as is enjoyed by the older issue of 7 per cent preferred stock, all of which had been sold out long since. The new stock is callable at $110.

BUFFALO, NIAGARA & EASTERN INCREASES DIVIDEND RATE.—The board of directors of the Buffalo, Niagara & Eastern Power Corporation has authorized an increase in the dividend rate on common stock of that company. The increase is from 25 cents to 30 cents per share in the quarterly dividend. This increase will be received by common stockholders in the dividend checks which are sent out on Dec. 31.

## Immobility a Prime Factor in Plant Valuation

IN DISCUSSING "The Valuation of Public Utilities" before the American Economic Association, Arthur Twining Hadley, president emeritus of Yale University, among other things said:

"Valuation and assessment are quite distinct things. An assessment is a price fixed by a constituted authority for its own purposes. A valuation is an attempt to determine what a piece of property is worth. A value is created by public demand, not by political authority. It is calculated on the basis of 'fair market price.'

"Until recently the words value and valuation had their definite meaning in American law, as they still have it in American business usage. But about 30 years ago, Senator La Follette, in his attempt to find a basis for judging whether rates were reasonable, assessed the cost of duplication of the railroads concerned and called the result physical value.

"Was he justified in applying the old and well-understood name value to such an assessment? Those who say yes base their answer on three different grounds.

"The first group says that they have discovered another kind of value, a physical value as distinct from a commercial value. The obvious answer is that there was no such thing to discover. Physical value is a contradiction in terms. Value is a social phenomenon, not a physical one. Value is not a thing inherent in goods themselves. It is a result of their adaptation to the needs and wants of the people; in other words, of demand.

"The second group sees that physical value is a fiction, but holds that duplication cost furnishes a good measure of value. The answer is that it is a very bad measure. We can find many railroad lines whose cost of duplication would be more than ten times as great as their commercial value to their present owners or to any other owners. A yardstick that is liable to an error of over 1,000 per cent cannot be called a good measuring rod.

"A third group, more intelligent than the other two, sees that cost is not a kind of value, and is not a good measure of value as it is, but says that it is a good measure of value as it ought to be. If an ordinary merchant, investing prudently, finds it hard to make over 6 per cent, 6 per cent on prudently invested capital ought to be enough to allow the investors in large corporations.

"The difficulty with this answer is that large investments in progressive industries are subject to risks from which merchandise is free. You cannot limit the profits of the successful concerns to the ordinary rate of commercial discounts without preventing developments and improvements. We have had a signal example of the failure of the attempt in the history of railroad development in recent years.

"If there is not enough demand for a given sort of merchandise in one place, it can be sent to another. If there has been an over-production of that merchandise which makes prices too low everywhere, the surplus supply can soon be used up. The consequence is that the price of merchandise seldom falls very far below cost. But in the case of fixed investment, the matter is different.

"The capital, once invested in a power plant or railroad, must stay where it is and cannot go somewhere else. If the local demand falls short of the expectation, the risk involved in locating a plant in a new territory is very great. The risk in developing new processes with it is greater still."

NEW YORK UTILITY REDUCES NUMBER OF SHARES.—The New York State Gas & Electric Corporation, Ithaca, has filed a certificate in the office of the Secretary of State reducing the number of shares of its no-par-value stock from 125,000 to 100,000.

# Business News and Market Conditions

## Electrical Exports Show Normal Growth

### Increase for 1927 is nearly 4½ per cent. European markets expand, while Western Hemisphere shows a decrease of $4,000,000

By Marshall T. Jones
Chief Electrical Equipment Division,
Bureau of Foreign and Domestic Commerce, Washington, D. C.

EXPORTS of electrical equipment for 1927 show an ever-increasing trend over former years. The total value of materials shipped abroad in 1926 was $98,495,245, as compared with $94,243,813 exported during the first eleven months of 1927. Details for the first 10 months of 1927 are shown in the accompanying table and compared with 1926. If the average for the first eleven months is taken to cover December shipments, the total for 1927 will run to $102,811,432, or an increase of 4.4 per cent over 1926.

As regards commodities, exports of direct-current and alternating-current generators and parts, including steam turbine sets, show a slight loss for 1927, amounting to about 7½ per cent, predicating this percentage on the basis of twelve months. The largest percentage loss was shown in the transformer classes, amounting to 25 per cent, in value nearly $900,000. Watt-hour, volt, and other meters also showed a slight loss of about 5 per cent. Domestic heating and cooking devices registered about an 11 per cent loss. Telephone equipment was another item that fell off to the amount of about 25 per cent. Gains, however, are shown for such items as motors, electric fans, lamp bulbs, motor-driven household devices, and electric light fixtures. The most startling gain was shown in the exports of domestic washing machines, amounting to 45 per cent, in value a gain of $424,000. Next come motor-driven household devices, such as vacuum cleaners, etc., showing a gain of 35 per cent, or $608,000 in value.

Radio receiving sets and equipment show a gain of only 2 per cent, amounting roughly, to $138,000, but this class of material amounts to approximately 8 per cent of the total exports, constituting the largest single class item. Flashlights and flashlight batteries have shown a decided increase as regards their exportation, gaining nearly $1,000,000 in value over 1926 figures.

Canada is our outstanding export market, consuming roughly 20 per cent of our total exports. Shipments to Canada during 1927 show a 10 per cent increase over those of 1926. The Western Hemisphere, owing to the fact that Canada is included therein, takes half of the total shipments, with Europe consuming about 14 per cent, the balance going to the remainder of the countries of the world. For the first eleven months of 1927 an increase of shipments to Europe over the total for 1926 is already shown, amounting to more than $1,000,000, whereas shipments to the Western Hemisphere have decreased by about $4,000,000. Our largest loss is shown in our trade with Japan, which is only a little more than half the figure shown for 1926. Australian trade has

### *Value of Electrical Exports for 1926 and for Ten Months of 1927 Compared with Same Period in 1926*

(Compiled from data issued by Bureau of Foreign and Domestic Commerce)

| Articles | Year 1926 | Ten Months 1926 | Ten Months 1927 |
|---|---|---|---|
| Generators: | | | |
| Direct-current: | | | |
| Under 500 kw | $959,830 | $765,477 | $706,395 |
| 500 kw. and over | 454,150 | 429,254 | 323,494 |
| Alternating-current: | | | |
| Under 2,000 kva | 187,675 | 163,137 | 153,678 |
| 2,000 kva. and over | 1,273,273 | 1,074,644 | 743,299 |
| Steam turbo-generator sets | 1,412,086 | 1,021,196 | 722,264 |
| Accessories and parts for generators | 919,823 | 699,022 | 917,513 |
| Self-contained lighting outfits | 1,151,144 | 911,041 | 1,080,868 |
| Batteries: | | | |
| Flashlight batteries | 1,674,309 | 1,289,743 | 1,772,093 |
| Other primary batteries | 2,020,298 | 1,663,909 | 2,023,040 |
| Storage batteries | 3,443,121 | 2,798,216 | 3,033,597 |
| Transforming or converting apparatus: | | | |
| Power transformers | 2,230,743 | 1,696,727 | 1,219,594 |
| Other transformers | 1,266,076 | 1,042,120 | 895,605 |
| Rectifiers, double-current and motor-generators, dynamotors, synchronous and other converters | 1,556,654 | 1,310,083 | 1,323,316 |
| Transmission and distribution apparatus: | | | |
| Switchboard panels, except telephone | 2,193,265 | 1,986,255 | 1,205,331 |
| Switches and circuit breakers over 10 amp. | 2,618,212 | 2,178,642 | 1,560,915 |
| Fuses and fuse block | 351,686 | 292,173 | 302,218 |
| Watt-hour and other measuring meters. | 492,828 | 407,802 | 353,723 |
| Volt, watt and ampere meters and other recording, indicating and testing apparatus | 2,152,257 | 1,736,226 | 1,673,345 |
| Lightning arresters, choke coils, reactors and other protective devices | 708,823 | 580,355 | 585,676 |
| Motors, starters and controllers: | | | |
| Motors under 1 hp | 1,999,587 | 1,632,607 | 2,167,062 |
| Stationary motors: | | | |
| 1 to 200 hp | 3,207,141 | 2,679,282 | 2,566,434 |
| Over 200 hp | 884,354 | 806,733 | 318,771 |
| Railway motors | 1,126,836 | 985,886 | 730,976 |
| Electric locomotives: | | | |
| Railway | 1,841,606 | 1,745,989 | 654,895 |
| Mining and industrial | 759,275 | 584,552 | 370,723 |
| Starting and controlling equipment for: | | | |
| Industrial motors | 1,394,687 | 1,154,580 | 920,997 |
| Electric railway and vehicle motors | 202,821 | 179,106 | 180,398 |
| Portable electric tools | 549,340 | 430,286 | 745,207 |
| Accessories and parts for motors | 2,180,747 | 1,852,858 | 1,999,413 |
| Electric appliances: | | | |
| Electric fans | 948,124 | 824,625 | 917,413 |
| Electric lamps: | | | |
| Metal filament | 1,603,230 | 1,336,399 | 1,290,565 |
| Other electric lamps | 280,929 | 217,746 | 341,194 |
| Flashlights | 2,057,673 | 1,715,641 | 2,010,308 |
| Searchlights and projectors | 573,968 | 350,360 | 665,464 |
| Motor-driven household devices | 1,743,677 | 1,393,127 | 1,959,921 |
| Domestic heating and cooking devices | 1,722,381 | 1,318,089 | 1,169,723 |
| Industrial electric furnaces and ovens | 253,307 | 183,180 | 355,017 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc | 1,477,521 | 1,213,445 | 1,375,669 |
| Signal and communication devices: | | | |
| Radio apparatus: | | | |
| Transmitting sets and parts | 555,640 | 417,214 | 293,701 |
| Receiving sets | 2,873,676 | 2,049,336 | 2,068,995 |
| Tubes | 867,631 | 719,251 | 825,776 |
| Receiving-set components | 2,016,466 | 1,511,262 | 1,806,752 |
| Receiving-set accessories | 2,501,042 | 1,860,930 | 1,891,314 |
| Telegraph apparatus | 1,018,224 | 829,996 | 818,258 |
| Telephone apparatus: | | | |
| Telephone instruments | 419,940 | 373,661 | 298,958 |
| Telephone switchboards | 2,218,587 | 2,109,873 | 715,522 |
| Other telephone equipment | 2,467,715 | 2,022,612 | 2,323,714 |
| Railway signals, switches and attachments | 505,460 | 420,100 | 656,374 |
| Bells, buzzers, annunciators and alarms | 296,348 | 249,890 | 275,133 |
| Other electric apparatus: | | | |
| Spark plugs, magnetos and other ignition apparatus | 1,904,103 | 1,681,707 | 1,718,882 |
| Insulating material | 1,380,142 | 1,169,770 | 1,132,946 |
| Metal conduit, outlet and switch boxes | 1,163,647 | 977,814 | 860,474 |
| Sockets, receptacles and lighting switches | 1,717,890 | 1,392,388 | 1,488,286 |
| Electric lighting fixtures, interior and street | 1,860,225 | 1,537,468 | 1,518,629 |
| Other wiring supplies and line material | 1,164,208 | 1,000,353 | 1,197,881 |
| Other electrical apparatus, not elsewhere stated | 7,422,890 | 6,102,594 | 6,170,674 |
| Rubber and friction tape | 352,310 | 288,432 | 358,798 |
| Globes and shades for lighting fixtures | 598,210 | 490,686 | 500,481 |
| Electrical glassware, except for lighting | 485,593 | 395,178 | 195,631 |
| Electrical porcelain: | | | |
| For less than 6,600 volts | 756,668 | 669,391 | 476,139 |
| For 6,600 volts and over | 787,007 | 688,887 | 510,281 |
| Carbons, carbon brushes and electrodes: | | | |
| Electrodes for electric furnaces | 1,640,837 | 1,381,863 | 1,463,768 |
| Other carbon products | 1,354,657 | 1,050,849 | 1,135,899 |
| Insulated wire and cable (iron and steel) | 275,906 | 216,171 | 171,376 |
| Copper, bare wire | 2,247,861 | 1,960,614 | 1,524,384 |
| Copper, insulated wire and cable | 4,916,008 | 4,210,621 | 4,347,769 |
| Refrigeration sets up to 1 ton capacity | * | * | 2,823,533 |
| Domestic washing machines | * | 149,840 | 194,747 |
| Total | $97,642,348 | $80,579,258 | $81,101,289 |

*Figures not collected.

## *Imports of Electrical Apparatus Into United States by Commodity and by Country of Origin January-November, 1927*

(Data furnished by the Bureau of Foreign and Domestic Commerce)

| Article | First Quarter | Second Quarter | Third Quarter | October and November |
|---|---|---|---|---|
| Carbon-filament incandescent electric lamps: | | | | |
| Miniature | $16,324 | $59,858 | $151,565 | $160,217 |
| Other lamps | 254,407 | 137,723 | 125,989 | 97,035 |
| Metal-filament incandescent electric lamps: | | | | |
| Miniature | 19,901 | 4,642 | 14,027 | 7,066 |
| Other lamps | 70,753 | 35,428 | 12,486 | 24,739 |
| Other electric lamps, including neon, etc | 1,375 | 6,440 | 911 | 1,966 |
| Generators | 210 | ....... | 6,728 | ....... |
| Transformers | ....... | 3,437 | ....... | ....... |
| Converters, double-current and motor-generators, dynamotors and other converting apparatus | 147 | ....... | 35 | ....... |
| Switches, circuit breakers, fuses, choke coils, reactors, sockets, plugs, etc. | 1,438 | 1,594 | 1,582 | 2,455 |
| Motors, stationary, railway, vehicle, automotive, and other | 6,104 | 2,218 | 468 | 878 |
| Electric fans and blowers | 32 | 26 | ....... | ....... |
| Table household, kitchen and hospital utensils and similar hollow or flat ware containing electrical heating element: | | | | |
| Electric flatirons | 17 | 143 | 101 | 6 |
| Iron or steel-enameled or glazed with vitreous glasses | 149 | 425 | 1,005 | 500 |
| Copper, brass, steel or other base metal | 1,416 | 456 | 300 | 358 |
| Industrial electric furnaces and ovens | ....... | 345 | 101 | ....... |
| Therapeutic apparatus and X-ray machines | 797 | 1,535 | 775 | 896 |
| Radio and wireless apparatus and parts | 10,198 | 119,688 | 115,469 | 85,801 |
| Telegraph apparatus | 2,226 | 58 | 2,125 | 631 |
| Telephone apparatus | 184 | 251 | ....... | 299 |
| Storage batteries and parts | 2,773 | 1,642 | 5,950 | 1,137 |
| Batteries other than storage | 106 | 5 | 155 | 390 |
| Electrical machinery and parts | 288,714 | 433,114 | 222,490 | 169,818 |
| Electric apparatus and parts | 19,192 | 51,209 | 32,005 | 44,282 |
| Total | $696,463 | $860,237 | $694,267 | $598,474 |

| Country | First Quarter | Second Quarter | Third Quarter | October and November |
|---|---|---|---|---|
| Austria | $77,527 | $5,434 | $11,405 | $19,505 |
| Australia | 4 | ....... | ....... | 10 |
| Azores and Madeira Islands | ....... | ....... | 39 | ....... |
| Belgium | 1,218 | 303 | 35 | ....... |
| Brazil | 10 | 8 | 31 | ....... |
| British West Indies | 10 | ....... | ....... | ....... |
| Canada | 5,440 | 11,261 | 10,170 | 9,335 |
| Ceylon | 7,423 | ....... | ....... | ....... |
| China | 3,401 | ....... | 17 | 55 |
| Cuba | 256 | 3 | ....... | 5 |
| Czechoslovakia | 13,316 | 263 | 968 | 632 |
| Denmark | ....... | 228 | ....... | ....... |
| France | 12,013 | 18,982 | 5,781 | 6,280 |
| French Oceania | ....... | 90 | ....... | ....... |
| Germany | 187,790 | 195,050 | 226,864 | 171,731 |
| Hungary | 1,530 | ....... | ....... | ....... |
| Irish Free State | ....... | ....... | 4 | ....... |
| Italy | 562 | 1,300 | 844 | 410 |
| Japan | 105,848 | 153,895 | 207,342 | 203,472 |
| Mexico | 260 | ....... | ....... | 300 |
| Netherlands | 937 | 430 | 2,200 | 5,336 |
| Norway | ....... | 33 | ....... | ....... |
| Philippine Islands | ....... | ....... | 7 | ....... |
| Rumania | 4 | ....... | ....... | ....... |
| Spain | 120 | 58 | 124 | 194 |
| Sweden | 66,025 | 78,133 | 32,682 | 120,686 |
| Switzerland | 198,433 | 261,412 | 160,776 | 8,398 |
| United Kingdom | 14,336 | 133,354 | 34,978 | 52,125 |
| Total | $696,463 | $860,237 | $694,267 | $598,474 |

also slightly decreased, as well as that with New Zealand and India. The Philippine Islands, however, have made up for some of this loss in the Far East. South and Central America, with the exception of Argentina, Brazil, and Colombia, show slight increases, whereas our Chilean trade has dropped off $3,000,000.

Virtually every European country has taken more electrical goods from us than they did in 1926, showing that our market there is slowly developing and furthermore that such growth is about equally distributed among all the countries. In general, the year's trade shows a normal growth along a great many lines, indicating that American manufacturers are slowly but surely pushing ahead to develop their foreign markets.

## Energy Consumption Per Domestic Customer

The accompanying table giving the energy consumption per domestic customer is based on kilowatt-hours sold to domestic customers and number of customers reported by 72 companies for the year 1926.

| Section | No. Companies Reporting | Minimum | Average | Maximum |
|---|---|---|---|---|
| New England | 6 | 259 | 339 | 440 |
| Middle Atlantic | 10 | 161 | 399 | 680 |
| South Atlantic | 4 | 256 | 404 | 550 |
| East North Central | 20 | 231 | 380 | 569 |
| West North Central | 7 | 275 | 383 | 468 |
| East-South Central | 5 | 298 | 337 | 371 |
| West-South Central | 6 | 268 | 334 | 384 |
| Mountain | 5 | 129 | 338 | 518 |
| Pacific | 9 | 122 | 463 | 815 |

## Imports of Electrical Apparatus Into United States

With this issue of the Electrical World a compilation giving the imports of electrical apparatus into the United States by commodity and by country of origin for the first, second and third quarters and the last two months of this year is presented. The figures for the first and second quarters have appeared previously, and figures for every succeeding quarter will be printed as soon as available. No particular articles stand out prominently in the table, nor is there an abnormal amount of any particular commodity imported. For the first half of the year Switzerland heads the list with $459,845, Germany comes second with $382,840 and Japan is third with shipments of $259,743.

## *Appliance and Merchandise Sales for 1926 and 1927*

(Compiled by *Electrical Merchandising*)

Note: These figures were compiled by *Electrical Merchandising* from sales records of associations and manufacturers and from estimates made by association executives and leading manufacturers.

| Appliance and Merchandise | 1926 Number Sold | 1926 Retail Value | 1927 Number Sold | 1927 Retail Value |
|---|---|---|---|---|
| Cleaners | 1,065,000 | 65,000,000 | 1,028,000 | 49,344,000 |
| Clocks | 90,000 | 2,250,000 | 95,000 | 2,500,000 |
| Cookers (660 watts and under) | 175,000 | 1,750,000 | 200,000 | 1,800,000 |
| Dishwashers | 6,500 | 1,040,000 | 9,000 | 1,440,000 |
| Fans | 1,000,000 | 15,250,000 | 750,000 | 11,250,000 |
| Fixtures, residential | 13,000,000 | 78,000,000 | 13,000,000 | 75,000,000 |
| Flashlights and renewal batt's | ....... | 40,000,000 | ....... | 44,000,000 |
| Floor polishers | 90,000 | 5,400,000 | 100,000 | 6,000,000 |
| Heating pads, etc | 230,000 | 1,840,000 | 255,000 | 1,657,500 |
| Hot plates, grills and table stoves | 300,000 | 1,800,000 | 315,000 | 1,890,000 |
| Ironing machines | 57,000 | 8,835,000 | 68,000 | 10,880,000 |
| Irons | 3,000,000 | 16,000,000 | 3,000,000 | 14,250,000 |
| Lamps, incandescent | 500,000,000 | 170,000,000 | 538,000,000 | 160,000,000 |
| Lighting units, commercial | 2,000,000 | 24,000,000 | 1,800,000 | 22,000,000 |
| Percolators | 400,000 | 6,000,000 | 450,000 | 5,400,000 |
| Portable lamps and shades | 6,000,000 | 80,000,000 | 6,000,000 | 72,000,000 |
| Plugs, pural | 3,000,000 | 1,200,000 | 3,000,000 | 1,200,000 |
| Radiators and heaters | 448,000 | 2,688,000 | 450,000 | 2,475,000 |
| Ranges (except wall outlet) | 110,000 | 16,500,000 | 110,000 | 17,600,000 |
| Ranges, wall outlet | ....... | ....... | 10,000 | 500,000 |
| Refrigerators, domestic | 248,000 | 65,200,000 | 365,000 | 82,125,000 |
| Sewing machines | 315,000 | 29,925,000 | 350,000 | 33,250,000 |
| Toasters | 600,000 | 2,250,000 | 625,000 | 2,343,000 |
| Vibrators | ....... | ....... | 150,000 | 1,150,000 |
| Violet ray outfits | 125,000 | 2,000,000 | 145,000 | 2,250,000 |
| Waffle irons | 180,000 | 2,160,000 | 300,000 | 3,300,000 |
| Washing Machines | 843,000 | 124,000,000 | 790,000 | 118,500,000 |
| Total | | 763,088,000 | | 744,104,500 |

# Market Conditions

OPTIMISTIC reports regarding sales this year are borne out by the encouraging trends directly reported by manufacturers as to the current business. Inquiries in New England presage good future sales, and electric illumination is attracting much attention. Central-station business closed in the Eastern district includes the purchase of $500,000 worth of substation equipment by the Brooklyn Edison Company and inquiries for more of such material from other companies. The United States Shipping Board also has contracted for electric drive marine equipment totaling close to $550,000. Wire and cable business gives an indication of being a feature of the demand during the next few weeks. Industrial plant sales have been exceptional and there are indications that they will continue.

An industrial company in Tennessee has ordered part of the equipment for a million-dollar hydro-electric plant. Central-station buying in the Southeast is only for immediate requirements. The Georgia Power Company has announced a budget of $12,755,000 for 1928. In St. Louis activity is mainly in the southwestern part of the territory. Two pole contracts for $60,000 each were placed on the Pacific Coast. Extensive campaigns are planned by the power companies to cover home lighting, heating and cooking.

## *Copper Prices Stiffen Despite Inactive Market*

Markets for the non-ferrous metals have been very quiet. Copper, however, has shown strength and is virtually established at 14⅛ cents delivered. Lead is unchanged in New York and slightly firmer in St. Louis, whereas zinc is a shade weaker. Tin prices are off a fraction of a cent in the domestic market.

NEW YORK METAL MARKET PRICES

| | Dec. 28, 1927 Cents per Pound | Jan. 4, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14 | 14⅛ |
| Lead, Am. S. & R. price | 6½ | 6½ |
| Antimony............ | 10⅞ | 10⅞ |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots............ | 6 | 5.95 |
| Tin, Straits........... | 57⅛ | 10¾ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper price Jan. 4, 1928, 15¾ cents.

## *Business Shows Revival in Eastern District*

The turn of the year has brought an encouraging tone in the New York market and other Eastern centers. Central-station business shows definite signs of revival, with actual commitments on the part of one leading utility company and projects for early maturity among other power interests in this territory. The Brooklyn Edison Company has divided an order for about $500,000 worth of substation equipment between two large manufacturers. The New York Edison Company has work under way on three new substations, and others are projected. The Public Service Electric & Gas Company, Newark, plans the erection of a substation at West Orange, N. J., and is expected to place orders for equipment within 60 days. The United States Shipping Board has contracted with a large manufacturer for electric drive marine equipment totaling close to $550,000, being a part of an appropriation of $15,000,000 available for machinery of this kind and the first order to be placed. Business in wire and cable gives indication of being a feature of demand during the next few weeks.

A leading manufacturer of industrial equipment reports very satisfactory business and says that sales in this line for more than a month past have been exceptional with indications of continuance on this basis for several weeks to come.

Forthcoming construction projects in the Eastern district include the following: Dwight P. Robinson & Company, New York, will handle an expansion program at the plant of the Gulf States Steel Company at Alabama City, Ala., including installation of power plant with capacity of 10,000 kw., complete electrification of drives on present rod mill, and other equipment electrification at an estimated cost of nearly $2,000,000. The Quartermaster, Second Corps Area, Governor's Island, New York, is asking bids until Jan. 16 for one air-injection or solid-injection full Diesel marine-type engine, two-cycle or four-cycle. The Huntoon Ice Company, 91 Seventh Avenue, New York, has filed plans for a three-story addition to its plant. C. Hoffberger & Company, Baltimore, Md., plans an eleven-story ice and cold-storage plant to cost about $850,000. The West Penn Power Company, Pittsburgh, plans the erection of a one-story equipment storage and distributing building at Charleroi, Pa.

## *Tennessee Industrial Plant Places Large Order*

Orders placed by an industrial company in Tennessee for waterwheels, turbines, generators and transformers for a 90,000-kw. hydro-electric generating plant which when complete will cost in the neighborhood of $1,000,000 were the most important business transacted in the Southeast. Central-station companies are purchasing for only immediate requirements, but, considering the season of the year, the volume of business is reasonably satisfactory. One company placed orders for 45,000 lb. of weatherproof solid-copper wire and $6,800 worth of creosoted pine poles.

Construction plans are as follows: The Central Florida Light & Power Company, Dunnellon, Fla., plans the construction of an ice plant at Iverness, Fla. Miami Beach, Fla., plans an ornamental lighting system on portion of Collins Avenue. The Georgia Power Company, Atlanta, has purchased the municipal power station and ice plant at McRae, Ga., and will build a transmission line and local substation. The Stimpson Computing Scales Company, Louisville, Ky., plans a new plant to cost about $100,000. The Carolina Power & Light Company, Raleigh, N. C., plans extensions in the Asheville district, to cost about $200,000. The Electric City Ice Company, Anderson, S. C., plans a 30-ton ice plant. The Railway Ice Company, 309 South La Salle Street, Chicago, plans an ice plant at Memphis, Tenn. The Carolina Cement Company, Port Huron, Mich., recently organized, plans a mill on the Trent River, near New Bern, N. C., to cost more than $2,000,000.

## *Business Accelerates in the Middle West*

The Middle West is entering the 1928 period with confidence founded on a prosperous year. The acceleration of business noticeable during the last quarter of 1927 is expected to continue throughout most of the coming year, at least through the first quarter of 1928. Jobbers' sales were generally satisfactory. Appliances are moving readily, particularly vacuum cleaners, one order being placed for 1,000 machines.

The Continental Ice Company, Savanna, Ill., will build an ice plant, estimated to cost $300,000. Kendallville, Ind., will take bids in January for a municipal power plant to cost about $85,000. Cedar Rapids, Iowa, plans an ornamental lighting system on 20 blocks in the business section. The Central States Electric Company, Cedar Rapids, plans a hydro-electric power plant on the Des Moines River, near Fort Dodge, to cost about $1,000,000, with transmission lines. Lansing, Mich., will erect a municipal power and water station to house present equipment and proposed additional machinery. The Swedish Hospital, Minneapolis, will build a power plant in connection with its proposed hospital unit, to cost $500,000. The Waldorf Paper Products Company, St. Paul, is asking bids until Jan. 10 for a power-plant and paper-mill addition, to cost about $200,000. St. Paul, will install an ornamental lighting system on portions of Hatch, Thomas and Albert Streets. The Universal Portland Cement Company, Chicago, plans a cement mill in the Cuyahoga River Valley near Cleveland, Ohio, to cost $2,000,000. The Department of Public Welfare, Cleveland, plans a power plant at the boys' farm at Hudson, estimated to cost $75,000. The Ohio Public Service Company, Elyria, Ohio, plans a one-story equipment storage and distributing plant to cost about

$75,000. New Philadelphia, Ohio, plans an ornamental lighting system on Ackley, Park and other streets. The Northwestern Public Service Company has been granted a franchise at Columbia, S. D., and will build a transmission line to that district. Madison, Wis., will install an ornamental lighting system on University Avenue and adjacent streets to cost about $24,000.

### *Sales Mainly in Southwestern Part of St. Louis District*

All of the activity in the St. Louis district seems to be centered in the southwestern part of the territory. Contracts noted are for six high-tension transformers amounting to $59,000; 65 motors of 35 hp., 50 hp. and 65 hp. for oil-well pumping at a cost of $67,000 and a switchboard for $5,300. An order for a small lot of motors, 25-hp. and 35-hp. units is reported as placed by a St. Louis company at a total cost of $5,750.

Construction projects in the district are as follows: The Arkansas Cold Storage Company, Little Rock, Ark., plans a three-story addition to cost $100,000. W. S. Merkle, St. Louis, has plans under way for a hydro-electric power project in the south-central portion of the state, to cost in excess of $1,000,000. Muskogee, Okla., plans an ornamental lighting system in the business district to cost $50,000. The Texas Central Power Company will build a power plant at Brownsville, Tex., to cost about $50,000. The Gulf States Utilities Company, Beaumont, Tex., is arranging an expansion program in 1928, to cost $1,200,000, including additions in the power plant at Orange. The Houston (Tex.) Lighting & Power Company will build a two-story substation on Peden Avenue, to cost approximately $35,000. The Central Power & Light Company, San Antonio, plans a lighting system at Bandera, Tex.

### *Two Large Pole Contracts Closed on Pacific Coast*

Yearly pole contracts were placed on the Pacific Coast by the Pacific Gas & Electric Company and the San Joaquin Light & Power Corporation. Each approximating $60,000, for delivery early in 1928. Power-company orders were mainly composed of emergency or small stock orders. Private pole-line jobs were reported from Morgan Hill, Jasper, Watsonville and Turlock, each on the basis of about 50 to 100 poles. Street-lighting business is excellent, orders are being placed for units in Sacramento, a Stockton order for about 80 is under consideration, and specifications are being written for 87 standards for Los Banos.

Business in the Seattle and Puget Sound centers was quiet, while inventory was taken. Few motor sales are reported, these being small and distributed about equally between lumber mills, allied industrials and dealers. The following projects will come up after the first of the year: Traffic-signal system for Yakima, boulevard lighting system in Olympia, underground wiring for police and fire-alarm system for Bellingham, and a second transmission line from the Puget Sound Power & Light Company plant at Concrete to Everett, a distance of more than 100 miles. A 120-ton pulp and paper mill costing $3,000,000 is proposed for Seattle, and Kelso and South Bend also announce proposed pulp mills.

Construction plans are as follows: Alhambra, Cal., plans an ornamental lighting system on Fremont, Hellman and other streets. Garden Grove, Cal., plans an ornamental lighting system in the downtown district. Karpen & Brothers, Inc., Chicago, plan a four-story furniture plant at Los Angeles, Cal., to cost $350,000. The Southern California Edison Company, Los Angeles, will build a power substation near Irvine, estimated to cost $110,000. The Pacific Gas & Electric Company, San Francisco, plans a substation at Yuba City, Cal., with initial capacity of 3,000 kw. Santa Barbara, Cal., plans an ornamental lighting system on State Street. South Pasadena, Cal., plans an ornamental lighting system on Milan Avenue and other streets. Grand Junction, Colo., plans an ornamental lighting system on Seventh Street.

### *Inquiries Increasing in New England District*

Inquiries received in the New England district forecast an encouraging trend. Central-station material orders have fallen off to some extent, though the amount of regular scheduled material sold compares favorably with the business of last year. Transformer inquiries are increasing, meter sales are fair, and control equipment is selling well.

The New England Telephone & Telegraph Company will expend $2,500,000 in expanding service in its territory. Plans for improvement of the Boston Elevated service will be presented to next legislature and include proposed expenditures amounting to $40,000,000. Factory expansion is announced by the Boston Gear Works. Building construction in view shows a trend comparable to that of last year. The Worcester Electric Light Company, Worcester, Mass., has filed plans for improvements and alterations in its station on Foster Street, estimated to cost $75,000.

# Activities of the Trade

## Servel Company Reorganizes as Servel, Inc.

All of the related Servel companies, which have been under receivership since August, 1927, have been reorganized and will go forward with the manufacture and sale of its compression and absorption refrigerating units. Colonel F. E. Smith, who was receiver for the original company and has been active in its reorganization, is president of the new concern, which is known as Servel, Inc. The other officers are: W. F. Thatcher, vice-president; D. L. Adkins, secretary; F. O. Cummings, controller, and H. W. Foulds, general sales manager. Colonel Smith in discussing the reorganization with a representative of the ELECTRICAL WORLD said that it was the aim of the new company to develop the refrigeration business and to co-operate with both the ice and the mechanical refrigeration industry.

Two new subsidiaries have been formed, one, Servel Sales, Inc., which will handle the marketing of the refrigerating units, and the other, Hercules Products, Inc., which will take care of gas-engine and commercial body sales. The reorganization committee, comprising G. W. Davison, N. F. Brady, C. M. Kittle, A. H. Wiggin and Murray Coggeshall, announced that Jan. 16 has been set as the last day when deposits of the five-year 6 per cent convertible notes of the Servel Corporation and claims against it and its subsidiaries will be received without penalty. Undeposited common shares of the corporation will be received up to that date on payment of two installments of $1 a share each, now past due, plus interest on the installments at 6 per cent annually.

## Williams Oil-O-Matic Holds Oil-Burner Training Schools

For the purpose of instructing dealers in proper installation and servicing of its oil-burner house-heating equipment the Williams Oil-O-Matic Heating Corporation, Bloomington, Ill., is conducting a series of regional training schools during January and February. Two-day sessions are being held in sixteen cities, and the schools will be open to central-station men, even though they do not sell oil burner equipment.

The schools are being held under the supervision of Earl Nesmith and R. D. Marshall, factory representatives of the corporation, and the schedule is as follows: Minneapolis, Minn., Jan. 3-4; Omaha, Jan. 6-7; Indianapolis, Jan. 9-10; Lansing, Mich., Jan. 12-13; Toronto, Jan. 16-17; Montreal, Jan. 19-20; Boston, Jan. 23-24; Rochester, Jan. 26-27; New York City, Jan. 30-31; Philadelphia, Feb. 2-3. Training schools will also be held in the following cities on dates to be announced later: Richmond, Va.; Charlotte, N. C.; Atlanta, New Orleans, Memphis and St. Louis.

# Directory of Electrical Associations

Printed in the First Issue of Each Volume

American Association of Engineers. Secretary, M. E. McIver, 63 East Adams St., Chicago, Ill.

American Electric Railway Association. Managing director, Lucius S. Storrs. General secretary, J. W. Welsh, 292 Madison Ave., New York City.

American Electrochemical Society. Secretary, Colin G. Fink, Columbia University, New York City.

American Engineering Council. Executive secretary, L. W. Wallace, 26 Jackson Place, Washington, D. C.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, P. W. Henry, 111 Broadway, New York City.

American Institute of Electrical Engineers. National secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets bi-monthly. Sections and branches meet monthly in the principal electrical centers throughout the country. Three national and several regional conventions held each year.

American Institute of Mining and Metallurgical Engineers. Secretary, H. Foster Bain, 29 West 39th St,, New York.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, M. M. Kelly, 29 West 39th St., New York.

Arkansas Utilities Association. Secretary-treasurer, R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Artistic Lighting Equipment Association. Managing director, G. P. Rogers, 711 Graybar Bldg., 420 Lexington Ave., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

Association of Electragists International (formerly National Association of Electrical Contractors and Dealers). Secretary, Laurence W. Davis, 15 West 37th St., New York City, N. Y. Direct membership throughout the United States and Canada.

Association of Iron and Steel Electrical Engineers. Managing director, John F. Kelly, Empire Bldg., Pittsburgh, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

Canadian Electrical Association (affiliated with N.E.L.A.). Secretary, H. W. Lyster, 712 Power Bldg., Montreal.

Colorado Utilities Association. Secretary-treasurer, O. A. Weller, Public Service Co. of Colorado, Denver, Col.

East Central Geographic Division, N.E.L.A. Secretary, D. L. Gaskill, Greenville, Ohio.

Eastern Association of Electrical Inspectors. Secretary, E. P. Slack, fifth floor, 85 John St., New York City.

Eastern Geographic Division, N.E.L.A. Secretary, Harold A. Buch, Telegraph Building, Harrisburg, Pa.

Electric Association (Chicago). Manager, R. Bourke Corcoran, 30 North Dearborn St., Chicago, Ill.

Electrical League of Colorado. Executive manager, George Bakewell, Jr., Gas & Electric Bldg., Denver, Col.

Electrical League of Utah. Field secretary, R. E. Folland, Newhouse Hotel, Salt Lake City, Utah.

Electrical Manufacturers' Club. Secretary, Walter F. Field, Safety Cable Co., New York City.

Electrical Supply Jobbers' Association. Executive secretary, E. Donald Tolles, 165 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Georgia Electrical Association. Secretary-treasurer, J. J. McDonough, Georgia Power Co., Dublin, Ga.

Great Lakes Geographic Division, N.E.L.A. Secretary-treasurer, R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Illuminating Engineering Society. General secretary, L. H. Graves, 29 West 39th St., New York City.

Illuminating Glassware Guild. Assistant business manager, C. H. Ferris, Stevenson Corp., 19 West 44th St., New York City.

Indiana Electric Light Association. William Stokes, acting secretary, 1547 Consolidated Building, Indianapolis, Ind.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, 37 West 39th St., New York City.

International Association of Municipal Electricians. Secretary, H. N. Lang, Box 1864, Orlando, Fla.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N.E.L.A. Secretary and treasurer, H. E. Weeks, Davenport, Iowa.

Kansas Section, N.E.L.A. Secretary, H. Lee Jones, 401 National Reserve Building, Topeka, Kan.

Kentucky Association of Public Utilities. Secretary, E. F. Kelley, Louisville Railway Company, Louisville, Ky.

Maryland Utilities Association. Secretary, G. S. Williams, United Railways & Electric Co. of Baltimore, 1005 Continental Bldg., Baltimore, Md.

Michigan Electric Light Association. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Middle West Geographic Division, N.E.L.A. Secretary-treasurer, T. A. Browne, 1519 O St., Lincoln, Neb.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

National Association of Electrical Inspectors. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

National Association of Railroad and Utilities Commissioners. Secretary, James B. Walker, 270 Madison Ave., New York.

National Committee on the Relation of Electricity to Agriculture. Director, E. A. White, 1120 Garland Bldg., Chicago.

National Electric Light Association. Managing director, Paul S. Clapp, 420 Lexington Avenue, New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1008 Marquette Building, Chicago, Ill. Central, New England, New York, Middle and Southern Atlantic States and Pacific Coast Divisions.

National Electrical Manufacturers Association. (Consolidation of Associated Manufacturers of Electrical Supplies, Electric Power Club and Electrical Manufacturers' Council.) Managing director, Alfred E. Waller, 420 Lexington Ave., New York City.

National Fire Protection Association. Chairman of electrical committee, A. R. Small, 109 Leonard St., New York City.

National Safety Council. Managing director and secretary, W. H. Cameron, 108 East Ohio St., Chicago, Ill.

Nebraska Section, N.E.L.A. Secretary-treasurer. T. A. Browne, 1527 Sharp Building, Lincoln, Neb.

New England Geographic Division, N.E.L.A. Secretary, Miss O. A. Bursiel, Statler Building, 20 Providence St., Boston, Mass.

New Jersey Electric Association. Secretary-treasurer, J. Hall Truman, Eastern New Jersey Power Co., Asbury Park, N. J.

New Mexico Utilities Association. Secretary-treasurer, Bernard L. Wiles, Albuquerque, N. M.

New York Electrical League. Secretary, David T. Brown, 270 Canal St., New York City.

New York Electrical Society. Secretary, H. E. Farrer, 29 West 39th St., New York City.

North Central Electric Association (Geographic Division N.E.L.A.). Executive secretary, J. W. Lapham, 803 Plymouth Bldg., Minneapolis, Minn.

Northwest Electric Light and Power Association (Geographic Division N.E.L.A.) Secretary, Berkeley Snow, 1208 Spalding Building, Portland, Ore.

Oklahoma Utilities Association. Manager, E. F. McKay, 1020 Petroleum Building, Oklahoma City, Okla.

Pacific Coast Electrical Association (Pacific Division N.E.L.A.). Secretary, Samuel H. Taylor, Suite 729-730, 447 Sutter St., San Francisco, Cal.

Pennsylvania Electric Association (State Section N.E.L.A.). Managing director, A. B. Millar; secretary-treasurer, Harold A. Buch, Telegraph Bldg., Harrisburg, Pa.

Public Utilities Association of Virginia. Secretary, A. H. Herrmann, Virginia Electric & Power Company, Richmond, Va.

Public Utilities Association of West Virginia. Secretary, A. B. Tunis, 306 Securities Building, Charleston, W. Va.

Radio Club of America. Secretary, Thomas J. Styles, 55 West 42d St., New York City.

Rocky Mountain Geographic Division, N.E.L.A. Secretary, O. A. Weller, Public Service Co. of Colorado, Denver, Col.

Society for Electrical Development, Inc. President, W. W. Freeman; chairman executive committee, C. L. Edgar; secretary-treasurer, J. Smieton, Jr., 420 Lexington Ave., New York. Annual meeting second Friday in September; directors' meetings second Friday in March, June, September and December; executive committee meetings every thirty days.

Society for the Promotion of Engineering Education. Secretary, Prof. F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Society of Industrial Engineers. Secretary, Geo. C. Dent, 608 South Dearborn St., Chicago, Ill.

Southeastern Geographic Division, N.E.L.A. Secretary, C. M. Kilian, 402 Wynn-Claughton Bldg., Atlanta, Ga.

Southeastern Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Southwestern Geographic Division, N.E.L.A. Secretary, S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association. Secretary, E. N. Willis, 403-4 Slaughter Bldg., Dallas, Tex.

Vermont Electrical Association. Secretary-treasurer, F. J. Sisco, St. Albans, Vt.

Western Section, International Association of Electrical Inspectors (successor to Western Association of Electrical Inspectors). Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers. Secretary, E. S. Nethercut, 1735 Monadnock Block, 53 W. Jackson Blvd., Chicago, Ill.

Wisconsin State Association of Electrical Contractors and Dealers. Chairman and secretary, L. W. Burch, 202 East Washington Ave., Madison, Wis.

Wisconsin Utilities Association. Executive secretary, John N. Cadby, 432 Broadway, Milwaukee, Wis.

Wyoming Utilities Association. Secretary, L. J. Meyer, Mountain States Telephone & Telegraph Co., Cheyenne, Wyo.

# Business Facts for Electrical Men

### Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

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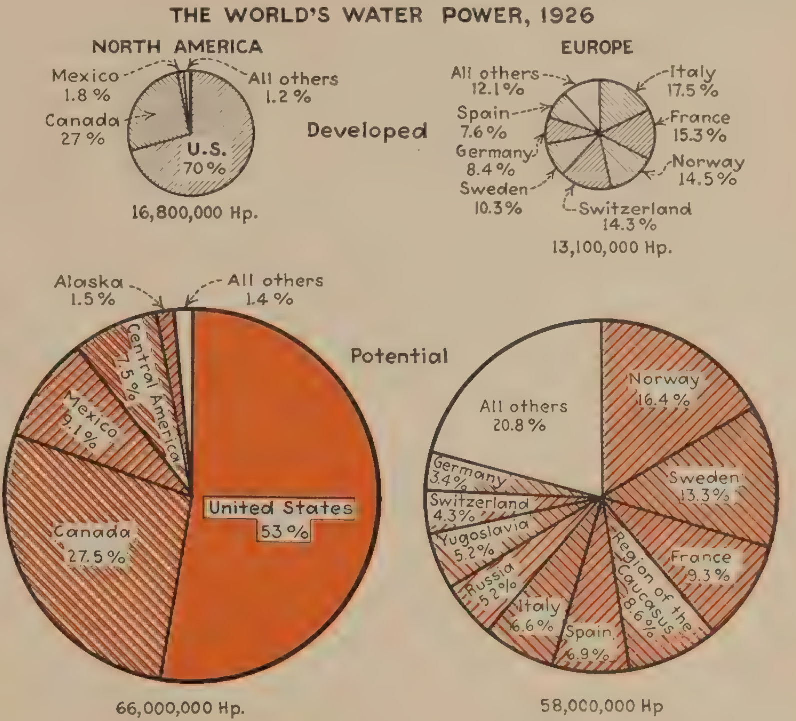
## A Hundred Niagaras

NEARLY half a billion hydraulic horsepower still awaits development before the world's known sites shall have all been put to use. The total potential horsepower has recently been estimated at 454,000,000; installed plants aggregate only 33,000,000 hp. Since the installed capacity may well amount to two or three times the power available at minimum flow, it is evident that a billion horsepower is not too high an estimate of the ultimate possibilities.

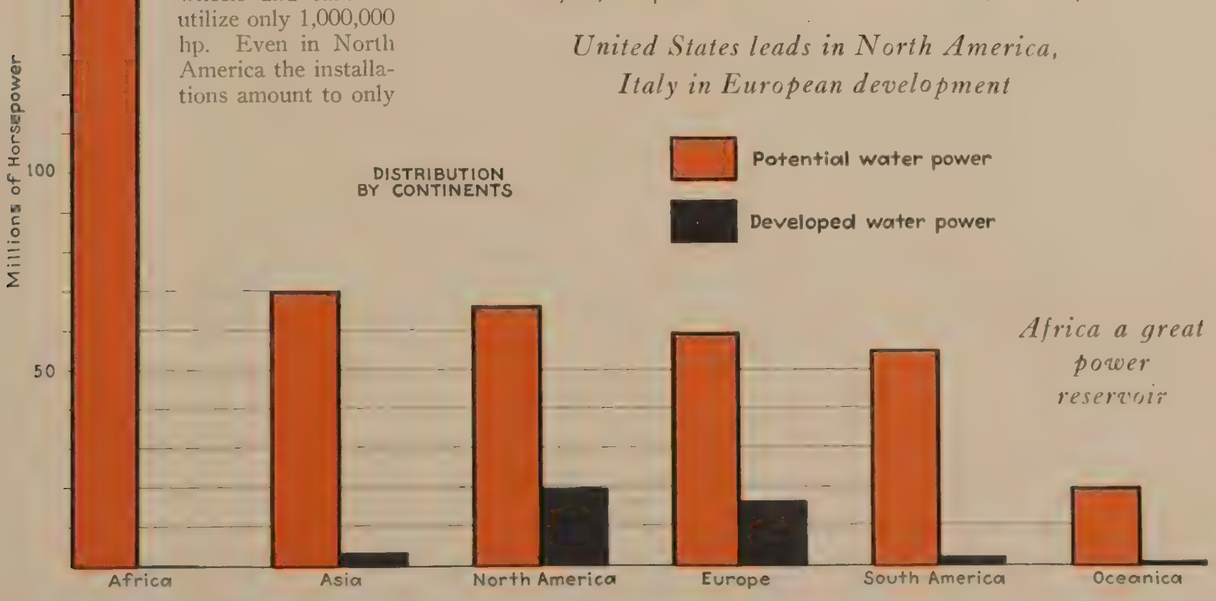
Toward the utilization of this great and continuously replenished storehouse of power dwellers in the North Temperate Zone have made a beginning, but compared with what may eventually be done the world's water-power resources have barely been tapped. Their greatest exploitation still awaits man's conquest of the tropics.

Of the available total, fully 40 per cent, or 190,000,000 hp., is in Africa. Asia has 69,000,000. South America 54,000,000. On those three great continents hydraulic wheels and turbines utilize only 1,000,000 hp. Even in North America the installations amount to only one-fourth of the low-water flow, and perhaps a tenth of what may ultimately be installed. The same may be said of Europe.

So long as the present economic balance continues between fixed charges on hydro-electric developments and the cost of energy from fuel, so long will mountain fastness and forest continue to resound to the roar of great waters not yet shackled.



*United States leads in North America, Italy in European development*



*Africa a great power reservoir*

# Southern States Continue High Production

IN ACCORDANCE with trends established in past years the manufacturing plants of the Southern States have been operating during the fall months at a rate materially exceeding that reported during the first half of the year. Productive activity in November was about on the same level as in September and October, but was 2 per cent over November, 1926.

During November three of the primary industrial groups of the Southern States—textiles, lumber and its products, and stone, clay and glass—witnessed productive activities over those reported for November, 1926. On the other hand, three other important industrial groups—fertilizers, rolling mills and steel plants, and paper and pulp—reported operations at a rate under those of 1926. The textile plants of the section, which have been operating at a comparatively high rate since September, 1926, continued to report near-record operations, the rate of activities in November having been exceeded only during January, 1927. An opposite trend was reported by the textile mills of New England, however, the rate of operations in that section during November being 14 per cent under October and 13 per cent under November, 1926.

*Indexes of Productive Activity in the Southern States*

All Figures Adjusted for Number of Working Days

| | Nov. 1927 | Oct. 1927 | Nov. 1926 | Average for First Eleven Months of 1927 | Average for Full Year 1926 |
|---|---|---|---|---|---|
| All industries | 137.0 | 134.6 | 134.2 | 127.6 | 115.9 |
| Fertilizers | 106.2 | 97.0 | 238.0 | 108.2 | 184.3 |
| Metals group | 111.4 | 117.4 | 145.0 | 128.2 | 129.5 |
| Food | 134.2 | 127.7 | ..... | ..... | ..... |
| Stone, clay and glass | 179.2 | 174.6 | 134.4 | 156.4 | 119.7 |
| Textiles | 164.0 | 157.7 | 143.7 | 145.6 | 261.3 |
| Paper and pulp | 107.9 | 115.0 | 122.9 | 101.6 | 118.3 |
| Lumber and its products | 124.0 | 121.4 | 108.7 | 100.8 | 101.0 |
| All industries United States | 115.2 | 119.9 | 111.9 | 115.9 | 113.1 |

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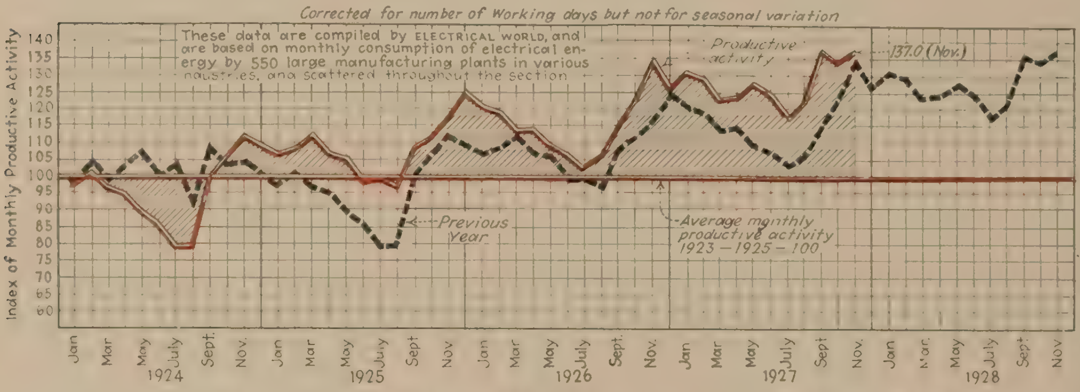
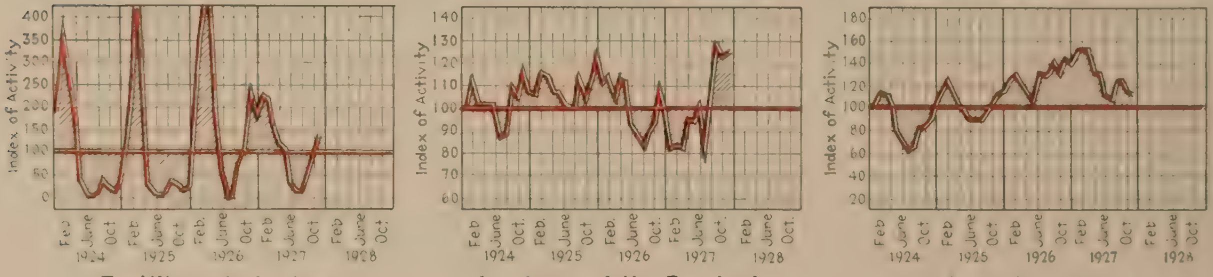
ELECTRICAL WORLD *Barometer of Industrial Activity in the Southern States*



GENERAL INDUSTRIAL ACTIVITY IN THE SOUTHERN STATES

*States in the* SOUTHERN *Group*

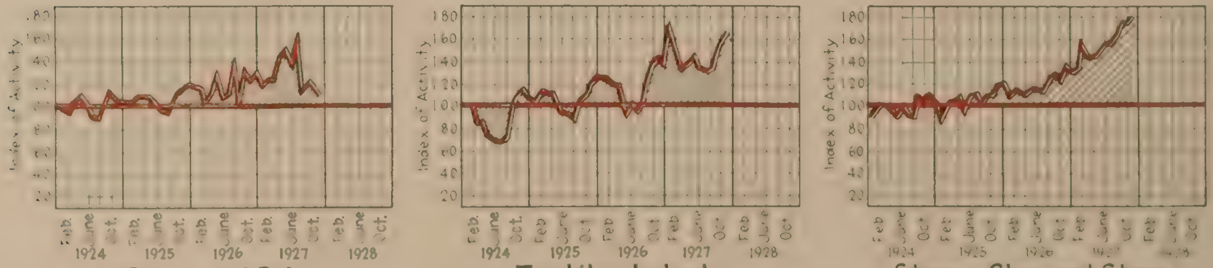
Delaware
Maryland
District of Columbia
Virginia
West Virginia
North Carolina
South Carolina
Georgia
Florida
Kentucky
Tennessee
Alabama
Mississippi
Arkansas
Louisiana
Oklahoma
Texas



Fertilizer Industry

Lumber and its Products

Metal Industries



Paper and Pulp

Textiles Industry

Stone, Clay, and Glass

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE SOUTHERN STATES

Electrical World

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W. H. ONKEN, JR.
*Editor*

VOLUME 91 *New York, Saturday, January 14, 1928* NUMBER 2

## *Era of Electrification at Hand*

AMERICAN railroads have come back. They have survived the attempt at governmental operation, a period of inadequate rates and years in which their credit and their business were in the doldrums. Railroad executives had the courage to overcome heavy obstacles, and national thanks are due them for their remarkable achievements.

The end is not yet, for in a recent statement General W. W. Atterbury pointed out many things which should be done to better transportation and make it more economical. Among these he put electrification, and well-founded rumors presage a major electrification program for the Pennsylvania Railroad in the near future. Other railroads are also ready for electrification in that several systems have worked out a fundamental plan and analysis to show where and when electrification is warranted. The Illinois Central terminal electrification in Chicago is going to be followed by other terminal electrifications because published results of electric operations in Chicago are convincing.

Not all railroad lines should be electrified. But heavy-traffic terminals in large cities, heavy-traffic main lines and lines with steep grades are prospects for electrification over which the electrical industry can keep busy for several years. Energy will be purchased from light and power systems in most cases, and the requirement of automatic train control makes it necessary to revise signal and structural arrangements on all railroads so that electrical overhead systems will be readily installed. The time is ripe for a major electrification program.

* * * *

## *Creation of Markets Opens Engineers' Fields*

ENGINEERS, as distinguished from scientists and technicians, justify their profession to the extent that they apply science to economic and social needs. In so doing they will enhance civilization as measured by the extent to which people enjoy happiness and can adapt themselves to the conditions of the time.

Particularly of late, there has been wider recognition of the fact that engineers must consider not only technical problems but economical organization or administration, finance and production. Each is essential, but a warning must be sounded not to make a fetish of organization, which is only a skeleton or framework into which individual human effort must be fitted. Through the recent revolution in financing methods every man on the street has become a capitalist, making corporate and public relations the concern of all. Production is the foundation of wealth and civilization, so that a community will enjoy both only as the average individual contribution of effort is high. Therefore engineers will do well to think of their mission in life as one to increase the productivity of their fellow men through scientific applications rather than to magnify the means to the end.

Even though our country affords the proof that substituting mechanical slaves for human slaves has brought the average laboring man the highest standard of living existent anywhere, some nations are being held back industrially and socially because of labor's belief there that increasing the productivity per worker through machinery will permanently displace workers. Obviously, there will be no work for those displaced unless something has been done to increase the need for workers. This something has involved increasing the demand for products and the development of new products through research. Merchandising, therefore, is an all-important activity which engineers must add to the already recognized factors influencing engineering development. Without an outlet for things produced or service made available, there is little need for production, and hence the engineer. There is no danger of "overselling" the American public so long as the productivity per worker is increased and thus the ability to augment his income.

* * * *

## *Governor Smith's Futile Water-Power Program*

GOVERNOR SMITH in his annual message to the Legislature of New York made an admirable presentation of his accomplishments as the chief executive of the Empire State. As a report of work done and hopes deferred the Governor's message merits commendation. That many of his recommendations have come to naught is not indicative of any lack of sincerity on his part, but of the fact that the Legislature has had a different view. In a measure it is well that this has been so, because some of Governor Smith's recommendations indicate a socialistic rather than a democratic tendency, and the plausibility with which he presents and argues for them makes them all the more insidious. For example, his recommendation for a state Water Power Authority empowered to use its own securities against the proved economic value of state water-power development is unsound and reveals the politician rather than the statesman. There is a tendency toward a super-government in the shape of "authorities," which apparently owe no responsibility to the people or to the Legislature and some of which are not even performing the work for which they were created.

The Port Authority, to cite one notable example, was appointed to wrestle with the port problem. To date it has done absolutely nothing along that line, but has taken up work like bridge building, which, however laudable, was never contemplated in the original legislation, and it has issued securities for that purpose at very low rates because people believe that the credit of the state is back of them. This is contrary to the fact. The proposed Water Power Authority would add to the existing bureaus, and although it might not have power to assess those benefited, as do the river control authorities, it would nevertheless be able to float securities on proposals which might conceivably be of questionable merit, for how can one prove the economic value of water-power development not in existence?

In addition, the Governor proposes to rob the Public Service Commission of some authority, because the Water Power Authority would have full control of rate regulation and of other problems arising in connection with state ownership and state control of water power. Further encroachment on state regulation is suggested by permitting localities to fix rates for public utility services within their borders. These are blemishes on an otherwise admirable record and it is fortunate for the public as well as for the public utilities operating in the state that the Legislature has not heretofore seen eye to eye with Governor Smith concerning these ideas. As a matter of practical politics also there is little likelihood of the present Republican Legislature passing many of the proposed measures or in any other way giving aid or comfort to a Democratic Governor with presidential aspirations.

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## *Efficient Service and Satisfied Personnel*

LABOR rarely has been a subject of controversy in the electric light and power industry. This has been so chiefly because the industry does not require much labor in the manufacture of its product and also because it realizes that efficient electric service largely depends upon a satisfied and efficient personnel. It is vain to expect alert, courteous, conscientious and willing service from employees inadequately paid or whose faithfulness to duty is unappreciated or unrecognized. Public utility service is vital to home, community and industrial life, and wherever possible every effort should be made to make that service better and more reliable. Adequate wages are, of course, essential; but faithful and intelligent effort is entitled to something more. The first may be demanded as a matter of right; the second will not be withheld by a wise management.

There are in existence among electric public utility and manufacturing companies many plans for improving employee relationships. Some involve pensions, others profit sharing, and still others employee partnership. One of the most successful plans is that followed by the Brooklyn Edison Company. In 1910 that company adopted a system of sharing its profits with its employees, and it has followed it ever since. More than half a million dollars was voted for that purpose recently. every employee who has served the company faithfully for two years receives, in addition to his regular pay, a percentage of his salary, depending on length of service, ranging from one-quarter to the full dividend rate paid on the capital stock. This is invested in the securities of the company, and as a result the Brooklyn Edison Investment Fund held, at the end of 1926, 2,338 shares of stock and $722,000 in bonds for the benefit of 5,200 employees. In addition, 1,100 employees individually owned 8,779 shares of stock, making a total of 11,117 shares of stock held either directly by or for the benefit of employees.

There are, of course, other ways of obtaining and holding the loyalty of employees which are just as democratic and effective in building up esprit de corps. Indeed, the Brooklyn Edison Company itself shows its interest in its employees' welfare in many other ways. The essential feature of any plan, however, must be a frank and just recognition of diligence and faithfulness on the part of employees, with no suggestion of condescension or paternalism. Employees should be able to feel that they can make public service their life's work. It is a great tribute to the management of any company to be free from labor troubles, but it is a much greater accomplishment to possess a satisfied, loyal, enthusiastic and willing organization, and such an organization management may obtain if it merits it.

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## *Intangibles in Purchasing*

AS THE art of electrical design develops, intangible factors assume greater importance to the discriminating buyer, be he a representative of the industry or a customer of one of its branches. In the machinery and apparatus fields the purchasing agent is considering many other points besides price, and slowly the general public is coming to realize that other elements than first cost ought to be weighed in sales transactions. It is a handicap that no common unit of measurement is available in dealing with many of the indefinite factors which influence buying, but an approach is being made by the use of the point system in balancing intangibles after the arithmetical elements in competitive bids have been listed and analyzed.

The point system has the advantage of being simple to apply, although the values obtained by its use are likely to vary widely among buyers. Individual judgment largely determines the weight given in specific cases to such items as the reputation of the manufacturer, the amount of previous experience the buyer or others in the industry have had with the product offered, the probable life of the equipment or commodity in question, value of accessibility, safety aspects, absence, or presence of fire risk, effect on the contentment, welfare and efficiency of employees, appearance of the design, and adaptability to further improvements. This is not as serious an obstacle to intelligent purchasing as might appear on the surface. The personal equation of the buyer affects the prorating of points, but such prorating can be made virtually free from bias where the purchasing agent is untrammeled by his superiors and accustomed to attacking the buying problem in a scientific manner.

In other words, a fair comparison can be made on the point system of even extremely elusive factors bearing upon the selection of a particular commodity or service, just as essays are evaluated point by point in prize competitions decided by committees working first as individuals and then in camera. In harmonizing individual interpretations of intangible value into unanimous or majority group action, as in discussing bids in a conference attended by the purchasing agent, engineering staff representatives and executives, it is only necessary to agree upon the number of points to be accorded to particular items and then to eliminate as fast as possible items valued alike or approximately alike by those in session, following with items in dispute. Upon final vote the last item in disagreement should be disposed of and the docket cleared for a fair decision taking into account all known elements in the purchase task.

## Outdoor Advertising a Revenue-Builder

ELECTRICAL advertising contributes about 4 per cent of the gross revenue which central-station companies receive from lighting in this country. This amounts to nearly forty million dollars, or to about one month's residence lighting bill. When we think of electrical outdoor advertising, the spectacular sign comes to mind and the bulletin and poster boards remain in the background. The latter are less spectacular, but they greatly predominate in the field. Even now the illuminated board contributes more revenue than the spectacular electric sign. It has the advantage of smaller cost and greater flexibility. The so-called electric sign is largely a night-shift worker. The illuminated bulletin board works two shifts—day and night—and its low cost makes it possible for it to invade many communities where the spectacular sign cannot be justified economically.

The revenue-building possibilities of bulletin boards are found in various directions. A large percentage of them are not illuminated and therefore are not working when they can be most effective. An illuminated board has high value as an attractor of attention because it stands out relatively alone. The distracting and competitive surroundings and background are largely lost in darkness. Then there is the matter of intensity of illumination. Contrast is of primary importance in obtaining attention. By increasing the amount of light the contrast is increased, and the speed of vision is likewise favorably affected.

Finally, there is a great field of development in the use of artificial light sources and lighting to add touches of the so-called electric sign to the illuminated board. The running border of light sources has already arrived. Trademarks and other devices may be emphasized by transparencies or by light sources. Silhouette letters and many other devices besides floodlighting are available. Complete effective development of the bulletin board is still to come. It is a logical movement which will bring to each locality electrical advertising in which economic considerations and visual appeal are justifiably blended.

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## The Metermen's Goal

THE extensive adoption of the four-wire, three-phase system of distribution, whether primary or secondary, has brought with it a number of problems for the meterman, as the choice of the proper meter to use on this system cannot be decided without considerable investigation of what equipment is available and what is best suited to the conditions. In the case of the Memphis Power & Light Company, where a large four-wire, three-phase network system is in operation, all of the possible schemes of metering received consideration. The final choice, as pointed out in an article elsewhere in this issue, was made on the most expensive method in so far as first cost is concerned. The reasons can all be given in one word—accuracy. It is the first consideration of a meterman. Of course he must consider the cost, but it never pays to sacrifice real accuracy for a small saving of investment cost.

As an indication of what modern metering requirements are, a case may be quoted from one utility that supplies a customer with 18,000 kw. at a high load factor and with a high power factor. The metering is done at 44,000 volts and is somewhat complicated because of the necessity of totalizing the power used on two feeders and measuring the maximum simultaneous kilovolt-ampere demand. The customer rather seriously questioned the accuracy of the equipment that was being used and finally spent about $6,000 purchasing and installing entirely independent equipment to meter the consumption by a different method and with apparatus of a make different from that used by the utility. The latter's equipment was in nowise disturbed. At the end of a week's operation the customer' meter showed 0.15 per cent less power than the utility's meter. The customer had been looking for a difference of from 12 per cent to 15 per cent. Such accuracy is not always secured, but a difference of less than 1 per cent between metering equipments can certainly be consistently secured by proper metering methods.

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## Commercial Versus Theoretical Research

RESEARCH has become a necessary auxiliary to management and operation in the industrial organism. More than a thousand companies have research divisions, 70 trade associations spend about $15,000,000 a year in research, 152 colleges spend about $1,500,000 for the same purpose, and several government departments participate. About $200,000,000 annually is now spent for research in this country. Electrical men have contributed greatly to the cause. Their industry is fortunate in that it deals with a new science which can be put to work only by the use of imagination and precision measurements. They have learned by experience that research is a profitable commercial activity and that it acts as the key to market supremacy. As a consequence research is an established auxiliary in all branches of the industry.

Commercial research should be divorced from theoretical research. They mix like oil and water. Commercial research should be tied directly to production and market objectives and must measure itself in dollars and in other commercial values. This class of research requires men who know manufacture and marketing as well as science. Their work must be focused on visualized objectives in the factories and on the properties. But general theoretical research should have no commercial ties. It is a job for scientists who sit on top of a mountain and try to pierce the unknown in every direction. These men are fact finders through the application of principles. Only general fields of science may be outlined for their guidance, and results depend entirely upon their individual limitations and upon interpretation of chance discoveries.

In the world of industry commercial research is needed by all groups and is an auxiliary to progress in every branch. But theoretical research is the true research and should not be placed second in any industry program. Each business should support some commercial research as part of its activities, but in addition industry should support theoretical researches. In the colleges an admirable atmosphere for the growth of this type of research exists, but they are too poor to do the tasks, and frequently they are too busy teaching to be concerned with research. Both the government and industry should study the research situation in order to provide means to place pure or theoretical investigation on an adequate basis. It only has permanent value and it deserves the utmost in co-operative support.

# *Oxford Shoals Plant*

## *of the Southern Power System Nearing Completion*

THE 45,000-kva. hydro-electric development of the Duke (formerly Southern) Power Company on the Catawba River between the existing Rhodhiss and Mountain Island plants will probably be placed in operation next April. On Nov. 1 about 100,000 cu.yd. of concrete had been poured out of the total required (200,000 cu.yd.) and 80 per cent of the total excavation (more than 100,000 cu.yd.) had been completed. The dam is 1,600 ft. long and the normal operating head will be 90 ft. The power-house structure will contain two 22,500-kva. generators and their corresponding 6,600/110,000-volt transformers installed as a unit. Switching will be performed on the high-tension side of the transformers.

# Unit-type Pulverizers Used in Kalamazoo Plant

New Michigan power house combines excellence in design with speed in construction. First use of powdered fuel by Consumers Company is unit type. Turbine bleeding in fullest use

By J. W. Mackenzie and W. E. Jacobs
*Consumers Power Company, Jackson, Mich.*

THE placing in operation of the new Kalamazoo steam plant of the Consumers Power Company on June 1, 1927, was marked with special interest by the members of that company and others not only because it was the first venture of the company in pulverized-fuel operation but also because it represented a new high standard, at least for that company, in the way of rapid plant construction. To build a 20,000-kw. plant, including foundations, between Oct. 1 and June 1 meant a very unusual construction period. Early deliveries became an important part of all contracts. The closest possible co-operation among the designing engineers, the construction department and the operating department was necessary in order that decisions might be reached early and plans scheduled in such a way as to deliver to the construction department all drawings in the order in which they were required for work. On the evening of June 1, 1927, the turbine was synchronized on the line and took its share of the system load.

### Factors Determining Station Design

The site of the new Kalamazoo plant was decided upon because the load studies of the system showed that additional capacity was required in this portion of the state. Also, sufficient transmission line facilities were already in service to take care of any excess power at this point. Railway service and an adequate supply of water for condensing operation were available here. The location of a plant at this site, together with three transmission lines, would insure the greatest possible reliability of service to the city of Kalamazoo. The company already owned the necessary property, and as there was a small plant at this location, it would not be necessary to provide an entirely new plant organization.

The other steam plants of the Consumers Power Company are stoker-fired, but in the design of this plant it was decided to use pulverized fuel for the following reasons:

1. In view of the results obtained from pulverized fuel in other companies, it was decided that this company should get some definite information of its own on this subject, and as the Kalamazoo plant would be built for its ultimate capacity, anything that was done in this plant would not commit the company in future design.

2. The present plants of the company were all equipped with underfeed stokers and furnaces arranged to use only high-grade West Virginia coal, and although it is possible to design this equipment for burning lower-grade coals, the present stokers do not adapt themselves readily to the use of Ohio, Indiana or Michigan coals. Accordingly it was thought that by designing the Kalamazoo plant for pulverized-fuel operation it would be possible to use some of the low-grade coals at such times as the coal market made their use economical.

3. Since this plant would have a single generating unit, it was possible to bleed the high stages of the turbine for feed-water heating without the complications that exist where more than one turbine is used. This made the use of economizers undesirable, and the installations of a high boiler and an air preheater without economizers would result in preheating the air to temperatures higher than was thought desirable to use with underfeed stokers. It will be noted from the cross-section, and also from the piping diagram that this plant is extremely simple to operate. A boiler pressure of 400 lb. was decided upon, because the standards for this pressure were well established, and although it was realized that efficiences would not be so good as in plants utilizing higher pressures or a reheat cycle, it was felt that, with a plant of this size and character of loading, these added complications could not be justified.

The generating equipment consists of a 20,000-kw.. bleeder-type, three-phase, 60-cycle turbo-generator, which feeds directly to the 5,000-volt bus from which all distribution circuits are taken. Any generation not required for the local load is taken from the main bus through three sets of transformers to the 40,000-volt and 140,000-volt transmission systems.

### Full Turbine Bleeding Used

The turbine receives steam at 350 lb. gage and 725 deg. F. total temperature. It is a fourteen-stage impulse machine arranged for bleeding from the fourth, seventh and eleventh stages for furnishing steam to operate a make-up water evaporator and to heat the feed water. The turbine exhausts into a two-pass surface condenser of 25,000 sq.ft. cooling surface, 23,500 sq.ft. of which is in the main condenser and 1,500 sq.ft. in an external air cooler. The condenser is equipped with a set of steam ejectors, which consists of two primary and two secondary jets together with inter- and after-condenser units for condensing the steam of the jets, condensate from the main unit being used for this purpose.

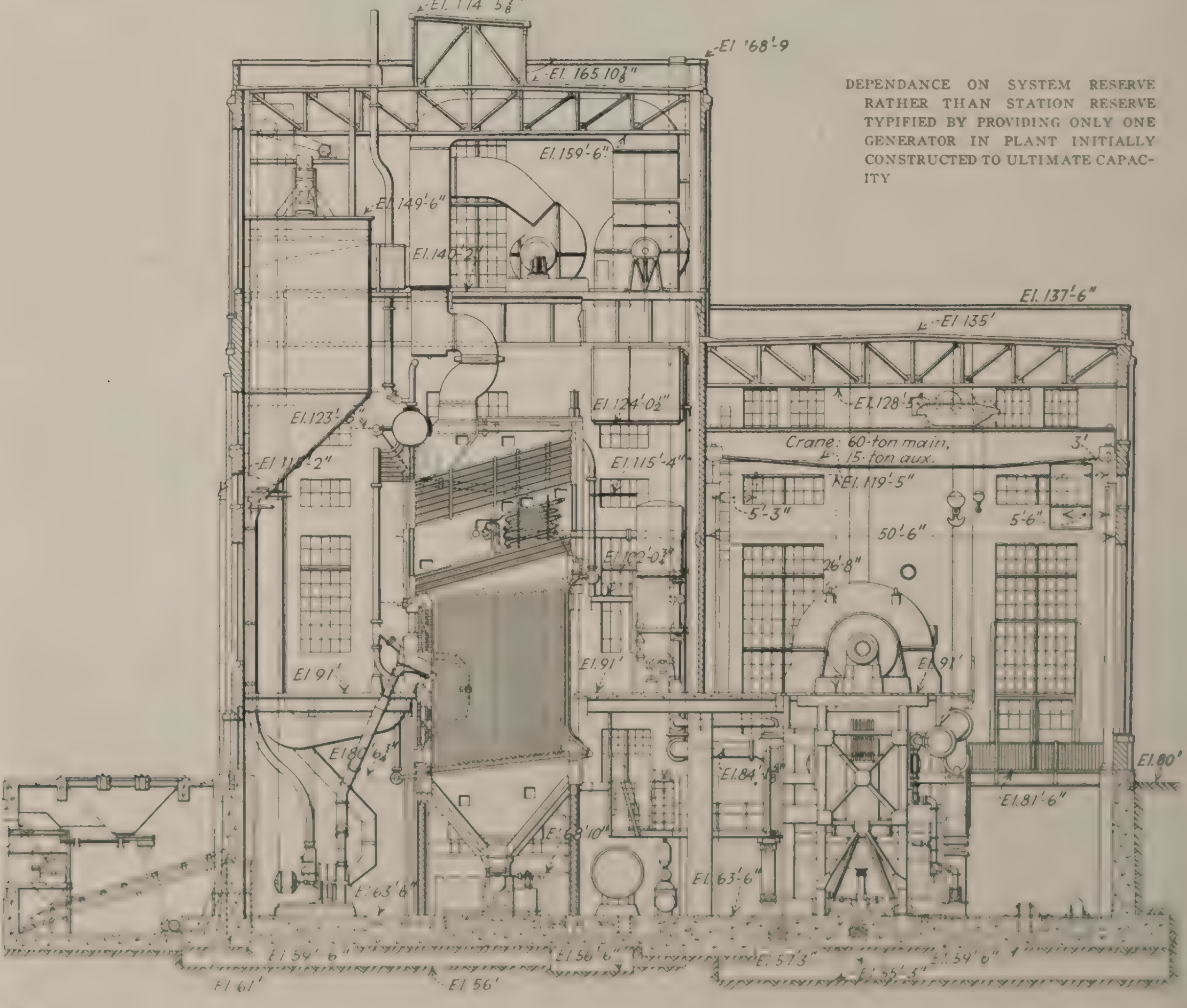
An underground concrete duct takes water from the Kalamazoo River after it has passed through traveling screens, which are installed in a separate screen house located about 130 ft. from the plant, and conducts the water to the plant for condenser cooling and for the plant raw water service. The circulating water is supplied by either or both of two centrifugal pumps of 15,500-gal.-per-minute capacity each, which are driven by 440-volt, 125-hp., constant-speed alterating-current motors direct connected to the pumps. These pumps are located in the turbine room basement and below river level.

The condensate from the main unit is handled by either of two 600-gal.-per-minute centrifugal hot well pumps driven by constant-speed alternating-current motors. The condensate passes through the ejector condensers and then through the eleventh stage bleeder heater to the boiler-feed pumps. From these pumps it passes in turn through the seventh and fourth stage heaters to the main boiler-feed header. Any heater may be bypassed and cut out of service, and in case of emergency the boiler-feed pumps can discharge directly into the auxiliary boiler-feed header without passing through the seventh or fourth stage heaters. Normally the water is fed into one end of the boiler drum through a single feed line fitted with a Venturi meter, a constant differential pressure control valve and a Copes boiler-feed regulator, or in emergencies, it may be fed by hand control through an auxiliary line into the other end of the boiler drum.

To assure de-aëration of the condensate, the condenser is equipped with a special type of hot well guaranteed to reduce the dissolved gases in the water to below the danger point. In order that the make-up may also be free from oxygen and corrosive gases, special arrangement is made for taking the make-up water from an outside pure water storage tank and spraying it into the top of the condenser. A surge tank is located in the top of the boiler room and is connected to the boiler-feed header. When the level in this tank falls below a safe working level, a float-controlled regulator opens a valve in the line from the storage tank to the condenser and make-up is drawn into the condenser by the vacuum. If the level in the surge tank rises nearly to the point of overflowing, the float-controlled mechanism opens a valve in a line joining the discharge of the condensate pumps with the outside storage and some of the condensate is pumped into the outside tank.

The boiler-feed pump equipment consists of two six-stage motor-driven and one four-stage turbine-driven centrifugal pumps, each designed to deliver 600 gal.-per-minute at a total head of 1,185 ft. with a positive head of 35 ft. on the suction. The motors are 440-volt, 1,150-r.p.m., 300-hp., constant-speed alternating-current, motors, and the turbine is a 300-hp. non-condensing turbine operating at 2,400 r.p.m. The turbine-driven pump is held as a spare for immediate service in case of trouble with the motor-driven pumps.

The fourth stage of the turbine is bled to furnish steam



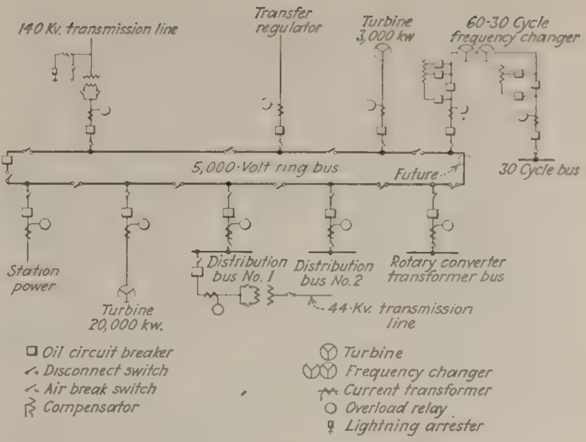
DEPENDANCE ON SYSTEM RESERVE RATHER THAN STATION RESERVE TYPIFIED BY PROVIDING ONLY ONE GENERATOR IN PLANT INITIALLY CONSTRUCTED TO ULTIMATE CAPACITY for heating the feed water in the high-pressure heater and for the evaporator. This heater, as well as the intermediate or seventh stage heater, is of the floating-head closed type built for 150 lb. steam pressure and 600 lb. water pressure. The drips from this heater are trapped into the intermediate or seventh-stage heater.

The evaporator is of the single-effect submerged-coil type, having a capacity of 12,000 lb. per hour. The vapor is piped into the seventh-stage heater, as is also the coil drain. The raw-water supply is obtained from an open heater and is pumped into the evaporator by means of a 50 gal. per minute motor-driven centrifugal pump through a float-controlled valve, which maintains a constant level in the evaporator shell. The open heater receives exhaust steam from the reciprocating house-service pump and also from the steam-driven boiler-feed pump when it is in operation.

The eleventh stage heater receives the drips from the seventh-stage heater and steam from the turbine bleeder and passes its drips into a small motor-driven hot well pump, which discharges into the boiler-feed pump suction header. In case the drip pump is out of service, the drips can be passed through a 15-ft. sealing loop into the hot well of the main condenser. Each heater is vented into the heater next lower in pressure or all of the heaters may be vented into the main condenser.

The boiler equipment consists of three 1,536-hp. cross-drum boilers designed for 400 lb. working steam pressure, which are set so as to be fired under the downtake end. The boilers are 24 section (two tubes per section) in width and are twenty tubes high, fourteen rows above and six rows below an intercheck superheater. One tube in each of the four bottom rows in each section is omitted, thus forming a slag screen to prevent slag bridging across the bottom tubes annd restricting the gas passage through the first pass. The omission of these tubes makes it the equivalent of a standard eighteen-tube high boiler. The boilers are baffled so as to make three passes, the horizontal baffle being above the lower deck of tubes, thus exposing the entire deck to radiant heat from the furnace.

In addition to the boiler heating surface, the side and rear walls consist of fin tube water-cooled surface, and a Lopulco type water screen is provided across the bottom of the furnace to prevent clinkering of the ash. The total water-cooled surface around the furnace is approximately 1,770 sq.ft., all of which is a connection into the boiler circulation, thus giving a boiler unit having 17,130 sq.ft. of heating surface.



MAIN STATION BUS ARRANGEMENT

Above each boiler is a large plate-type air preheater with 21,600 sq.ft. of effective heating surface and having 150 elements, the plates of which are 16 ft. high and 5 ft. wide, both air and gas passages being ½ in. in width. It is expected that this preheater will reduce the flue gas temperature below 300 deg. F. at the normal boiler ratings and will preheat the air to about 425 deg. F.

The coal-pulverizing equipment consists of two four-ton per hour capacity Type 5-A Simplex unit pulverizers per boiler located on the boiler room basement floor. The mills are driven by 440-volt, 100-hp., constant-speed alternating-current motors operating at about 1,150 r.p.m. The fans on the end of the mill shaft draw about 800 cu.ft. of air per minute through the mill and about 12,000 cu.ft. per minute from the hot air duct, the two streams of air joining at the discharge of the mill and constituting

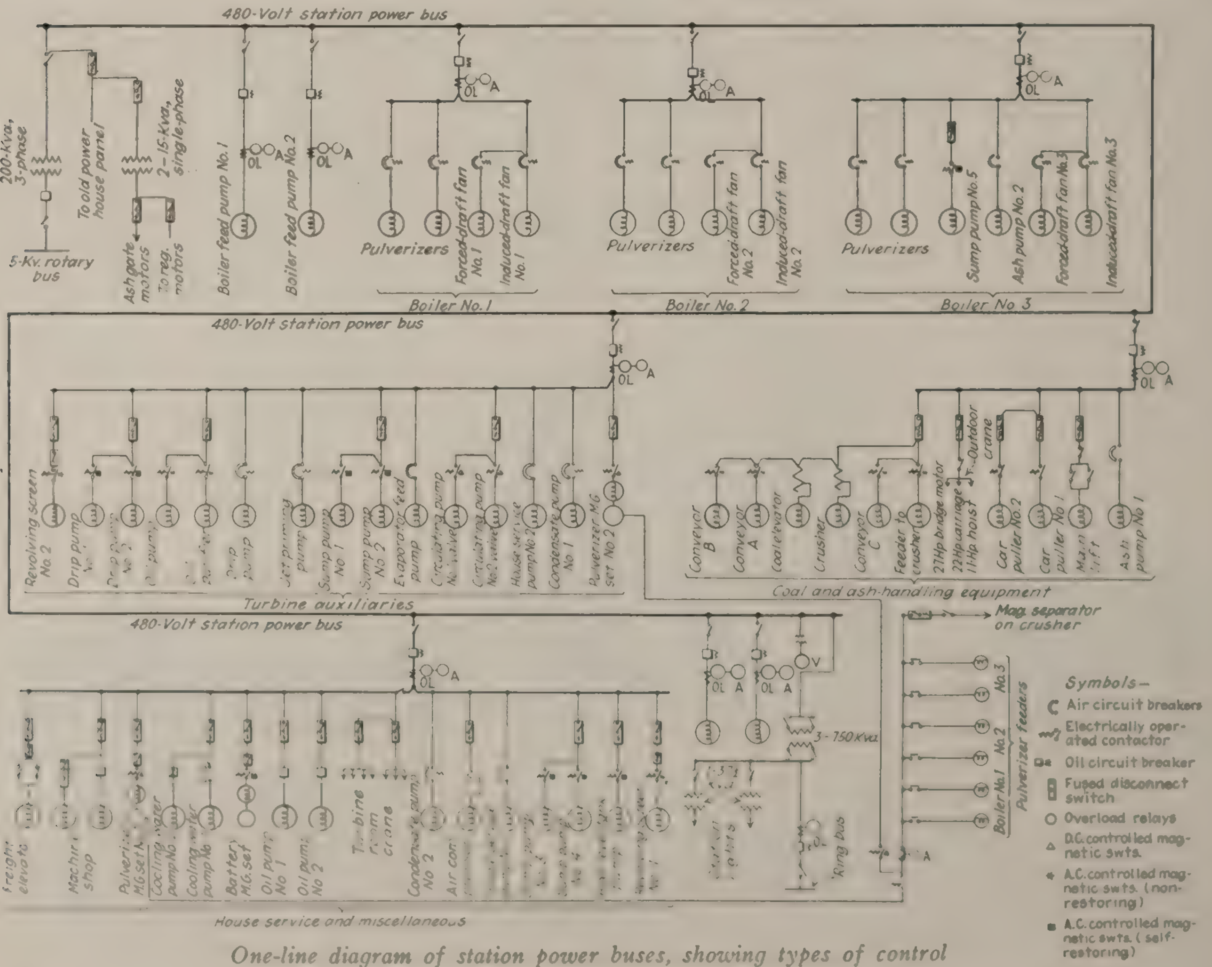
KALAMAZOO PLANT OF CONSUMERS POWER COMPANY the primary air supply to the burners. The primary air is from 35 to 70 per cent of the total air for combustion, depending upon the amount of coal being burned.

There are four horizontal turbulent-type burners per boiler located in the front wall of each furnace just above the boiler room floor and arranged with the axis of the burners inclined downward 20 deg. from the horizontal, two burners to each pulverizer. Each boiler is equipped with individual forced and induced-draft fans, which are located on the air preheater floor above the boilers. The forced draft fans take air from the top of the boiler room and force it through the air preheater and through two large ducts per boiler down the front of the boiler room to the burners. These fans have a capacity of 55,000 cu.ft. per minute at 100 deg. F. They are driven by 440-volt, 125-hp., alternating-current slip-ring motors with a maximum speed of 1,150 r.p.m. and a speed variation of 50 per cent. The induced draft fans take the gases from the air preheater and discharge them into a breeching leading to a single concrete stack. These fans each have a capacity of 100,000 cu.ft. per minute at 380 deg. F., and are driven by 440-volt, 250-hp., alternating-current slip-ring motors with a maximum speed of 585 r.p.m., and a speed range of 50 per cent. Additional draft control is obtained by means of electric-operated dampers in both the forced and induced draft ducts controlled by push and pull-buttons located on the boiler control panel.

Coal is received at the plant in hopper-bottom cars on either of two tracks, each of which is fitted with a track hopper. One track is between the coal storage pile and the boiler room and the other is located on the other side of the storage pile. The outside track hopper is connected to the discharge of the nearest hopper by means of an underground belt conveyor. From the track hoppers coal is fed to a 50-ton capacity rigid hammer type crusher and then to a bucket elevator, by means of which it is elevated to the top of the boiler room and discharged to a distributor belt, which distributes it to the three bunkers. At the receiving end of the distribution belt the coal passes over a Merrick weightometer for automatic weighing. Bailey coal meters are also installed in the coal spouts to the pulverizers in order to weigh the coal to the individual pulverizer units. · An overhead bridge-type crane, equipped with a 2-yd. bucket, spans a coal unloading trestle, the storage pile and one of the track hoppers, thus providing facilities for handling coal from the cars to storage and reclaiming from storage to the track hopper.

Motor-operated ash gates, located at the bottom of the furnace hopper below the water screen, drop the ash into a sluiceway through which part of the condenser circulating water is passed. The sluiceway discharges into a pit, from which the water and ash are picked up by two 8-in. dredge pumps and discharged on adjoining low ground. Here the ash settles out and the water slowly drains back into the river.

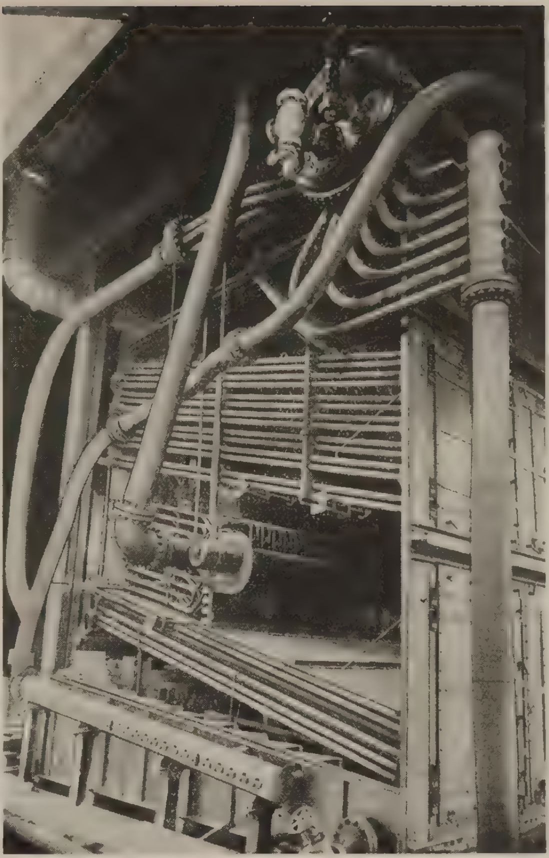
The various station power auxiliaries are arranged in



*One-line diagram of station power buses, showing types of control* six groups, each connected to the main station power bus through an oil-circuit breaker as shown on the drawing. This arrangement is expected to reduce interruptions to the station power by permitting only the oil-circuit breaker controlling the group at fault to trip. The station power bus is supplied with power at 480 volts by two banks of transformers. One bank consists of three 750-kva. single-phase transformers and connects directly to the station ring bus through an automatic oil-circuit breaker. The other bank consists of one 200-kva. three-phase transformer and is connected to the rotary connecter transformer group bus, as shown in the diagram. The three-phase transformer is installed for stand-by and plant shutdown service.

The diagram of the station power layout shows the methods used to connect the various motors to the group buses. These are four different types of contactors used for motor starting, a contactor with an alternating-current closing coil which must be reclosed by hand in case the alternating-current power fails, a contactor with an alternating-current closing coil which will reclose the contactor upon the return of power after a failure, a contactor with a direct-current closing coil which will hold the contactor closed so long as there is a direct-current power, and a manually operated contactor. All motors are started across the line. The control for the oil-circuit breakers to the group buses, the oil-circuit breakers on the two circulating pump motors and other miscellaneous auxiliaries having electrically controlled contactors is centered on a station power switchboard, which is conveniently located in the generator room at the end of, and at right angles to, the main switchboard. On this board are also located the relays for the automatic oil-circuit breakers.

Two 10-kw. motor-generator sets, one of which is a reserve, each connecting to a different station power group bus, furnish direct-current power for the operation of the magnetic separators, the dampers and the pulverizer feeder motors. The control for these two motor-generator sets is so arranged that should the group bus to which the set being used is connected become de-energized, the other set will immediately start up, providing the group bus to which it is connected is energized.



BOILER, SUPERHEATER AND WATER-WALL CIRCULATING PIPING BEFORE BRICKING-IN

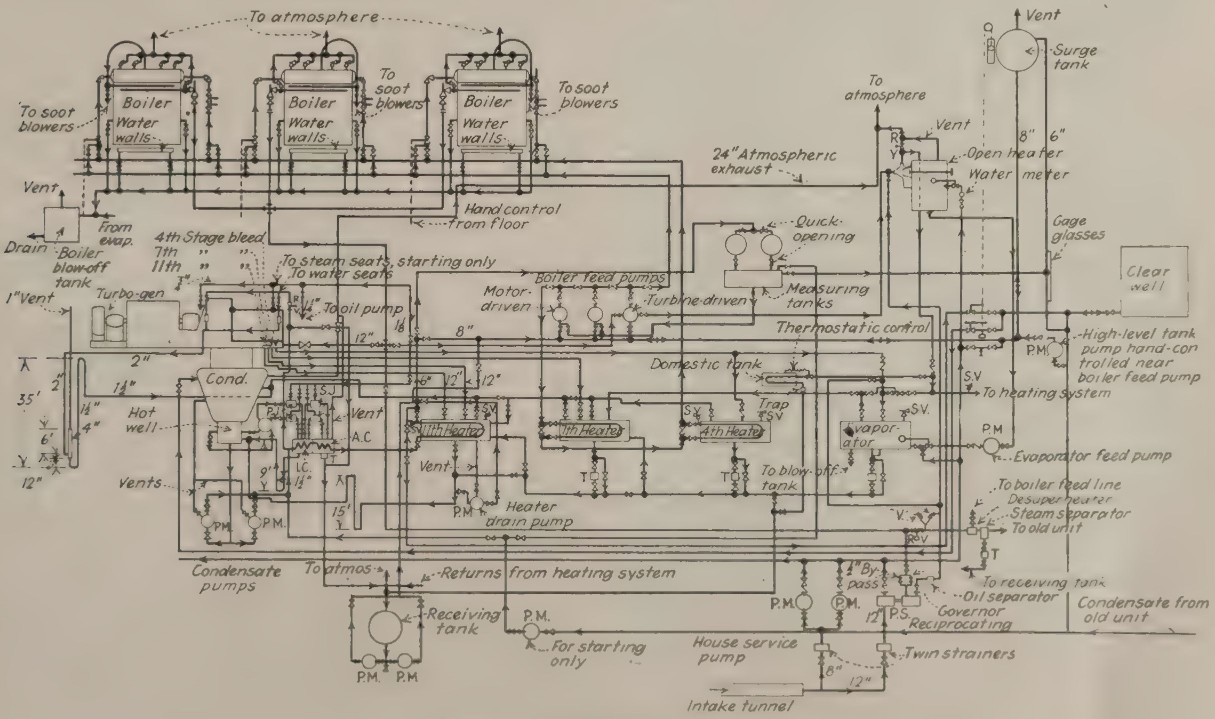


Diagram of Main Station Layout

The motors on the drum controllers for the forced and induced draft fans are operated from the station storage battery. It is necessary to operate these drum controller motors from the storage battery because in case the station power fails the drum controllers must return to starting position, all resistance in, before the fan motors can be started.

The generating rating is 25,000 kva., 5,000 volts, 2,890 amp., three phase, 60 cycle. The generator is excited by a 135-kw., 250-volt, direct-connected exciter, which, in turn, is excited by a 2-kw., 115-volt pilot exciter mounted on the frame of the main exciter. The two exciters insure stable operation under conditions that make it necessary to carry a weak field on the generator. The grounding system layout, including all motors in the plant, is very complete. At present the generator neutral is not grounded. Ground plates connected by pigtails to the ground network were located in each motor base when it was poured. Each motor frame is grounded with a copper cable to the ground plate. The generator is protected at all times against a fault in the windings by differential relays which trip both the generator oil-circuit breaker and the field switch. These are located on a separate panel apart from the main switchboard. The generator is protected against overload only during synchronizing. The tripping circuit from the overload relays is through a contact on the synchronizing switch.

The main station bus is built in ring form with disconnects between the points where the various circuits tap on. At present there is only one bus tie oil-circuit breaker, but ultimate plans call for two. There is a set of disconnects located where the future bus tie breaker will be installed, and this set is usually open, thus permitting the ring bus to be split by the other breaker.

From the sketch of the ring bus it may be seen that with the disconnects open between the frequency changer and the rotary converter transformer group, the bus tie oil-circuit breaker can be opened during cases of transmission line trouble, leaving the 20,000-kw. turbine on the half of the bus with the local distribution. The 140-kv. transmission line and frequency changer would then be left on the other half. A transfer regulator connecting to the main ring bus, a transfer bus and transfer oil-circuit breakers on each distribution circuit provides a means of transferring any distribution circuit to the transfer regulator. A 44-kv. transmission line connects to the distribution group bus instead of to the main ring bus. This allows for carrying this group bus off this transmission line while the group oil-circuit breaker is being removed for inspection or repair. The station lights may be supplied from either of two banks of 37-kva. transformers, which are connected to the station power bus or from the steam-driven exciter, which is an auxiliary for the 3,000-kw. generator.

As previously stated, the plant was started on June 1, and although some starting troubles were experienced, these troubles were not serious, and after a few days' time the plant was put into regular full-load operation and has operated according to system demands since that time. Although the boiler efficiencies are not yet all that was expected, due to some adjustments that are necessary in connection with the fuel-burning equipment, these troubles are not serious nor anything that should be difficult to overcome. The plant efficiency is much better than has been the experience of this company with a plant so soon after it was started. At the time of the design of the plant it was contemplated it would be possible to generate 1 kw.-hr. with 1¼ lb. of good quality coal, and the present results show that it will be easily possible to reach this figure. These are not the highest efficiencies as considered today, but for a plant of this size are very satisfactory results for the pressures and conditions that were adopted in the design. This plant was designed by the engineering department of the Commonwealth Power Corporation and built by the construction department of the Consumers Power Company.

## *Data on Principal Equipment in Addition to Kalamazoo Station Consumers Power Company*

### *Turbo-Generator*

| | |
|---|---|
| Manufacturer | General Electric Co. |
| Number | 1 |
| Rated capacity, kw. | 20,000 |
| Rated capacity, kva. | 25,000 |
| Voltage | 5,000 |
| Phase | 3 |
| Frequency | 60 |
| Revolutions per minute | 1,800 |
| Steam pressure, gage | 375 |
| Superheat, deg. F. | 250 |

### *Direct-Connected Exciters*

| | |
|---|---|
| Main exciter | |
| Rated capacity, kw. | 135 |
| Voltage | 250 |
| Amperes | 540 |
| Pilot exciter | |
| Rated capacity, kw. | 2 |
| Voltage | 125 |
| Amperes | 16 |

### *Generator Air Coolers*

| | |
|---|---|
| Manufacturer | General Electric Co. |
| Cooling surface, sq.ft. | 11,700 |
| Number of passes | 4 |
| Kind of tubes | Admiralty |
| Diameter of tubes | 1 in. |
| Cooling water supply | Raw water |

### *Condensers*

| | |
|---|---|
| Manufacturer | Wheeler Cond. & Eng. Co. |
| Tube surface, sq.ft. | 25,000 |
| Connection to turbine | Rigid |
| Support | Springs |
| Kind of tubes | Admiralty |
| Diameter of tubes | 1 in. |
| Water passes | 2 |

### *Circulating Pumps*

| | |
|---|---|
| Manufacturer | Wheeler Cond. & Eng. Co. |
| Number | 2 |
| Speed, r.p.m. | 400 |
| Capacity, g.p.m. (1 pump) | 15,500 |
| Drive | 440-volt, 125-hp. a.-c. motor |

### *Condensate Pumps*

| | |
|---|---|
| Manufacturer | Wheeler Cond. & Eng. Co. |
| Number | 2 |
| Type | 2-stage centrifugal |
| Speed, r.p.m. | 1,150 |
| Capacity, g.p.m. (1 pump) | 600 |
| Drive | 440-volt, 40-hp. a.-c. motor |

### *Air Ejectors*

| | |
|---|---|
| Manufacturer | Wheeler Cond. & Eng. Co. |
| Number | 1 |
| Type | Twin 2-stage jets with inter- and after-condenser |
| Capacity | 25 cu.ft. free air at 28.5 in. vac. |
| Steam consumption (2 jets) | 1,280 lb. per hour |

### *Boiler-Feed Pumps*

| | |
|---|---|
| Manufacturer | Pennsylvania Pump & Compressor Co. |
| Type | Centrifugal 2 six-stage, 1 four-stage |
| Discharge head | 1,185 ft. |
| Suction head | + 35 ft. |
| Capacity (1 pump) | 600 g.p.m. |
| Drive | 2 440-volt, 300-hp. a.-c. motors, 1 300-hp. Kerr. tur. |

### *Feed-Water Heaters*

| | |
|---|---|
| Manufacturer | Griscom Russell Co. |
| Number | 3 |
| Surface | |
| 11th stage | 1,170 sq.ft. |
| 7th stage | 1,080 sq.ft. |
| 4th stage | 1,016 sq.ft. |

### *Evaporator*

| | |
|---|---|
| Manufacturer | Griscom Russell Co. |
| Number | 1 single effect |
| Location | Between 4th and 7th stages |
| Capacity | 12,000 lb. per hr. |

### *Boilers*

| | |
|---|---|
| Manufacturer | Springfield Boiler Co. |
| Type | Cross-drum |
| Number | 3 |
| Rated horsepower | 1,536 hp. |
| Size of tubes | 3 in., 9 gage |
| Steam pressure | 100 lb gage |
| Furnace volume | 8,750 cu.ft. |

### *Water-Cooled Walls*

| | |
|---|---|
| Manufacturer | Combustion Engineering Co. |
| Bottom Screen | |
| Type | Lopulco |
| Size of tubes | 4 in., 6 gage |
| Heating surface | 320 sq.ft. |
| Side walls (2) | |
| Type | Fin |
| Size of tubes | 4 in., 6 gage |
| Heating surface | 900 sq.ft. |

| | |
|---|---|
| **Rear wall** | |
| Type | Fin |
| Size of tubes | 4 in., 6 gage |
| Heating surface | 550 sq.ft. |
| Total water-cooled surface | 1,770 sq.ft. |

*Superheater*

| | |
|---|---|
| Manufacturer | Superheater Co. |
| Type | Elesco 4 loop |
| Location | Interdeck-Headers through setting |

*Air Preheaters*

| | |
|---|---|
| Manufacturer | Combustion Engineering Co. |
| Number | 3 |
| Type | Vertical plate, counter flow |
| Spacing (air passages) | ½ in. |
| Spacing (gas passages) | ½ in. |
| Height of elements | 16 ft. |
| Width of element | 5 ft. |
| Number of elements | 150 |
| Heating surface | 21,600 sq.ft. |

*Induced Draft Fans*

| | |
|---|---|
| Manufacturer | Clarage Fan Co. |
| Number | 3 |
| Capacity | 100,000 c.f.m. at 380 deg. F. and 8.5-in. draft |
| Maximum speed | 585 r.p.m. |
| Drive | 250-hp., a.-c. slip-ring motor |
| Speed variation | 50 per cent |

*Forced Draft Fans*

| | |
|---|---|
| Manufacturer | Clarage Fan Co. |
| Number | 3 |
| Capacity | 55,000 c.f.m. at 100 deg. and 8.25-in. pressure |
| Drive | 125-hp. a.-c. slip-ring motor |
| Maximum speed | 1,150 r.p.m. |
| Speed variation | 50 per cent |

*Stacks*

| | |
|---|---|
| Number | 1 |
| Kind | Concrete |
| Height | 267 ft. |
| Diameter inside at top | 12 ft. |

*Unit Pulverizers*

| | |
|---|---|
| Manufacturer | Furnace Engineering Co. |
| Number | 6 |
| Size | 5-A Simplex |
| Capacity | 8,000 lb. per hour |
| Drive | 100-hp. a.-c. induction motor |
| Kind of fuel | West Virginia bituminous |
| Heat value per pound as fired | 13,200 B.t.u. |

*Burners*

| | |
|---|---|
| Manufacturer | Furnace Engineering Co. |
| Type | Bailey-Tenney |
| Number | 12 |
| Capacity each burner | 4,000 lb. per hour |

*Coal-Handling Equipment*

| | |
|---|---|
| Manufacturer | Jeffrey Manufacturing Co. |
| Type of conveyors | Belt conveyors and bucket elevator |
| Crusher | Rigid hammer type |
| Capacity | 50 tons per hour |
| Coal scales | Merrick Weightometer |
| Coal meters | Bailey Meter Co. |

*Miscellaneous Equipment*

| | |
|---|---|
| Building steel | Wisconsin Bridge & Iron Co. |
| Steel sash and skylights | Truscon Steel Co. |
| Firebrick | |
| Firebrick | Harbison-Walker Co.<br>A. P. Green Co.<br>Chas. Taylor Sons Co. |
| Insulating brick | Celite Products Co. |
| Front boiler walls | Liptak Fire Brick Arch Co. |
| Station crane | Cleveland Crane & Engineering Co. |
| Elevators | Hollister-Whitney Co. |
| Traveling screens | Chain-Belt Co. |
| Soot blowers | Bayer Co. |
| Sump pumps | American Steam Pump Co. |
| Service pumps | American Steam Pump Co. |
| Heater drip pumps | Worthington Pump & Machinery Corp. |
| Oil-purification system | DeLaval Steam Turbine Co. |
| Air compressor | Pennsylvania Pump & Compressor Co. |
| Feed-water regulator | Northern Equip. Co. |
| Constant excess pressure regulator, | S-C Regulator Mfg. Co. |
| Evaporator feed-water heater, | Swartwout Co. |
| High-pressure gate valves, | Lunkenheimer Co. |
| Piping | Murray W. Sales & Co. |
| Recording instruments | Bailey Meter Co.<br>—Brown Instrument Co. |
| Indicating thermometers, | Taylor Instrument Co. |
| Boiler meters | Bailey Meter Co. |
| Venturi meters | Builders Iron Foundry |
| Draft gages | L. M. Ellison Company |

# Pole-Setting Costs Cut 37 Per Cent

A LINE construction truck equipped with an earth auger saved a Middle Western utility $4,187 in ten months of operation and increased the speed of pole setting and the efficiency of the unit. The boring heads are universal in movement and adjustable to 45 deg. in any direction by means of a worm sector on each head. The latter also provides a means of rigidly locking the heads in any desired position. This universal movement means that the auger rack can be brought to a perpendicular digging position quickly.

According to the Four Wheel Drive Auto Company, this device will bore any hole and set the pole in any location where hand digging is possible and where it is practicable to place a truck. Cost data were as follows:

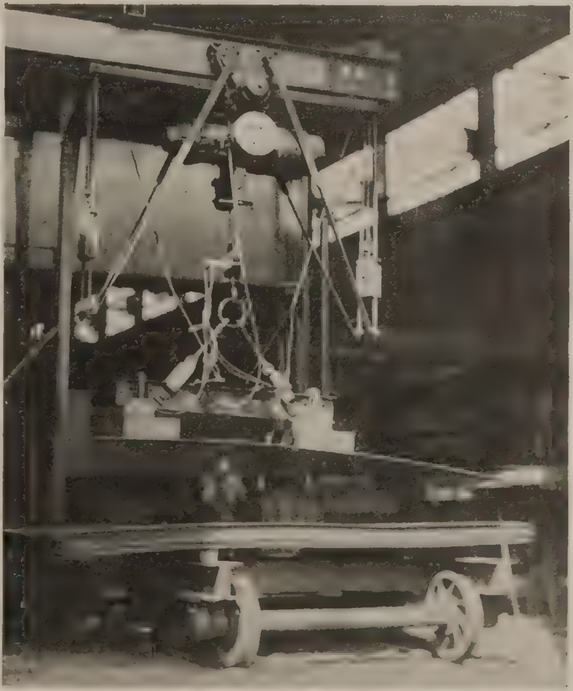
| | | | |
|---|---|---|---|
| Truck traveled, miles | 1,600 | Interest and depreciation per pole | $0.83 |
| Holes dug | 2,931 | Repairs per pole | $0.137 |
| Poles set | 3,102 | Total cost per pole | $2.287 |
| Poles replaced | 749 | Cost by hand method | $3.63 |
| Labor cost per pole | $0.89 | Saving by machine | $1.35 |
| License and truck expense, per pole | $0.43 | Saving on 3,102 poles | $4,187.70 |

The actual saving, however, was greater than this, as the machine was used considerably for maintenance work and the operating cost for this service is included in the totals. Twenty per cent of the poles set were replacements. The saving effected through the pulling of the old poles is not included in the $4,187.70.

# Crane Magnets Aid Metal Handling

PRESSED steel car ends and similar material in the form of steel plates are now handled by the Union Metal Products Company, of Hammond, Ind., in a manner that offers greater ease, speed and economy and has marked safety features.

Two rectangular lifting magnets, manufactured by the Electric Controller & Manufacturing Company, of Cleveland, are hung from a spreader beam, which in turn is suspended by a cable from a monorail hoist. The plates are charged into a heating furnace, one at a time, by an operator located in a control room opposite the end of the furnace. The floor man, who is customarily used to steady the plates as they are carried to the charging platform, has been eliminated by the introduction of a mechanical device. Two arms extend from the monorail hoist parallel to the track, and vertical slides are hung and rigidly braced at each end. A counterweight is suspended at each end from a cable that runs up over a pulley and down at an angle to the spreader beam supporting the magnets. This rigging has been found to be sufficient to hold the magnets in proper alignment and to damp swinging after one or two oscillations.



MAGNETIC CRANE ELIMINATES FLOOR MAN

# Forward and Reverse Operation Controlled by Single Button

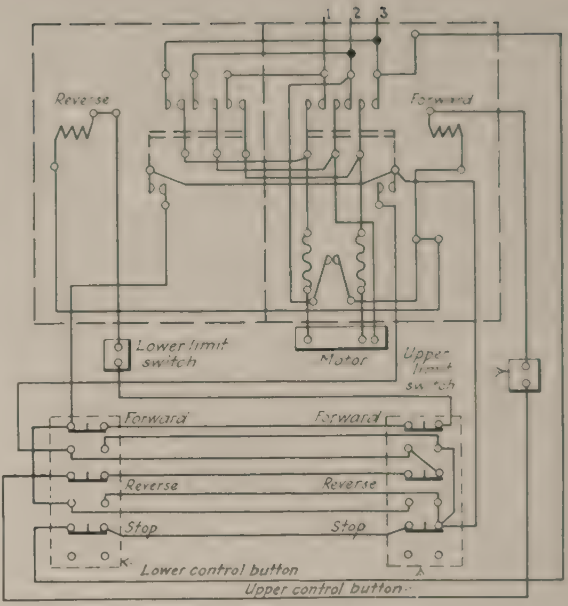
By H. W. Wikle
General Electric Company, Atlanta, Ga.

Operating practices in the plant of the Louisiana Pulp & Paper Company at Bastrop, La., required an unusual control plan for a chain conveyor driven through a worm gear by a 7½-hp. 440-volt, three-phase 60-cycle, squirrel-cage induction motor. This conveyor is 40 ft. long and rises to an elevation of approximately 9 ft. Control from the upper and lower terminals is desirable.

Referring to the starting point as "A" and the end as "B," it was desired (1) to start the conveyor in the forward or upward direction by means of a push button located at "A"; (2) stop the upward motion by a push button at "B"; (3) start the conveyor in the opposite or downward direction by the same push button at "B," and (4) stop the downward motion by the same push button at "A."

The accompanying diagram indicates how this result was accomplished through the use of a magnetic reversing switch, two limit switches and two push-button stations. One push button starts the motor forward and also stops the motor when it is running in the reverse direction. The other push button starts the motor in the reverse direction and also stops the motor when it is running forward.

The controls are so interlocked that with the motor running forward from one push button it must be stopped at the other one before the latter can be operative to reverse the direction of rotation of the motor. Likewise with the motor running in the reverse direction from the second push button it must be stopped at the first before starting the motor in the forward direction.



SCHEMATIC DIAGRAM OF TWO-BUTTON MULTIPLE ACTION CONTROL

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# Capacities of Meters and Ratings of Instrument Transformers

*Standards of West Penn System*

Size of Meter Required

| | |
|---|---|
| Residences; wholesale houses; elevators | 35 to 50 per cent of connected load |
| Stores | 75 per cent of connected load |
| Small stores; restaurants; single motors | 100 per cent of connected load |

CAPACITIES IN KVA. FOR FULL LOAD ON STANDARD METERS

| Size | Single Phase | | | Three-Phase | | | | | Direct Current Two Wire |
|---|---|---|---|---|---|---|---|---|---|
| | Two-Wire | | Three-Wire | | | | | | |
| Amp. | 115 Volts | 230 Volts | 115–230 Volts | 230 Volts | 460 Volts | 2,300 Volts | 6,900 Volts | 25,000 Volts | 650 Volts |
| 5 | 0.6 | 1.2 | .... | 2.3 | 4.6 | 23 | 69 | 250 | 3.3 |
| 10 | 1.2 | 2.3 | 2.3 | 4.6 | 9.2 | 46 | 138 | 500 | 6.5 |
| 15 | 1.7 | 3.5 | 3.5 | 6.9 | 13.8 | 69 | 207 | 750 | 9.8 |
| 25 | 2.9 | 5.8 | 5.8 | 11.5 | 23.0 | 115 | 345 | 1,250 | 16.3 |
| 50 | . | 11.5 | 11.5 | 23.0 | 46.0 | 230 | 690 | 2,500 | 32.5 |
| Above Meters are Self-Contained | | | | | | | | | |
| 75 | | 17.3 | 17.3 | 34.5 | 69.0 | 345 | 1,035 | 3,750 | 48.8 |
| 100 | ... | | 23.0 | 46.0 | 92.0 | 460 | 1,380 | 5,000 | 65.0 |
| 150 | ... | . | 34.5 | 69.0 | 138.0 | 690 | 2,070 | 7,500 | 97.5 |
| 200 | ... | . | 46.0 | 92.0 | 184.0 | 920 | 2,760 | 10,000 | 130.0 |
| 300 | .. | . | 69.0 | 138.0 | 276.0 | 1,380 | 4,140 | 15,000 | 195.0 |
| 400 | .. | . | 92.0 | 184.0 | 368.0 | 1,840 | 5,520 | 20,000 | 260.0 |
| 500 | | | 115.0 | 230.0 | 460.0 | 2,300 | 6,900 | 25,000 | 325.0 |
| 750 | . | | 173.0 | 345.0 | 690.0 | 3,450 | 10,350 | 37,500 | 488.0 |
| 1,000 | | | 230.0 | 460.0 | 920.0 | 4,600 | 13,800 | 50,000 | 650.0 |
| 1,500 | | | 345.0 | ....... | 1,380.0 | 6,900 | 20,700 | 75,000 | 975.0 |
| 2,000 | .... | ...... | 460.0 | ....... | 1,840.0 | 9,200 | 27,600 | 100,000 | 1,300.0 |
| | | Above meter needs one current transformer | Above meters need one three-wire or two two-wire current transformers | Above meters need two current transformers | Above meters need two potential and two current transformers | | Use 6,900 volt metering equipment or two potential and two current transformers | Use high-tension metering equipment or two potential and two current transformers | Use shunts and external resistances as required for each make of meter |

SIZE OF CURRENT TRANSFORMERS, PRIMARY AMPERES

| Indoor Two-Wire 4,600 Volt | Indoor Three-Wire 1,150 Volt | Indoor Two-Wire 6,900 Volt | Outdoor Two-Wire 6,900 Volt | Outdoor Two-Wire 13,800 Volt | Busbar Two-Wire 2,300 Volt | Indoor or Outdoor Oil Insulated Volt 34,500 |
|---|---|---|---|---|---|---|
| 5 | ......... | 5 | 5 | 5 | 750 | 5–10 |
| 10 | ......... | 10 | 10 | 10 | 1,000 | 10–20 |
| 15 | ......... | 15 | 15 | 15 | 1,500 | 15–30 |
| 25 | ......... | 25 | 25 | 25 | 2,000 | 25–50 |
| 50 | ......... | 50 | 50 | 50 | 2,500 | 50–100 |
| 75 | 75 | 75 | 75 | 75 | 3,000 | 75–150 |
| 100 | 100 | 100 | 100 | 100 | 4,000 | 100–200 |
| 150 | 150 | 150 | 150 | 150 | 5,000 | 150–300 |
| 200 | 200 | 200 | 200 | 200 | 7,500 | 200–400 |
| 300 | 300 | 300 | 300 | 300 | 10,000 | . . |
| 400 | 400 | 400 | 400 | 400 | ......... | ......... |
| 500 | 500 | 500 | 500 | 500 | ......... | ......... |
| 750 | ......... | 750 | ......... | ......... | ......... | ......... |
| 1,000 | ......... | 1,000 | ......... | ......... | ......... | ......... |

Note: Transformers will stand 20 per cent overload continuously. All current transformers have a 5-amp. secondary rating.

RATED VOLTAGES OF POTENTIAL TRANSFORMERS

| Primary Voltage | Voltage Ratio | Types |
|---|---|---|
| 230 | 2:1 | Dry type |
| 460 | 4:1 | Dry type |
| 2,300 | 20:1 | Dry type |
| 6,900 | 60:1 | Dry type; indoor oil-insulated type |
| 13,800 | 120:1 | Indoor oil-insulated type; outdoor oil-insulated type |
| 23,000 | 200:1 | Indoor oil-insulated type; outdoor oil-insulated type |
| 66,000 | 600:1 | Indoor oil-insulated type; outdoor oil-insulated type |

# Four-Wire Metering

Various methods available discussed with data showing comparative accuracies obtained. The three-phase, four-wire, three-element meter adopted by the Memphis Power & Light Company

By E. A. Corum and F. L. Christenberry

*Meter Department Memphis Power & Light Company, Memphis, Tenn.*

MEASUREMENT of energy in three-phase, four-wire circuits may be done in any of the following four ways: (*a*) With three single-phase meters, (*b*) a three-phase, four-wire, three-element meter, (*c*) a three-phase, four-wire, two-element, split-coil meter having a third current coil with an equal number of ampere turns working with each potential coil but 60 deg. out of phase and (*d*) a three-phase, three-wire, two-element meter using three current transformers with their secondaries connected in delta. Based on the experience of the Memphis Power & Light Company, the first two methods, *a* and *b*, are the most desirable, because of the accuracy of registration.

Three single-phase meters, as used in *a*, are the easiest to test and can be calibrated to a higher degree of accuracy, there being no interference between elements and the necessary bucking and balancing of the elements are eliminated. As regards first costs of the four methods, the following figures may be used for comparison based on an 100-amp., 2,200-volt to 110-volt installation, the figures including only the cost of the meter or meters as the case may be, current and potential transformers and test blocks: Method *a*, \$170; *b*, \$185; *c*, \$145, and *d*, \$140. Labor and other materials will change the ratio between the various methods to some extent for the entire installation.

As noted, the first cost of the three single-phase meter method is less than the three-element meter method, but the method taken as a whole is less satisfactory, as there are more chances for error occurring in the preparation of the bills where the three readings must necessarily be added. Also, if the customer has separate power and lighting contracts, some confusion and expense may arise as to which meter is the lighting meter. In addition, with three single-phase meters the measurement of demand, which is necessary in most cases, requires special equipment. For these reasons and others that will be discussed later in reference to methods *c* and *d*, the Memphis company adopted the three-element meter when the three-phase, four-wire network system was installed in Memphis. (See Electrical World for Oct. 23, 1926, page 855, for a description of this system.)

From the standpoint of first cost, the three-element meter method is the most expensive, but, when all factors are considered, it is really the most satisfactory. Most of the objectionable features of the three single-phase methods are eliminated in this meter and all of the desirable features have been retained, except the ease of testing.

The results obtained from the use of three single-phase meters and from three-element meters, so far as accuracy of registration is concerned, are identical. As a typical example, assume a voltage from phases A, B and C to neutral of 100 volts and a balanced load of 5 amp. on each phase. From the power formula we have at unity power factor

$E_a I_a \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase A
$E_b I_b \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase B
$E_c I_c \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase C

or a total energy consumed and registered of 1,500 watts, the correct figure. If the voltage in phase A is increased to 110 volts, then

$E_a I_a \cos\theta = 110 \times 5 \times 1 = 550$ watts in phase A

with phases B and C remaining as above, giving the total energy consumed and registered of 1,550 watts, which is correct. If the voltages in phases A and B are both 110 volts, then

$E_a I_a \cos\theta = 110 \times 5 \times 1 = 550$ watts in phase A
$E_b I_b \cos\theta = 110 \times 5 \times 1 = 550$ watts in phase B

with phase C remaining as above, giving the total energy consumed and registered of 1,600 watts, the correct figure. Thus the three single-phase meters or the three-element meter will register correctly at all times any unbalance of voltage or load that may occur.

ACCURACIES OF TWO-ELEMENT SPLIT-COIL METER (FIGS. 1 TO 6) AND OF TWO-ELEMENT METER USING THREE CURRENT TRANSFORMERS CONNECTED IN DELTA (FIGS. 7 TO 12)

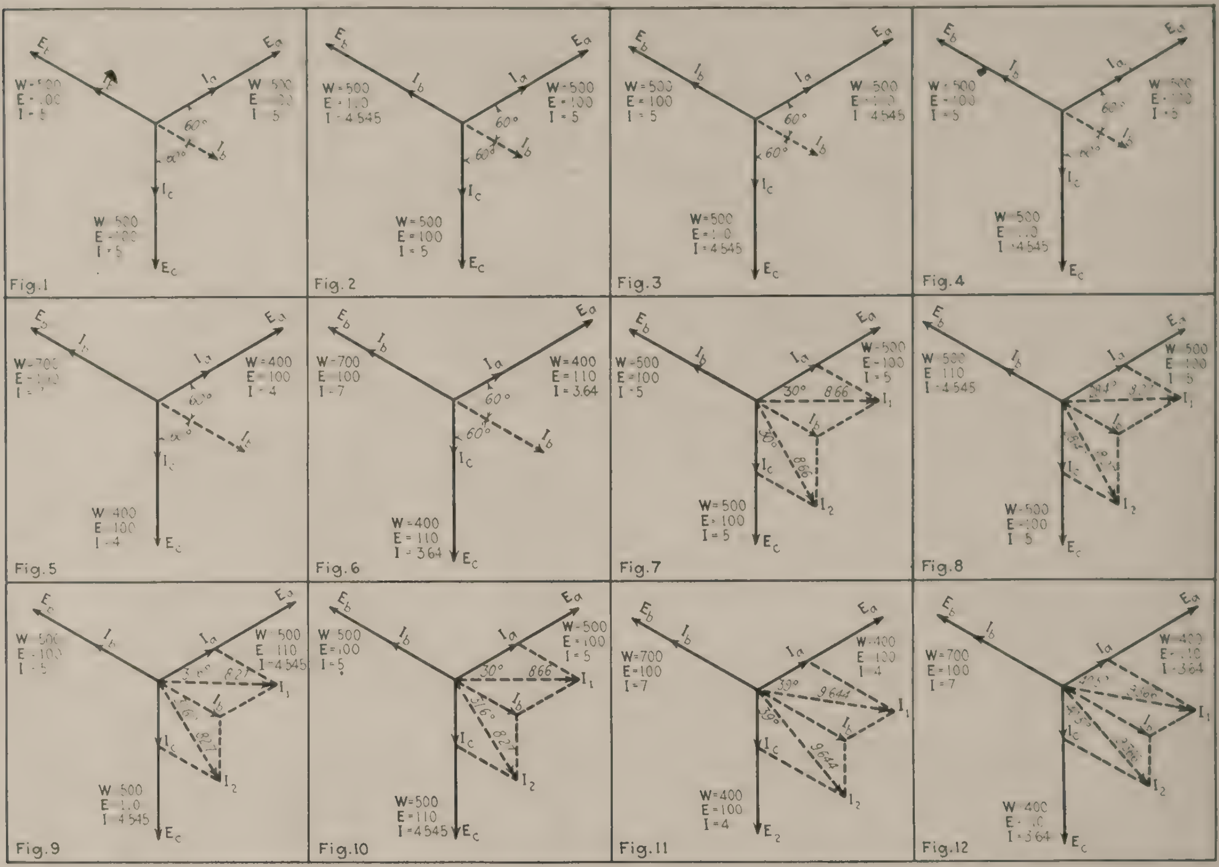
| Figure Number | Voltages | | | Load, Watts | | | Energy Consumed, Watts | Energy Registered, Watts | Accuracies of Registration, Per Cent |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | | | |
| 1 and 7... | 100 | 100 | 100 | 500 | 500 | 500 | 1,500 | 1,500 | 100.00 |
| 2 and 8... | 100 | 110 | 100 | 500 | 500 | 500 | 1,500 | 1,454 | 96.93 |
| 3 and 9... | 110 | 100 | 110 | 500 | 500 | 500 | 1,500 | 1,550 | 103.33 |
| 4 and 10... | 100 | 100 | 110 | 500 | 500 | 500 | 1,500 | 1,525 | 101.67 |
| 5 and 11... | 100 | 100 | 100 | 400 | 700 | 400 | 1,500 | 1,500 | 100.00 |
| 6 and 12... | 110 | 100 | 110 | 400 | 700 | 400 | 1,500 | 1,570 | 104.67 |

The three-phase, four-wire, two-element, split-coil meter will register correctly providing the voltages are balanced, but it is very hard to adjust properly because as yet the manufacturers have provided no way for making any adjustment on the split coil. Also, this meter requires the carrying of spare parts that are not interchangeable with other meters. The accuracies of this meter under various conditions of voltage and load unbalance are shown in Figs. 1 to 6, inclusive, all examples being taken with unity power factor.

The three-phase, four-wire, two-element meter with three current transformers costs less than the three-element meter, but, like the split-coil meter, is not accurate with unbalanced voltages.

A fact not generally realized is that the split-coil meter and the delta-connected meter give the same accuracies under the same conditions of voltage unbalance. To illustrate this point the results obtained from the formulas used in conjunction with Figs. 1 to 12, inclusive, have been tabulated, this tabulation being given herewith.

The problems of metering three-phase, four-wire systems may be summed up as follows: The three single-phase meter is accurate, is easily calibrated and connections are easily made and checked, but it has the disadvantage of not recording total registration on one dial, requires more mounting space and is not suitable for



FIGS. 1 TO 12—RELATIVE ACCURACIES OF THREE-PHASE, FOUR-WIRE, TWO-ELEMENT, SPLIT-COIL METERS (1-6) AND THREE-WIRE, TWO-ELEMENT METERS (7-12) UNDER VOLTAGE AND LOAD UNBALANCE

Fig. 1—Voltages on phases A, B and C, 100 volts; balanced load of 500 watts on each phase.
$E_aI_a \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase A
$E_aI_b \cos\theta = 100 \times 5 \times 0.5 = 250$ watts plus
$E_cI_b \cos\theta = 100 \times 5 \times 0.5 = 250$ watts in phase B
$E_cI_c \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,500 watts; meter correct.

Fig. 2—Voltages on phases A and C, 100 volts; phase B, 110 volts; balanced load of 500 watts on each phase.
$E_aI_a \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase A
$E_aI_b \cos\theta = 100 \times 4.545 \times 0.5 = 227$ watts plus
$E_cI_b \cos\theta = 100 \times 4.545 \times 0.5 = 227$ watts in phase B
$E_cI_c \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,454 watts; meter 3.07 per cent slow.

Fig. 3—Voltages on phases A and C, 110 volts; phase B, 100 volts; balanced load of 500 watts on each phase.
$E_aI_a \cos\theta = 110 \times 4.545 \times 1 = 500$ watts in phase A
$E_aI_b \cos\theta = 110 \times 5 \times 0.5 = 275$ watts plus
$E_cI_b \cos\theta = 110 \times 5 \times 0.5 = 275$ watts in phase B
$E_cI_c \cos\theta = 110 \times 4.545 \times 1 = 500$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,550 watts; meter 3.33 per cent fast.

Fig. 4—Voltages on phases A and B, 100 volts; phase C, 110 volts; balanced load of 500 watts on each phase.
$E_aI_a \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase A
$E_aI_b \cos\theta = 100 \times 5 \times 0.5 = 250$ watts plus
$E_cI_b \cos\theta = 110 \times 5 \times 0.5 = 275$ watts in phase B
$E_cI_c \cos\theta = 110 \times 4.545 \times 1 = 500$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,525 watts; meter 1.67 per cent fast.

Fig. 5—Voltages on phases A, B and C, 100 volts; 400 watts on phases A and C, 700 watts on phase B.
$E_aI_a \cos\theta = 100 \times 4 \times 1 = 400$ watts in phase A
$E_aI_b \cos\theta = 100 \times 7 \times 0.5 = 350$ watts plus
$E_cI_b \cos\theta = 100 \times 7 \times 0.5 = 350$ watts in phase B
$E_cI_c \cos\theta = 100 \times 4 \times 1 = 400$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,500 watts; meter correct.

Fig. 6—Voltages on phases A and C, 110 volts; phase B, 100 volts; 400 watts on phases A and C, 700 watts on phase B.
$E_aI_a \cos\theta = 110 \times 3.64 \times 1 = 400$ watts in phase A
$E_aI_b \cos\theta = 110 \times 7 \times 0.5 = 385$ watts plus
$E_cI_b \cos\theta = 110 \times 7 \times 0.5 = 385$ watts in phase B
$E_cI_c \cos\theta = 110 \times 3.64 \times 1 = 400$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,570 watts; meter 4.67 per cent fast.

Fig. 7—Voltages on phases A, B and C, 100 volts; balanced load of 500 watts on each phase.
$E_aI_1 \cos\theta = 100 \times 8.66 \times 0.866 = 750$ watts on element 1
$E_cI_2 \cos\theta = 100 \times 8.66 \times 0.866 = 750$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,500 watts; meter correct.

Fig. 8—Voltages on phases A and C, 100 volts; phase B, 110 volts; balanced load of 500 watts on each phase.
$E_aI_1 \cos\theta = 100 \times 8.27 \times 0.8794 = 727$ watts on element 1
$E_cI_2 \cos\theta = 100 \times 8.27 \times 0.8794 = 727$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,454 watts; meter 3.07 per cent slow.

Fig. 9—Voltages on phases A and C, 110 volts; phase B, 100 volts; balanced load of 500 watts on each phase.
$E_aI_1 \cos\theta = 110 \times 8.27 \times 0.852 = 775$ watts on element 1
$E_cI_2 \cos\theta = 110 \times 8.27 \times 0.852 = 775$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,550 watts; meter 3.33 per cent fast.

Fig. 10—Voltages on phases A and B, 100 volts; phase C, 110 volts; balanced load of 500 watts on each phase.
$E_aI_1 \cos\theta = 100 \times 8.66 \times 0.866 = 750$ watts on element 1
$E_cI_2 \cos\theta = 110 \times 8.27 \times 0.852 = 775$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,525 watts; meter 1.67 per cent fast.

Fig. 11—Voltages on phases A, B and C, 100 volts; 400 watts on phases A and C, 700 watts on phase B.
$E_aI_1 \cos\theta = 100 \times 9.644 \times 0.777 = 750$ watts on element 1
$E_cI_2 \cos\theta = 100 \times 9.644 \times 0.777 = 750$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,500 watts; meter correct.

Fig. 12—Voltages on phases A and C, 110 volts; phase B, 100 volts; 400 watts on phases A and C, 700 watts on phase B.
$E_aI_1 \cos\theta = 110 \times 9.366 \times 0.7604 = 785$ watts on element 1
$E_aI_2 \cos\theta = 110 \times 9.366 \times 0.7604 = 785$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,570 watts; meter 4.67 per cent fast.

recording maximum demand. The split-coil meter and the two-element meter with three current transformers the secondaries of which are connected in delta are inaccurate on unbalanced voltage and connections are not easily made or checked. The delta connection requires oversize transformers or 10-amp. meter coils, and the split-coil meter is hard to calibrate and parts are not interchangeable. The three-element meter is accurate under all conditions of load and voltage, is suitable for demand recording and the total registration is recorded on one dial. The connections are also easily made. The disadvantages of higher first cost and possibly of the fact that the moving element is heavier, causing greater wear on the jewel, are offset by the fact that the method is accurate under all conditions which have been studied in this investigation.

# Power Requirements of Machinery Used in Cotton Mills

Trends in motor drive practice. Average data on typical applications. Plant load distribution analysis offered in connection with estimate basis

By H. H. Bodge

*Power Engineer Fall River (Mass.) Electric Light Company*

SINCE 1894, when the pioneer textile electric drive was installed in the shape of seventeen 65-hp. induction motors at the Columbia Mills, in Columbia, S. C., the growth of electric service in textile mills has increased to a point where more than two-thirds of the 3,000,000 hp. required to run these establishments in this country is furnished by motors. In outlining the trends in motor application it may be helpful to touch briefly upon the present process routine involved in cotton mills.

Purchased cotton arrives in 450- to 600-lb. bales measuring about 30x40x58 in. The first process requiring power is the opener. Cotton is fed from the bale or from the mixing floor to the feed box, where it passes through a beating process, which loosens the compressed fibers and beats out some of the motes and dust. After beating it passes by suction through a pipe or conductor to the next machine. Openers are best operated by individual drive, the motor mounted on the machine and belted directly to the drive pulley. The average type of opener requires 3 hp. preferably ventilated by ducts directly from outside air.

The next process, lapping, further cleans and loosens the fibers and forms them into laps or rolls. Usually there are three lapping machines—the breaker, the intermediate and the finisher. All three continue to clean the cotton. During the last few years single machines have been introduced that accomplish the required beating in one operation or handling and in general effect a combination of the three processes previously used. Such an outfit requires 20 hp. to operate. All types of lappers are best driven with individual motors. The elimination of overhead belting and shafting in the picker room is very desirable, owing to the large amount of lint and dust that collects everywhere. The fire hazard is large and warrants extra precautions and expense to avoid the possibility of fire from overheated motors or improper wiring.

The laps are carried next to the cards, where the cotton is fed over a revolving cylinder covered with what is known as card clothing. This clothing is made of cloth or rubber having wire teeth of about No. 34 gage inserted in it which stand 200 to 600 per square inch. Through this the cotton is passed. The combing action of the process further cleans and lays the fibers more or less parallel to one another. From this cylinder the combed cotton is removed in the form of a sheet, drawn through a trumpet and formed into a round mass called sliver. This is coiled in a can for handling.

A card is a delicately adjusted machine and great care must be taken not to overload it. The average production is about 150 to 175 lb. per day, or approximately one lap every two hours. Sliver cans hold from 7 to 8 lb. each and run full in about twenty minutes. Cards require very little power, the custom being to drive them in groups of twenty to twenty-five. When laying out a card room, 1 hp. per card is found to be about right. Some of the more recent installations in the South have used individual drive, the motor being geared directly to the drive shaft. This method is ideal but expensive.

Cotton is valued by its length of staple. Commercially graded cotton known as 1¼ staple will have mixed in it all lengths of fiber from ¼ in. to 1½ in. The next process, combing, sorts out and rejects all (or any desired per centage of) fiber below 1¼ or below any other specified length. This treatment conduces to much evener and smoother yarn. Of late years combers have been introduced to handle much shorter fibers than previously and are coming more and more into use.

Before cotton is passed through the comber, however, two preparatory processes form the card sliver into narrow laps or cheeses from 8 to 14 in. in width. The first is called a sliver lap machine, which takes the card sliver from twelve to twenty cans and spreads them out into the shape of a lap. The second is called a ribbon lapper. Usually six sliver laps are fed into this machine, where it is drawn out to the weight of a single sliver lap. The lap delivered by this process is much evener and smoother than that delivered by the sliver lapper.

From the ribbon lapper this lap is fed to the comber, which sorts out and rejects the short fibers. The comber delivers its product in the form of a sliver similar to the card sliver. Combers require ½ to ¾ hp., depending upon whether they are six or eight head machines, and are driven in groups. The silver lapper requires 1 hp. and the ribbon lapper ½ hp. They are usually driven in the same group with the combers.

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*From a paper before the New England Association of Central Station Power Engineers.

When the sliver leaves the comber, the fibers have been laid approximately parallel and are of uniform length, but owing to their natural tendency to curl and twist, they stand out in many directions. It is the purpose of the next process, drawing, to stretch some of this curl out of the fibers and to finish the process of parallelizing. Six cans of comber silver are fed together between rolls and drawn into one sliver. This constitutes one delivery of drawing. Each machine usually has six deliveries and requires 1 hp. to drive. Group drive is generally used for this process.

HORSEPOWER REQUIREMENTS OF COTTON MACHINERY

| | Hp |
|---|---|
| Opener with feeder | 2½ |
| Hopper bale opener | 3 |
| Cylinder opener | 6 |
| Hopper feeder | 1½ |
| Self-feeding opener | 3 |
| 1 Beater, breaker, lapper | 5½ |
| 1 Beater, breaker, lapper, cage section | 6 |
| 1 Beater, breaker, lapper, gauge, box and condenser | 7½ |
| Combined self-feeding opener and single beater breaker lapper | 9 |
| 1 Beater, intermediate, lapper | 4 |
| 1 Beater, finishing, lapper | 4 |
| 2 Beaters, breakers, lappers | 7½ |
| 2 Beaters, intermediates, lappers | 6 |
| 2 Beaters, intermediates, lappers | 7½ |
| 2 Beaters, finishing lappers | 7¾ |
| 2 Beaters, finishing lappers | 0 |
| 6 Beaters, breakers, lappers | 9 |
| 3 Beaters, intermediates, lappers | 8½ |
| 3 Beaters, finishing lappers | 8 |
| Thread extricator and condenser | 1¾ |
| Thread Extricator | 1½ |
| English card | 1 |
| American card | ½ |
| Revolving flat card, 450 lb. per week | ¾ |
| Revolving flat card, 700 lb. per week | 1 |
| Revolving flat card, 1,000 lb. per week | 1¼ |
| Sliver lap machine | ½ |
| Ribbon lap machine | ½ |
| No. 6 fan | 5 |
| Railway head detached | ½ |
| Comber, 6 head | ½ |
| Comber, 8 head | ¾ |
| Drawing frames, ordinary rolls six deliveries per frame | 1 |
| Drawing frames, metallic rolls, five deliveries per frame | 1 |
| Slubber, 45 to 60 spindles per machine | 1 |
| Intermediate, 55 to 65 spindles per machine | 1 |
| Roving, 65 to 85 spindles per machine | 1 |
| Jack or fine roving, 100 spindles | 1 |
| Spoolers, 150 to 250 spindles per machine | 1 |
| Spoolers, 300 spindles per machine | 1 |
| Warpers, four to five per machine | 1 |
| Ball warper, two per machine | 1 |
| Slasher | 1½ |
| Spinning, *warp yarns:* | |
| 16's and coarser, 70 spindles per machine | 1 |
| 22's and coarser, 75 spindles per machine | 1 |
| 40's and coarser, 80 spindles per machine | 1 |
| 60's and coarser, 90 spindles per machine | 1 |
| 80's and coarser, 100 spindles per machine | 1 |
| Spinning, filling-yarns: | |
| 16's and coarser, 110 spindles per machine | 1 |
| 22's and coarser, 90 spindles per machine | 1 |
| 28's and coarser, 85 spindles per machine | 1 |
| 40's and coarser, 90 spindles per machine | 1 |
| 70's and coarser, 100 spindles per macnine | 1 |
| 90's and coarser, 110 spindles per machine | 1 |
| 90's and coarser, 110 spindles per machine | 1 |

Ring Spinning

| | Spindles per Horsepower | | |
|---|---|---|---|
| Speed | Yarn 7-10 | Yarn 12-15 | Yarn 20-30 |
| 5,000 | 140 | 150 | 170 |
| 5,500 | 125 | 140 | 150 |
| 6,000 | 110 | 125 | 140 |
| 6,500 | 100 | 110 | 125 |
| 7,000 | 90 | 100 | 110 |
| 7,500 | 80 | 90 | 100 |
| 8,000 | 70 | 80 | 90 |
| 8,500 | 63 | 70 | 80 |
| 9,000 | 54 | 63 | 70 |
| 9.500 | 49 | 54 | 63 |

| | |
|---|---|
| Looms, 30 to 40 in., 5 per machine | 1 |
| Looms, 48 to 72 in., 4 per machine | 1 |
| Looms, 81 to 90 in., 3 per machine | 1 |
| Looms, 99 to 108 in., 2 per machine | 1 |
| Gingham loom, 5½ per machine | 1 |
| Wide loom (92 in.), 1 per machine | 1 |

The several operations up to this point have been devoted to cleaning and parallelizing the fibers. In the next process, slubbing, twist is introduced and the product is wound on bobbins.

From the slubber these bobbins are passed to the roving frames, where the stock is further drawn out and twisted. There are generally three processes: slubbing, intermediate roving and fine roving. The work done in all of these processes is exactly the same. Each successive machine delivers finer (or lighter) stock than it receives. Four-frame drive is highly recommended for this process. In slubbing, 45 to 60 spindles operate on 1 hp. in intermediate roving, 55 to 65 spindles per horsepower and in fine roving from 80 to 100 spindles per horsepower. The variation is due to the various spindle speeds used. The faster the spindle speed the fewer the spindles that can be operated with 1 hp.

The final process in making yarn is spinning, which consists of further drawing out and imparting the final twist to the product. There are two ways in which spinning is accomplished—mule spinning and ring spinning. Mule spinning is the older system and is used almost universally in England. In the United States, however, ring spinning has supplanted the old method except for very fine yarns.

Several methods are in use for driving spinning frames —individual drive, four-frame drive and group drive. Individual drive, well installed, is without question the best that can be obtained, but it is expensive. Four-frame drive is very popular and is easily installed, 20-hp. double-end motors designed for the purpose being available. This makes a neat and flexible installation and has proved satisfactory in every way. Group drive is the least desirable, although the low investment cost makes it attractive when ample funds are not available. Groups requiring 100 hp. are installed in many mills, and although they are somewhat better than the steam drive, they tend to defeat the real advantages of motor drive. Groups requiring not more than 50 hp. give good results but lack the flexibility of the four-frame method.

The power required per spindle to operate spinning frames varies widely, depending on the speed of the spindle, the size of the yarn and whether the yarn spun is intended for warp or filling. The accompanying table gives the power required under various conditions. Sixty spindles per horsepower is a safe average.

Two kinds of yarn are spun in a cotton mill—warp yarn and filling yarn. The filling yarn passes directly from the spinning frames to the weave room. The warp yarn, however, requires the following processes: spooling, warping, slashing or sizing and drawing-in.

The object of spooling is to take yarn from bobbins, on which it has been spun and wound with irregular tension, and rewind it regularly on spools. These spools hold from ten to fifteen bobbins. Spoolers usually have about 250 spindles and are group driven. Each 250 spindles require 1 hp.

Warpers and spoolers are usually in the same room and all are driven by one motor. This is not objectionable when the total load does not exceed 35 to 40 hp. The full spools are next mounted on a reel, or frames holding from 300 to 600 spools, which are unwound and the strands laid evenly on a beam or large spool holding 24,000 yd. and weighing approximately 430 lb. The number of ends wound on the beam is determined by the character and width of the cloth to be woven. Warpers require about 1 hp. each and are group driven.

Slashing, or sizing, is the next process. Warper beams are unwound and the yarn is passed through a hot size bath made principally of starch, after which it is run over a steam-heated drum and dried. It is then wound again on a beam and is ready for weaving.

Warp beams are placed on a frame with the loom harness suspended in front. There are two or more harnesses according to the character of the cloth woven. If two harnesses are used, one end of the warp is drawn through an eye in one harness and the next end through an adjacent eye in the other harness. With more harnesses, the warp may be drawn in various ways according to the design of cloth. Three to four looms operate with 1 hp. and are driven in groups requiring not more than 50 hp. each.

There is a growing tendency toward individual drive weaving, and this is unquestionably superior from a manufacturing standpoint. The investment, however, is high and I question whether the slight increase in production offsets the high fixed charges of such an installation.*

Since the World War the textile industry, especially in New England, has found itself confronted with keen Southern competition. High taxes, labor costs, obsolete machinery and worn-out power plants are largely responsible for the present Northern textile depression.

Many steam-driven mills would gladly turn to purchased power if finances allowed, realizing the advantages and low power costs derived from such a move. Under present conditions, however, ideal installations are difficult. Mill superintendents and treasurers are today carefully analyzing costs which a few years ago were considered trivial and are figuring in mills instead of cents as previously.

Old plants seldom electrify as a whole but install a motor here or there as required until it is found no longer profitable to continue running the engine. The general practice has been to split up the existing line shafts into groups and install the proper sized motor. This method is cheapest, and although far from perfect, is a vast improvement over the old drive.

The average cotton mill driven electrically has a load distribution as follows: Openers, waste machines and pickers, 4 per cent; carding, 6 per cent; drawing, combers and speeders, 22 per cent; spinning, 33 per cent; spooling and warping, 5 per cent; slashing, 1 per cent; weaving, 15 per cent; machine shop, 0.5 per cent; lighting load, 4 per cent; miscellaneous power, fire pump, elevators, etc., 9.5 per cent.

An over-all estimate of the horsepower required to operate a mill can be safely based upon 0.032 hp. per spindle—that is to say, a mill of 100,000 spindles would require 3,200 hp. plus about 20 per cent for being overmotored, or about 3,800 hp. in motors installed.

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**The use of individual motor drives for looms is making striking headway, ½ hp. per loom being widely applied up to 42-in. and ¾ hp. on larger units, rising to 5 to 10 hp. on duck looms.*—EDITORS.

# Load Distribution Between Parallel Lines

BY EARL BAUGHN
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Spokane, Wash.

FREQUENTLY it is desirable to know the distribution of power between two or more proposed dissimilar transmission lines in parallel under varying conditions of load or the effect of adding another line to an existing network. When calculated analytically, the equations become quite cumbersome and involved if more than two parallel lines are assumed. A simple graphical method based on the Perrine-Baum line regulation diagram has been used by the writer to solve both simple parallel lines and also quite complicated networks. Results for different assumed load conditions are quickly and easily determined.

The line regulation diagram as first proposed by Perrine and Baum, either in its simple form based on the resistance, reactance and capacitance of the line or the more accurate diagram based on the A, B, and C auxiliary constants of the line, is used by the author. However, any similar regulation diagram in which the receiving-end voltage is the vector of reference and the sending-end voltage vector is allowed to vary in phase displacement and amount may be used.

### PARALLEL TRANSMISSION LINES

When two or more transmission lines are operated in parallel, there are three things common to all—namely, the sending-end voltage, the receiving-end voltage and the angular displacement between the sending-end and receiving-end voltages. Reference to Fig. 1 shows that the voltage regulation diagram gives the delivered kilowatts and power factor of a line for any sending-end voltage and angular displacement for an assumed constant receiver voltage. Therefore, to solve for the kilowatts transmitted and the power factor of parallel lines, it is necessary only to make line regulation diagrams for each line for the same receiver voltage, and by assuming the same sending-end voltage and angular displacement between sending and receiver voltages for the different lines, the division of power is immediately determined.

In order that results may be had much more accurately and quickly, the charts for the lines concerned are made on tracing cloth with the same volts per inch scale so that they may be placed one upon the other with the receiver voltages in coincidence. Then for any chosen point on a sending end voltage circle the power and power factor on each line may be read from the charts. Also since we are concerned only with the kilowatt part of the dia-

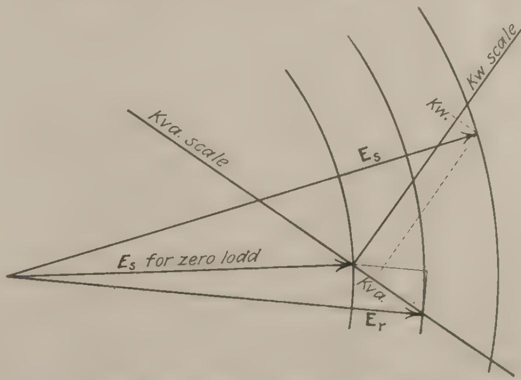


FIG. 1—LINE-REGULATION DIAGRAM (PERRINE-BAUM)
Diagram gives delivered kilowatts and power factor of a line for any sending-end voltage and angular displacement for an assumed constant receiver voltage.

gram, the chart is usually constructed as shown in Fig. 2, the receiver voltage vector being represented only by its tip end and the chart turned in such a way that the kilowatt scale is vertical.

If one line is of different voltage than the other and has transformers at each end, the chart for that line must include the constants of the transformers added to those of the line. The constants of the line must also be reduced to the constants of an equivalent line referred to the voltage of the receiving bus.

The general method described may be extended to the solution of extended and complicated networks. For instance, assume the network represented in Fig. 3. To solve this network charts should be made to the same volts per inch scale for the lines numbered 1 to 5. Then for any assumed amounts of power generated at *A* and at *B*, and loads at *C* and *D*, the distribution of power in the lines may be obtained by placing charts one upon the other, always remembering that the receiving-end volts for lines 2, 3 and 5 must coincide, that sending-end volts for the lines 1, 3 and 4 must also coincide, and that receiver voltage of line 1 is the same in phase and amount as the sending-end voltage of line 2, or vice versa, depending on the assumptions as to sending and receiver ends when the charts were made. The same is true of lines 4 and 5—that is, the angular displacement between the voltages at *A* and *B* and over line 1 plus the displacement between the voltages at *B* and *C* over line 2 equals the displacement between the voltages *A* and *C* over line 3.

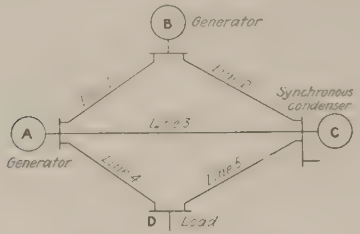


FIG. 3—TRANSMISSION NETWORK ASSUMED TO SHOW APPLICATION OF GRAPHICAL SOLUTION

Charts similar to those of Fig. 2 are made for each of the five lines and the same method of solution followed.

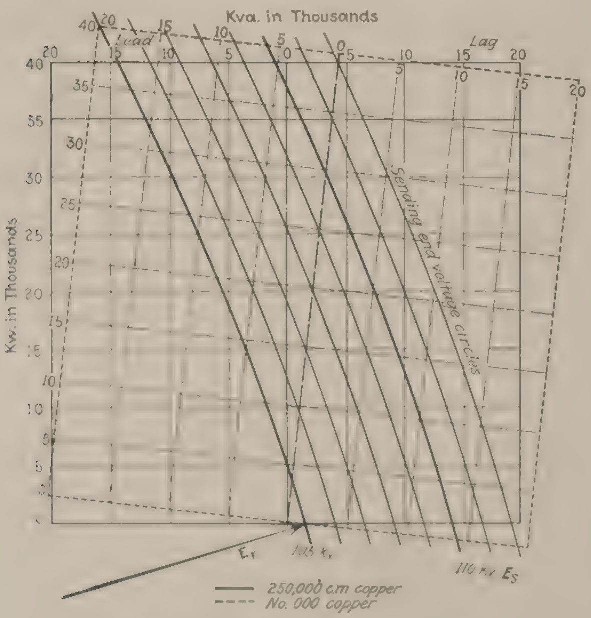


FIG. 2—REGULATION DIAGRAMS OF TWO PARALLEL TRANSMISSION LINES

Charts for the two lines are made to same scale on tracing cloth so that one may be placed upon the other with receiver voltages in coincidence. For any point on a receiver voltage circle the power and power factor on each line may be read from the charts. The charts are for two lines each 50 miles long, one of No. 3/0 copper in dashed lines, the other of 250,000-circ. mil copper in full lines. Receiver voltage is assumed to be 105,000 volts.

In solving a network it is usually permissible to disregard the transmission line losses, as they are rather difficult to include when reading the charts and results are not influenced a great deal by the losses. Accuracy of results by this method depends entirely on the care used in making the charts and in adjusting the position of one chart upon another before readings are made.

# Turbo-Unit Added for $16 Per Kva.

IN THE 1925 extension of the South Street station of the Narragansett Electric Lighting Company, Providence, R. I., a 43,750-kva. steam turbo-generator unit was added at a cost, including condenser, air-cooler equipment and minor auxiliaries, of $687,750. These costs were itemized in an appraisal by Jackson & Moreland, engineers, Boston, on behalf of the New England Power Association in connection with recent proceedings before the Rhode Island Public Utilities Commission, and are presented herewith as based on the company's detailed field outlay.

The turbo-generator consists of a 35,000-kw. (80 per cent power-factor) General Electric unit designed for 1,800 r.p.m., 350 pounds steam pressure and 200 deg. F. superheat, with provision for steam extraction at the eighth, twelfth and fourteenth stages, the generator being of 4-pole, type ATB design and wound for 11,000 volts. A 175-kw., 250-volt, compound-wound 6-pole exciter is also included. The condenser is of the Elliott-Ehrhart twin type, having two centrifugal extraction pumps each driven by a 250-hp., 2,300-volt, three-phase Westinghouse induction motor. The installation also embraces a surface-type air cooler, built in five sections, using fresh water at 90 deg. F., with a rating of 600 gal. per min. at 80 deg. F. and a unit output of 43,800 kva.

ITEMIZED INSTALLATION COST OF 43,750-KVA. UNIT

| | |
|---|---|
| Turbine, generator and exciter | $499,572 |
| Jet condenser and auxiliaries | 45,368 |
| Air cooler equipment | 36,203 |
| Lubricating oil system, including one No. 55 Sharples motor-driven purifier and one No. 600 Toval purifier with motor and piping | 10,590 |
| Also, one No. 122 Andale oil cooler, type 201F | 3,918 |
| Carbon dioxide fire extinguisher outfit, allocated portion of cost assigned to above generator | 5,976 |
| Fire extinguisher water and steam lines | 2,634 |
| Instrument piping for turbine and auxiliaries | 428 |
| Foundation for unit | 8,944 |
| Preliminary operation | 5,364 |
| Contractor's compensation, 5 per cent | 30,950 |
| | $649,947 |
| Condensing water piping from intake tunnel to condenser and thence to discharge tunnel, of 30-in. cast-iron, special fittings | 19,178 |
| Contractor's compensation, 5 per cent | 959 |
| Instruments | 13,835 |
| Spare parts | 2,990 |
| Contractor's compensation, 5 per cent | 841 |
| Total | $687,750 |
| or per Kva. | $15.72 |

# Tracing Radio Interference

### Details of routine method of locating various kinds of trouble. Test set proves value of audio-radio selective hook-up

By James H. Hanly

Radioman Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

IN ANSWERING a radio interference complaint, it is necessary to hear the noise as reproduced by the customer's receiver. If the difficulty is not within the set itself, the troubleman should then start the test set in his car, tune it to the disturbing signal and explore the district as shown in the accompanying diagram. By using such a route the section where the noise is the loudest may be noted. A set which may be used for either radio- or audio-frequency amplification should be employed. Ordinarily the tuning of the set should be done at radio frequency, using the detector rheostat for audibility control. When the point of maximum sound intensity has been reached, the double-throw switch should be placed in the audio position on the set and, by patroling the locality, a point where the alternating-current audio tone becomes distorted can be found. This is the location of the trouble or noise.

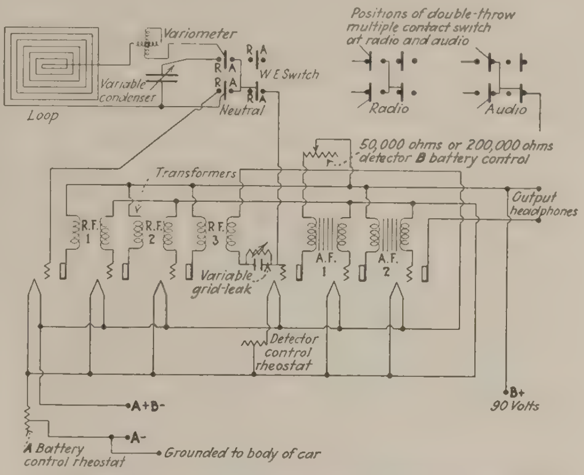
This method of testing can be used on high-tension systems up to 22,000 volts. On systems over 22,000 volts the audio test is not practical, as the electrostatic field is so intense that any radio-frequency components of the trouble are drowned out by the audio-frequency tone. Another reason is that, in most cases, the circuits of very high-voltage systems are placed too high for the loop to enter the field of the radio-frequency component. To lower the filament current of the tubes to a point where the tone may be heard without discomfort lowers the sensitivity of the pick-up and the trouble could never be found. The most successful method of locating trouble on voltages higher than 22,000 volts involves the use of the radio circuit with the audibility control.

When testing at audio frequency the troubleman must become familiar with the various noises so that he will not be confused by those not involved in the trouble. Under a street-railway wire the pick-up of the driving motors can be heard. Although this has been found at times to cause interference, it should be disregarded, due to the fact that although the set is in the field of the trolley, the street car may be miles away. This form of trouble must be found at radio frequency in order to constitute a source of interference. Another misleading noise heard at audio frequency is a "tick-tick" while under a telephone cable or telegraph line. This noise must be disregarded, as it is never heard at radio.

Whenever a case of trouble is believed to come from the street-light circuits, the same method of locating trouble can be used very successfully, but the most effective method is to test every lamp on the circuit. In doing so the troubleman can find all of the cases of radio interference on that circuit. A patrol of the circuit will also eliminate the possibility of its becoming open due to defective street-light fixtures. For this work the audio side of the set must be used at all times.

The most frequent causes of interference from power companies' systems are high-tension insulators, lightning arresters, primaries and arc wires in trees, 2,300-volt insulators, loose plug in primary cutout, and loose or defective street-light fixtures.

The troubleman must be familiar with the various characteristics of every type of wireless receiving set if the weak spots or possible causes of noise in the apparatus are to be located. Loose connections, defective grid leaks, condenser plates touching, low voltage on B batteries, diaphragm too close to magnets in speaker, and defective tubes are among the many causes of noise in a set.

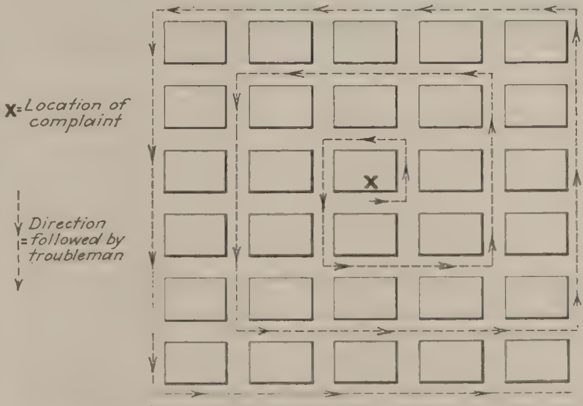


WIRING DIAGRAM OF RADIO-AUDIO RECEIVING SET

### Type of Test Set Recommended

The present supersensitive radio receivers require equally sensitive test sets for locating radio interference. Such a set should have two important features. It must be sensitive enough to receive at radio frequency the interference heard by the customer and it must also be able to show the exact location of the trouble. This second feature requires a less sensitive instrument, because a very sensitive test set will frequently pick up the noise with equal intensity over a wide area.

To overcome this disadvantage, the audio-frequency test set was developed. In using the audio testing can be done in the electrostatic field, the set relying on the position of the loop in that field for the amount of pick-up.



GENERAL PLAN OF ROUTE FOLLOWED BY RADIO COMPLAINT MAN

The test set used by the Blackstone Valley Gas & Electric Company for more than a year with excellent results has six tubes—that is, three radio, one detector and two audio. The radio-frequency tubes are coupled by frequency transformers of the untuned type. This method of coupling makes only the one tuning condenser used to tune the loop necessary. The detector tube circuit is similar to the ordinary set except that a variable grid leak is used which is located on the operating panel.

To change from radio to audio operation a switch is used which at radio connects the condenser across the loop and also connects one side of the loop to the negative of the A battery and ground and the other side of the loop to the grid of the first radio-frequency tube. At audio the loop is short circuited and connected directly to the grid of the detector tube. The total weight of the set complete with batteries is about 20 lb.

## Porcelain Duct Entrances Reduce Cable Sheath Troubles

By William Beauregard* and O. G. Brush†

CABLE sheath troubles have been reduced 90 per cent on the system of the Fall River (Mass.) Electric Light Company by the use of a new design of duct entrance for manhole service. The objective was the elimination of the wear of cables at duct edges, and the experience is based on eight months' service. The equipment consists of porcelain duct bells precast into a concrete block with rounded edges, thus permitting a maximum bend in the cable without fear of sharp corners. Prior to preceasting, the bells are mounted on an adjustable steel form. A fiber collar is cut in half, the cut edge being fastened on the porcelain with a beveled edge upward. This allows the fiber conduit to fit exactly and makes a smooth joint.

FINISHED MANHOLE USING PRECAST DUCT ENTRANCES

In making the mold for the precast block, the form is laid on a wooden base or floor, the sides are boarded up and a 1 to 2 mixture of concrete is poured around the porcelains. After about 48 hours' setting, the form is removed and the precasting is ready for installation. Any desired combination of precast entrances can be made and the bells are designed to fit any size conduit. When installing in a concrete manhole, the precast entrance is mounted at duct elevation and the concrete is poured around. In brick manholes, when the bricklayer arrives at duct level, the precast entrance is mounted and the brick is placed around it. This construction has been found especially useful where springs or water are encountered. The cost is only about 1 per cent of the cost of the manhole on concrete work, and the precasting is usually done on rainy days and in spare time under cover. In the case of brick manholes, it has been found cheaper to install a precast entrance, including the cost of the material, than to brick around the duct entrance.

DUCT BELLS MOUNTED ON ADJUSTABLE FORM AND BOXED IN PREPARATORY TO PRECASTING BLOCK

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## Welded Buildings Economical, but Experience Essential

"TWO classes of cost savings are secured in welded construction," declared Gilbert D. Fish, consulting structural engineer of the Westinghouse Electric and Manufacturing Company, before the Affiliated Technical Societies of Boston, recently. "There is a reduction in the tonnage of steel required, and there is a saving per ton in the cost of the steel handled. Tonnage is saved by the use of lighter members and the elimination of much connecting material. For example, the five-story arc-welded building at Sharon, Pa., contains 12 per cent less steel than would a similar riveted building. In a welded railroad bridge now under construction at Chicopee Falls, Mass., the amount of steel being used is 33 per cent less than that needed for riveted construction.

"Savings in the cost of handling are due to the fact that a very large proportion of the punching, fabrication and detailing essential for riveting is not needed with arc welding. In an arc-welded building erected at Derry, Pa., 60 per cent of the steel was not fabricated, and the cost of the structure was 12 per cent below its cost if riveted.

"It is expected that welded bridges of the future will prove somewhat more permanent than riveted ones, because the immovability of the joints removes the chief cause of fatigue. Although weld metal is less ductile than rivet steel, a properly designed and executed welded joint should have greater endurance under stress reversals than a good riveted one, because in the case of the latter the connection members and rivets are subject to slight motions back and forth, frequently beyond the elastic limit. Another factor favoring long life for welded joints is their smoothness and absence of rivet heads, with corresponding ease of painting and lessened tendency to corrode.

"Now that arc welding is widely regarded as a coming method which may presently cause extensive changes in structural practice, it is time to sound a warning against its hasty or ill-considered adoption by those to whom it looks too easy. The opposition that has been faced all along the line by those who have built pioneer structures by welding has forced careful consideration of every step, has called for proof of the safety of every detail and has brought about inspection of more than ordinary thoroughness. With the recent noticeable relaxation of opposition to welded construction, with the rapid awakening of interest among steel fabricators, engineers and architects and with the rising demand by the public that the clamor of the pneumatic rivets be stopped, there approaches the day when bad engineering or bad welding may cause something to give way.

"There is nothing dangerous about welding if proper control is exercised; the only danger is that which is inherent in any new method—the lack of experience on the part of those using it. The steps necessary to insure control are correct engineering, schooling of welding operators and inspection by men trained in that work."

# Cooking Schools Prove Value by Increased Sales

By Edward Horry

Vice-President and General Manager Edison Sault Electric Co., Sault Ste Marie, Mich.

THE COOKING school demonstration has been found to be an effective agency to promote the sale of electric ranges. For two years the Edison Sault Electric Company has utilized such demonstrations, usually in the spring, and in these two years it has sold more ranges than in any previous six years. The total number of residence accounts is 2,669. Gas competition is strong. A four-day cooking school last spring brought out an attendance of 557 and six ranges and twelve refrigerators were sold in the three weeks following the school. The sales were made by people coming in and buying, not by high-pressure methods. The refrigerator sales were a by-product of the school.

The school was held in a garage adjoining the power company office, and the entrance was arranged so that attendants passed through the company sales room. The garage was cleaned up and decorated, chairs rented, a platform built and the kitchen set up. The electric refrigerator was placed close to the range, kitchen cabinet and work table, so there was little lost motion. Preparing and cooking the food were demonstrated and explained. Various schemes may be used for creating interest. In the last school there was a cake-baking contest, with 46 entrants, a worth-while prize being offered to the winner.

The cost of the 1927 school, except for the demonstration platform, which is available for many other uses, and the cost of cleaning the garage, which is charged only partly to the school because the place needed cleaning anyhow, was $197, including $64.65 for newspaper advertising, $21.61 for cooking and baking supplies, $20.18 for prizes, $17.29 for materials for decorating, $25.39 for labor and $20 for rental of chairs.

It is not possible to assign a figure of total range sales attributable to the cooking school. Its effect is cumulative over a period of years and there is no way of telling whether sales made in December are the results of a demonstration in April or not. However, the management of the Sault company is convinced of the value of these efforts and will continue them. It believes that the independent central station in the small town can accomplish, commercially, as much in proportion as does the larger system.

The Edison Sault Electric Company is perfectly willing to open its files to utilities interested in this subject, if more detailed information is desired.

# 600 Lumens Per Foot Used on Oakland's "White Way"

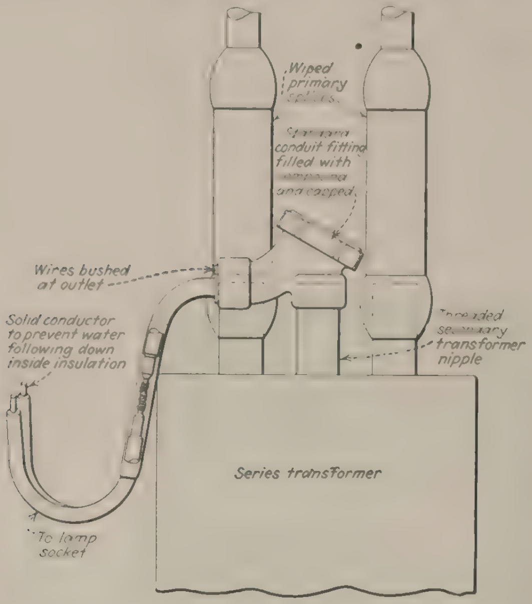
EMBARKING upon a comprehensive program for the modernization of its street lighting, Oakland, Calif., recently placed in operation more than 3 miles of white-way lighting in its central business district. Two-light standards numbering 353, of typical Oakland design, are spaced approximately 100 ft. apart, located in opposition on both sides of the street, and are equipped with two 15,000-lumen lamps. The contrast between the new lighting, which gives 600 lumens per linear foot of street, and the old obsolete system is strikingly shown in the illustration.

NIGHT VIEW OF OAKLAND'S NEW LIGHTING SYSTEM AND STANDARD POST ADOPTED

Three post designs that permit competitive bidding have been adopted by Oakland, Calif. The use of these designs has been made compulsory in the interest of uniformity.

The new lighting system was installed under provisions of the California state municipal improvement act of 1911 by which the cost of the improvement is assessed against the property owners. The cost of the present lighting system to the property owners was $4.63 per front foot. In addition to the capital cost of the system the property owners pay a part of the energy and maintenance cost. The proportion of this expense that the property owners bear was determined by figuring what the maintenance would be on a lighting system that would be adequate for public safety and convenience and assessing the property owners for the difference between this and the cost of maintaining the ornamental system installed. The base upon which the city figured its proportion of maintenance was a single-light standard with one 6,000-lumen lamp giving 120 lumens per linear foot of street.

The installation is of interesting design. To avoid the trouble experienced in the past with water following down the low-voltage leads in the post and getting into the transformers in the base of the posts, City Electrical Superintendent C. E. Hardy specified that the low-voltage leads be taken out from the transformers through a compound-filled conduit fitting. The details of this construction are shown in the accompanying diagram.


Wiped primary splices
Standard conduit fitting filled with compound and capped
Wires bushed at outlet
Solid conductor to prevent water following down inside insulation
Threaded secondary transformer nipple
Series transformer
To lamp socket

COMPOUND-FILLED CONDUIT USED TO PREVENT THE ENTRANCE OF WATER INTO SERIES STREET-LIGHTING TRANSFORMER

# Ornamental Street Lighting Construction Costs

THE accompanying tabulation shows the unit and extended prices, less lamps, of the new ornamental street-lighting system at Elmhurst, Ill. Elmhurst is a town of about 12,000 population in the Chicago metropolitan district. The installation includes 893 single-lantern concrete standards; 2,500-lumen and some 1,000-lumen lamps are used.

COST OF ORNAMENTAL STREET LIGHTING AT ELMHURST, ILL.

| Classification | Unit Price | Extension |
|---|---|---|
| 283,000 ft. of trenching, 4 ft. x 10 in., and backfilling | $0.04 | $11,320.00 |
| 9,900 ft. of 2½-in. wrought galvanized iron pipe under street crossings | 0.98 | 9,702.00 |
| 1,300 ft. of 2½-in. wrought galvanized iron pipe under railroad crossings | 1.00 | 1,300.00 |
| Twelve brick masoury manholes installed complete | 145.00 | 1,740.00 |
| 107,000 ft. No. 8 5,000-volt parkway cable installed | 0.25 | 26,750.00 |
| 359,000 ft. No. 8 2,500-volt parkway cable installed | 0.15 | 53,850.00 |
| 893 reinforced concrete lighting standards installed complete | 38.00 | 33,934.00 |
| 893 solid bronse octagonal lanterns installed wired complete | 44.50 | 39,738.50 |
| 893 post holes 20-in. diameter 4 ft. deep complete | 0.90 | 803.70 |
| 47 4.2-kva. branch line constant-current 6.6 amp. subway-type transformers | 156.00 | 7,332.00 |
| One 4 P S T 400-amp. remote-control oil circuit Breaker installed complete | 420.00 | 420.00 |
| Six 2 P S T 400-amp. remote-control oil circuit breaker installed complete | 378.00 | 2,268.00 |
| Twelve 6,600-volt. S P combination disconnecting switch and fuse installed complete | 52.00 | 624.00 |
| One 3-kva. 2,300-230/115-volt 60-cycle | 62.50 | 62.50 |
| Six 34-kva. moving coil 6.6-amp. C S STA type regulators | 720.00 | 4,320.00 |
| One length 150 ft. 30-conductor No. 19 wire control cable installed complete | $195 00 | $195.00 |
| One slate panel 24x24x1½-in. drilled for watt-hour meter installed | 25.00 | 25.00 |
| Sixteen cells 400-amp.-hour storage battery, complete with knife switch installed complete | 26.00 | 416.00 |
| One 6-amp., 75-volt bulb-type rectifier installed complete | 180.00 | 180.00 |
| Three 4,000-volt low equivalent lightning arresters installed complete | 110.00 | 330.00 |
| One piece approximately 100 ft. of No. 2 lead-covered four-conductor, 4,000-volt service cable | 285.00 | 285.00 |
| One pipe frame switchboard complete with busbars, insulators, etc. | 500.00 | 500.00 |
| Twelve two-wire, 4,000-volt disconnecting potheads installed complete | 22.00 | 264.00 |
| Six two-wire, 4,000-volt non-disconnecting potheads installed complete | 18.00 | 108.00 |
| One four-wire disconnecting pothead installed complete | 38.00 | 38.00 |
| One four-wire non-disconnecting pothead installed complete | 25.00 | 25.00 |
| One concrete cable vault installed in substation | 124.00 | 124.00 |
| 60 ft. of 3-in. iron conduit laid in floor of substation as specified | 1.50 | 90.00 |
| 250 ft. of 2½-in. iron conduit laid in floor of substation as specified | 1.00 | 250.00 |
| 110 ft. of 4-in. fiber conduit laid in concrete as specified | 1.75 | 192.50 |
| One set portable testing instruments as specified complete | 510.00 | 510.00 |
| One transformer substation building completely erected | 3,675.00 | 3,675.00 |
| Total | | $201,372.00 |

# Boiler Plant Equipment Costs

FROM the cost sheets of an eastern power company are taken the following cost data applying to various boiler plant equipment installed about two years ago in a tidewater station extension under excellent engineering supervision. Four boilers with a combined rating of 7,168 hp. were installed with pulverized coal burners, a new stack, and other apparatus. In using these items in checking other work, they should be applied in segregated form, as indicated, and not totaled to obtain the over-all cost of a complete installation. As itemized, the costs given represent outlays actually made with the equipment installed.

MISCELLANEOUS BOILER PLANT COSTS
EQUIPMENT INSTALLED 1925

| | |
|---|---|
| 2—1876-hp. B. & W. cross drum water tube boilers, 385 lb. steam pressure, 18,755 sq.ft. heating surface each; tubes 20 high, 36 wide, 4-in. tube diameter and 10-in. steam outlet | |
| 2—1,708-hp. similar boilers, tubes 18 high and 36 wide; 17,084 sq.ft. heating surface per boiler | |
| 4—B. & W. superheaters, each 120,000 lb. steam per hour to 200 deg. F. above saturated steam temperature at 375 lb. | |
| Water screens for powdered fuel furnace tubes 4 in. diam., 14 in center to center, 430 sq.ft. bottom; 599 sq.ft. side walls, 468 sq.ft. rear wall | $325,691 |
| 1—Extra boiler drum, 36 in. x 26 ft. 10.5 in., with equipment for testing, 400 lb. | 7,551 |
| Settings for above four boilers, including 9-in. fire brick lining furnace bottom walls and filling top ash gates, rear, side and front walls fire brick and Sil-O-Cel construction | 113,725 |
| Steel sheet boiler casings | 40,810 |
| Diamond soot blower equipment | 15,063 |
| Soot conveyors | 12,953 |
| 32—Lopulco pulverized coal burners, 8 per boiler | 3,975 |
| Contractor's compensation on above items | 25,988 |
| 4—Air preheaters, consisting of two 40,000 sq.ft. Ljungstrom regenerative type; one 15,000 sq.ft. B. & W. tube type, and one 14,000 sq.ft. Combustion Engineering plate type, and accessories to Ljungstrom type | 104,871 |
| 2—50,000 c.f.m. forced draft fans, Sturtevant No. 110, 5 turbovane, driven by 40-hp. variable-speed slip-ring motor, and | |
| 2—110,000 c.f.m. Sturtevant induced draft fans, 8-ft., one driven by 40-hp. motor and one by 200-hp. motor | 41,789 |
| Air ducts | 35,982 |
| Flues and uptakes | 17,884 |
| Combustion control system | 27,[illegible] |
| Steel stack and bonnet, 18 ft. 9.5 in. diameter, 220 ft. high above roof | 40,677 |
| Radial brick lining in upper part of stack 4.5 in. | 7,055 |
| Pulverized coal piping, 700 ft. of 8-in. coal house to bins | 32,929 |
| Coal piping from weigh bins to bunkers (two 8-in.) | 12,650 |
| Weigh bins and testing apparatus | 7,006 |
| Coal pump for testing | 6,814 |
| 24—5.5-in. multiple type coal feeders, 50-hp. motor each and four 7,500 c.f.m. blowers, 12-hp. motor each | 4,302 |
| Coal piping for testing | 3,985 |

# Financing for Service

*BOND and debenture financing in its various aspects was discussed in the Dec. 24 issue under the caption, "Financing for Service." The discussion is here continued, with special bearing upon stock financing and the importance of customer sales in public relations.*

THE history of the changes leading up to the preferred stock provisions now in almost general use by utility companies is similar in some respects to that of the evolution of the modern open mortgage. These changes have followed amendments to state corporation laws enacted from time to time as experience has dictated their necessity or advantage. While the amount of stock which may be issued is fixed by charter (subject to change by stockholders' vote), this is not a serious handicap, as stockholders' authorization of a warranted increase ordinarily can be obtained, though on occasion special effort may be necessary to obtain it. Preferred stocks usually are now issuable in series, with dividend rate and redemption price determined for each series as created, and ordinarily subject, with respect to issuance of additional stock of any series, to charter provisions prescribing a minimum margin of earnings over dividend requirements and sometimes specifying the relation of total preferred stock to value of assets or to total capitalization. These amplifications have materially facilitated the raising of capital through sales of stock with salutary effect on the disproportion between senior and junior securities formerly existent in the capital structures of many utility companies.

### Value of Customer Sales

Since customer-owner campaigns on an extensive scale were undertaken about thirteen years ago, great strides have been made by electric utilities in placing their preferred stocks among investors in the territories they serve. Aside from its effectiveness as a means of regularly procuring funds, this procedure has been advantageous in other important respects. It has aroused a growing interest in and better understanding of the problems of the utilities. Their long records of uninterrupted dividend payments have inspired confidence in their securities as investments, a significant supplement to the confidence in their intent and ability to serve economically and well. General adoption of plans requiring only small installment payments has encouraged small wage earners in increasing numbers to purchase preferred stocks and thereby regularly to save part of their earnings. Attracted by good investment returns, possessors of larger incomes have joined the rapidly growing ranks which now comprise 5,000,000 direct holders of public utility securities.

Not long ago almost any reference to preferred stock issues would have brought to the forefront the question of voting rights, then receiving much attention principally because of opinions expressed by one of the country's widely known economists with particular reference to certain industrial corporations. In the ensuing discussions various theories were advanced, many of them premised on circumstances foreign to preferred stocks of regulated public utilities. More than a year has passed, the air has cleared and now we find ourselves about where we were before a few isolated cases of roundly criticised industrial financing encouraged the many-sided arguments that for a time seemed to stir the world of finance. The supposition that a preferred stockholder is a partner in the business seems to be the principal reason for advocating that preferred stock be endowed with the full voting privilege.

"Preferred stock" implies, at least to most people, a stock having preference over some other stock. If the preferred stock is of the type which has been usual for so long that the mere mention of the term warrants the assumption that it is, it has prior call over the common stock on earnings for the purpose of paying its dividends, and on assets for the purpose of paying the par or otherwise stated amount in the event of dissolution.

### Not Partner in Ordinary Sense

The term "partner," used without qualification, implies proportionate sharing of profits and risks, a condition not at all applicable to the holder of a security who must receive the full amount of a stimpulated sum from earnings before any part of such earnings can be applied to the payment of dividends on the common stock, and who, in the event of the winding up of the business, must receive the full amount of a stipulated sum before any part of the proceeds of sale of the assets can be paid to the owners of the common stock erroneously spoken of as his "partners." And, incidentally, it is not unusual, in fact it is quite usual, to find that a so-called "non-voting" preferred stock has voting rights in certain events, such as default in dividend payments and on proposals to increase the authorized amount of preferred stock, create a security having prior rights or to mortgage or sell assets. The holder of such a preferred stock is not, or at least need not be, concernd with the details of management so long as the terms of the contract made with him are met, and particularly when the operations and issuance of securities of the issuing corporation are subject to commission jurisdiction and the corporation is controlled by those who have proved themselves worthy of the trust and able to discharge the attendant responsibilities and who have large actual investments in the common stock. Such a situation is vastly different from that of an unregulated industrial corporation, controlled through the medium of a nominal issue of so-called "management stock" or otherwise by interests that do not own or represent a large actual investment in the stock of the corporation.

Before leaving the subject of voting rights it may not be amiss briefly to comment upon the apparent indifference of stockholders. A review of the records of the voting at stockholders' meetings of large representative corporations over a period of years would probably disclose some highly interesting facts, if newspaper reports on their meetings are indicative of the attitude of the average stockholder. At annual meetings held principally for the election of directors, usually requiring only the vote of a majority of voting stock, often but little more than the essential majority is represented despite the fact that the stockholder is called upon merely to sign a printed proxy and mail it in an envelope already stamped and addressed. It has often been found necessary to organize campaigns and actively solicit proxies in order to obtain the minimum vote required by statute at meetings at which action is proposed to be taken on special matters of unquestioned advantage to the stockholders. In that connection it is interesting to note that an official of one of the large public utility holding companies was recently told by a stockholder that she would sell her stock if she was to be bothered by having to vote upon any matter. It can hardly be said that such indifference is indicative of dissatisfaction, as serious dissatisfaction if it existed would undoubtedly be evidenced in some manner, perhaps by sale of the stock, if not by direct communication with officials of the corporation.

The amounts of common stock issued by electric utilities in late years have, in the aggregate, represented a greater proportion of their total security issues than ever before, though the procedure has been, in general, somewhat different from that followed in their bond and preferred stock financing.

### METHODS OF DISTRIBUTION

Bonds usually are sold in blocks to investment bankers, who in turn distribute them to investors. Preferred stocks, when sold in customer-owner campaigns, as has been true in the majority of cases, are disposed of through the companies' own securities departments or regular employes in small lots day after day until the amount of the issue has been sold. On the other hand, it has been the practice among the majority of utility companies to make to their stockholders a single subscription offering of the total proposed issue of common stock, such offerings as a rule being made not more frequently than once a year. Many of the important electric utilities of the country are now either under holding company control or have holding or investment companies among their large common-stock holders, with the result that the holders of the preferred often greatly outnumber the holders of the common stock. The amounts of issues of additional common stock applicable to these large holdings usually are subscribed for in order that proportionate interests in the equities may be maintained. Thus, notwithstanding its importance as a means of obtaining capital, the common-stock financing of the electric utilities has come less before the general public than their bond and preferred stock issues, due to the more concentrated ownership.

In addition to the large investments made from time to time in their common stocks, well-managed electric utilities usually leave in surplus account a considerable portion of the earnings available for dividends on the common stock, such surplus being reinvested in the properties and business. Analyzed from any viewpoint, this policy is conservative and worthy of encouragement, though sometimes the common-stock holders are penalized, or attempts are made to penalize them, for such conservatism. Earnings which common-stock holders are legally entitled to receive as dividends but which the directors wisely elect to reinvest in the business and thereby strengthen the position of the corporation are entitled to earn reasonable returns, just as are the invested proceeds of securities issued to provide for capital requirements. When the reinvested earnings are not capitalized, the result is an increase in the rate of earnings on the common stock, assuming, of course, continuance of reasonable returns on the total investment.

Such situations at times have stimulated the ambitions of those seeking political preferment on any pretext, and encouraged claims of exorbitant charges for services, the accumulated surplus being pointed to as evidence of past excesses, and the high rate of current common-stock earnings as evidence of continuance of the alleged abuses.

As a matter of fact, earnings on the common stock of a utility corporation may reach a high rate while at the same time its entire earnings remain within the limits of reasonable returns. Let us take, as a hypothetical case, a corporation with $10,000,000 of property and $10,000,000 of capitalization consisting of, say, 60 per cent, or $6,000,000, of bonds; 20 per cent, or $2,000,000, of preferred stock, and 20 per cent, or $2,000,000, of common stock. With such a capital structure and a well-developed and growing business, sound rate schedules and policies of management, property in first-class operating condition and satisfactory public and employee relations, the corporation should be able, at least under market conditions similar to those now prevailing, to sell its bonds at a 5¼ per cent annual cost and its preferred stock at a 6¼ per cent annual cost. Earnings equal to the commonly recognized, though not always realized, return of 8 per cent on the $10,000,000 of property would amount to $800,000. After deducting annual interest and preferred dividend charges at 5¼ per cent and 6¼ per cent respectively, there would be available for the $2,000,000 of common stock $360,000, or 18 per cent. If two-thirds of such earnings, or 12 per cent, were paid as dividends on the common stock, $120,000 would remain in surplus, the investment in the business being thereby increased to $10,120,000, on which 8 per cent return would be $809,600. Deducting the same interest and preferred dividend charges would leave earnings for the next year of $369,600, or 18.48 per cent, on the $2,000,000 of common stock. Continuing under the same conditions, at the end of five years the investment would be more than $10,700,000, on the basis of which earnings on the $2,000,000 of common stock would be more than 20 per cent, and yet the rate of return would not exceed 8 per cent. As the corporation issued additional securities the annual interest and preferred dividend charges on the additional securities would, of course, vary from the rates used in the foregoing illustration, according to the investment market conditions prevailing at the time of issuance, with corresponding effect on the rate of common-stock earnings.

Political attacks of the character referred to have been more often directed against companies under holding company control. This was probably because holding companies, before their actual usefulness and important aid in the development of the electric industry were as well understood and as widely recognized as at present, seem to afford targets as so-called "trusts" and "big business," and perhaps, too, because the stronger holding companies were in better position than individual stockholders to permit their operating subsidiaries to retain in surplus and reinvest in the business large proportions of the earnings available for common-stock dividends.

Though earnings are limited to reasonable returns, the assurance of a stable and expanding market for their product or service affords an outlook for soundly capitalized and well-managed electric utilities that warrants the complete removal of their securities from the field of speculation. Many new and important uses for electricity are constantly being found and almost unlimited opportunities exist for further cultivation of fields already entered. Less than 2 per cent of the railroad mileage of the country is electrified, and electricity on the farm, practically unknown until a comparatively few years ago, is now being extensively applied with great savings to the farmer in money and physical effort. Progress along these lines, as well as extensions into new fields, will entail heavy development costs and make it imperative that ample capital be available when needed from time to time.

Within the past few years there has been a notable tendency toward legislative recognition of the advantages to savings banks and trust funds of investing in public utility securities. This tendency will undoubtedly receive further impetus from the growing necessity of making available to fiduciary institutions additional fields for the safe and profitable employment of their large and rapidly growing funds.

Though costs of labor, material and fuel today are still more than 50 per cent higher than the pre-war levels of 1913, the householder pays about 15 per cent less for his electric current than he did at that time, its cost to him being practically the smallest item in the family budget. Service extensions not supported by immediately available revenues have been made to encourage upbuilding of communities and attract industries, and standards of service have been immensely improved. These accomplishments are the result of research, initiative and able administration and have merited the approbation of the public.

Notwithstanding their creditable records, however, the electric utilities cannot merely rest upon their laurels. It is incumbent upon their executives to pursue diligently possibilities of further improving and extending service and reducing charges; to continue to justify public support of their policies of operation and development, and to protect the investments of those who have supplied and must continue to supply the large amounts of needed capital. The dangers of unwarranted attacks have greatly diminished as the public has come to have a better understanding of the problems and affairs in general of the utility companies, and evidence is not lacking of the confidence of the utility companies themselves that, when conversant with the facts, the public will be fair to the industry that has contributed and will continue to contribute so much to its well being.

## Standard Motor Dimensions

SINCE the data were collected for publishing the table on page 1100 of the Nov. 26, 1927, issue of the ELECTRICAL WORLD, giving a comparison of alternating-current motor dimensions the Crocker-Wheeler Electric Manufacturing Company has offered its 50-P motor to supersede the 13-Q motor which was listed. The values for the new 50-P motor corresponding to those listed in the table are as follows:

| | | | Shaft Extension, In. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Make | Type | Frame | *u* | *n* | *t* | *s* | *h* | *d* | *b* | 2*f* |
| Crocker-Wheeler.. | P | 50 | 1½ | 4 | ¼ | ⅛ | 11/16 | 7 | 10⅝ | 8½ |

| Make | Type | Frame | *a* | 2*e* | *x* | | *m* | *c* | " |
|---|---|---|---|---|---|---|---|---|---|
| Crocker-Wheeler..... | P | 50 | 13⅜ | 11½ | .. | 6 5/16 | 6¼ | 16 11/16 | 13⅜ |

In the original Table I the column under shaft extension, headed "*a*," should have been headed "*u*" to correspond with the diagram.

# A Grounding Policy That Will Promote Development

By D. HAYES MURPHY
*President Wiremold Company*

THE grounding policy recommended by the National Electrical Manufacturers Association committee on grounding and adopted by the association will help to clear the air on this subject, definitely present the manufacturers' viewpoint and possibly prevent a multiplicity of rules that may only retard development.

The proper grounding of equipment has always been a matter of diversified opinion, particularly as regards portable apparatus. The vast majority of manufacturers are so absorbed in the problems of their individual concerns that they often fail to grasp the significance of the larger industry problems, such as proper grounding rules, and the direct bearing which these problems have on their private business. To solve these problems it is only necessary that they be presented in such a way that they will receive serious consideration. The merger of the various manufacturing groups into the National Electrical Manufacturers Association has provided a splendid forum for the necessary discussions and means for putting plans into effect.

By making understood a basic problem of the industry such as this grounding question the N.E.M.A. has recorded an achievement. The manufacturers are bound to support such a constructive movement, which is for the benefit of the industry and the general public. This is a distinct step in the right direction and represents substantial progress on the part of the manufacturers in supplying the public with more and better electrical service.

## Interesting Transformers Used on Conowingo Project

AT THE hydro plant of the Conowingo project and at the large switching station used in the interconnection developments in this region some large and unusual transformers are installed. The Conowingo plant transformers were made by the General Electric Company and are thirteen in number. Each transformer is rated at 26,667 kva., giving a bank rating of 80,000 kva. Four banks of these transformers and one spare are provided. Water-cooled two-winding units are used, which step the voltage from 13,800 to 220,000.

At the Plymouth Meeting substation, seven transformers manufactured by the Westinghouse Electric and Manufacturing Company are to be installed. These units are rated at 33,333 kva. each and, therefore, provide two 100,000 kva. banks with one spare unit at this station. The energy from Conowingo and that from the Pennsylvania-New Jersey interconnection is stepped down from 220,000 to 66,000 volts. On the transformer units, in addition to the 220,000 and 66,000-volt windings, there is a 13,200-volt tertiary winding. This winding is used for the triple purpose of closing the delta, operating synchronous condensers and operating the tap-changing equipment installed on the 66-kv. side of the transformers.

An interesting feature of the Plymouth Meeting transformers is that they are self-cooled and arrangements are made for impinging air on the radiators to obtain high ratings.

# Sales Conference Studying Problems

### One committee now engaged in planning adequate wiring campaign. Whole-hearted support needed to carry out plans when formulated

By W. E. Sprackling
*Chairman Electrical Industry Sales Conference*

IF A MAN is satisfied to let his business run itself, if he does not push it actively because he has heard that we are going to have a fairly prosperous year, his business is headed for the rocks. Likewise, if an industry is willing to sit back and take what is thrown at it without an earnest effort to go out and get something in addition, then that industry is not going to have as prosperous a year as it would have otherwise. In other words, 1928 will be as prosperous as we want to make it.

W. E. SPRACKLING

The favorite indoor sport for business men at this time of year is for everyone to catch the ear of everyone else and wisely whisper therein just what the year 1928 has in store for us. Fortunately for us all, our present national banking system, plus a thorough study of cause and effect on the part of various statisticians and financial agencies, allows us all to shoot fairly close to the mark with our predictions. But all of this information concerns only business in general. It does not mean that every business or every industry will be affected alike. Heaven forbid! Such a thing would mean the burying of initiative—the killing of incentive. It would be a calamity that could not exist.

In the past our electrical industry has been too content to follow the easy-going path of taking what is given to us or at best to pick the business plums that could be reached without effort—let the poor fellow who had to work for a living strain his back for the plums higher up. Now we find that we have grown and need those plums we once scorned. So we all wake up to find that we have with us this "new competition" we hear so much about, and we get together in an Electrical Industry Sales Conference. What to do! Echo answers, "A-plenty." But it can't be done over night. It can't be done in a month. There is no open sesame that will lead us into verdant fields and green pastures. We have got to start in and work for a living. We have got to go back and rework the old fields. We have got to spend some money on fertilizers and new equipment. We have got to do some earnest cultivation of the present market.

The sales conference has decided on one thing which many will say was self-evident—and in that they are correct, of course. The conference said, in substance, "The only way we can sell more current, sell more appliances, more portable lamps, fixtures, transformers and what not, is to have plenty of places in the home to plug in current-consuming devices whether they be two-dollar portable lamps or an electric refrigerator selling at $750." In other words, we must see to it that homes are adequately wired. Therefore the conference appointed an excellent committee representing the best brains in the industry on this particular subject. That committee is now figuring out an "adequate wiring campaign" that will be universal in its operation and nation wide in its appeal.

The committee will have a little more than a month to study the subject, write up its findings and hand in a definite report to the conference at its next general meeting on Jan. 11. That report will call for immediate action. Then the proposition will be placed before the industry as a whole to support the project and help to make the year 1928 more prosperous or else to sit back with that, "let-George-do-it" attitude and wait to see somebody else step forward first and say, "I am with you!" Whatever the plan may be, the industry as a whole is not going to be 100 per cent satisfied with every detail of it. That is one prediction that is easy to make. But whether everyone is sold on every detail of the plan or not, the fact remains that the campaign will be an industry campaign and should be given the whole-hearted support of everyone in the industry.

Another industry problem the conference had put up to it was the problem of the contractor as a group. He is our direct contact with the public as far as wiring installations go. He is at times a fine journeyman, at other times he is only a fair workman; sometimes he is terrible. As a salesman he is a fine mechanic. What to do with him! He is a real problem. And so, the Electrical Industry Sales Conference has taken on this job and has given it to a fine committee that best knows what is needed. It is giving the subject a lot of thought, But its problem is one that is going to take time and patience. No one can expect an immediate solution to that perplexing situation. Suffice it to say that all branches of the industry are joining hands to try to work out an answer.

There are other committees at work as well as the two mentioned. Each has a single broad subject to work on, a particular problem to solve. What does it all mean? Where does it all point? It means that for the first time the electrical industry is working as a unit, that there is a realization of the need for team play. It points toward a time when duplication of effort will cease, when spasmodic attempts by one group will be replaced by co-ordinated group effort.

But while the Electrical Industry Sales Conference can devise the plan and point out the way, it can never hope to go out and put the campaign across of itself. The actual accomplishment of any plan requires the wholehearted, active, enthusiastic support of everyone in every group of the industry. And that is just where each one of us will play his part in making not only the year 1928 more prosperous but 1929 even more prosperous than 1928 and 1930 bigger still. We, as an industry, have it right in our own power to make our prosperity just what we will it to be by the amount of time, effort, interest and money we put into the means of bringing that prosperity to us. The extent of our prosperity lies in our own hands.

## *Favors Support of Flood Control*

*I THINK there is a good deal of popular misunderstanding as to what can be done in the way of flood control. In the past, control has been accomplished in large measure by natural reservoirs which have been increased moderately in capacity. Such control helps but cannot begin to cope with such a situation as existed in the Winooski Valley of Vermont and several other places last November. We were fortunate that the storm did not extend up and down a principal river valley rather than across several states. Had it done the former, one or more cities might have been drowned out. The flow in some New England streams was so great that had it been in the same proportion in the larger rivers, the latter would have had in them five times the normal flow of Niagara—that is, more than a billion and a quarter second-feet in the case of the Connecticut and the Kennebec.*

*To store sufficient water to take care of a condition even approaching the foregoing would be a monumental task even on one river. I believe, however, that a great deal can be done to take care of all ordinary freshets and that there are places on most New England rivers where more water can be stored than we have ever considered possible before if we have co-operation among the different affected interests. A great deal can be done if we can get even a large part of the people interested in any one river. I do not believe that we ought to do it through the federal government, except possibly in the case of immensely large rivers, and even with these, if feasible, the work should be done by the states or by interests working within the states and not by the national government.*—WALTER S. WYMAN.

## Customers in Canada, 1924 and 1925

A RECENT report on central electric stations in Canada, published as a portion of the Census of Industries, 1925, by the Dominion Bureau of Statistics, indicates that there were 1,279,731 central station customers in Canada at the close of 1925. This is an increase of 6.7 per cent over the number at the end of 1924.

In the last year for which statistics are available, there was an increase of about 8 per cent in the number of residential lighting customers and 2.6 per cent in the number of commercial lighting customers, but a slight decrease in the number of power customers. This decrease was confined to the three provinces, Quebec, Manitoba, and Alberta. Taking the country as a whole, the number of domestic lighting customers is about 50 per cent of the total number of families; in the most populous province, Ontario, it runs up to 55 per cent.

## Census Bureau Asks Co-operation

OPERATIONS of American industry are once more to be surveyed and counted by the federal government. The next biennial census of manufactures will cover data for 1927. Until 1919 these industrial censuses were taken every five years, but at the close of 1921 the biennial census of manufactures was instituted. Such an advance in the collection of general production data is in line with the new economic era under the influence of which business and industry has been functioning since the war period. The success of the government in this task will depend almost entirely upon the co-operation received from manufacturers in furnishing the basic data required. The Census Bureau states that manufacturers of the nation can render a real service to industry by returning the government questionnaires just as soon as the basic data are available. The Census Bureau stands ready to do its part immediately the figures are received from the manufacturing plants. The value of the present census of manufactures, therefore, depends upon the co-operation extended by the manufacturers in making early reports of 1927 operations.

Timely data on both production and distribution are absolutely essential to the fullest development of business and industrial management, elimination of waste, both material and physical, standardization and research; and the more timely the data, the greater their value. In the past it has been impossible for the federal Census Bureau to collect, tabulate and make public the complete basic data on production under a year and a half, although data on some special industries have been issued within a year after the taking of the census. The Census Bureau is making every effort this year to make the summary figures available many months ahead of the previous censuses.

## Rural Rates Raise Usage 68 Per Cent

FARMS receiving service from transmission lines in Wisconsin increased during the year ended June 30, 1927, from 9,945 farms to 13,749 farms—an increment of 3,804, or 38.2 per cent. Utilities are not looking necessarily toward the increase of farm customers so much as toward the class of farm connected. They seek increased load density, of course. That the approach of near uniform rate structure is having its effect may be seen in the following: One utility studied the accounts of 2,354 customers on its farm lines. Where modern rate structures have been put into effect, the result of this survey indicated the following average kilowatt-hours per month:

| | |
|---|---|
| First half of 1925, average kilowatt-hours per month....... | 35 |
| Second half of 1925, average kilowatt-hours per month...... | 37 |
| First half of 1926, average kilowatt-hours per month....... | 44 |
| Second half of 1926, average kilowatt-hours per month...... | 59 |

Another study was made of 36 customers, whose old records before the application of a modern rate structure indicated an average of 48 kw.-hr., whereas, after the application of the new rate structure, the average increased to 116 kw.-hr., an increment of 142 per cent. One farmer averaged 606 kw.-hr. per month in 1925 and 1,024 kw.-hr. per month in 1926. Recently a line having 38 rural customers was analyzed with the following results:

| | |
|---|---|
| Number of customers | 38 |
| Total kilowatt-hours in 1925 | 9,563 |
| Average kilowatt-hours per year | 251 |
| Total kilowatt-hours in 1926 | 12,533 |
| Average | 329 |
| Kilowatt-hours in 1927 (seven months) | 23,839 |
| Average | 627 |

This shows an increase of 90.5 per cent for seven months of 1927, as compared with twelve months in 1926.

### Benefit of Commercial Approach

These figures support the opinion that new customers begin service better educated to the value of electrification on the farm than do old customers. Their consumption starting from the outset at monthly figures is greatly in excess of that of old customers. One rural customer recently added to a rural line was properly approached by the commercial department in that area and placed an order for the following equipment: One refrigerator, one washing machine, one vacuum cleaner, one ironing machine, one electric iron, one toaster, one percolator, one electric range. It is easy to understand why this customer's first meter reading indicated a consumption of 363 kw.-hr.

# Letters from Our Readers

## *District Representative Plan Misunderstood*

*To the Editor of the* Electrical World:

I note on page 1311 of your Dec. 24 issue that the writer of the article is laboring under the impression that the Stone & Webster district "representative plan" is primarily for the purpose of selling appliances, instead of what it really is: A complete and adequate "service" established for the purpose of promoting customer understanding and appreciation by a complete, well-rounded and satisfactory effort adequately to serve the public.

To render this complete and satisfying service, among other things the district representative plan substitutes an intelligent, high-grade and adequately trained district representative, whose first duty is to see to it that customers in his district receive adequate and satisfactory service. The representative reads the meters, which duty becomes a means of frequent and systematic contact with the customer, thereby rendering the superior service to be expected from a really competent person. A woman commentator has recently stated that women always like to do business with people whom they know and whom they can trust. The carefully selected and trained district representative fulfills this need.

The kilowatt-hours sold to the average residence customer may be accepted as a practical measure of the satisfying service rendered by the utility. To sell and deliver a large number of kilowatt-hours, the home customer must possess reliable appliances, so satisfactory that they will be in constant use. The practical way promptly to bring about this condition is to see to it that the home customer is induced to purchase the kind of equipment necessary, which will be used because its use is an advantage.

If the utility does not see to it that this is done, development and revenue will lag with the result that customer understanding and appreciation of the service rendered to the customer, as well as good public relations will suffer. If the utility relies only upon other sales agencies than its own, whose sole interest is from the standpoint of merchandising profit, and if it does not lead in sales activities, there is a lack of prompt and adequate development of the service.

The sales effort is but one of several important duties of the district representative. Thorough, systematic and well-directed effort result in better public understanding and appreciation, which is one of the great benefits derived from the district representative plan. Customers recognize and welcome the district representative plan as a superior service and not as a selling scheme, although large sales result. Such an inexcusable episode as that detailed in your editorial "Good Intentions Gone Wrong" (Dec. 31, 1927, page 1335) could not happen under a bona-fide "district representative" plan.

Norman T. Wilcox.

## *Principles Underlying Economical Water Heaters*

*To the Editor of the* Electrical World:

I have been interested in the article appearing in the Nov. 19 issue of the Electrical World entitled "Electric Water Heating" because I have developed equipment of this kind for use on our central heating plant, using steam as the heating medium. I believe all of the arrangements shown in the illustrations could be modified to give an adequate supply of hot water from much less energy.

I have found that if the water is heated very hot, only a very little is necessary; but if not heated so hot, each user will run off a great deal of warm water in the hope of obtaining some that is hotter, resulting in a great waste of heat. To take advantage of this condition, a small amount of water should be heated very hot in the top of the boiler with as little transfer of heat to the bottom as possible, the heater gradually increasing the depth of the very hot water to act as a reserve supply. By having the cold water enter the side of the boiler near the bottom in place of the top, this condition will be greatly improved as to all three of the designs shown.

The heater shown in the third illustration on page 1046, inserted through the side of boiler about half way up, will have to heat all the water above it before any warm water is obtained, while the space below it will be found nearly useless. The heater on the outside, shown in the center cut connected with circulating pipes, will work well when new, but the bottom circulating pipe will gradually get stopped up with dirt, resulting in an overheated heating element and a very poor supply of hot water. The heater inside the boiler and surrounded by a tube would be almost perfect if the tube could be made large and of a non-heat-conducting material, perhaps one tube outside the other with an air space between. If the tube is just an ordinary metal tube, most of the boiler will have to be heated before any real hot water is obtained at the top.

Lewis Jones, Jr.

Overbrook, Pa.

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Pressure, Temperature and Efficiency of Condensing Turbines.*—E. A. KRAFT.—A general consideration of the theoretical features involved in the design and thermodynamics of modern turbines. The author has considered the various conditions accompanying adiabatic steam expansion from different initial pressures and under varying degrees of superheat. The bleeding of steam turbines for the purpose of preheating feed water has been considered in relation to the thermal efficiency of such practices and in connection with preheating of the steam. Resuperheating of the steam under theoretical and practical conditions and under various adjustments of operating factors, receives attention. It is stated in conclusion that so far as constructional and shop practices, materials and operations permit, it may be maintained that perfection in the design of steam turbines has been nearly achieved.—*A. E. G. Progress, (Germany)* November, 1927.

*Water Softening Practice Developments.*—CHARLES P. HOOVER.—The author has classified the developments in water softening processes according to the following orders: handling of chemicals, mixing devices, Dorr clarifiers, methods for further reducing hardness, substitution of zeolite for soda-ash to remove non-carbonate hardness, and recarbonation. The advantages and practices involved in the pneumatic handling of materials and the application of the chemicals to the water are reviewed and the types of mixing tanks or agitating devices, as well as the disposal of sludge produced as the result of this softening process, and a discussion of the relative stabilization of the softening effect with various types of hardness, are included. A brief consideration of the desirability of using aluminum salts to avoid the incrustation of sand grains through which the water is filtered has been added.—*The Canadian Engineer,* Nov. 15, 1927.

*Pulverized Fuel.*—The serial report of the Prime Movers Committee of the National Electric Light Association includes statements by operating companies utilizing pulverized fuel giving data regarding operating results and maintenance factors. Information received from manufacturers has been included in this report, and developments in design and operation, accompanied by suggestions, are offered by the equipment companies. The committee concludes that there is an increase in the use of turbulent type burners, preheated-air and water-cooled furnace walls, and that the unit system presents some advantages over the central system, although not without its own limitations and that comparative data regarding the two methods should be available within the next year. The statements by operating companies contain data on energy consumption, pulverized coal, boiler ratings, boiler efficiency and maintenance.—*Report, National Electric Light Association,* 1927.

## *Electrophysics, Electrochemistry and Batteries*

*The Generation of Electricity Direct From Heat.*—T. F. WALL.—A discussion of some laboratory experiments in the production of electricity directly from heat and an analysis of the results obtained as a result of such tests. The author states that, in view of the great advances which have been made in recent years in the production of heat resisting alloys and the work which has been successfully accomplished in protecting metals from corrosion, the thermal-electric generator has been brought within the realms of commercial feasibility. As the result of these tests, it has been established that a practical form of generator will have the hot junction maintained at the very highest temperature possible. It is further essential that the internal resistance of such a generator shall be as low as possible. These two fundamental requirements form a basis for the design in practical form of a thermal-electric generator. The author's experiments have led to the general conclusions that a gas-ring heated thermal-electric generator cannot be expected to have such a high average thermal efficiency as a coke-fired generator. The definite convenience and ease of control make a gas-ring generator a useful substitute for small accumulators, particularly for such purposes as these where a steady source of electromotive force is required. This type of thermal-electric generator may provide a valuable means for charging electric storage batteries. For a coke-fired generator, the values of the thermal efficiency become from 3 to 4 per cent, when the generator is delivering its maximum output, and 12 to 16 per cent when the generator is short-circuited.—*The Electrical Review—(England),* Nov. 18, 1927.

*High-Frequency Currents.*—E. W. MARCHANT.—A general discussion of the characteristics of high-frequency currents is offered in this article. The oscillatory discharge of a condenser, the Faraday-Mossotti theory of polarized particles, the magnetization of iron at high frequencies, the high frequency surges in electricity-supply networks, the production of electric waves by high-frequency currents, the determination of the power factor of a dielectric from the cyclogram and a method of showing magnetization curves with a cathode-ray oscillograph, are all considered.—*The Journal of the Institution of Electrical Engineers, (England),* November, 1927.

## *Generation, Control, Switching and Protection*

*Sudden Short Circuit of Alternators.*—SADATOSHI BEKKU.—The mathematical solution of the problem involving a sudden short circuit upon a symmetrical three-phase alternator may be obtained by solving the simultaneous differential equations. The author has applied the linear transformation of the method of symmetrical co-ordinate and the fundamental differential equation assumed minimum complexity. Heaviside's expansion theorem was applied to this case and the actual computation involved few difficulties. The mathematical solution of the problem involved in the case of the ordinary salient pole alternator upon sudden short circuit was found to be too complicated for ready solution but was verified from experiment which indicated that the machine may be treated as the ideal symmetrical alternator of appropriate electrical constants, without causing any serious error. The concept of the equivalent symmetrical alternator is convenient for the study of transients and the constants may be determined by various measurements. The three-phase short circuit current may be considered to consist of damped, direct current components, tending to zero, and the damped alternating current components tending toward the sustained short circuit current. The damped alternating current component may be considered as the constant induced voltage provided by the variable positive phase sequence impedance. From calculations and tests the assumption has been verified that the transient positive phase sequence impedance just after the occurrence of short circuit is practically equal to the sustained positive phase sequence impedance of the alternator. The latter is constant for the sudden application of negative phase sequence voltage. The author concludes that the short circuit current of the ordinary alternator may be calculated from several measured data, which are open circuit tests, short circuit tests, stator resistance and negative phase sequence impedance.—*No. 203, Researches of the Electrotechnical Laboratory* (Tokyo).

## *Illumination*

*Improved Designs for Stage Lighting Equipment.*—W. C. BROWN AND F. M. FALGE.—Developments in types of theaters and of presentation, as well as the growth of syndicate management, have brought about notable improvements in stage-lighting facilities. The authors have summarized the limitations of older practices in stage lighting, the requirements of the various classes of equipment and the characteristics incorporated in modern design. The discussion is limited to general stage lighting and does not treat of the important class of operations utilized for a special effect. Footlights, overhead lighting, proscenium borders, border lights, cyclorama lights, floodlights and spotlights are all considered in connection with their use for achieving the desired illumination. Suggested balances in illuminating effects have been made specific in several instances. — *Transactions of the Illuminating Engineering Society*, 1927.

*Farm Lighting.*—W. C. Brown.—The principles and construction methods involved in the satisfactory illumination of farms, houses, barns and outside areas is the subject of this bulletin. A general exposition of the principles of good lighting as related to the sufficiency of light and the elimination of glare, as well as the correct size of reflector for the type of bulb required, and the selection of lamps of the proper voltage, receive specific recommendations for the lighting of each of the structures found on farm properties. The lighting of the farm home, including the various rooms, hallways, passages, etc., is discussed, and recommendations for the installation, wiring, wire size and general construction are made—*Bulletin No. 53, National Lamp Works.*

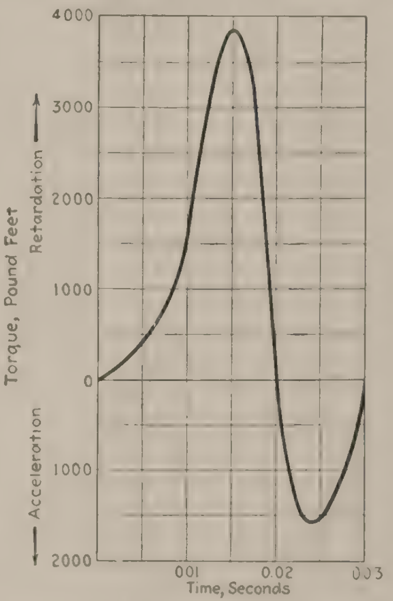
## *Transmission, Substations and Distribution*

*Hollow Conductor for 220/380-Kv. Line.*—D. I. Fuchs-Rieks.—The Rhine-Westphalian double-three-phase transmission line has a length of 125 miles and will operate at 380 kv. A hollow copper cable, made of two layers of rectangular strands, wound over a twisted copper ribbon was chosen. The outside diameter of the cable is 1⅝ in., and its weight is 14,400 lb. per mile. Complete mechanical tests were made in the laboratory on sample pieces of this cable to establish its safety. An ultimate rupturing strength of 29,500 lb. was measured. The cable was shipped on large drums, each holding 6,700 ft. in one piece. A number of interesting details are given, describing the method of installing this heavy cable on the high steel towers of the line. Thirteen long-span river, valley or road crossings had to be provided. Ten-disc insulators of either single or double string type, equipped with a top and bottom ring equalizer, insulate the six lines from the towers.—*Siemens Zeitschrift*, October, 1927.

*1,000-kw. Complete Automatic Portable Sub-station for British Columbia Electric Railway Company.*—In an endeavor to secure an adequate source of reserve equipment to insure complete continuity of service, a 1,000-kw. automatic sub-station was mounted upon a flat car and a superstructure built around a portion of it. This installation consists of a 1,000-kw., 600-volt, direct-current, 6-phase, 60-cycle rotary converter; 1,100 kva., 3-phase, self-cooled transformer, adaptable to converter voltages of 34,500 and 11,500; a motor-operated high-tension oil circuit-breaker and all accessories, including alternating current and direct current lightning arresters, gang-operated air-break switches, and two service-restoring 1,000 amp., direct-current feeders. The converter and switchboard are inclosed, while the transformer, oil circuit-breaker and other high-tension apparatus is of the outdoor type and is mounted on the uncovered portion of the car. The station is full automatic, being started and stopped by load demand. It is fully protected against low voltage, phase failure, phase reversal, alternating current overload, direct current overload, overheating of the converter windings, overheating of the converter bearings, reverse polarity, overspeed, phase unbalance, loss of field, and direct current reverse current. The power transformer and instrument transformers may be connected to operate either from an 11,500 or a 34,500-volt line.—*Electrical News (Canada)*, Nov. 15, 1927.

## *Units, Measurements and Instruments*

*An Instrument for Measuring Short-Circuit Torque.*—B. W. Penney.—It is stated by the author that the torque produced by a short circuit, or other transient will cause a corresponding acceleration of the rotor of an electrical machine. If the rotor is not connected to a load, the acceleration will be directly proportional to the torque. A small instrument is described which can be attached to the end of the shaft of the machine to be tested. This device records the instantaneous acceleration of the rotor, the corresponding torque being calculated. The acceleration is measured by two separate methods. The first method gives points on an acceleration time curve, and the second gives a continuous record of the torque. The change in velocity is recorded on the oscillogram, so that, by using a six-element oscillograph, a simultaneous record can be obtained, showing both the acceleration and the short circuit currents. The mechanism for closing the short circuit at the desired point of the voltage wave and the method of checking the accuracy of the instrument are described. The instrument can also be used for measuring sudden shocks to motors and other rotating machinery.—*Journal of the American Institute of Electrical Engineers*, November, 1927.



TORQUE-TIME CURVE FOR A SINGLE PHASE SHORT CIRCUIT

## *Telegraphy, Telephony, Radio and Signals*

*The Development of the Televox.*—R. J. Wensley.—Automatic substation control may be secured by means of a recently developed device, without the necessity of any communication wire other than the customary telephone line. When the telephone bell rings, this instrument lifts the receiver and a characteristic musical note indicates the receptive condition of the apparatus. A buzzer at dispatching headquarters emits a tone of definite frequency and a sending of the desired number of impulses will cause the proper circuit to function. Operation is then secured through the use of a tone of another frequency and upon completion of the transaction, the machine cuts itself off. The dispatcher's phone is entirely free from attachments, as is the receiving phone in the substation. This device is not limited to local exchange service, but may be used over toll lines, thus enabling the centralized operation of extensive transmission systems with no expense other than toll charges.—*The Electric Journal*, December, 1927.

## *Miscellaneous*

*Structure of a Protective Coating of Iron Oxides.*—Richard M. Bozorth.—This investigation constitutes an X-ray analysis of a Bower-Barff protective coating on iron, showing the chemical constitution and order and thicknesses of the three layers composing the coating. In the preparation of this coating the iron was heated to 730 deg. F. in an air-tight furnace and brought into contact with steam for about an hour, cooled slightly in the air, reheated to 715 deg. F. with steam again for another hour and cooled in the air. This method produced a coating between 0.1 and 0.3 mm. in thickness. Chemical analysis of this coating cannot determine definitely the amount of any phase because it cannot determine what phases exist. The X-ray analysis described by the author does, however, not only distinguish between the three oxides and give a means for estimating roughly the amounts of each present, but also permits the determination of the position of any phase relative to the other phases and to the iron on which the coating is formed. This analysis shows that three oxides are present in layers parallel to the surface X-rays of two wave lengths of different penetrating power are reflected in turn from the surface of the sample. The relative positions of two layers, each composed of one oxide, can be determined from the relative intensities of lines due to each oxide on photographs taken with iron and copper.—*Reprint* B-247, *Bell Telephone Laboratories, Inc*

# Book Reviews

## *Engineering of Power Plants*

By R. H. Fernald and G. A. Orrok. Third edition. New York: McGraw-Hill Book Company, Inc. 663 pages, illustrated. Price, $5.50.

In the revised edition of this good text on power plants the authors have done a fine job. This book has been notable in that it gives cost values and dimensional figures for power-plant equipment, and therefore a big task looms up when these data come up for revision in new editions. It takes daring to put cost figures on power-plant equipment, and the authors warn their readers that the values are only relative or approximate; but it is good engineering to use tangible data in colleges and it is a good idea to introduce economics into power-station classes. Accurate data are not needed to bring out methods of economic analysis in the selection of power-plant equipment.

Twenty-six chapters in this book outline the whole power-station field as it exists today and introduce to readers the equipment available and the present practices in power-station design. All through the book an economic and commercial rather than a theoretical point of view is found. The authors discuss power plants in terms of equipment or of application, and general considerations are brought out whereby the element of common sense is developed in the student. While primarily a college text book, there are many engineers who will find the new edition very valuable.

## *Direct Current*

Vol. I. Second edition. By Chester L. Dawes. New York: McGraw-Hill Book Company, Inc. 582 pages, illustrated. Price, $4.

In the second edition of this text the author has revised several chapters, added new material and inserted new problems. It is a companion volume to his work on alternating currents and is notable for its clear and logical presentation of the subject matter. Fundamental definitions and measurements are accented, and the material is of sufficient scope to cover the subject thoroughly. The measurement chapters, the magnetic-circuit treatment and complete material on batteries are features of the text. A larger set of new problems will add to the value of the new edition.

## *Hochspannungstechnic*

By Arnold Roth. Berlin: Julius Springer. 534 pages, 437 illustrations, 3 inserts, 75 tables.

To a considerable extent practice has anticipated theory in the design of high-tension apparatus, in the author's view, the insulation being simply strengthened at points found to be weak until it stood up under operating conditions. This is ascribed to the circumstance that theory dealt with certain assumed ideal conditions—for instance, smooth cylindrical conductors for transmission lines—whereas in practice these had slight projections or rough places favoring dielectric breakdown. In machinery local overvoltages caused failures and were combated by practical measures before their cause was fully appreciated. The purpose of the present volume is evidently to give a physical picture of what is known to occur, by a liberal use of oscillograms, photographs of arcs and flashovers, and diagrams, rather than to present mathematical theories. Formulas are by no means absent; discussions of line oscillations, traveling waves and reflections are scarcely conceivable without the use of equations, but the latter are here simplified by omitting minor factors or terms, and are thus kept out of the realm, for instance, of hyperbolic functions. The book should be particularly helpful to the reader who wants to visualize the mechanism of high-tension disturbances, perhaps as an introduction to more highly analytical treatises.

## *Rotary Converters: Their Principles, Construction and Operation*

By E. P. Hill. New York: D. Van Nostrand Company. 329 pages, illustrated.

Principles and operating characteristics of rotary converters are treated in this book and design details are subordinated. It is a reference book for students and a very good book for engineers concerned with the purchase, testing, installation and operation of rotary converters and auxiliary equipments. Some design formulas and a large amount of basic theoretical matter are supplemented by good graphs, photos and commercial data. Transformers for rotary converters, starting methods and equipments, service operations, operating characteristics, and specifications and tests are fully treated. The book is a welcome addition to the existing literature on the subject matter.

## *Thermionic Phenomena*

By Eugene Bloch. Translated by J. R. Clarke. New York: E. P. Dutton & Company. 145 pages, illustrated. Price, $2.50.

The phenomena of electrical conductivity in the neighborhood of substances which are heated to a sufficiently high temperature are discussed in this book by Professor Bloch. Recent theories and researches are incorporated, especially those of Dr. Langmuir. Thermionic emission from hot substances has afforded study for scientists since 1895, and since 1910 it has supplied engineers with many new and valuable tools. Yet today, aside from a few principles, the phenomena still baffle scientists in large measure. Quantitative values are inaccurate, and what actually goes on cannot be explained on a qualified basis. Metals and salts give thermionic emissions which can be measured and studied. This is a surface phenomenon, resulting from ionization as generally accepted, but the laws of dissociation of ions, with temperature, materials, pressure and other variables, remain to be fixed accurately.

Fortunately the vacuum tube, the radio tube, the X-ray and other devices relying upon thermionic emissions have been developed and can be used. Many more useful devices lie in the future. In this little book the subject of thermionic emissions is outlined briefly in theory, in experimentation and in practical application. It is a good book to read to get a bird's-eye view of a new development in engineering.

## *Electric Currents in Telephone and Telegraph Conductors*

By J. A. Fleming. Fourth edition, revised and extended. New York: D. Van Nostrand Company, Inc. 415 pages, illustrated.

In the new edition of this excellent book Professor Fleming has revised and brought up to date the material of the older editions and has added a new chapter to treat of nickel-iron alloys, thermionic repeaters and other new developments. Carrier telephony, phantom-circuit applications and a consideration of inductive co-ordination add to the completeness of the book. This volume has long been notable for its praiseworthy presentation of a very difficult subject approached mathematically.

The late Oliver Heaviside and other writers used complicated mathematics, but Professor Fleming, using methods developed by Professor Kennelly, developed a treatment which can be understood without great labor. The book has long been a reference work and textbook for American colleges, and the new edition will be welcomed.

## Books Received

*Electrical Power Transmission.* By E. A. Loew. New York: McGraw-Hill Book Company. 388 pages, illustrated. Price, $4.

*Mathematisches Praktikum.* By Dr. Horst von Sanden. Leipzig: B. G. Teubner. 122 pages, illustrated.

*Physikalisch-Technischen Reichsanstall.* Berlin: Julius Springer. 642 pages, illustrated.

*Commercial Survey of the Southeast.* By John M. Hager. Washington, D. C.: Government Printing Office. 477 pages, illustrated. Price, $1.

*Mechanical World Year Book.* Manchester, England: Emmott & Company, Ltd. 348 pages, illustrated. Price, 1s. 6d. net.

*Emile Berliner, Maker of the Microphone.* By Frederic William Wile. Indianapolis: Bobbs-Merrill Company. 351 pages, illustrated. Price, $4.

*Electric Control Gear and Industrial Electrification.* By William Wilson. New York: Oxford Press. 336 pages, illustrated. Price, $8.50.

# News of the Industry

## Honor Paid to W. W. Freeman

*James H. McGraw Award Medal for Co-operation Presented to Him at Banquet Attended by Many Prominent Executives*

A DISTINGUISHED company of electrical men paid tribute to W. Winans Freeman on Tuesday evening at a dinner given at the Hotel Roosevelt, New York, on the occasion of the presentation of the James H. McGraw Award medal for co-operation. Prominent executives of the central-station, manufacturing, jobbing and contractor-dealer industries, to the number of three hundred, from Eastern points and as far west as Chicago, gathered to express the approval of the industry of the outstanding service rendered by Mr. Freeman in accomplishing the reorganization of the Society for Electrical Development, by which its directorate has been made officially representative of the major national associations of the industry. It was in recognition of this that the medal was awarded.

Mr. Freeman is chairman of the Union Gas & Electric Company of Cincinnati, vice-president of the Columbia Gas & Electric Company, New York, and for eight years has been president of the Society for Electrical Development. The speaking program constituted a symposium by the executives of the organized industry, Howard T. Sands speaking for the National Electric Light Association, Clarence L. Collens for the National Electrical Manufacturers' Association, George E. Cullinan for the Electrical Supply Jobbers' Association, Joseph A. Fowler for the Association of Electragists and J. E. North for the League Council.

P. G. Gossler, president of the Columbia Gas & Electric Company, paid a personal tribute to Mr. Freeman, and Owen D. Young, chairman of the General Electric Company, eulogized the practical ideal which is the basis of the McGraw Award, the recognition of the service of individuals in the advancement of the industry.

Mr. McGraw, in presenting the medal and purse, further developed this theme. He said:

> The greatest problem in our highly specialized business world of today is the development of men. If highly organized corporations are so dependent upon individuals for the necessary enthusiasm and initiative, how much more urgent is the need of the great industry? In a close-knit business organization there are many practical incitements and rewards for original thinking and the independent exercise of resourcefulness and responsibility. But the work men do in the broad interest of an industry finds no such ready recognition and recompense. The time most men give to association activities is usually wrested from the day's work and is only accomplished by personal sacrifice and an increase of the loads they carry.

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W. W. FREEMAN

> It is impossible, however, to overestimate the importance of national policies and purposes in the affairs of an industry. National ideals and ethics inspire broad, embracing programs that can only be accomplished as a product of co-operation. They influence the results which both the local and the company policies may be expected to effect. Such ideas as standardization within an industry, elimination of waste through simplification in the number of excess and duplicating varieties of manufactured products, uniformity in terminology, co-ordinated or co-operative sales campaigns and a dozen other expressions of industry co-operation could never have been initiated or established but for the leadership of men who were willing to take time from their own personal and company affairs to work for the co-operative development of the common purposes of the industry in which they were engaged.
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> It has been an unfortunate and perhaps a costly thing to industry that it has been so difficult in the past to recognize contributions made by men in association work or as individuals. There has been no official time or place nor appropriate occasion in which their services to the industry could and would be acknowledged and publicly recognized as a natural expression of the industry's appreciation. We must strengthen the appeal of co-operative work among eligible men, and if we are to develop this we must find many ways in which the individual may find the rewards that come through the attention, the understanding and the sympathy of the industry for which he works, without which he cannot find full satisfaction and feed the fire of his spirit. I hope that through the years to come these awards may assist in encouraging men to think for the broader interest of the industry at large.

Mr. Freeman received an ovation. In responding he dwelt upon the promise of broadened opportunity now opened to the electrical industry through the closer unity that has been effected between the national associations. He modestly insisted that the credit for the accomplishment should go to his associates on the directorate of the society and to the staff.

Charles L. Edgar, president Edison Electric Illuminating Company of Boston, was chairman of the dinner committee. Frank W. Smith, vice-president United Electric Light & Power Company, New York, was toastmaster.

Mr. Freeman was selected for the award by judges representing the four branches of the industry—J. E. Montague, S. L. Nicholson. G. E. Cullinan and James R. Strong. The following citation accompanied the medal presented to Mr. Freeman:

> W. Winans Freeman, chairman of the Union Gas & Electric Company, Cincinnati, and vice-president of the Columbia Gas & Electric Company, New York, as president of the Society for Electrical Development for eight years, has been an outstanding leader in the cause of co-operation in the electrical industry. He came to head the society at a time when, owing to a lack of official tie-in with other industry organizations, it was an imperfect instrument. But the time was not then ready for an actual affiliation between the national groups, for electrical men had not yet become convinced of the industry's need, in the field of market development, for centralized leadership and service. In the face of problems and difficulties which would have proved insuperable to men of ordinary courage, Mr. Freeman carried forward the work with unflagging zeal and confidence and, by his personal encouragement and guidance, made possible the more rapid and effective organization and development of local electrical leagues throughout the country and the establishment of other valuable services to electrical progress.
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> Despite discouragement, he held to the task until a year ago the critical financial condition of the society arrested the attention of the industry and compelled decision, whereupon with unabated confidence and enthusiasm Mr. Freeman seized the opportunity to make the problem officially an industry concern and, at a heavy cost of his personal time and energy, brought about a sweeping reorganization of the society directorate. By the appointment of the presidents and managing directors and other representatives of the four major national associations of the electrical industry and the League Council, he achieved a broad official co-ordination of all electrical interests, so that the directorate of the society now becomes practically a council of the industry.
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> In recognition of this distinguished contribution to the advancement of the spirit and practice of co-operation among electrical men, the judges have awarded to Mr. Freeman the medal and purse for co-operation for 1927, given under the James H. McGraw award.

# Manufacturing Profits and Policies

## Federal Trade Commission Dwells on These in the Second Part of Report on Electrical Industry—Holding Companies Weighed—N.E.L.A. "Lacking in Frankness"

LITTLE to support the demand for an investigation of the electrical industry is contained in part two of the Federal Trade Commission's report, which was sent to the Senate on Jan. 12. While the report points out that "the financial operations of holding companies escape state regulation" and mention is made of complaint that the state commissions must pass upon the allowance of items without having the authority to obtain information regarding their reasonableness, there is nothing in the report suggesting centralized supervision of the industry from Washington. It seems to be the idea of the Trade Commission that there might be federal legislation which would give the state commissions more latitude in obtaining information from companies chartered in another state. The Federal Trade Commission's summary of its report follows, with small omissions:

The General Electric Company has been for many years the largest manufacturer of power-plant machinery and equipment in the United States. Its value of sales billed increased from $16,000,000 in 1893 (the first complete year after its formation) to nearly $327,000,000 in 1926; its total investment increased from about $51,000,000 in 1893 to nearly $382,000,000 in 1926, and its net earnings were a little less than $3,000,000 in 1893 and (before deducting federal income taxes) over $59,000,000 in 1926.

As compared with the census classification of "electrical machinery, apparatus and supplies," which includes important products that are not used by the electric power industry, the value of the General Electric Company's output has represented from 16 to slightly more than 20 per cent of the total value for the country in recent census years. For the more important units of electric power equipment the General Electric Company's proportion is larger, representing for the census years 1919, 1921 and 1923 from 46.9 to 51.6 per cent of the value of all generators, from 52.2 to 58.3 per cent of the transformers, from 34.2 to 42 per cent of the motors, and from 32 to 45.1 per cent of the control apparatus. These percentages measure roughly the importance of the General Electric Company as a producer of the heavier lines of power equipment.

Prior to 1925 the three largest companies were the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Manufacturing Company. In 1925 the American Brown Boveri Electric Corporation, a domestic company manufacturing under American and foreign patents and technical information, was organized, thereby adding a fourth company to the group. The Brown Boveri company acquired several important firms manufacturing transformers, switches and electric railway equipment.

### Manufacturing Profits

During the five-year period 1922-1926 the rate of profit of the General Electric Company, before deducting federal income taxes, ranged from 11.2 per cent to 16.2 per cent. Considering only the earnings on its investment in the electric manufacturing business (i.e., excluding outside investments), the rates of return during the same period ranged from 14.3 per cent to 22.8 per cent. The profits of other electrical companies were not obtained for this period, but for 1924 financial reports were received from 79 companies engaged to a greater or less extent in the manufacture of goods used by the electric power industry. The average rate of return for these companies, which had an aggregate total investment of about $490,000,000, was 9.6 per cent in 1924 as compared with 15.1 per cent for the General Electric Company, though some of these companies had higher rates of return than the General Electric Company.

The inquiry respecting competitive conditions in the manufacture and distribution of electric power equipment was limited to those lines, such as generators, transformers, motors, switches and switchgear, station equipment and line materials, that are essential to the production and distribution of electrical energy. Prior to 1925 the manufacture of such equipment was carried on partly by the three large companies mentioned above, generally known as "full-line" companies, manufacturing practically all kinds of power equipment, and partly by a large number of smaller "short-line" companies, confining their production in some cases to a single kind of equipment.

### Large and Small Companies

The prices of these large companies are regarded in the trade as maximum levels above which the other comparatively small manufacturers generally cannot hope to sell. It is also the general belief among these comparatively small manufacturers that the large companies compete actively in price, quality and service. Some small manufacturers stated that although the large companies undoubtedly have the power to crush them by price competition, this power has not been used in recent years. It was stated, however, by certain small manufacturers of fractional-horsepower motors that in recent years prices have been reduced to levels at which they have been unable to compete. Many small manufacturers, on the other hand, stated that other small companies rather than the very large ones are their sharpest price competitors. The general opinion among the many small manufacturers called upon was that the General Electric and Westinghouse companies dominate the trade chiefly because of their financial resources, country-wide distribution and service organizations and their control of many of the largest wholesalers. The elements in the competition of the large companies that are most difficult for the small manufacturers to meet are the lump-sum bid, the quantity discount and the consignment of motors. There was some complaint of oppressive patent litigation, but no substantial evidence has been obtained on this point.

Preference for the equipment of one manufacturer over that of another because of previous installations plays an important part in the purchasing of some power interests, but in general power companies secure competitive bids and appear to purchase their equipment from the lowest bidder, other conditions as to the guaranteed efficiencies, times of delivery, etc., being satisfactory. Some large power groups distribute their purchases among different manufacturers for the specific purpose of maintaining competition.

Several manufacturers stated that prior to 1925 they were unable to sell to companies affiliated with the Electric Bond & Share Company, which was then controlled by the General Electric Company. Executives of the Electric Bond & Share Company stated that the company's policy had always been to purchase from the General Electric Company only in case the latter's prices and terms were at least as favorable as those of other companies. A study of the generators in use during 1925 in the plants of companies affiliated with the Electric Bond & Share Company, however, showed that for specified five-year periods within which such generators were installed from 1905 to 1925 91 to 97 per cent were of General Electric make, as compared with from 60 per cent to 75 per cent for other privately owned companies not so affiliated and from 36 to 44 per cent for municipal plants.

### Patents and Research

The General Electric and Westinghouse companies, through their research organizations, have been leaders in developing patents, technical information and manufacturing experience in the nature of trade secrets that are of value to companies in foreign countries. Foreign companies likewise have patents and information valuable to companies in America. The result is that these two large American companies have severally entered into contracts with numerous large electrical manufacturing interests in the principal foreign industrial countries. By these contracts each party, among other things, makes the other its exclusive licensee under its patents in a specified territory. Thus these two large American companies have obtained the American rights under the foreign patents of many of the most important foreign companies. These rights may be used or withheld from use as the big companies see fit, as no other American manufacturer can obtain the rights without the consent of their American holders. Thus potential competition both of the foreign companies and of other American manufacturers who might otherwise obtain rights under the foreign patents is eliminated.

In the beginning of the electric power industry two or more independent plants frequently competed in supplying electrical energy in a given locality. This, however, resulted in comparatively small plants and in duplication of distribution lines, with resulting high costs for the energy sold by each of the competing companies. Consolidations of local companies followed, until at the present time each city or district usually is supplied by a single operating company. In most states these local monopolies are recognized by laws declaring them to be public utilities subject to governmental regulation. State regulation of sale of power is confined to intrastate commerce. The growing movement of power across state lines, with the development of large operating units and their connection to form larger so-called "superpower" systems, is steadily increasing the importance of interstate commerce in power, which is beyond the field of state regulation and for which there is at present no adequate provision for federal regulation.

### Holding-Company Situation

Particularly during the last twenty years, numerous so-called holding companies have grown up which control, finance and manage local operating companies, sometimes situated in as many as twenty or more states. These holding companies normally own only voting stocks amounting in many cases to not more than 25 per cent of the total outstanding capitalization of operating companies. In many states the issuance of securities by operating companies and the expenditure of funds raised thereby is subjected to state regulation. The final transactions of a mere holding company, however, controlling operating companies in a given state but chartered in another state, escape direct regulation, because the holding company is not engaged in intrastate commerce in that state nor even doing business there. Consequently, the opportunity for unchecked speculative pyramiding of holding-company structures exists, and it has been exploited by the sale to the public of a large volume of holding-company securities that are based upon their equities, merely, in what has been aptly described as the "control of control" of operating properties. Not only do the financial operations of holding companies escape state regulation, but the fees charged for their services to operating companies likewise occasion difficulty to state regulatory agencies. Fees for financing and construction services are allowed to be capitalized as a basis for rates, while fees for operating management are chargeable to operating expenses. State commissions must pass upon the allowance of these items without adequate authority to obtain information regarding their reasonableness, if the holding companies are incorporated in other states. Some complaint on this score has been noted in particular instances.

### RATE REGULATION

Rate regulation was one of the earliest and still is the most important function of state regulatory bodies. The determination of the amount of investment to be used as a basis for measuring the fairness of rates is an important feature of rate regulation. The view of the Massachusetts and other state utility commissions as well as of the Interstate Commerce Commission that capital honestly and prudently invested should be taken as the controlling factor in the determination of fair and reasonable rates appears to be gaining ground. It is the frequent practice of holding companies, however, to group a number of local operating companies and merge them to form a single large operating company, with the possibility of profit to the holding interests in the turnover of the properties. Applications to state commissions for increased valuations following such mergers sometimes have been made and allowed.

The characteristic feature of the power industry under governmental regulation is the absence of competition in the usual sense of the word. Electric power, however, is in constant competition with other forms of power, particularly in the manufacturing industries. Electric power companies, therefore, frequently offer exceptionally low rates to induce industrial concerns to buy power rather than to produce it, and they also make sales to distributing companies at low rates. Such low rates, often made by special contract and with little or no effective supervision by regulatory agencies, may be for sales of power in interstate commerce, in which case state commissions do not have jurisdiction. Consumers of electrical energy for lighting, however, whose aggregate consumption represents not more than 25 to 30 per cent of the total demand but who pay 60 to 70 per cent of the gross amount derived from sales of energy, are dependent upon effective public regulation to insure that their rates are fair.

A notable feature of the power industry is the competition among holding-company interests to acquire desirable operating properties in various states. The frequent result of this competitive bidding, it is alleged, is speculative fluctuations in the prices of voting stocks of operating companies, for which prices paid often do not coincide with book equities nor bear any reasonable relationship to past or probable future earning capacities.

### THE INDUSTRY ASSOCIATIONS

The power industry has a large and very active trade organization—the National Electric Light Association, which in 1926 included in its nine classes of membership 15,820 of the leading power operating and holding companies, manufacturers of electric power equipment, engineers, scientists and others interested in the development of the power industry. The object of the association, as set forth in its constitution, is to advance the art and science of the production, distribution and use of electrical energy largely through educational methods. The association's activities may be classed under three general heads: (1) Compilation and dissemination of technical and other information; (2) co-operation with other organized groups of manufacturers, dealers, engineers, scientists, financial interests, underwriters and with state and federal governmental agencies in the consideration of matters affecting the power industry, either directly or indirectly, and (3) educational activities intended to create public good will for the industry as at present conducted under private ownership subject to public regulation. Through its extensive divisional and committee organization, co-operation with technical, trade, financial, governmental and other organizations, and through its contacts with the press and other agencies for the molding of public opinion, the association undertakes many lines of activity that are unusual in trade association programs, and until quite recently, at least, it has sometimes been lacking in frankness toward the public.

There were formerly two manufacturers' trade associations and one manufacturers' social organization, federated under what was known as the Electrical Manufacturers' Council, which in 1927 were consolidated under the name of the National Electrical Manufacturers' Association. The council exercised an unusual amount of control over the activities of its constituent associations in applying the rule that all acts or proposed activities should be subject to review by the council's legal committee and its employed counsel. In this way the council was apparently alert in keeping the manufacturers' association activities in line with the requirements of the anti-trust laws.

## Rate Cut to Save Cleveland Consumers $1,500,000

Announcement has been made by the Cleveland Electric Illuminating Company that a reduction amounting to approximately $1,500,000 will be made this year in the cost of electricity to residential and commercial consumers because of lower rates. The reduction was made possible by increased efficiency and economy in generation of electricity, according to company officials, and, in accordance with its policy, is passed on to the consumer. This is the third reduction announced by the company in the last four years.

The new rates as announced are 5 cents per kilowatt-hour for the first 80 kw.-hr., 4 cents for the next 420 kw.-hr. and 2.8 cents for all energy over 500 kw.-hr a month. The former rate was 5 cents for the first 500 kw.-hr. and 2.8 cents for more than 500 kw.-hr.

## Boulder Dam Bill Is to Be Reported Favorably

*Committee So Decides, Despite Vigorous Opposition from Arizona Men—Four of Secretary Work's Fact-Finding Advisers Report*

A FAVORABLE report on the Swing-Johnson Boulder Dam bill will be made Jan. 14 by the committee on irrigation and reclamation of the House of Representatives. An announcement to this effect was made Jan. 10 by Representative Smith of Idaho, the chairman of the committee.

Mulford Winsor, president of the Arizona State Senate, appeared before the committee and urged that no legislation be enacted until an agreement can be reached by all of the states in the basin. It was declared that a similar view is held by Utah, Wyoming, Colorado and New Mexico. Representative Douglas of Arizona told the committee that the bill was unsound and summarized his reasons for that conclusion as follows: (1) Because by its very terms it implicitly provides for additional appropriations in excess of the $125,000,000; (2) by its very terms construction work and expenditures of money cannot be begun before firm and binding contracts for the sale of electrical energy are in hand; (3) because, even though contracts in hand be necessary and essential under the terms of the act before construction work could be begun or expenditures made, it will be impossible to obtain such contracts; (4) because the federal government can never be reimbursed for its expenditures, even assuming that it could obtain contracts; (5) in the absence of an agreement with Mexico, or pronouncement placing Mexico on notice, the construction of a dam at Boulder Canyon under the terms of the Swing-Johnson bill will provide a regulated flow of water which can and will be so applied to beneficial use in Mexico that the southwestern part of the United States will be seriously affected in its agricultural development throughout its entire future.

H. S. McClusky, a member of the Arizona Commission for the Colorado River, told the committee that in considering charges that the "Power Trust" is financing the opposition to the Swing-Johnson bill attention should be given the fact that "a pernicious lobby is lined up in support of the measure." He said further that a former governor of Pennsylvania and the Hearst organization are connected with this lobby.

Secretary Work of the Interior Department wrote to Chairman Smith indorsing the bill, and the committee had also before it four reports from as many advisers named in April by Secretary Work to consider the project from every angle. Senator Waterman of Colorado, a fifth adviser, has not yet reported.

The advisers, including James R. Garfield, former Secretary of the Interior; Governor Emerson of Wyoming, former Governor Scrugham of Nevada and Professor William F. Durand of Stanford University, reported individually on questions asked by the Secretary as to the feasibility of the project and whether or not the government could and should proceed without unanimous approval of the Colorado River Basin states.

Indorsement of the project is contained in the Garfield report, which also urges its immediate construction, primarily because of flood menace to the Imperial Valley. It holds that the federal government has the right to proceed.

The Scrugham report, while urging immediate action, deals largely with the power to be developed, and suggests a plan for allotment of power which Mr. Scrugham believes would be approved by Arizona, Nevada and private power interests.

While recognizing the need for flood protection, Governor Emerson insists that the Colorado River compact should be ratified by all seven states before the proposed legislation is enacted.

Engineering features stand out in the Durand report, which emphasizes the flood danger and declares that the All-American Canal, which its proponents hold would relieve the Imperial Valley from dependence upon Mexico for water, is not only an urgent need, but that it could be constructed for considerably less than the government's estimate of $31,000,000.

The Chamber of Commerce of the United States has adopted resolutions directed against government ownership at Boulder Dam.

## "The New Competition" to Come Before N.E.M.A.

Charles F. Abbott, executive director of the American Institute of Steel Construction, will address the general meeting of the Supply Division of the National Electrical Manufacturers' Association on the afternoon of Tuesday, Jan. 24, on "The Third Industrial Revolution," giving experiences of the steel industry which may help the electrical industry to meet its own problems. H. T. Bussmann of the Bussmann Manufacturing Company will follow Mr. Abbott with an account of what the sales conference has accomplished and will also present a program of action for the Supply Division.

The grounding and distribution sections of the National Electrical Code will provide important topics at the convention, which will extend from Monday to Friday, and there will be full discussions on the development of markets. Study of "the new competition" will also form part of the proceedings.

A dinner meeting of section chairmen of the Supply Division, with D. Hayes Murphy presiding, will be held at 7:00 p.m. at the Hotel Commodore on Jan. 23. Gerard Swope, president of the N.E.M.A., and members of the board of governors will attend.

## Wired Radio, Inc., Applies for Wave Bands

Wired Radio, Inc., has applied to the Federal Radio Commission for permission to use short waves for broadcasting radio programs over light and power wires. The commission will take no action until after the hearing on short-wave allocations on Jan. 17. The request was for permission to use three frequencies in the band commencing with 1,500 kilocycles.

The North American Company bought the plans of General George O Squier several years ago and through its subsidiary, Wired Radio, Inc., has been developing the system for several years. The latest technical development permits of a single receiving set with three switches for use in the reception of any of three programs sent over central-station three-phase systems. As visualized in future development, programs will be made at a central location and will be transmitted by wire to the ultimate user. If the plan becomes popular, it may be that the way will be opened for charges to users of the equipment.

The application placed before the commission indicates the ripening of the wired-radio plan, and it is reported that several electrical groups are concerned in starting it on its career. The utilities are much interested because the sets will use considerable energy.

## Floodlighting the Quaker City Edison Building

An unusually fine example of floodlighting was given at Philadelphia on New Year's Eve, as described last week (Electrical World, page 70) when the Philadelphia Electric Company's new 23-story office building at Ninth and Sansom Streets was illuminated for the first time with moving light of many hues, said to be the only permanent installation of that kind yet made. In the installation 483 floodlamps are used, rated at from 500 cp. to 1,000 cp.

The installation was designed by Arthur A. Brainerd, assistant illuminating engineer of the company. He was the winner of a McGraw prize at the last N.E.L.A. convention. The Pittsburgh Reflector Company supplied 467 of the floodlamps three weeks after they were ordered. Two 18-in. floodlamps were supplied by the General Electric Company, fourteen prismatic inclosing units were furnished by the Holophane Glass Company, while the color caps and lenses were supplied by the Laco-Phillips Company. The electrical work was installed by the J. F. Buchanan Company of Philadelphia. The total load is 262 kw.

## Herminghaus Suit Ended

*Southern California Edison Company Acquires 17,500 Acres of Riparian Land Along the San Joaquin for Sum Put at $1,000,000*

BY A SETTLEMENT out of court of the suit brought against it by the Herminghaus estate, the progress of which has been followed in these columns, the Southern California Edison Company has acquired title to 17,500 acres of land bordering the San Joaquin River in Fresno and Madera Counties. The consideration was reported to be $1,000,000.

The property involves riparian rights to water in the San Joaquin River which the power corporation was restrained from impounding in its Florence Lake hydro-electric reservoir in the Sierras east of Fresno. Litigation over the Southern California Edison Company's condemnation suit against Mrs. Amelia Herminghaus and other heirs of the Herminghaus estate to obtain these rights had lasted three years.

## Governor Fuller Backs Massachusetts Commission

In his address to the Massachusetts Legislature at its opening session on Jan. 4, Governor Alvan T. Fuller came squarely to the support of the Department of Public Utilities in its resistance to all efforts to substitute for the department's present method of rate valuation one based on reproduction cost new less depreciation and indorsed the department's recommendations as outlined in the ELECTRICAL WORLD for Dec. 17 (page 1265), declaring the time to be ripe for the enactment of such legislation.

## Sales Conference Developing Industry Program

The Industry Sales Conference, composed of delegations representing the four major national associations and the League Council, held its second meeting on Wednesday in the board room of the National Electrical Manufacturers' Association, New York, to consider the recommendations of the committee that had been appointed to study the problems presented by the present inadequacy of house wiring.

The plans of the conference are taking the direction of a broad program that will combine a national movement of locally organized selling campaigns to merchandise the idea of adequacy in house wiring, these campaigns to enlist the co-operation of all local interests, the central-station companies assuming the responsibility for leadership, and utilizing the services of the leagues. This will entail national direction and regional field service and a consistent continuing program looking forward over a term of years, with highly organized selling of convenience outlets as its first major objective.

To carry forward such a movement will require the co-operation and support of the contracting industry. The conference is developing the possibilities of organizing a broad educational work among all contractors, to promote better standards of estimating, cost keeping and business methods similar to the work that has been so successfully done in the plumbing industry. In effect this would provide an expansion of the very effective service that the Association of Electragists has been performing for its members, but to embrace the entire personnel of the contracting industry, now working for the most part uninfluenced by any association. This subject is being well studied and programmed.

At the same time, careful consideration is being given to the needs for adopting the merchandising policies of the industry to such a movement, so that the installation of additional outlets in the home may be capitalized by the immediate sale of appliances. The reports of these functional committees were analyzed and finally referred to the executive committee of the conference as the basis for the full report and recommendations which will be presented this spring to the four national associations, now acting as a council of the industry in the directorate of the Society for Electrical Development.

## *A New Year's Epitome of "Electrical World" History*

The *Electrical World* (published under that name since 1883 and tracing its history back to 1874) is a consolidation of the *Electrical Engineer* (founded in 1882 as the *Electrician*) and the *American Electrician* (founded in 1896). Final consolidation under the title of *Electrical World* took effect on Jan. 1, 1906, the *Electrical World* and the *Electrical Engineer* having been acquired by the McGraw Publishing Company in 1899 and amalgamated as the *Electrical World and Engineer*, and the *American Electrician*, a McGraw monthly, having been absorbed seven years later.

The roster of past editors of the *Electrical World* includes Carl Hering, Louis Bell, W. D. Weaver, T. C. Martin and many other men prominent in the electrical industry—some, like those named, no longer living, and others, like C. O. Mailloux, A. S. McAllister, Frank F. Fowle, F. M. Feiker, D. H. Braymer and H. V. Bozell, still active in engineering and industrial service. William H. Onken, Jr., is now editor and L. W. W. Morrow managing editor. Other members of the present staff are: Earl Whitehorne, commercial editor; Allen M. Perry, associate editor; G. F. Wittig, statistical editor; H. M. Cameron, financial editor; F. C. Wells, news editor; Eustace C. Soares, manufacturing and markets editor; E. R. Searles and E. M. Glennon, assistant editors; F. R. Innes and T. P. Kindig, Western editors; H. S. Knowlton, New England editor; Walter C. Heston, Pacific Coast editor, and Paul Wooton, Washington correspondent.

## Ontario Hydro Defeated at "the Soo"

*Voters of Sault Ste. Marie, Ontario, Accept Plans of Great Lakes Power Company in Preference to Those of Provincial System*

THE Ontario Hydro-Electric Power Commission lost its fight for the development of power at Sault Ste. Marie, Ontario, in the municipal elections in that city on Jan. 2, when a majority of the voters accepted the Great Lakes Power Company's proposal to supply the power needs of the community. (See ELECTRICAL WORLD for Dec. 10, page 1219). One feature which entered into the contest in its closing hours was an announcement by the Algoma Steel Corporation that a win for the Hydro would destroy the labor of five years in negotiations for an extension of its industries entailing an expenditure of $12,000,000. The steel plant has arranged for power at a definite price, and it insisted that a victory for the Hydro would put the whole power question "up in the air."

The Algoma Power Company, which, like the Great Lakes Power Company, is a subsidiary of the Middle West Utilities Company of Chicago, will begin surveys at once on the Montreal River, 90 miles from "the Soo," where it is held that 25,000 hp. can be developed and transmitted.

## A.E.C. Steadfast Against Federal Ownership

Meeting in Washington from Monday to Wednesday inclusive of this week, the American Engineering Council went on record in opposition to the expenditure of federal funds for the Boulder Dam project, on the ground that it involves federal ownership and sale of power. The council therefore voted its disapproval of the Swing-Johnson bill. The bill of Senator McKellar to establish a Muscle Shoals commission was likewise disapproved by the meeting.

That the American Engineering Council is opposed to the principle of federal subsidy was also made clear in a discussion of the Tillman bill, which would advance government funds for the development of agriculture, home economics and industry. While agreeing unanimously that the engineering profession should support a sound federal program to assist agriculture, it was maintained that this form of assistance does not coincide with the engineering point of view.

Action of the council on legislative measures followed the recommendations of its public affairs committee, headed by A. W. Berresford of New York. Mr. Berresford, a notice of whom appears under "Men of the Industry," was elected to succeed Dean Kimball of Cornell University as head of the A.E.C. Sir Esme Howard, Ambassador from Great Britain to the United States, was the speaker at the banquet on Tuesday evening.

# "Electrical World's" London Letter

## Underground Cables Urged by Heterodox Engineer for England's Proposed Interconnected Network—Standardization, Lighting, New Installations, Commercial Progress, "Personals"

By Bernard C. Holding
*Editor of "The Electrician"*

London, Jan. 1, 1928.

ELECTRICALLY speaking, the last months of 1927 over here were full of items of interest, though it is difficult to point to any one of these as being of outstanding importance.

One interesting feature has been the reading of the inaugural addresses of the chairmen of the various sections of the Institution of Electrical Engineers. In these addresses many unorthodox viewpoints have become apparent, one of the sectional chairmen actually having the temerity to urge the merits of underground cables, as against overhead lines, for the extensive interconnected supply network that is proposed for this country. Committed, as we seem to be, to the overhead method, this voice cannot be regarded otherwise than one crying from the wilderness, even though the arguments adduced in favor of the underground method seem to have some merit.

Great activity is noticeable in the issue of British Standard Specifications for various types of electrical equipment. During November a revised specification was issued for bayonet lamp holders, the dimensions of which will now conform to the international standard laid down by the International Electrotechnical Commission in so far as interchangeability is concerned. Another new standard established is for reversible protected-type two-pin plugs and sockets with earthing connections.

### Interest in Lighting

As we have heard from one of our illuminating engineers who studied lighting conditions in such places as New York, Chicago, Detroit, Cleveland, Schenectady, Boston and Philadelphia, great attention is being paid to lighting service in your country. Similar interest is being aroused over here by the various lighting service bureaus which have been established in some of the large towns. The London bureau has recently been rearranged on new lines which permit the reproduction of both good and bad lighting in actual home, shop, school and factory surroundings. Great success is also attending the giving of lectures on home lighting to large audiences of housewives, schoolteachers, tradesmen and others.

In the field of public lighting it is becoming increasingly apparent that the whole of the lighting of thoroughfares in this country should be placed under the supervision of one central advisory body. With the continued growth of motor traffic, the part which suitable public lighting can play in accident prevention assumes ever-increasing importance, and this factor alone is sufficient reason for tackling public lighting problems on national lines.

On the electricity supply side of the industry, November has seen the inauguration of power-station extensions at the municipal undertakings of St. Pancras and Stoke-on-Trent, the former comprising a further 10,000/12,500-kw. Brush-Ljungström generating set. This station was the first in England to install plant of this type, having started up a 1,500-kw. set by the same makers in 1914. During the month one of the London company undertakings—the Charing Cross Electricity Supply Company, Ltd.—started up a new General Electric-Fraser & Chalmers oil-engine set comprising a 1,750-b.-hp. six-cylinder oil engine coupled to a 1,200-kw. direct-current generator. This is believed to be the largest stationary set of its kind yet built in Great Britain.

On the commercial development side of the supply industry elaborate electricity showrooms have been opened by the Battersea (London) Borough Council and by the Westminster Electric Supply Corporation, Ltd., which has announced a new tariff reducing the cost of energy for cooking and for "off-peak" water heating to the very low figure of ½d. per kilowatt-hour.

Other matters of interest during recent weeks included the unveiling of a memorial tablet to Michael Faraday in his native borough of Southwark, where the nucleus of a Faraday Memorial Collection of the best books on electricity and allied sciences has been formed; the Commercial Motor Exhibition, where six-wheeled electric trackless trolley buses, with double-deck, covered-top bodies, were seen, and the change-over to automatic working of a busy London telephone exchange.

Of personal interest is the appointment of Lieut.-Col. W. A. Vignoles, borough electrical engineer of Grimsby and a past-president of the Incorporated Municipal Electrical Association, as director and secretary of the British Electrical Development Association in the place of J. W. Beauchamp, who is retiring at the end of the year to become chief engineer of the South Wales Power Company. It may also be of interest to record that at the next general election Prime Minister Baldwin is to have as a Labor party opponent H. M. Gibson, a clerk in the Manchester Electricity Department.

# Mr. Insull Supplements His Reed Committee Testimony

The investigating committee which held hearings a year ago, under the chairmanship of Senator Reed of Missouri, to inquire into alleged irregularities in the 1926 senatorial elections in Pennsylvania and Illinois, resumed its sittings last week. This inquiry is of special interest to the electrical industry because it brought from Samuel Insull, president of the Commonwealth Edison Company, an admission that he had contributed very large sums to political campaigns, including that of Frank L. Smith, former chairman of the Illinois Commerce Commission, for United States Senator.

It may be remembered that Mr. Insull and his attorney, Daniel J. Schuyler, refused to disclose to whom $40,000 of the utility head's total contributions of $237,925 went on the ground that to do so would be a betrayal of confidence. Contempt proceedings were thereupon threatened by the committee. Last week, feeling released from the obligation of secrecy, Mr. Insull and Mr. Schuyler testified that half of the $40,000 went to Charles F. Francis, of the Small-Lundin faction in Cook County politics, and half to George F. Harding of the "Big Bill" Thompson group. Mr. Insull testified that he frequently borrowed various sums for campaign contributions from the Commonwealth Edison Company, placing an "I. O. U." in the drawer and eventually repaying the sums by check.

When Mr. Schuyler was on the witness stand Senator Reed sought to obtain admissions that in his view Mr. Insull contributed to campaign funds because his utility companies were involved in political controversy. Mr. Schuyler said that if he were in Mr. Insull's position with vast interests to protect he would desire to maintain friendly relations with public officials.

# Commission Asks for Data on Political Expenditures

Cognizance of public agitation concerning contributions by utility companies or their officials to political campaigns has been taken by the California Railroad Commission, which on Jan. 3 adopted the following resolution, addressed to the various utilities under its jurisdiction:

> Resolved, That by order of the Railroad Commission you are required to supplement your 1927 annual report with a statement showing the amount of money, if any, expended by you for political purposes, the accounts to which such expenditures were charged and the purposes for which such expenditures were incurred or made.
>
> By "expenditures for political purposes" is meant such expenditures, including allocations of compensation of executives, officers and employees for time devoted to political purposes, as are incurred or made to elect or defeat a candidate for public office, or to support or defeat any measure on the ballot, or to place any measure on the ballot, or to keep it from being placed on the ballot at any state, county, municipal or other election during the year.
>
> Such statement shall be submitted by the president or general manager of the company under oath, which oath shall show that he knows the facts contained in the statement to be true and correct of his own knowledge. Such affidavit should also show that no expenses for political purposes have been incurred which are not included in the statement.

## Purchases and Mergers

### *Niagara, Lockport & Ontario Company Starts Operation as New Consolidation—Central Maine Power Company Authorized to Buy Four Others*

IDENTITIES of the former Niagara, Lockport & Ontario Power Company and the Western New York Utilities Company were merged on Jan. 1 in the new Niagara, Lockport & Ontario Power Company, with headquarters in Batavia, N. Y. The Western New York Utilities Company became one of the Buffalo, Niagara & Eastern group last spring, and petition for its consolidation with the Niagara, Lockport & Ontario was filed in the fall. It had had its headquarters in Batavia and branch offices in Albion, Medina and Brockport. The old Niagara, Lockport & Ontario Power Company had headquarters in Buffalo.

Authority has been given to the Central Maine Power Company by the Public Utilities Commission of Maine to issue bonds and stock for the purchase of the Western Maine Power Company for $1,057,437, the Fryeburg Electric Light Company for $27,301, the Bethel Light Company for $36,403 and the Black Stream Electric Company for $51,000. These purchases total $1,172,141 and other moneys will be expended for betterments.

The Harlem Valley Electric Corporation, Chatham, N. Y., has filed a certificate in the office of the Secretary of State merging with it the Chatham Electric Light, Heat & Power Company. The Public Service Commission has approved the transfer by Harlan E. Ralph of an electric distributing system in Belleville, Ellisburg and Henderson, Jefferson County, to the Woodville (N. Y.) Electric Light & Power Company for $8,000.

The Mohawk-Hudson Power Corporations has received permission from the New York Public Service Commission to acquire the stock of the Schodack Light & Power Corporation, which supplies electricity in Castleton and immediate vicinity. The Schodack company has been buying its electricity. The New York Power & Light Company has made application to the Public Service Commission for permission to merge with it the Blue Hill Light & Power Company of Livingston, Columbia County.

It is planned to sell the rights and lines on Indian River, in the southwest portion of St. Lawrence County, N. Y., owned by the Rossie Electric Company, to the Oswegatchie Light & Power Company. The Rossie company's rights are in the main undeveloped.

The City Council of Hooker, Okla., has sold the municipal light and power plant to the Inland Utilities Company of Kansas City for $30,000, subject to approval of the voters. Citizens of Locust Grove, Okla., have voted to sell their distribution system and municipally owned transmission line to the Public Service Company of Oklahoma, to which a franchise has been granted.

Purchase of the electric light and power plant at West Fork, Ark., has been announced by the Southwest Power Company. The purchase price was not made public.

The Carolina Power & Light Company, Raleigh, N. C., has taken over the South Carolina Power & Light Company, with headquarters at Kingstree, S. C., serving the interconnected towns of Kingstree, Manning, Lake City, Andrews, Lanes, Greeleyville and Scranton.

The village of Sargent, Neb., has called a special election for Jan. 24 to pass on the question of selling the municipal plant to the Nebraska Electric Power Company for $17,500.

The Indiana Public Service Commission has authorized the purchase by the Interstate Public Service Company of the Holton Electric & Power Company for $15,400.

Acquisition by the Washington Water Power Company, Spokane, of the plant and system of the Calispel Light & Power Company on Jan. 1 added the towns of Dalkena, Usk and Cusick, Wash., to the first-named system. The company recently purchased also the Lacrosse (Wash.) Electric Company and the Greenacres Power & Light Company, as well as the Potlach Consolidated Company in Idaho, these systems having distribution systems only.

Prentiss, Miss., has received bids from power companies for the sale of its municipal plant and is considering them.

The Alma (Ga.) lighting plant has been taken over by the Southeast Georgia Power Company.

Control of the Union Power Company's plant at Drumhellar, Alberta, Canada, has been acquired by the International Utilities Corporation, and it is the intention of the new owners to make Drumhellar the center of distribution for electric power over a wide area where coal mines abound.

## Attack Authority of Tennessee Commission Over Streams

Charging that the Railroad and Public Utilities Commission of Tennessee has no authority in law for the powers it attempts to exercise in control and regulation of water-power development upon the streams of the state, suit has just been filed in the Nashville Chancery Court by the Tennessee Eastern Electric Company against the commission, praying the court to construe the legal powers of the commission, and likewise to declare the rights of the owners of water-power sites. Pending the determination of these issues, the court is asked to enjoin the commission from granting any permit on a designated power site on the Holston River which the petitioning company has planned to develop.

Because of the rapid growth of its territory, says the petition, the company began several years ago to acquire title to lands along the Holston River for the purpose of building a large hydroelectric plant, and it has now expended about $500,000 for this purpose and acquired 2,500 acres of land for a dam site. Assumption last fall by the commission of authority over state water power, the company asserts, prevented further progress on the development and confused in the minds of the public the entire question of the right on the part of the owner of riparian rights to proceed with the development of water power of any character, and particularly where such development pertains to non-navigable streams. Determination of this case may have a marked effect upon the development of the water-power resources of Tennessee and perhaps of other states.

## Briefer News

THIRTY-NINE MILLIONS TO BE SPENT BY MICHIGAN ELECTRIC UTILITIES THIS YEAR.—Michigan electric utility companies will spend about $39,000,000 in the coming year in extending and improving service, according to the Public Utility Information Bureau of that state. The added facilities will make it possible to take on 50,000 more customers. Farm service is to be pushed.

WATER-POWER PROJECT FOR TRINITY COUNTY, CAL.—Preliminary plans for a power plant on streams in Trinity County, Cal., have been filed at Sacramento with an application for water rights from George E. Waggoner, Stockton, and Robert L. Little, Los Angeles. The applicants seek to divert 100 cu.in. from Stony and Deer Creeks and Stuart's Fork, producing approximately 20,000 hp. The water will be used to supplement other grants for the plant, which is to be situated near Weaverville. An eventual outlay of $5,000,000 is said to be entailed.

LIGHTING COURSE FOR CONTRACTORS.—A course in illumination for electrical contractors will be launched on Jan. 17 under the auspices of the lighting committee of the Metropolitan New York Section of the National Electric Light Association. The course will consist of five lectures, each complete with demonstrations, to be given at 8 p.m. on Tuesday evenings for five weeks in the Electric Building in Long Island City. Later, similar courses will be given in the other boroughs of the city. On Jan. 1 the registration for the course was 65, and it is expected the total enrollment will exceed 75. Lecturers will represent the Edison Lamp Works, Harrison, N. J.; the Westinghouse Lamp Company, Bloomfield, N. J.; the Graybar Electric Company, the United Electric Light & Power Company and the New York Edison Company.

RAILROAD ELECTRIFICATION TO BE A TOPIC AT MICHIGAN ENGINEERING CONFERENCE.—"The Electrification of Steam Railroads in the United States" will be discussed by W. M. Vandersluis, electrical engineer Illinois Central Railroad, at the afternoon session of the Michigan Engineering Conference at the Hotel Statler, Detroit, on Friday, Jan. 27, over which Alex Dow will preside and which will be addressed also by John Lyle Harrington on "The Part of the Engineer in Enterprises Based on Engineering." A. L. Powell will speak on "Science with Art in Lighting" at the evening banquet, over which H. H. Higbie, past-president Illuminating Engineering Society, will preside. The talk by Mr. Powell, who is the manager of the engineering department of the Edison Lamp Works at Harrison, N. J., will be illustrated. On Saturday Prof. Comfort A. Adams will speak on welding, C. F. Hirshfeld of the Detroit Edison Company on "Two Blades Where But One Grew Before," and Prof. George L. Clark of the University of Illinois on "X-Rays as an Engineering Tool."

Conowingo Condemnation Rights Upheld. — By declining to hear argument for the defense the United States Supreme Court last week indicated that it would dismiss the appeal of James C. Colgate from the decision of the Pennsylvania courts, already noted in these columns, upholding the right of the Philadelphia Electric Company to condemn land in Pennsylvania for a transmission right-of-way from its Conowingo development. The plaintiff held such condemnation to be illegal because the power plant itself was in another state.

Flathead Lake Agreement at Power Commission Hearing.—Agreement to raise the level of Flathead Lake to 2,893 ft., an altitude said to be satisfactory both to local residents and to promoters of the Columbia Basin project, was reached at a Federal Power Commission hearing held by Major John Butler in Polson, Mont., and continued in Kalispell, Mont., late in December. Application of the Rocky Mountain Power Company for a large development at the foot of the lake is expected to be granted on the filing of an amended application reducing the altitude from 2,902 ft.

Lower Rates in South Georgia Sought by State Commission.—The Georgia Public Service Commission has required the Georgia Power & Light Company, operating in a number of south Georgia cities, to show cause why it should not reduce both light and power rates in all of the communities that it serves. The company, which is a subsidiary of the National Public Service Company, a former Fitkin property, now under Insull control, obtains part of its power from Florida, and it is the opinion of the commission, according to Chairman James A. Perry, that this fact ought to enable the company to reduce its charges. Cities and towns affected by the order include Bainbridge and Waycross.

Houston Lighting & Power Budget. —A sum of $6,242,804 is to be spent on improvements during 1928 by the Houston Lighting & Power Company. This figure is approximately $500,000 in excess of the amount expended on improvements by the company during 1927. The program will bring the lighting and power facilities of Houston to a standard considerably above the present demands of the city, officials of the company say. The improvement program calls for expenditures as follows: New substations and improvements to existing substations, $363,841; substation and transmission transformers, $127,000; communication, $98,000; improvements of distribution system, $352,779; improvements of transmission system, $195,089; improvements of substation feeders, $401,000; improvements of power stations, $254,845; new turbines for Deepwater plant on the Houston Ship Channel, $3,000,000; improvements and extensions to underground system, $255,000; stores and shop buildings, $406,500; new meters, $140,000; new transformers, $140,000; short line extensions, $200,000; street-lighting equipment, $75,000; miscellaneous improvements, $233,750.

Receivership Sought by Spartanburg Company as Step to Readjustment.—The South Carolina Gas & Electric Company of Spartanburg, S. C., which was bought last fall by the Southern Public Utilities Company of Charlotte, N. C., controlled by the Duke Power interests, is defendant in an action instituted in the United States District Court by the Merchants & Farmers' Bank of Spartanburg as trustee asking appointment of a receiver. The action is taken as a new step in the direction of a financing plan to prevent the company from being operated at a loss of $100,000 per annum, owing in large measure to interest charges fixed by outstanding bonds and other forms of indebtedness. It is expected that the Southern Public Utilities Company will find in the action brought by the bank an opportunity to have the whole problem involving Spartanburg's utilities adjusted on terms that will allow them to go forward with a progressive program.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for January 7, page 80.]

Electrical League Conference — 30 North Dearborn Street, Chicago, Jan. 16 and 17. Society of Electrical Development, 420 Lexington Avenue, New York.

New England Electrical Credit Association—Boston, Jan. 17. C. A. Kane, 176 Federal St., Boston.

N.E.L.A. Commercial Section—Edgewater Beach Hotel, Chicago, Jan. 18-20. A. J. Marshall, 420 Lexington Avenue, New York.

National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 23-27. S. N. Clarkson, 420 Lexington Ave., New York.

New England Central Station Association of Power Engineers—Chamber of Commerce, Boston, Jan. 25. T. D. Bond, C. H. Tenney & Co., Boston.

Artistic Lighting Equipment Association—Winton Hotel, Cleveland, Jan. 25-28. G. P. Rogers, 711 Graybar Bldg., New York.

Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.

Iowa Section, N.E.L.A.—Roosevelt Hotel, Cedar Rapids, Feb. 2 and 3. H. E. Weeks, Davenport, Iowa.

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21. J. C. Plankington, Northwestern Electric Company, Portland, Ore.

High Voltage for New Wilmington-Atlantic City Line.—According to C. H. Howell, general manager Atlantic City Electric Company, plans for the steam-electric plant to be built on the Delaware River opposite Wilmington, Del., jointly by the American Gas & Electric Company and the American Electric Power Corporation, as reported in the Electrical World for Dec. 17 (page 1263), include a 232-kv. transmission line to be built from Churchtown, near Pennsville, N. J., the site of the plant, on Deepwater Canal, to Atlantic City. The plant, which is eventually to have a capacity of 400,000 kw. and may cost $13,000,000, will serve parts of Atlantic, Cape May, Ocean, Cumberland, Gloucester and Salem Counties in New Jersey as well as the territory of the Delaware Electric Power Company. Cost of the transmission line is put at $1,000,000.

International Agreement on Development of Kootenai Expected in Year.—Delay of one year at the request of Secretary of State Kellogg, during which time a satisfactory plan for reclamation and power uses of the Kootenai River is expected to be reached, was announced at a hearing in Nelson, British Columbia, held late in December, at which the Canadian and American governments and private interests were represented. Flood protection for northern Idaho farmers, a reclamation project at Creston, just over the intenational line, and a reservoir and dam to develop 35,000 hp. for the West Kootenai Power & Light Company is in prospect. Three former United States senators, sitting as American members of the joint commission on boundary waters, asserted that they were satisfied a conspicuous example of co-operation between nations and for both agricultural and power development would result from the long-litigated situation on the Kootenai River and lake.

Notes From Ohio.—The Defiance City Council has passed an ordinance for the erection of a municipal lighting plant to cost $405,000. Defiance is served by the Toledo Edison Company. ——The Dayton Power & Light Company, which is building a second line to Washington Court House from its Dayton plant, has about half of the poles set and will dismantle, move and reassemble 190 steel towers now in use along the Bowersville Road. The line will not be completed until July.——A second reduction in rates within a period of two months for electrical energy furnished by the Wooster Electric Company is announced. The company's first cut was voluntary. The new one was perhaps hastened by an application for a 25-year franchise made by the Western Reserve Power & Light Company. Company officials say it would have been made a little later on in any event.

ARKANSAS POWER & LIGHT BEGINS 110-KV., 47-MILE TRANSMISSION LINE.—The Arkansas Power & Light Company began on Jan. 3 to build the 110-kv. power line that is to extend from the Woodward substation at Pine Bluff to the Dixie substation in North Little Rock, a distance of 47 miles. At the same time the work of enlarging the Woodward and Dixie substations was started. At North Little Rock several transformers will be installed, and the Woodward station will be rebuilt of steel. It is hoped to have the work completed by March 15. This is the first of several expansion projects to be undertaken by the company in Arkansas this year.

BRITISH COLUMBIA UTILITY COMPANY REDUCES RATES.—For the sixth time since 1917 domestic lighting rates will be reduced by the British Columbia Electric Railway Company in Vancouver on January 1. The new rates will be 4 cents a kilowatt-hour on the first step and 2 cents on the second. Corresponding reductions will be made in suburban areas and in commercial rates. In the city of Victoria rates will go down from 7 cents to 6 cents a kilowatt-hour, with the abolition of the meter charge but the inauguration of a minimum charge of $1 a month. The reductions are estimated to mean a saving to the public of $325,000 a year.

NEW ENGLAND POWER COMPANY CONSTRUCTION.—The largest single item in construction expenditures listed by the New England Power Company with the Massachusetts Department of Public Utilities is that of transmission lines, on which the company between Aug. 1, 1926, and Oct. 31, 1927, expended $894,520. To bring the new transmission-line construction to completion another $113,480 will be required. The next largest item is for transforming and switching stations, for which the ultimate cost is figured at $618,756, of which $590,734 has been expended. The company has under way a 110,000-volt steel-tower line between Bellows Falls, Vt., and Pratt Junction, Mass., cost of which is estimated at $650,000, and another line of similar voltage between Ayer and Tewksbury, Mass., which is expected to cost $344,430, besides a substation to cost about $475,800 under way at Pratt's Junction.

DOWNTOWN INDIANAPOLIS TO HAVE ALTERNATING CURRENT.—Installation of an alternating-current system for the downtown business district of Indianapolis will be the principal improvement undertaken by the Indianapolis Power & Light Company this year, according to President Norman A. Perry. Company officials will also direct their attention to the further consolidation of distribution lines throughout the city, a work that has been in progress since early in 1927. The new downtown system will be installed gradually and the buildings of the future will be supplied from it. A substation will be built in the southeastern part of Indianapolis and one of the company's existing downtown substations will be moved to a better location. The company is changing over its fleet of trucks to electric vehicles since this form of transportation is proving economical for a large percentage of truck work.

EXPANSION OF OKLAHOMA GAS & ELECTRIC'S HORSESHOE LAKE STATION.—The equipment which is now being added to the electric generating station of the Oklahoma Gas & Electric Company at Harrah will give a capacity of 87,500 hp. A 40,000-hp. turbo-generator is being added with two boilers which will burn powdered fuel. A heavy transmission line has been completed between the Horseshoe Lake station and the Riverbank station at Muskogee, the final link between Sapulpa and Drumright being now ready. The company also announces that interchange of power with the Public Service Company of Oklahoma is made possible by a line recently finished between the Seminole oil field and the Public Service lines west of Weleetka. The company is constructing a short 13,000-volt transmission line to connect its system with a 5,000-kw. steam plant being built 3 miles west of Howe by David Reed of Fort Smith, Ark., partly to furnish power to coal mines in the vicinity.

## Commission Rulings

CONSUMPTION CHARGES FOR ELECTRIC REFRIGERATOR.—The Illinois Commerce Commission has sustained the complaint of a consumer against the rates of the Illinois Northern Utilities Company for energy supplied to a refrigerator. The complainant contended that it was inequitable to attach a motor-driven device to the light circuit and that it should be attached to a heating circuit, since, the contention went on, the mechanical refrigerator is more nearly an off-peak consumer than ordinary domestic heating and cooking devices. The commission, in ordering a reduction of the refrigerator rates to place them on an equality with heating rates, agreed, saying that the refrigeration load factor is better by reason of the more continuous use of energy and that there was nothing in this record to show that the energy consumed by an electric refrigerator should be charged for at a higher rate than energy consumed by the ordinary domestic heating and cooking devices.

LEASE OF WATER RIGHTS IN CONSIDERATION OF CONTRACT AS FACTOR IN VALUATION.—In adjusting the valuation of the West Coast Power Company, the Washington Department of Public Works made several decisions. One of these, relating to the exclusion of unused standby equipment, was noted in the ELECTRICAL WORLD for Oct. 15 (page 808). In addition, the commission decided that the value of water rights leased to another company as part of the consideration for a contract under which power is purchased at reduced rates might be included in the rate base at a figure determined by giving proper consideration to the net savings under the contract and a proper distribution of such savings between the utility and its customers. No separate figure should be allowed, the commission held, for going value when the values already assigned to the various units of property are not those of a bare plant but those of a going concern and the pioneer losses have already been adequately covered in the operating expenses. A return in excess of 14.05 per cent was found to be unfair and unwarranted, and a decrease in rates was ordered so that rates would yield a return of 8 per cent.

## Recent Court Decisions

DE FOREST RADIO PATENTS AGAIN SUSTAINED.—Another step in the long contest over radio patents was taken last week when the United States Court at Wilmington, Del., handed down an opinion dismissing the suit of the General Electric Company against the De Forest Radio Company in which it was sought to restrain the De Forest company from making and using radio apparatus on the ground that four basic patents were infringed, covering electrical discharge apparatus and the process of manufacture and use of vacuum tubes. The court decided that the first and main patent of the four is invalid in view of prior art and because it lacked patentable novelty and for other reasons. The court held that only the third patent, covering the use of potassium in radio tubes, was valid.

DAMAGES FOR INJURY TO PROPERTY CAUSED BY NOISE FROM SUBSTATION REFUSED.—In Brady vs. City of Tacoma suit was brought by a householder whose property faces a municipal substation where 110-kv. current is stepped down upon the theory that there had been a taking or damaging of the property without compensation in that it was depreciated in market value and rendered less valuable for use by the unsightliness of the substation, the continuous noise attending its operation and the potential damage to adjacent residents by injury or death from fallen wires or other cause incident to the operations. The substation was admittedly properly built and equipped. The trial court held that there could be no recovery on account of the first and last causes, but found that the plaintiffs were damaged to the extent of $400 by reason of the continuous noise. On appeal by both parties, the Washington Supreme Court reversed the judgment against the city, holding that sounds of commercial and industrial activity must be material, substantial and unreasonable to warrant recovery of damages to adjoining property and that the electric substation was not improperly located so as to authorize recovery of damages to nearby residential property by continuous humming noise. (259 Pac. 1089.)*

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *A. H. Manwaring Retires After 46 Years*

**Albert H. Manwaring**, engineer of transmission and distribution of the Philadelphia Electric Company, retired Jan. 1 after forty-six years of continuous and active service. It was in August, 1879, that he entered the employ of the Brush Electric Company, Cleveland, manufacturer of carbon lamps and arc lights and electric light plants, the pioneer electric lighting system in this country. In August, 1881, he became affiliated with the Brush Electric Company of Philadelphia as transmission and distribution engineer, which position he held with the Philadelphia Electric Company until his voluntary retirement.

A. H. MANWARING

Mr. Manwaring is the inventor of the broad carbon lamp, the tower wagon, electrically operated for trimming arc lamps, the electrically driven pole truck and the cable plow for installing underground cable. In 1892, he organized the Philadelphia Electrical & Manufacturing Company, of which he is president. He is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the Franklin Institute and other associations.

**James E. Lannigan**, vice-president of the Whitaker & Bogardus Realty Company, has resigned to become assistant manager of the Fulton Light, Heat & Power Company of Fulton, N. Y.

**Robert J. Moran** has been appointed assistant chief of the electrical department of the Philadelphia Fire Underwriters' Association.

**Leonard H. Church**, for the last year and a half affiliated with the editorial staff of Electrical World, first in New York and more recently in Cleveland, is now editorial representative of the *Electric Railway Journal* in Chicago, with the title of assistant editor. For three years previous to assuming editorial duties in New York, Mr. Church was a member of the faculty of the electrical engineering department of the Kansas State Agricultural College, Manhattan, Kan. In addition to his academic work, while in the Middle West Mr. Church served as a consulting engineer in the Red Wing rural project in Minnesota and specialized in rural electrification in Kansas.

## *A. W. Berresford Heads Engineering Council*

A. W. Berresford, for many years prominently identified with the manufacturing branch of the electrical industry was elected president of the American Engineering Council at a meeting held this week in Washington, D. C. The selection of Mr. Berresford places at the head of the council an engineer-executive possessing a wide knowledge of general engineering and a broad background of actual experience in industrial enterprises.

For 22 years Mr. Berresford was identified with the Cutler-Hammer Manufacturing Company, having served in the capacity of vice-president and general manager for a period of almost twenty years. He resigned from this executive position in 1923, and, three years later, became executive vice-president of the Nizer Corporation, following the consolidation of that organization with the Kelvinator Corporation and the Grand Rapids Refrigerator Corporation, operating as divisions of the Electric Refrigeration Corporation. He severed his connection with the refrigeration branch of the industry last summer. In association work Mr. Berresford has been extremely active, being a past president of the American Institute of Electrical Engineers, the Electrical Manufacturers Club and of the Associated Manufacturers of Electrical Supplies.

A. W. BERRESFORD

## *P. H. Chase Succeeds Manwaring in Philadelphia*

**Philip H. Chase**, formerly assistant engineer of transmission and distribution of the Philadelphia Electric Company, has been appointed transmission and distribution engineer of the company to succeed A. H. Manwaring, who recently retired. Mr. Chase's first affiliation with the electrical industry was as an employee of the Public Service Electric Company of Newark, N. J., where he spent seven years as assistant to the superintendent of distribution, supervising distribution and substation operation, and, subsequently, as assistant engineer on electrical station and substation design and construction. In 1917, he became chief electrical engineer in general charge of electrical work on the various properties of the American Railways Company of Philadelphia, now the American Electric Power Corporation. It was in 1921 that he joined the Philadelphia Electric Company.

P. H. CHASE

A native of Hanover, N. H., Mr. Chase received his technical education at the Massachusetts Institute of Technology and at Harvard University. In the course of his engineering career, he has been active in association work, having been at various times president of the Pennsylvania Electric Association, chairman of the technical section and chairman of the overhead systems committee. He has also done extensive work on committees of the American Institute of Electrical Engineers, the Illuminating Engineering Society and the National Electric Light Association.

**Gerard Swope**, president of the General Electric Company, sailed for Europe Jan. 7 aboard the Cunard liner Aquitania to spend a short time abroad.

**Thomas A. Edison** left his home at West Orange, N. J., Jan. 12 to spend the winter at his home in Fort Myers, Fla.

# Financial and Statistical News

## *Call Money Movements*
## *Common Stocks at New High*
## *Bonds Active and Firm*

UNAFFECTED by the rise of call money to a point higher than at any time during 1927, power and light stocks made advances over 1927 high levels, during the first week of the new year. Since that time, the call rate has returned to normal, but, at the same time, utility stocks have receded slightly in accordance with the general trend of the market. The average price of fifteen representative power and light stocks is now 121, against 91 for the corresponding week last year.

Bond prices have also continued to rise, and demand for high-grade issues is very strong. The average price of nine representative power and light bonds, as computed by the ELECTRICAL WORLD is now 105 against 98 this week last year. The last calendar year showed an advance of more than 7 points in this group, and financial men in the industry state that they anticipate no change in this trend. Such a view is supported by a comparison of yields with those on railroad bonds, for example, especially as the investing public is beginning to appreciate the relative merits of power and light company bonds as compared, yield for yield, with those of some other industries.

## New England Power to Issue New Stock

The New England Power Company has petitioned the Massachusetts Department of Public Utilities for authority to issue 68,000 additional shares of common stock at a par value of $25 per share to meet the cost of plant additions. Including common stock of the par value of $5,100,000 previously petitioned for, the total par value of the company's securities will be $36,037,000, if the board acts favorably. These securities will consist of $17,000,000 in common stock and $6,814,000 in preferred, both par values, and $2,223,000 in first mortgage bonds, face value. The improvements to which the proceeds of the 68,000 shares are to be applied approximate $1,700,000.

## Saluda Dam Project Calls For $17,000,000

Financial plans for the construction of the Saluda Dam, one of the largest hydro-electric projects in the United States, have just been arranged by the Lexington Water Power Company, a subsidiary of General Gas & Electric Corporation. The plan comprises two issues, a $12,000,000 issue of first mortgage 5 per cent, 40-year bonds, and a $5,000,000 issue of 5½ per cent convertible debentures. The former are sold at 98 and interest, and the latter at 98½ and interest.

Great interest has been focussed upon this huge development. The dam to be constructed will have the largest cubical content of any dam in the country and the lake will be the largest artificially created in the country. The capacity of the power house, from the standpoint of average firm kilowatt-hour output, will be exceeded by only one hydro-electric generating station in America, that of the Niagara Falls Power Company. The cost of the development is expected to be approximately $21,000,000.

Provision for the disposal of the huge amount of power which will be available has already been made. Contracts extending until 1980 have been consummated with Carolina Power & Light Company, Duke Power Company and Broad River Power Company.

The debentures will be convertible into $6 cumulative preferred no par stock of the company, after January, 1931, on the basis of 10 shares of such preferred stock for each $1,000 principal amount of debentures, with adjustment for accrued dividends and interest.

## Philadelphia Consolidation Involves Expanding Activities

### Greater Opportunities and Increasing Demand for Power Will Result in an Increase in the Operating Staffs Rather Than a Reduction

THE probable policy of the dominating company following a merger or absorption is always the occasion of much speculation. In the case of the United Gas Improvement—Philadelphia Electric situation, President Arthur W. Thompson has given out some idea of prospects and economies to be effected. Following are statements from his recent address before the Philadelphia Electric Company section of the National Electric Light Association.

References have been made in the newspapers to economies which might result from this consolidation of interests in Philadelphia. It is not necessary to refer to how this will be brought about to most, if not all of you in the industry. Briefly, when one realizes that, with the Conowingo power brought into the joint territory of these companies, with the coupling up of transmission and distribution lines, with the closing down of many power plants and using them only for peak load purposes, it is then one realizes the economies that can be made.

These references have not been made with the idea of reducing the forces of the Philadelphia Electric Company, or through having The U.G.I. do the work; on the contrary, through the consolidation of the interests, through expansion and development of the territory, will the greatest results be obtained. The U.G.I. proposes to stand by with its efficient personnel, who are engaged in public utility work over a wide area, and who have a wide range of activities, to help the Philadelphia Electric organization wherever possible.

There are opportunities for big steam plants on the Delaware River, and the immense Conowingo development of hydro-electric, through the generation, transmission and distribution of power will be unrivaled, except in some few local places where hydro-electric can carry all of the load.

Philadelphia metropolitan area comprises a territory of approximately 2,000 sq.mi. The present community of interests of the Philadelphia Electric and the U.G.I. opens up a new field of activity for each and every one of you, through the very linking of these properties together. Elimination of waste benefits the consumer, patron or investor and brings opportunity for advancement and promotion to all of you, with prospects for greater compensation.

Of course, if I could not come before you with optimism, with encouragement, I should not be here. This great city or metropolitan area is third in size in the United States and one of the greatest communities of diversified industries in the United States. Power has and will continue to encourage development of this diversified industry and the small industrial plant. When it is known and fully realized that the Philadelphia Electric Company power rates on file with the Public Service Commission of this State gives to the power consumer a rate lower than any other city in the United States except Buffalo, there will be more rapid industrial development here.

More employees, more promotions, more executive positions will be necessary to meet the demand for electric service and, as I have announced previously, the policy of the U.G.I. is to continue not only the charter and the corporate company of the Philadelphia Electric, but to supplement it and bring the various properties together to make these economies. All of which should be and is, no doubt, an incentive to do good work on the part of all of you.

## American Water Works Declares Common Extra

The directors of the American Water Works & Electric Company declared a quarterly dividend of 25c. on the common stock and a semi-annual dividend of one-fortieth of a share of common stock on the common stock. Both dividends are payable February 15 to stockholders of record February 1. Previously the company had been paying 2c. quarterly in cash and semi-annual stock dividends of 2½ per cent. The net power output of the electric subsidaries of the American Water Works & Electric Co., Inc., to consumers for the month of November was 138,634,345 kilowatt-hours, compared with 135,721,509 kilowatt hours for the month of November, 1926, a gain of 2 per cent. For the first eleven months of 1927 net power output totaled 1,507,278,844 kilowatt-hours, against 1,348,312,188 kilowatt-hours, a gain of 12 per cent.

## Stockholders Approve Combination

Stockholders of the companies involved in the proposed merger with the Public Service Electric & Gas Company voted in favor of consolidation as follows:

In the case of Public Service Electric & Gas Company 11,997,521 shares were voted for and none against; 48,876 shares of Essex & Hudson Gas Company were voted in favor and 7,861 against; 81,589 shares Paterson & Passaic Gas & Electric Company for, 5,967 against; 3,082 shares New Brunswick Light, Heat & Power Company for, none against; 8,123 shares Somerset, Union & Middlesex Lighting Company for, 1,277 against.

## Tennessee Electric Will Resume Stock Sale

In conjunction with the Tennessee Electric Power Company's construction program of the new year, involving expenditures of approximately $5,000,000, the company announced the resumption of the sale of its first preferred shares to the people of Tennessee. The price is $100 per share, paying $6 a year dividends, to yield a return of 6 per cent. The company's expansive building and development program and stock sales activities go hand in hand. In the last four years, Tennessee Electric Power's construction expenditures have equalled or exceeded $5,000,000 a year and in this period about $8,500,000 of the company's securities have been purchased by investors in Tennessee. Demand for Tennessee Electric Power preferred shares has been increasing year after year, so much so, in fact, that, in 1927, the company's portion of new capital through stock was placed with investors in the first six months of the year. This necessitated a cessation of the customer-ownership securities' program for the remainder of the year, resulting in numerous inquiries as to the reasons therefor. The present 6 per cent issue has enjoyed a steady increase in price since its offering less than two years ago, superseding a 7.20 per cent issue in effect prior to that. The 6 per cent stock first sold for $90 per share, then $92.50, $95, $97 and now $100. It may be purchased at $100 cash or on a time payment basis of $10 per share, each deposit earning interest at the rate of 6 per cent per annum, when the stock is fully paid for.

## Power and Light Maturities Exceed $86,000,000 for 1928

OWING to extensive refunding operations in the public utility field during the last year, bond and note maturities for 1928 have fallen off from $280,413,000 in 1927 to $208,768,000 in the calendar year 1928. Contrary to expectation, however, the power and light total has advanced from $56,042,000 in 1927 to $86,411,000 in 1928, being 41 per cent of the total for all public utilities this year, according to Dow, Jones & Company.

Such an increase, however, is not sufficient to be of any special significance. Refunding in the power and light industry has been carried out on a very extensive scale during the last year, a total of $879,000,000 out of aggregate financing for all purposes, of $2,128,909,000 being for refunding purposes. Such operations have brought about a huge saving in interest charges, possibly $15,000,000 yearly, and they have also helped to simplify and strengthen capital structures as well. The total retirement of $86,000,000 in these issues in 1928 will add materially to this reduction in fixed charges.

Out of the issues maturing in 1928 in the power and light industry, at least four bear 7 per cent interest rates, and the majority are 6 per cent. Interest charges to the extent of probably $5,000,000 are wiped out, disregarding the question as to whether or not these issues are replaced by new offerings. Maturities for 1928 by main classes are:

| | |
|---|---|
| Industrials .......... | $244,116,830 |
| Pub. Railroad issues.. | 292,156,390 |
| Foreign Govt. issues.. | 144,883,240 |
| Public Utilities...... | 208,768,720 |
| | $889,925,180 |

A statement of power and light maturities, by months, appears below:

| Due | Company | Rate | Amount |
|---|---|---|---|
| | **January** | | |
| Jan. 1 | General Pwr. & Lt., 6 mos. | 5 | $1,750,000 |
| Jan. 1 | General Pwr. & Lt., 1-yr.. | 6 | 750,000 |
| Jan. 1 | Central West Public Service, 6-mos.............. | 5½ | 1,250,000 |
| Jan. 1 | Bloomington & Normal Ry. & Lt., gen......... | 5 | 1,164,000 |
| Jan. 1 | New Bedford Gas & Edison Lt., 1st A.............. | 6 | 885,000 |
| Jan. 1 | Blue Ridge Pwr., 1st..... | 6 | 500,000 |
| Jan. 1 | New Bedford Gas & Edison Light, 1st B........... | 7 | 477,000 |
| Jan. 1 | Central Illinois Public Service, serial......... | 5 | 400,000 |
| Jan. 1 | Manufacturers Power, 1st | 6 | 400,000 |
| Jan. 1 | Hutchinson Water, Light & Power, 1st.......... | 4 | 212,000 |
| Jan. 15 | Edison Electric Illum. of Boston, 3-yr.......... | 4½ | 30,000,000 |
| Jan. 15 | Southern California Edison, deb.................. | 7 | 1,000,000 |
| Jan. 15 | Detroit Edison, deb...... | 7 | 246,000 |
| | January total .......... | | $39,034,000 |
| | **February** | | |
| Feb. 1 | Hartford Elec. Lt., 3-yr... | 7 | $4,000,000 |
| | February total.................... | | $4,000,000 |
| | **March** | | |
| Mch. 1 | Central Arkansas Ry. and Light, 1st. ........... | 5 | $1,854,000 |
| Mch. 1 | Consol. Pub. Serv., 1-yr... | 5 | 500,000 |
| Mch. 1 | Northern Texas Electric, 5-yr.................. | 7 | 500,000 |
| | March total...................... | | $2,854,000 |
| | **April** | | |
| Apr. 1 | East. Coast Utilities, 1-yr. | 5 | 600,000 |
| | **May** | | |
| May 1 | Vermont Power & Manufacturing, 1st.......... | 5 | 250,000 |
| | May total........................ | | $250,000 |
| | **June** | | |
| June 1 | Central Indiana Pwr., 3-yr. | 6 | $5,000,000 |
| June 1 | Elec. Pub. Utilities, 1-yr... | 5 | 1,500,000 |
| June 1 | Texas-Gulf Power, 1-yr... | 5 | 900,000 |
| June 15 | Central States Edison, 1-yr. | 5 | 850,000 |
| | June total........................ | | $8,250,000 |
| | **July** | | |
| July 1 | Lake Ontario Pwr., 1-yr... | 6 | $500,000 |
| July 15 | Federal Pub. Utilities, 1-yr. | 5 | 1,000,000 |
| | July total........................ | | $1,500,000 |
| | **August** | | |
| Aug. 1 | Eastern Texas Elec., 3-yr.. | 5 | 4,000,000 |
| | August total..................... | | $4,000,000 |
| | **September** | | |
| Sept. 1 | United Lt. & Pwr., 3½-yr.. | 5½ | $4,873,000 |
| Sept. 1 | Central States Pwr. & Lt., 2-yr.................. | 5½ | 250,000 |
| | September total.................. | | $5,123,000 |
| | **October** | | |
| Oct. 1 | Queens Elec. Lt. & Pwr., 1st | 5 | $250,000 |
| | October total.................... | | $250,000 |
| | **November** | | |
| Nov. 1 | Columbus Elec. & Pwr., 3-yr.................. | 5 | $2,500,000 |
| Nov. 1 | Southern Cities Utilities, 1-yr.................. | 5 | 2,000,000 |
| Nov. 1 | Midland Utilities, notes | 5 | 1,500,000 |
| Nov. 1 | N'eastern Iowa Pwr., 1st. | 6 | 600,800 |
| Nov. 1 | N'eastern Iowa Pwr., 1½-yr | 5 | 300,000 |
| Nov. 2 | Edison Electric Illum. of Boston, 1-yr ......... | 4 | 10,000,000 |
| | November total .......... | | $16,900,800 |
| | **December** | | |
| Dec. 1 | Com'wealth Pr., serial 1-yr. | 5 | 500,000 |
| Dec. 1 | Uncas Pwr., 1st......... | 5 | 200,000 |
| Dec. 31 | Broad River Pwr., 2-yr.... | 4 | 2,950,000 |
| | December total................... | | $3,650,000 |

Electric light and power bonds and notes maturing in

| | | | |
|---|---|---|---|
| January..... | $39,034,000 | July........ | 1,500,000 |
| February.... | 4,000,000 | August .... | 4,000,000 |
| March...... | 2,854,000 | September.. | 5,123,000 |
| April....... | 600,000 | October..... | 250,000 |
| May........ | 250,000 | November.. | 16,900,800 |
| June........ | 8,250,000 | December.... | 3,650,000 |
| Elec. light and power maturities in 1928.. | | | $86,411,800 |

## American Gas Plans Stock Increase

A proposal to increase the number of shares of no par common stock of the American Gas & Electric Company from 2,250,000 to 4,000,000 shares will be submitted to the stockholders of that company at the annual meeting to be held Feb. 21. At the annual meeting held last year the common stock of the company was changed from $50 par value to no par value at the rate of five new shares for one old share of stock. If the proposed plan meets with the approval of the stockholders the financial set-up of the American Gas & Electric Company will consist of 4,000,000 shares of no par common stock, 600,000 shares of $6 cumulative preferred stock, $6,282,000 of 5 per cent collateral trust bonds and $46,904,000 of 6 per cent debenture bonds.

## Five Utility Offerings

During the second week of January, four electric light and power companies offered new securities to the amount of $26,700,000.

The Lexington Water Power Company floated two loans, one in the form of first mortgage bonds, amounting to $12,000,000, the other in the form of convertible debentures amounting to $5,000,000. The bonds were priced at 98 and interest and the debentures at 95½ and interest.

The National Electric Power Company issued 6 per cent cumulative preferred stock, totaling $5,000,000, the price being $94.50 per share and accrued dividend, to yield 6.35 per cent.

The Gulf States Utilities Company issued 30,000 shares of $6 dividend preferred stock at 100 and accrued dividend. Proceeds from the sale of this stock will be used to provide additional capacity to care for the rapidly expanding business or to reduce notes payable, which on Nov. 30, 1927, amounted to $2,885,000, held by the Eastern Texas Electric Company. One-third of this issue has been reserved by the company for sale in the territory served.

Gold bonds of the Arizona Edison Company were issued to the amount of $1,700,000, the price being 96 and interest, to yield about 5.33 per cent. These bonds, dated Jan. 1, 1928, mature Jan. 1, 1948.

## Company Reports

| Name of Company | Gross Earnings Twelve Months Ended Nov. 30 1927 | 1926 |
|---|---|---|
| American Power & Light | $62,743,819 | $58,886,148 |
| Bangor Hydro-Electric | 1,870,752 | 1,707,968 |
| Baton Rouge Electric | 1,015,036 | 946,336 |
| Blackstone Valley Gas & Electric & Subsidiaries | 5,907,202 | 5,467,392 |
| Cape Breton Electric | 650,015 | 607,435 |
| Central Illinois Light | 4,372,046 | 4,168,015 |
| Cities Service | 32,925,032 | 24,465,508 |
| Columbus Electric & Power and subsidiaries | 4,192,091 | 3,711,163 |
| Commonwealth Power | 52,837,950 | 48,887,334 |
| Consumers Power | 26,438,745 | 23,862,848 |
| Detroit Edison | *42,724,849 | *40,483,659 |
| Eastern Texas Elec. & subs. | 7,133,557 | 5,577,438 |
| Edison Electric Illuminating of Brockton | 1,920,086 | 1,762,922 |
| Electric Light & Pwr. Co. of Abington & Brockton | 622,445 | 580,829 |
| El Paso Electric | 2,992,004 | 2,804,802 |
| Galveston-Houston Electric and subsidiaries | 5,038,616 | 4,505,672 |
| Illinois Power | 2,632,771 | 2,572,177 |
| Lowell Electric Light | 1,790,447 | 1,713,816 |
| North Texas Elec. & subs. | 2,668,920 | 2,524,395 |
| Northern Ohio Power | 12,478,762 | 12,000,144 |
| Ohio Edison | 1,903,720 | 1,802,910 |
| Penn-Ohio Edison | 13,102,094 | 12,581,239 |
| Portland Electric Power | 12,158,668 | 11,701,528 |
| Puget Sound Power & Light and subsidiaries | 14,808,793 | 13,429,532 |
| Savannah Electric & Power | 2,237,544 | 2,216,304 |
| Sierra Pacific Electric | 1,243,246 | 1,249,271 |
| Southern California Edison | 30,487,312 | 27,533,028 |
| So. Indiana Gas & Electric | 3,033,310 | 2,862,947 |
| Tampa Electric | 4,737,109 | 4,816,505 |
| Tennessee Electric Power | 12,472,642 | 11,961,246 |
| Virginia Elec. & Pwr. & subs. | 15,440,586 | 14,248,838 |

* Eleven months ended Nov. 30.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 10 | Low 1927 | High 1927 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, 4% com.—no par ex. div. | 141 | 83 | 150½ |
| Ala. Pwr., $7 com. pf.—no par | 114 | 107 | 115 |
| Allis Chalmers Mfg., 6% com | 117½ | 88 | 118½ |
| Aluminum Co. of Amer., com. | k124 | 67½ | 145½ |
| Aluminum Co. of Amer., 6% pf | k105½ | 101½ | 106½ |
| Amer. & Foreign Pwr., 7% pf.—no par | 107 | 86 | 109½ |
| Amer. & Foreign Pwr., com.—no par | 23½ | 18½ | 31 |
| Amer. Bosch Magneto, com.—no par | 21 | 13 | 26½ |
| Amer. Brown Boveri Elec.† | 17 | 5½ | 39½ |
| Amer. Brown Boveri Elec., pf. $7 | 63 | 40 | 98 |
| Amer. Gas & Elec., 6% pf.—no par | 108 | 95½ | 108½ |
| Amer. Gas & Elec., com. †—no par | 119½ | 68½ | 125 |
| Amer. Lt. & Trac., 6% pf | 115 | 112 | 120 |
| Amer. Lt. & Trac., new com. | m174 | 164½ | 186 |
| Amer. Pwr. & Lt., 6% pf | 109½ | 97½ | 109½ |
| Amer. Pwr. & Lt., com. †—no par | 63 | 54 | 73½ |
| Amer. Pub. Serv., 7% pf | a 99 | 94 | 104 |
| Amer. Pub. Serv., com. † | k 70 | 65 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf | 86 | 73 | 90 |
| Amer. Pub. Utilities, 7% pr. pf | a 92 | 92 | 96 |
| Amer. Pub. Utilities, com | k 60 | 58 | 70 |
| Amer. States Sec., A | 4½ | 2½ | 5½ |
| Amer. States Sec., B | 4½ | 2½ | 5½ |
| Amer. Superpwr., 6% ptc pf.—25 | 29½ | 26½ | 29½ |
| Amer. Superpwr., 6% 1st pf | l 102½ | .... | .... |
| Amer. Superpwr., Class A†—no par | 37½ | 27½ | 41½ |
| Amer. Superpwr., Class B†—no par | 38 | 28½ | 43 |
| Amer. Wtr. Wks. & Elec., 6% pf | 101½ | 99½ | 103½ |
| Amer. W.W. & E., com. new—no par | 59½ | 46 | 72½ |
| Anaconda Copper cap. $3 | 56½ | 41½ | 60½ |
| Appalachian Electric Pwr., 7% pf | 106½ | 100 | 109 |
| Arkansas Pwr. & Lt. 7% pf | 107 | 108 | 110 |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 97 | 85 | 98 |
| Assoc. G. & E., Class A, 10—no par | 49½ | 35 | 52 |
| BABCOCK & WILCOX, 7% com. | 120 | 113 | 132 |
| Binghamton L., H. & P., $6 pf | 102½ | 93 | 103½ |
| Birmingham Elec., pf. $7—no par | 109 | 105 | 111½ |
| Blackstone Valley G. & E., 6% pf | k107 | 103 | 110 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k128 | 98 | 153 |
| Blaw-Knox, com † | i 95 | 70 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f217 | .... | .... |
| Broad River Pwr., 7% pf | 104½ | 97 | 105½ |
| Brooklyn Edison, 8% com | 211 | 148½ | 225 |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26½ | | |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 33½ | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf | k 99 | 96 | 104½ |
| California Ry. & Pwr., 7% pf | k135 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | l109½ | 107 | 109 |
| Central & S. W. Util., $7 pf.—no par | a102 | 92½ | 99½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a107 | 98½ | 105½ |
| Central Ark. Ry. & Lt., 7% pf | 104½ | 100 | 104 |
| Central Ill. Pub. Serv., $6 pf | a 98 | 85½ | 100 |
| Central Ind. Pwr., 7% pf | a 95½ | 85½ | 95½ |
| Central Maine Power, 6% pf | 95 | .... | .... |
| Central Maine Power, 7% | 106 | 102 | 110 |
| Central Pwr. & Lt., 7% pf | 105 | 100½ | 105 |
| Central States Elec., 7% pf | 105 | 92½ | 104½ |
| Century Elec., 6% com | b142 | 114 | 162 |
| Chicago Fuse Mfg., com.—$2.50 no par | a 33½ | 30 | 35½ |
| Cincinnati Gas & Elec., 5% com | g100 | 96½ | 101½* |
| Cities Service, $6 pf.—no par | l 95½ | 87* | 94 |
| Cities Service, pf. B—no par | l 8½ | 8* | 8½* |
| Cities Service, pf. BB—no par | l 88½ | 80½* | 86* |
| Cities Service, com.—20 | l 56 | 40½ | 58½* |
| Cities Service, Bks. Shrs.—10 | l 27½ | 22½* | 27* |
| Cities Service Pwr. & Lt., 7% pf | 105 | 100½ | 106½ |
| Cities Service Pwr. & Lt., 6% pf | 96½ | 90 | 95 |
| Cleveland Elec. Illg., 6% pf | 112 | 108 | 114 |
| Cleveland Elec. Illg., 10% com | 350 | 285 | 370 |
| Columbia Gas & Elec., 6% pf | 109½ | 99½ | 110½ |
| Columbia G. & E. com. $5—no par | 91½ | 82½ | 98½ |
| Columbus Elec. & Pwr., $2 com.—no par | 65 | .... | .... |
| Columbus Elec. & Pwr., 7% pf | 107 | | |
| Columbus Ry., Pwr. & Lt., 6% 1st pf | 107 | 98½ | 108 |
| Columbus Ry., Pwr. & Lt., 6½% pf. B | 105 | 96 | 106 |
| Columbus Ry., P. & L. com.—no par | 105 | 75 | 110 |
| Commonwealth Edison, 8% com | a168 | 138 | 173 |
| Commonwealth Pwr., 6% pf | 104½ | 91½ | 105 |
| Commonw'th Pwr., $2, com.—no par | 64½ | 48½ | 78½ |
| Conn. Lt. & Pwr., 8% pf | 118 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf | 112 | 112 | 119 |
| Cons. Gas of N. Y., pf | 102 | 93 | 103 |
| Cons. Gas of N. Y., com. $5—no par | 121½ | 94 | 125½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf | e111½ | 110½ | 112½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf | e112 | 110½ | 114½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf | e113 | 112½ | 117 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf | e127½ | 127 | 130½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 68½ | 51 | 71 |
| Consolidated Pwr. & Lt., 7% pf | 105 | 100 | 106 |
| Consumers Pwr., 6% pf | 104½ | 100 | 106½ |
| Consumers Pwr., 6.6% pf | 106 | 103 | 107½ |
| Continental Gas & Elec., 8% ptc. pf | 109 | 103 | 110 |
| Continental Gas & Elec., 7% pr. pf | 106½ | 100 | 107½ |
| Contl. G. & E. com. $4.40—no par | *k225 | 210 | 265 |
| Crocker Wheeler, com.† | 23 | 23 | 38 |
| Crocker Wheeler, 7% pf | 82 | 78 | 88 |
| DALLAS PWR. & LT., 7% pf | 111 | 107 | 111½ |
| Dayton Pwr. & Lt., 6% pf | 108 | 101 | 109½ |
| Detroit Edison, 8% com | 167½ | 133½ | 170 |
| Dubilier Condenser, com.—no par | 3½ | 2 | 5 |
| Duke Pwr., cap | 135 | 115 | 145 |
| Duquesne Lt., 7% pf | 115½ | 114½ | 117½ |
| EASTERN NEW YORK UTIL., 8% pf | k110 | 102 | 112 |
| Eastern New York Util. com | k 65 | 70 | 75 |
| Eastern States Pwr. $7 com. | 12 | 9 | 14 |
| Eastern States Pwr., pf | 97 | 90 | 99 |
| East. Tex. Elec., 7% pf | 107 | 106 | 109 |
| Edison Elec. of Boston, $12 com. ex.div. | d260 | 217 | 267 |
| El Paso Elec. 7% pf | 110 | 105 | 112½ |
| Elec. Bond & Share, 6% pf | l111 | 105½ | 111 |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 76½ | 67½ | 80½ |
| Electric Household Util.† | a 15½ | 11 | 15½ |
| Elec. Investors, 6% pf.—no par | 100½ | 92 | 101 |
| Elec. Investors, com.†—no par | 41½ | 32½ | 47½ |
| Elec. Pwr. & Lt., ctfs. pf | 107½ | 96 | 109 |
| Elec. Pwr. & Lt., ctfs., 40% pd | k121½ | 103½ | 122½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 29½ | 16½ | 32½ |
| Elec. Refrig. cap.† | 11½ | 5½ | 37 |
| Elec. Ry. Securities, com.—no par | 6½ | .... | .... |
| Elec. St. Battery com. $5.25—no par | 73½ | 63½ | 81 |
| Elmira Wtr., Lt. & R.R., 7% pf | k104 | 99 | 105½ |
| Empire Pwr., ptc.† | 34 | .... | .... |
| Engr. Pub. Serv., $7 pf.—no par | m107½ | 93 | 108½ |
| Engr. Pub. Serv., com.—no par | 34½ | 21 | 39½ |
| Eureka Vacuum Cleaner, com. $4—no par | 74½ | 50 | 77½ |
| FAIRBANKS MORSE, 7% pf | k109 | 107 | 112 |
| F.-M., com.—$3—no par | 36½ | 30 | 43 |
| Federal Lt. & Trac., com. $1.40 | 42½ | 33 | 47 |
| Federal Lt. & Trac., $6 pf.—no par | 99 | 91 | 100 |
| Florida Pwr. & Lt., 7% pf | 106 | 102 | 107 |
| Ft. Worth Pwr. & Lt., 7% pf | l113 | 108 | 114 |
| GALVESTON-HOUSTON ELEC., 6% pf | 65 | 68 | 80 |
| Galveston-Houston Elec., com | 35 | 26 | 32 |
| General Cable, Cl. A $1 no par | 58 | 55½ | 62½ |
| Gen. Elec. $3 com.—no par | 135½ | 81 | 146½ |
| Gen. Elec., special—6% | 11½ | 11 | 11½ |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 36½ | 34 | 47 |
| Gen. G. & E. (Del.) pf. A $8—no par | k122½ | 113½ | 134 |
| Gen. G. & E. (Del.) pf. A $7—no par | k107½ | 100 | 110 |
| Gen. G. & E. (Del.) pf. B $7 | k103½ | 96 | 105 |
| Gen. Pub. Serv., $7 cum. pf., no par | k110 | 102 | 112 |
| Gen. Pub. Serv., com., no par | 16½ | 11½ | 18 |
| Ga. Ry. & Pwr., 8% pf | k125 | 119 | 125 |
| Ga. Ry. & Pwr., 7% pf | k113½ | 106 | 115 |
| Gt. Western Pwr., 7% pf | l104 | .... | .... |
| IDAHO PWR., 7% pf | 109 | 103 | 110 |
| Ill. No. Utilities, 6% pf | k 96 | 88 | 97 |
| Ill. Pwr. & Lt., 7% pf | 103 | 99 | 104 |
| Ingersoll Rand com | 93 | 86 | 96 |
| Int. Combus. Engr. com. $2—no par | 52 | 40½ | 64 |
| Int. Combustion Engr. 7% pf | 104½ | 101 | 105 |
| Int. Util., Class A $3.50—no par | k 50½ | 24 | [illegible] |
| Int. Utilities, Class B—no par | 10 | 3 | 11½ |
| Interstate Pwr., pf.—$7—no par | 97 | 93 | 100 |
| Interstate Pub. Serv., 7% pf | 102 | 98 | 104 |
| Iowa Ry. & Lt., 7% pf | k 98½ | 97 | 100 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 105½ | 97½ | 108 |
| Johns-Manville, com.†—no par | 119½ | 55½ | 126½ |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Jan. 7. lBid price Wednesday, Jan. 11. mLatest quotations available. †Dividend rate variable. *1928.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 10 | Low 1927 | High 1927 |
|---|---|---|---|
| KANSAS CITY PWR & LT pf. $7 | k114½ | 109 | 116½ |
| Kansas Gas & Elec., 7% pf | l108 | 103 | 107½ |
| Kentucky Hydro-Elec., 7% pf | a102 | 94½ | 104 |
| Kentucky Sec., 6% pf | k 91 | 83 | 90 |
| Kentucky Sec., 5% com | 115 | 100 | 135 |
| Kentucky Utilities, 6% pf. | k100 | 95 | 101 |
| LACLEDE GAS LT., 12% com. | 200 | 173½ | 267½ |
| Lehigh Pwr. Sec., com.—no par | 20½ | 15 | 22 |
| Long Island Ltg., 7% pf. | 111 | 107 | 112½ |
| Long Island Ltg., com.†—no par | 169 | 139 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 104 | 98 | 105 |
| Louisville Gas & Elec., cl. A. $1.75 | 28⅛ | 23⅛ | 30½ |
| MAN ELEC. SUPPLY, cap. $5—no par | 52 | 43 | 132 |
| Manila Elec., com.† no par | k 45½ | 40 | 60 |
| Maytag Mfg., com. .50—no par | 33½ | 23⅛ | 35½ |
| Memphis P. & L., pf.—$7—no par | k109 | 107 | 111 |
| Metropolitan Ed., pf.—$6—no par | 104½ | 93 | 106 |
| Metropolitan Ed., pf.—$7—no par | 108 | 104 | 110 |
| Metropolitan Ed., com. $5—no par | k 70 | 60 | 72 |
| Middle West Utilities, 7% pf | a120 | 110⅛ | 119 |
| Middle West Util., 7% pr. lien | a128 | 117½ | 127 |
| Middle West Util., com. $6—no par | a128 | 108 | 125 |
| Midland Utilities, pr. ln. 6% pf. | a106 | 97¾ | 107½ |
| Midland Utilities, 7% pf. A | a103½ | 96¾ | 103½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k102 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k 98½ | 98 | 101½ |
| Minn. Pwr. & Lt., 7% pf. | l108 | 104 | 107½ |
| Miss. River Pwr., 6% pf | 106 | 94 | 108 |
| Miss. River Pwr., 3% com | 62 | . |  |
| Mohawk Hudson Pwr., 1st pf.—$7 no par | 106 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | 106 | 94 | 107 |
| Mohawk Hudson Pwr., com.—no par | 30½ | 20½ | 32½ |
| Montana Pwr., 5% com | 103½ | 81½ | 109½ |
| Montreal Pwr., 7½% com | f 90 | .... | .... |
| Mountain States Pwr., 7% pf | 102½ | 97 | 103 |
| Mountain States Pwr., com.† | 17 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109 | 98 | 110 |
| National Carbon, 8% pf. | a138 | 130½ | 139½ |
| National Elec. Pwr., A† | a 28½ | 22 | 28½ |
| National Lt., Ht. & Pwr., com | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 109 | 101 | 111½ |
| National Pwr. & Lt., com.†—no par. | 22½ | 19⅛ | 26½ |
| National Pub. Serv., 7% pf. | 99½ | 93 | 102 |
| National Pub. Serv., 7% ptc., pf. | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 22⅛ | 18⅛ | 24 |
| National Pub. Serv., B com.—no par | k 25½ | 14 | 30 |
| Nebraska Pwr., 7% pf. | 110 | 106 | 109½ |
| Nevada-Calif. Elec., com. | 34 | 25 | 36½ |
| New Brunswick Pwr., 4% pf. | k 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k103½ | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | k101 | 95 | 100 |
| New Orleans Pub. Serv.—7% pf. | 108½ | 103 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 95 | 91 | 100 |
| N. Y. Central Elec., 7% pf | k102½ | 101 | 104 |
| New York Power & Light 6% pf nopar | m102 | .... | .... |
| New York Power & Light, 7% pf. | 115 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com | k109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | k109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | k 28½ | 27½ | 29⅛ |
| Niagara, Lock & Ont. Pwr., 7% pf. | k115 | 110½ | 116 |
| No. Amer., 6% pf.—50 | 53½ | 50 | 55 |
| No. Amer., com.—10 | 59⅞ | 45⅝ | 64½ |
| No. Amer. Edison, $6 pf.—no par | k104 | 96⅞ | 105 |
| No. Caro. Pub. Serv., pf.—$7—no par | 103½ | 93 | 105 |
| Northeastern Pwr., com. | 20¾ | 14½ | 25 |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 18⅛ | 9⅞ | 20⅛ |
| No. Ont. Lt. & Pwr., 6% pf. | k 98 | 84 | 95 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 108½ | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 126½ | 109⅛ | 136⅛ |
| No. Texas Elec., 6% pf | 45 | 45 | 70 |
| No. Texas Elec., com. | 10 | 5 | 36 |
| OHIO BRASS, com. B $4—no par | k 95 | 74 | 116 |
| Ohio Brass, 6% pf. | k110 | 100 | 111 |
| Ohio Pwr., 6% pf | 104½ | 96 | 106 |
| Ohio Pub. Serv., $6 pf | k103 | 95 | 102 |
| Ohio Pub. Serv., 7% pf | 110 | 103 | 111 |
| Ohio River Edison, 7% pf. | 108½ | 103 | 109½ |
| Oklahoma Gas & Elec., 7% pf. | 108½ | .... | .... |
| PACIFIC Gas & ELEC., 6% pf. | 26⅛ | 24½ | 26½ |
| Pacific Gas & Elec., 8% new com. | 47¾ | 31 | 50 |
| Pacific Pwr. & Lt., 7% pf. | l106 | 102 | 105½ |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 79 | 75½ | 80 |
| Penn-Ohio Edison, 6% pf. no par | k 95½ | 80⅝ | 97 |
| Penn-Ohio Edison, 7% pf | 107½ | 97½ | 104 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 108 | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par. | l109½ | 107 | 109 |
| Penn Wtr. & Pwr., 8% com., new | m 73 | 47¼ | 75 |
| Phila. Co., 5% pf. 50. | k 48⅝ | 40 | 51 |
| Phila. Co., 6% pf.—50 | 52½ | 50 | 53½ |
| Phila. Co., com.—50 | k150 | 85½ | 153½ |
| Phila. Elec., 8% com.—25 | c 55⅛ | 46 | 58⅛ |
| Portland Elec. Pwr., 7% pf. | 102 | 97½ | 102½ |
| Portland Elec. Pwr., 6% pf. | 75 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 73 | 55 | 70 |
| Portland Elec. Pwr., com. | 33 | 22 | 30 |
| Potomac Elec. Power, pf | k111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | k 60 | 28 | 60 |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | l107 | 99* | 103* |
| Pub. Serv. of N. J., 6% pf | 104½ | 98½ | 105 |
| Pub. Serv. of N. J., 8% pf. | 134½ | 125 | 135½ |
| Pub. Serv. of N. J., $2 com.—no par | 41⅞ | 32 | 46½ |
| Pub. Serv. of No. Ill., 6% pf. | a113½ | 101½ | 113⅝ |
| Pub. Serv. of No. Ill., 7% pf. | a120 | 112½ | 120½ |
| P. S. of No. Ill., com. $8—no par | a160⅝ | 140⅝ | 161½ |
| Pub. Serv. of No. Ill., $8 com. | k160 | 130⅝ | 160 |
| Pub. Serv. of Okla., 7% pr. ln. | k103 | 90 | 103 |
| Pub. Serv. Elec. & Gas, 6% pf. | k108½ | 102 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | k108 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 94 | ... | ... |
| Puget Sound Pwr. & Lt., com. | 37½ | 28 | 38½ |
| RADIO COPR. OF AMER., $3.50 pf.—50 | k 55⅛ | 49 | 57 |
| Radio Corp. of Amer., com.—no par. | 104⅞ | 41⅛ | 101 |
| Rhode Island Public Service, pf. $2—no par | 30⅜ | 28½ | 30⅝ |
| Rochester Gas & Elec. 6% pf. D | k105½ | 101 | 103½ |
| Rochester Gas & Elec., 7% pf. B | 105½ | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105¾ | 101½ | 103½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf | k111 | 105 | 112½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel Corp. | 1½ | 10cts | 10½ |
| Sierra Pacific Elec., 2% com. | 31⅝ | 24½ | 31½ |
| Sioux City Gas & Elec., 7% pf | 107 | 99 | 105½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l108½ | ... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 85½ | .. | .... |
| Southeastern Pwr. & Lt., com.—no par | 43⅞ | 29⅛ | 46 |
| So. Calif. Edison, 8% pf. | k 45 | 36½ | 40 |
| So. Calif. Edison, 7% pf. | 28⅞ | 27⅞ | 29½ |
| So. Calif. Edison, 6% pf | 26½ | 24½ | 26¼ |
| So. Calif. Edison, 8% com. | 43⅞ | 31⅛ | 45 |
| Southern Cities Utilities, 7% pf. | 70 | 67 | 90½ |
| Southern Cities Utilities, com. $4 | m 30 | 23½ | 42½ |
| Southwestern Lt. & Pwr., A $3 | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf | 88½ | 83 | 91½ |
| Southwestern Pwr. & Lt., 7% pf | k110 | 103 | 113 |
| Springfield (Mo.) Ry. & Lt., 7% pf. | m102 | 95 | 102 |
| Standard Gas & Elec., 8% pf | 65¼ | 57½ | 66 |
| Standard Gas & Elec., 7% pr. pf. | 110½ | 103 | 113 |
| Standard G. & E., com. $3.50 | 58½ | 54 | 65½ |
| Standard Power & Light, com. | 31½ | 22 | 32 |
| Standard Pwr. & Lt., 7% pf. | 104 | 98 | 105 |
| Staten Island Edison, pf.—$6—no par | 101½ | 99 | 103 |
| Superheater, $6 com.—no par, ex div | 162 | 170 | 185 |
| Syracuse Lighting, 7% pf. | k111 | 103 | 111 |
| Syracuse Lighting, 8% pf. | 117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 62½ | 49 | 64½ |
| Tenn. Elec. Pwr., 6% pf | 101½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf | 109 | 103 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 26 | 20 | 30 |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf | l114 | 104 | 113½ |
| Tide Water Pwr., 8% pf | 108½ | 105 | 111 |
| Timken Roller Bear., com.—$4 no par | 132½ | 78 | 142 |
| Toledo Edison, 7% pf | l109 | 102* | 107* |
| Toledo Edison, 6% pf | k102 | 95 | 105 |
| Toledo Edison, 6% com | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | k 96 | 96 | 99 |
| UNITED GAS & ELEC., 7% pf. | 102 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 74 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c112½ | 89½ | 118½ |
| United Lt. & Pwr., pf.—$4—no par | a 55 | 50 | 57 |
| United Lt. & Pwr., pf.—$6 50—no par | a 97 | .... |  |
| United L. & P., com. A 48—no par | 14 | 12⅛ | 15½ |
| United L. & P., com. B 48—no par. | k 19 | 16 | 21 |
| Utah Pwr. & Lt., 7% pf | l109½ | 104 | 109 |
| Utica Gas & Elec., 7% pf | 105½ | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf | 98 | 93 | 100 |
| Utilities Pwr. & Lt., com. A $2 | 29½ | 27 | 34 |
| Utilities Pwr. & Lt., com. B $1—no par | 19⅞ | 13½ | 23½ |
| VERMONT HYDRO-ELEC., 7% pf | k 97 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k108 | 105 | 110 |
| WAGNER ELEC., 7% pf. | b 97 | 68 | 93½ |
| Wagner Elec., com.—no par | b 38⅞ | 18½ | 39⅞ |
| Washington Ry. & Elec., 5% com | 455 | 180 | 475 |
| Washington Ry. & Elec., 5% pf. | 101½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | k178 | 136 | 182 |
| West Penn Elec., 6% pf | 113½ | 102 | 112½ |
| West Penn Elec., Cl. A $7 | 106½ | 97⅛ | 111 |
| West Penn Pwr., 7% pf. | 115⅛ | 111 | 118 |
| West Penn Pwr., 6% pf | k112½ | 100⅛ | 111 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf | k103 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 103 | 96 | 106 |
| Western States Gas & Elec., com | 38 | . . . |  |
| Westinghouse Elec. & Mfg., 8% com.—50 | 94⅞ | 67⅛ | 94½ |
| Weston Elec. Instrument, Cl. A $2—no par | 30⅞ | 30 | 34⅛ |
| Weston Elec. Instrument, com.—no par | k 12⅛ | 11 | 18⅛ |
| Wheeling Elec., 6% pf. | k103 | 95 | 104 |
| Worthington Pump, 7% pf. A | k 46 | 44 | 61½ |
| Worthington Pump, 6% B | k 41 | 37 | 54½ |
| Worthington Pump, com. | k 28½ | 20⅛ | 46 |
| YALE & TOWNE com. $5—25. | k 73⅞ | 70½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 7. *l*Bid price Wednesday, Jan. 11. *m*Latest quotations available. †Dividend rate variable. *1928.

NEW PUBLIC SERVICE ISSUE.—The Public Service Company of New Hampshire has been granted authority to issue $1,800,000 in 4½ per cent first and refunding mortgage gold bonds by the Public Service Commission. Decision regarding the petition of the company to issue 3,400 shares of preferred stock $6 dividend series was reserved. The issue is planned to cover the purchase of electric properties at Salmon Falls, Conway and West Stewartstown.

NEW ENGLAND POWER STOCK ISSUE.—The New England Power Company, Worcester, Mass., has petitioned the Public Utilities Commission for authority to change the par value of its common stock from $100 to $25 and to issue additional common stock to the amount of $1,700,000. The company already has a petition pending with the commission that seeks an issue of additional common stock to the amount of $5,100,000.

WESTERN ELECTRIC PAYS SPECIAL DIVIDEND.—Directors of the Western Electric Company on Dec. 13 declared a special dividend of $13 per share in addition to the regular quarterly dividend of 50 cents per share on the outstanding 3,750,000 shares of no-par-value common stock, both payable Dec. 31 to holders of record Dec. 24.

STOCK PROFITS DISTRIBUTED TO SHAREHOLDERS.—Directors of the Connecticut Power Company, Hartford, Conn., have authorized the distribution to stockholders of a $75,000 profit accrued from the sale of 5,000 shares of stock of the New England Power Company at $65, purchased in 1925 for $50 a share. A payment of $1 a share was paid to stockholders Jan. 5 to stock of record Dec. 27. The Hartford Electric Light Company also authorized a payment to stockholders of the major part of profits of $150,000 from the sale of 10,000 shares of stock for $65 a share, all of which was purchased from the New England Power Association in 1925 for $50 a share. A similar distribution was made to that in the case of the Connecticut Power Company.

EDISON COMPANY TO ACQUIRE ONTARIO POWER SHARES.—Application has been filed by the Southern California Edison Company for permission to acquire the 4,750 shares of preferred stock outstanding of the Ontario (Calif.) Power Company. The Edison company had previously applied for permission to acquire all of the outstanding common stock of the Ontario company.

# Business News and Market Conditions

SALES in the industry are light and inquiries have fallen off in virtually all sections of the country. Electrical men point to this condition as seasonal and say that projects ahead indicate an early resumption of activity. In New England small motor sales maintain a good showing and optimism is prevalent despite a slow start. Inquiries show a tendency to lag in the Eastern district but there are indications that sizable commitments will be made both by industrial and central-station plants as well as railways.

In St. Louis manufacturers are optimistic, and several inquiries are reported for oil pipe line pumping equipment. A seasonal lull is noted in the Southeast but there is a reasonable amount of industrial business in prospect. In the Middle West the building outlook is encouraging. On the Pacific Coast many large buildings are projected. A cement company purchased $100,000 worth of switchboard, oil circuit breakers and other equipment, and the city of Tacoma ordered $6,000 worth of current-limiting reactors and a voltage regulator. An appropriation of $65,000 and authority to purchase certain electrical equipment for Seattle's Cedar Falls plant is before the financial and utilities committee of the city council.

## *Early Orders Expected in Eastern District*

While inquiries show a tendency to lag in the Eastern district, market interest is lively, owing to indications that sizable commitments soon will be made both by industrial and central-station plants. One manufacturer states that inquiries are just about one-half as much as in the early weeks of December. An optimistic tone is shown in connection with forthcoming railroad business. Sales have been good during the last few weeks, and, with definite appropriations for electrification work, it is expected that 1928 will produce high records in that line. On the other hand, electric traction sales are extremely light at the moment and a prominent manufacturer of such equipment looks for the slow movement to prevail for a number of weeks. Several utilities are expected to enter the market at an early date for transformers, switching equipment, controls and other substation apparatus. Business in heavy motors and other industrial electrical equipment is holding up well, and the next 30 to 60 days is expected to bring to maturity several orders now pending. Fractional horsepower motors are noticeably weak at present, and not much is looked for in this direction for a number of weeks to come.

Northern New York is developing as a bright spot in the present situation. The Buffalo, Niagara & Eastern Power Company, Buffalo, has placed an order with a large manufacturer for a good quantity of distributing equipment for local installation, and is scheduling an active year for work of this character. Another utility in this section will soon give a contract for a heavy amount of substation apparatus. The Plattsburg Power & Electric Corporation is concluding arrangements for the acquisition of the hydro-electric power plant of Peck Brothers at Shushan, Washington County, and will tie in with its system. The new year shows advancing activity in the Baltimore district and good central station business is anticipated in this quarter. The Consolidated Gas, Electric Light & Power Company of Baltimore will be actively interested in the proposed hydro-electric power plant to be located on the Susquehanna River, south of Holtwood, Pa., on which initial work will soon begin. The ultimate project will cost close to $20,000,000.

Current construction operations in the Eastern district include the following: The Public Service Electric & Gas Company, Newark, N. J., plans a substation on Peace Street, New Brunswick, to cost about $75,000. Jersey City, N. J., plans a marine terminal on the Hudson River waterfront to cost approximately $10,000,000. Harrison, N. J., plans installating an ornamental lighting system on Fourth Street. The American Gas & Electric Company, New York, plans a steel-tower transmission line from site of its proposed power plant at Churchtown, near Pennsville, N. J., to a connection with the system of the Atlantic City Electric Company, estimated to cost $1,000,000.

## *Volume of Metal Sales Higher at Steady Prices*

Sales of most of the non-ferrous metals have been of average volume. Prices, in general, have shown little change, with the exception of tin which has declined over a cent during the week in view of a weaker market in London.

NEW YORK METAL MARKET PRICES

| | Jan. 4, 1928 Cents per Pound | Jan. 11, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14⅛ | 14.05-14.125 |
| Lead, Am. S. & R. price | 6¼ | 6¼ |
| Antimony........... | 10⅝ | 10¾ |
| Nickel, ingot ...... | 35 | 35 |
| Zinc spots......... | 5.95 | 6 |
| Tin, Straits .... | 10⅞ | 56⅛ |
| Aluminum, 99 per cent | 24 30 | 24 30 |

Base copper wire price Jan. 11, 1928, 15¾ cents

In fact, all the metals have been weaker in London in the last two or three days. Though it is the general impression that the copper market is very quiet, the total domestic sales have been the highest since the first week of December, and not far below an average week's business. Buying has been fairly well distributed between rolling mills and brass manufacturers. More than the usual proportion has been taken by Middle Western consumers, reflecting greater activity in automobile lines, especially Ford.

## *Sales in New England District Are Light*

Sales of electrical supplies and equipment in the New England district are light. Central-station orders were confined to a few purchases of switch and control apparatus, one of which for about $5,000 was noted. Heavy equipment interests lagged and inquiries are few. Small motor sales, alone, maintain a good showing and orders for a number of ratings from 10 hp. up to 30 hp. are recorded. One representative reports an increase in demand for motor-connected pump units, and another reports elevator-control apparatus is attracting more attention than at this time last year. Scheduled material is in steady demand, though the orders are for small lots as a rule. A prominent manufacturer forecasts normal business prospects for the coming year. General optimism prevails, despite what appears to be a slow start.

## *Heavy Building Planned on Pacific Coast*

Projected construction, recently announced on the Pacific Coast includes the new plant of the Loyola University near Los Angeles, worth $5,000,000, the $1,250,000 Bar Association Building and the $800,000 medical building, both of Los Angeles, and a $600,000 apartment house, the $400,000 Y.M.C.A. hotel and the $2,000,000 Olympic Club of San Francisco. New hospitals are projected for East Oakland and the University of California campus in Berkeley. Street lighting plans for Shattuck Avenue in Berkeley, Waverley Avenue in Palo Alto and for the city of Tulare are now being prepared. An airport for Livermore is projected. Machinery orders reported include eight assorted motors sizes 5 hp. to 50 hp., valued at $8,000, for a steel company in the Bay region. A 100-hp. synchronous compressor motor, valued at $2,000, for a chemical company. A 55-hp. oil well motor, complete with transformer and accessories, valued at $3,500, and six transformers, size 50-kva., valued at $4,000 for the Kern Oil Fields; a motor-driven air compressor, valued at $6,000; a lightning arrester, valued at $3,000 for the Truckee District, six assorted transformers, 50 kva. and 75 kva., valued at $4,500, for a mining company and motor generator sets and accessories, valued at $6,000 for the United States Navy Yard at Mare Island, an order for 32 duplex electroliers, valued at $7,000, is reported as an extension to the Modesto lighting system. There are about 50 in. of snow on the Sierras, a little better than the average. All natural business factors are excellent.

The majority of Seattle jobbers report inventory will be completed within ten days' time and that last week's sales established a new record for a like time and period. Equipment costing $100,000 was purchased by the Superior Portland Cement Company at Concrete, Wash.; $6,000 of current-limiting reactors and one induction-type single-phase voltage regulator for the city of Tacoma, and about 75 motors, ranging from 100 hp. down distributed among out-of-town dealers, lumber mills and industrial plants. An appropriation of $65,000 and authority to purchase certain electrical equipment for Seattle's Cedar Falls plant is before the finance and utilities committees of the city council. Construction projects are as follows: The Gila Bend Light & Power Company, Gila Bend, Ariz., plans a power plant to cost about $35,000; and also a local street-lighting system; the Salt River Valley Water Users' Association, Phoenix, Ariz., plans a transmission line and pumping plants in connection with a proposed irrigation project to cost about $6,000,000; Los Angeles, Calif., plans a lighting system on Bronson Avenue, and portions of Fourth, Fifth and Martland Streets, as well as on the Harbor Boulevard and Valley Spring Lane; the Pacific Gas & Electric Company will extend its power plant at Napa, Calif.; Sacramento, Calif., plans a lighting system on a number of streets, with underground conduit lines; San Francisco, Calif., will install an improved lighting system on Golden Gate Avenue; Stockton, Calif., plans an early call for bids for an ornamental lighting system on Center and Main Streets, and Weber Avenue, to cost about $75,000; Tulare, Calif., plans a lighting system in the business district; Southern California Edison Company will build a new substation at San Marino; the Mountain States Telephone & Telegraph Company will extend its central station at Meridian, Idaho, to cost $35,000, and the Peru Mining Company, Deming, N. M., plans a milling plant to cost in excess of $125,000.

## *Seasonal Lull Evident in Southeast*

A seasonal lull is evident in the electrical field in the Southeast, and central-station companies are purchasing mostly for immediate requirements. The only large order placed was by a new motor-assembling plant and called for power transformers totaling 1,500 kva. and distribution transformers aggregating 1,325 kva. There is a reasonable amount of other industrial business in prospect but no immediate announcements are expected. The demand for transformers and meters continues satisfactory, one central-station company purchasing small power and distribution transformers totaling $14,700, while its house type meter orders aggregated $8,000. Some other central-station orders during the past ten days called for switch house and switching equipment amounting to $5,100 and bushings and arresters totaling $3,100. Two municipalities in Georgia recently placed orders for poles for maintenance work, one order amounting to $1,000 and the other $600. Another Georgia town ordered white-way equipment totaling $7,000.

A large restaurant being built in a Georgia city contemplates the purchase of electric ovens and miscellaneous heating appliance to the extent of $3,000 and orders will undoubtedly be placed this week. The Georgia Power Company will construct 6 miles of 2,300-volt 3-phase line for the purpose of supplying service to the towns of Belleville and Manassas and also will construct a multiple street-lighting system in the latter town.

Construction projects are as follows: The Florida Public Service Company has purchased property at Fort Meade, Fla., and plans construction of a substation. The Lavonia Cotton Mfg. Co., Lavonia, Ga., will soon begin the complete electrification of its mill, estimated to cost $50,000; the Georgia Power Company plans a transmission line from Louisville to Waynesboro, and to Vadalia, Mount Vernon and McRae, with a substation to be built at the last noted place; Waynesboro, Miss., plans an ornamental lighting system in the downtown district; the Carbide & Carbon Chemical Corporation, South Charleston, W. Va., plans rebuilding the portion of its plant recently destroyed by fire with loss of more than $350,000.

## *Manufacturers Optimistic in St. Louis District*

The feeling expressed by manufacturers and power company officials regarding business in the St. Louis district is optimistic. Inquiries have been received for oil pipe-line pumping equipment, and local contracts were closed for two 1,500-kva. transformers and one 80-kva. generator. In the western part of the district an order was placed for switching equipment valued at $33,000 and circuit breakers amounting to $1,300. An order from the southwest section called for lift-bridge equipment, consisting of motors and control and amounting to $4,500. Jobbers report a fair general business and a good movement of building materials.

Construction projects are as follows: Bentonville, Ark., plans an ornamental lighting system in the business district; the Arkansas Power & Light Company will improve its Woodward and Dixie substations, and will construct a 110,000-volt transmission line between the two points, at an estimated cost of $450,000; Kansas Power & Light Company, Atchison, Kan., plans additions to its ice plant; the Bastrop Ice & Storage Company, Bastrop, La., plans an addition to its ice plant to increase the capacity to 60 tons; the City Ice Company, Kansas City, Mo., plans, an ice plant at Fifteenth and Winchester Streets; the Southwestern Light & Power Company has contracted with Chickasha, Okla., for a lighting system in the business district; the Texas Electric Service Company plans a transmission line from Wichita Falls to Dundee, Tex.; Central Power & Light Company plans improvements in its power plant at Laredo, Tex., to cost close to $250,000; the Texas Power & Light Company will construct a transmission line from Lufkin to Huntington, Tex.; the San Antonio Public Service Company plans the addition of a 30,000 kw. unit at its Comal power plant at New Braunfels and the Woldert Peanut Products Company, Tyler, Tex., plans rebuilding the portion of its plant recently destroyed by fire with a loss of about $400,000.

## *Building Outlook Encouraging in Middle West*

The Middle West apparently got off to a good start the first week of the new year. Final reports of inventories indicate normal stocks on hand and a general good condition. Week end reviews report an entirely optimistic attitude toward the coming year, with expressed determination to make 1928 equal, or surpass, 1927. The building outlook is encouraging, heavy awards for highway construction are anticipated, and large track accessory purchases were made this week, approximately 20,000 tons being placed since Jan. 1. The various utility companies will undoubtedly continue their conservative policy of purchasing which proved so successful last year. Among the interesting items placed this week were 655,000 lb. Muntz metal condenser tubes, complete coal storage and reclaiming equipment with appurtenances, and two ash sluicing pumps with appurtenances. Jobber's sales are about normal for this period of the year. A survey of last year indicates increased sales of appliances except fan motors, and 1928 is expected to equal this record.

The Bennett Organ Company, Blue Island, Ill., plans an addition to cost $200,000; Champaign, Ill., plans a lighting system to cost $35,000; the Elgin National Watch Company, Elgin, Ill., plans a new addition, estimated to cost $450,000; the Indiana Board of Agriculture, Indianapolis, Ind., has approved plans for an improved lighting system at the State Fair Grounds; the Central States Power & Light Company has approved plans for an addition to its power plant at Iowa Falls, Iowa, to cost about $300,000, and also will extend transmission lines; Sidney, Iowa, plans a municipal power plant; the Wolverine Tube Company, Detroit, Mich., plans extensions in its plant to cost about $300,000; the Lansing Ice & Fuel Company, Lansing, Mich., plans extension in its ice plant; Benson, Minn., has authorized plans for a municipal power plant and system; the Public Service Company has authorized the construction of a transmission line to Edmore, N. D., and vicinity; the Cleveland Electric Illuminating Company, Cleveland, plans an addition to its storage plant on Miles Avenue.

# Activities of the Trade

## Westinghouse Gets Order for Ten Electric Cars

L. S. Miller, president of the New York, Westchester & Boston Railway Company, has announced the placing of an order for ten additional electric passenger cars with the Westinghouse Electric & Manufacturing Company. These new cars are to be put into operation on a new extension which the New York, Westchester & Boston Railway is constructing between Harrison and Rye, N. Y., and which will be finished about next spring. The cars are 72 ft. over all in length and will be equipped with Westinghouse single-phase motors and control.

## Pacific Coast Contract Let to Pelton and General Electric

The city of Seattle, Board of Public Works, has awarded contracts on three items of the $145,000 worth of hydro-electric generating equipment for the No. 6 unit of Cedar Falls. Contract for an 18,000-hp. turbine, costing $60,285, and a 325-hp. water wheel, costing $4,985, for driving an exciter, was let to the Pelton Waterwheel Company of San Francisco. A contract for three 5,000-kva. transformers, costing $24,885, was also let to the General Electric Company.

## Woodward Governor to Hold School of Instruction

Following a practice inaugurated last year by the Woodward Governor Company of Rockford, Ill., the company will hold at its factory during the last day of January and the first three days of February, 1928, a school of instruction on the care, operation and theory of governor-operation in general. The school will deal strictly with governor problems and is open to anyone interested. The company states that it will provide the school and the instruction so that power companies and anyone interested may send their representatives to attend the school at their own expense.

## General Electric Establishes Contributory Pension Plan

A contributory pension plan whereby employees pay a small part of their wages from year to year to a pension fund, supplementing the old-age pension system which the General Electric Company has had in effect since 1912, has been announced by Gerard Swope, president of the company. At the same time Mr. Swope announced the creation of a pension trust. Instead of the company carrying a reserve on its balance sheet sufficient to meet its obligation to employees reaching the retiring age, $5,000,000 has been turned over to the trustees of the new trust by the company.

Pensions at present are computed at 1½ per cent of the earnings of employees for each year of continuous service. Under the contributory plan of additional pension which it is proposed to make effective Jan. 1, 1929, 1½ per cent of the annual earnings of the employees will be turned over to the custodians, a board of seven, on which the employees will have representation. This money will be invested and held for the employees individually. Interest will be allowed to accumulate. The retiring age in the past has been 70 years for men. Under the new plan it is proposed to make this 65 years for men and, as at present, 60 years for women. At the time an employee reaches the retiring age the custodians of the fund will pay the accumulated amount in full or in installments. If an employee leaves the service of the company or dies before reaching the pension age, the amount accumulated, with interest, will be given him or his estate.

## General Electric Orders for 1927 Decrease 5 Per Cent

Orders received by the General Electric Company during the year 1927 amounted to $309,784,623 compared with $327,400,207 for 1926, a decrease of 5 per cent, Gerard Swope, president, has announced. For the three months ended Dec. 31, orders amounted to $76,708,532 compared with $80,406,570 for the final quarter of 1926, also a decrease of 5 per cent. Sales billed and earnings for the year will be announced the latter part of March, when the annual report of the company is published.

## Allis-Chalmers Company to Build Plant in Seattle

The erection of a three-story plant at First Avenue, South, and Atlantic Street, is planned by the Allis-Chalmers Manufacturing Company, Milwaukee. Work is scheduled to begin March 1 on a concrete structure, 60x150 ft., to cost about $100,000. The plant will be used for manufacturing and assembling purposes.

The Clay Products Company, Inc., Brazil, Ind., manufacturer of "Super-Quality" vitrified clay conduit, announces a change in its marketing policy. Except in a few isolated territories, the company will sell directly to the customer, instead of through distributors, as in the past. The company expects, through this arrangement, to furnish better service, and to assure the quality of the delivered conduits. Frank N. Gormley will remain in charge of clay conduit sales.

The Eureka Vacuum Cleaner Company, Detroit, announces that on Dec. 14 it produced the two-millionth Eureka vacuum cleaner. Unlike its predecessors, this units is made of black velvet, rhinestones and gold. After being displayed at one of the company's major branches, it will be placed in a permanent exhibition at the Detroit offices of the company, along with the millionth cleaner.

The Henkel Manufacturing Company, 122 South Michigan Boulevard, Chicago, announces an electric fixture-mirror-cabinet combination known as the "Edge-Lite" for bathrooms. The combination has an adjustable lighting fixture which can easily be placed on any of the three sides of the mirror by sliding it in a grooved slot in the frame.

The Electric Vacuum Cleaner Company, Inc., Cleveland, announces that Ralph B. Wilson, who joined the organization in 1920 as manager of central station sales, has been appointed vice-president and general sales manager. Harry C. Hahn, who has been Mr. Wilson's assistant for the last several years, has been named as the new head of the central-station sales department of the company.

The Gillette-Vibber Company, New London, Conn., manufacturer of "Gee-Vee" electrical specialties, announces a new type of "Gee-Vee Endo," a split-type fitting for clamping on the ends of armored cables.

The Parker-Kalon Corporation, New York City, manufacturer of metallic drive screws, announces that its factory and general offices will move from 352 West Thirteenth Street, to 200 Varick Street, New York City on Dec. 1.

The Black & Decker Manufacturing Company, Towson, Md., announces a combination grinder and buffer furnished with a 5-in. grinding wheel and a 6-in. wire wheel brush. The company has also placed on the market a new ball-bearing ½-in. electric drill.

The Ohio Brass Company, Mansfield, Ohio, announces the opening of an office at 721 Healy Building, Atlanta. K. V. Farmer, H. H. Hoxie, J. A. Whatley and G. W. Willis, sales representatives of the company in that part of the country, will be stationed at that office.

The Lincoln Electric Company, Cleveland, announces the transfer of John Van Horne from Atlanta to Moline, Ill., where he will be found at 514½ Fifteenth Street, covering the Tri-Cities for the sale of "Linc-Weld" motors and "Stable-Arc" welders. He will operate under the direction of R. D. Malm, Western manager at Chicago.

# New Equipment Available

## "Switch Start" Motor

A new "Switch Start" motor built in sizes from ½ hp. to 30 hp. for either two-phase or three-phase, 60-cycle current has been placed on the market by the Lincoln Electric Company, Cleveland. This motor is so designed that it can be started directly across the line and the starting current will be below the requirements of the National Electric Light Association. The chief claim of the manufacturer for the motor is that operating characteristics, such as power factor, efficiency, maximum torque, temperature rise, etc., have not been sacrificed in order to secure low starting currents.

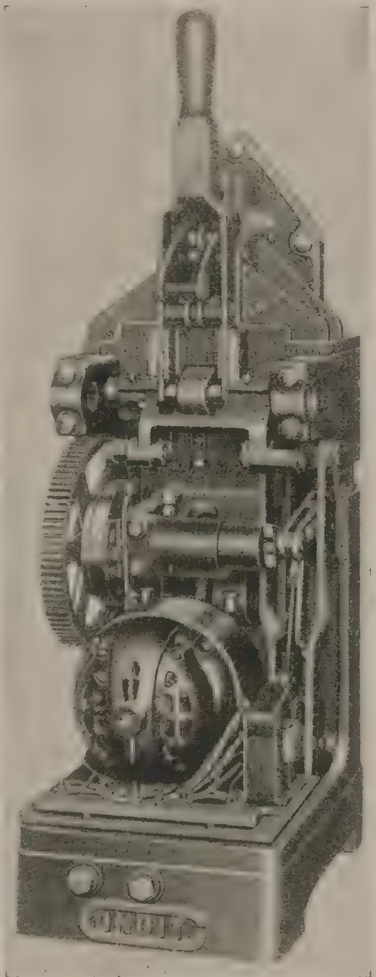
Tests made by the manufacturer show that starting torques of from full load to better than 250 per cent of full load, depending on the horsepower and speed, are possible without exceeding the N.E.L.A. requirements as to starting currents. The torque curve of the "Switch Start" motor shows a gradually increasing torque up to the maximum torque point. On sudden high overloads it is claimed that the "Switch Start" motor also has a very high or maximum pull-out torque. The line is of welded steel construction and is normally equipped with sleeve bearings, although ball bearings will be furnished at the customer's request. Large shafts, large bearings and waterproofed insulation are claimed for these motors.

## Fuse and Disconnect Cut-Out

A double-duty fuse and disconnect cut-out which will act as a protective unit has been developed by the James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis. The cut-out acts as a protective unit by having a higher rupturing capacity. The housing and handle are made of vacuum plastic wet-process porcelain. The manufacturer states that the horn fiber used in the construction of this cutout is specially treated and seasoned and a coat of Bakelite varnish applied to exclude moisture. The cartridge contacts are made of materials of high resilient qualities, and the brass line contact castings are of generous proportions. The cut-out is available in eight different types.

## High-Speed Circuit-Breaker Closing Mechanism

An oil circuit breaker closing mechanism (type MO-1) of compact design has been developed by the Condit Electrical Manufacturing Corporation, Boston. It consists essentially of a combination of springs, mechanism and a motor through which stored energy is released for closure at will or automatically. The actuating spring is always under tension ready for closure, as the motor sets the spring after each closing operation. Less than one-fourth second elapses between the energizing of the release coil and the closing of the breaker. After closing, from five to ten seconds is taken by the motor in storing energy in the spring for the next operation, depending on the size and type of breaker. Automatic reclosing may be obtained by using an external timing relay. The mechanism is well adapted to panel, panel frame or wall mounting in substations or isolated switch houses. It can be furnished as follows: Automatic trip-free with one, two or three coils; transformer trip or two-coil series trip. It can be operated from a 200-watt potential transformer. The mechanism is specially adapted to the operation of moderate capacity breakers for synchronizing purposes and for automatic change-over switching.



OIL CIRCUIT-BREAKER CLOSING MECHANISM. AN EXTERNAL TIMING RELAY WILL PROVIDE AUTOMATIC RECLOSING

## Dust-Tight and Oil-Immersed Starting Equipment

For special applications the Westinghouse Electric & Manufacturing Company is now building two modifications of its standard equipment of "Line-starters." One of these has special provision for excluding dust. Another modification has all of its parts in which sparks or arcing might occur immersed in oil. Another development is a water-tight and gas-tight push-button station, in which all the elements that operate to open and close the circuit and on which there may be sparking are inclosed in an air-tight chamber.

## Low-Voltage Terminal

A new type of low-voltage terminal for indoor or station service has been recently placed on the market by the Standard Underground Cable Company, Pittsburgh. It is designed for mounting on the end of pipe conduit or connected to the sheath of a lead-covered cable by means of a stuffing box gland or a plumber's wiped joint. The line is made of cast iron with bakelite insulating tops and conductor outlets, the joints being rendered moisture-proof by liberal gaskets. These terminals are suitable for terminating low-voltage power or control cables or similar low-potential conductors.

IMMERSION HEATER.—An electric immersion heater for electroplating solutions and other liquids which will not attack lead has been developed by the General Electric Company. It is primarily intended for low-temperature heating only. The unit consists of a steel-sheathed helicoil unit covered with a lead jacket swaged tight to the steel unit. The terminals are brought into a terminal box suitable for conduit connections. It is made in two sizes, both for a maximum demand of 5 kw., one for 110-volt circuits and the other for 220-volts. Only the lower portion of the heater dissipates heat. The upper portion, being inactive, allows the unit to be used in tanks in which the level of the solution may be as low as 10 in. from the top of the tank. The heater can be supplied in different formations.

NEON LIGHT FOR AVIATION USE.—A new type of quartz neon gas-filled lamp for aviation use has been developed by research engineers of the General Electric Company. The lamp, which resembles a ball of reddish orange fire when in use, emits all its visible radiations in the long wave lengths, which tests have shown to have greater fog-penetrating power than light higher in the spectrum. It was found that during a heavy morning mist, when the laboratory building in which the new lamp was housed could not be seen 500 ft. away, the brilliant red glow penetrated to a distance of half a mile or more.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Dec. 20, 1927)

1,652,999. Electric Motor; S. C. Benson, Cleveland, O. App. filed Oct. 25, 1921. Means for automatically cutting off the electric supply and to stop the motor, whenever objectionable sparking occurs at the commutator and particularly when the armature coil opens.

1,653,014. Induction Heater; E. E. Kittredge, J. A. Forster and R. D. Johansen, Alameda, Calif. App. filed Aug. 10, 1926.

1,653,031. Signaling System; F. Zogbaum, New York, N. Y. App. filed Jan. 19, 1922. In which switches or other objects may be remotely controlled and supervised.

1,653,070. Resistance Regulating Apparatus for Electric Welding; A. Smith, San Mateo, Calif. App. filed April 20, 1925.

1,653,078. Relay; F. H. Winter, Schenectady, N. Y. App. filed Jan. 12, 1927. Differential relay.

1,653,086. Electric Switch; C. Christensen, Chicago, Ill. App. filed March 13, 1923. Oil break type.

1,653,107. Single Phase Transformer; W. Kochling, Waidmannslust-Berlin, Germany. App. filed May 17, 1927. Having a magnetic core with an uneven number of winding legs such as three, five, and so forth, the windings being so arranged that the magnetic flux in adjacent winding legs flows in opposite directions.

1,653,117. Suspension Insulator; J. M. Peck, Honeoye Falls, N. Y. App. filed June 26, 1925.

1,653,141. Electrode Holder; J. E. Woodland, Richmond Hill, N. Y. App. filed June 23, 1926. For holding the carbon electrodes in motion picture machines and similar apparatus.

1,653,177. Flow Indicator; A. Herz, Chicago, Ill. App. filed Dec. 26, 1924. Also for use as low water alarm.

1,653,195. Tripping Device for Electric Switches; J. D. Wood, Quincy, Mass. App. filed Nov. 3, 1924.

1,653,251. Temporary Fastening Means for Outlet Boxes; J. C. Boyton, Cleveland, O. App. filed July 9, 1926.

1,653,267. Device for Pulling Cables and Flexible Conduits; D. H. Garber, deceased, by G. E. Dunn and A. C. Neer, Indianapolis, Ind. App. filed Aug. 7, 1924.

1,653,283. Circuit Making and Breaking Device; S. B. Hood, Minneapolis, Minn. App. filed July 31, 1924. Using a liquid medium, such as mercury.

1,653,365. Incandescent Electric Lamp; C. F. Lorenz, East Orange, N. J. App. filed June 28, 1923. For projection purposes.

1,653,367. Misch Metal Wire; J. W. Marden and M. N. Rich, East Orange, N. J. App. filed Jan. 29, 1925. The production of misch metal in a form suitable for introduction into vacuum devices to serve as a clean-up agent and method of fabricating in ribbon form.

1,653,375. Protective Device; B. E. Shackelford, East Orange, and W. H. T. Holden, Bloomfield, N. J. App. filed Feb. 15, 1921.

1,653,376. Arc Welding Machine; J. S. Skelly, Monongahela, Pa. App. filed April 8, 1925. Adapted for use in welding the edges of the plates of an air-heating element or similar article.

1,653,378. Method of Making Bimetallic Wire; B. F. Steel, East Orange, N. J. App. filed July 1, 1922.

1,653,385. Lamp Mount; E. W. Beggs, Glen Ridge, N. J. App. filed Nov. 16, 1923. For lamp operated at a high temperature and utilized as a light source for projection apparatus.

1,653,404. Automatic Reclosing Mechanism; G. H. Middlemiss, Birmingham, England. App. filed June 20, 1924.

1,653,436. Insulator; H. P. Liversidge, Bala, Pa. App. filed July 22, 1918. Having band or sleeve shrunk on the insulator for subsequent connection with a top or base, as by co-operating screw threads or other desirable mechanical means.

1,653,443. Controller for Electric Elevators; E. B. Thurston, Toledo, O. App. filed Nov. 19, 1926. Using polyphase alternating current motors.

1,653,504. Transformer; E. Moxter, St. Louis, Mo. App. filed Nov. 22, 1923. Secondary current selectively effected independently of any change or variation in the voltage of the primary current and independently also of any variation or change in the structural factors and ratio of both the primary and secondary windings.

1,653,565. Method of Butt Welding by Means of an Electric Arc; W. F. Heinemann, Shorewood, Wis. App. filed Aug. 13, 1926.

1,653,579. Storage Battery Attachment; P. M. Marko, Brooklyn, N. Y. App. filed July 24, 1926. To permit the use of a "trickle" charger with the battery.

1,653,584. Insulator Support for Wires; P. L. Peterson, Worcester, Mass. App. filed March 27, 1926. For securing twin wires to the side of a pole or post.

1,653,599. Discharge Bar for Neutralizing Static Electricity; W. H. Chapman, Portland, Me. App. filed April 8, 1927. Such as are placed near the surface of textile fabrics or paper in the process of manufacture or printing.

1,653,600. Electric Battery Cell Unit and Process of Making the Same; H. M. R. Dam, Astoria, N. Y. App. filed Dec. 15, 1924. Of the flat type.

1,653,602. Thermostatic Device; W. C. Lindemann and E. A. Rutenber, Milwaukee, Wis. App. filed April 24, 1923. For automatically controlling the temperature of ovens and the like.

1,653,605. Method of Protecting Carbon or Graphite Electrodes in Fused Electrolytes; E. A. Ashcroft, Waye, near Ashburton, England. App. filed Feb. 23, 1927.

(Issued Dec. 27, 1927)

1,653,614. Storage Battery Separator; R. C. Benner, Bayside, N. Y. App. filed Oct. 9, 1922.

1,653,659. Thermostatic Control Device; H. E. Reeve, Deceased; by Helen Reeve, Executrix, New York, N. Y. App. filed March 21, 1922. For automatically making and breaking a power circuit or for otherwise exerting power greater than that supplied by the direct action of a thermostat upon change in temperature.

1,653,669. Combination Flash Light and Circuit Tester; B. M. Rydzy, Michigan City, Ind. App. filed June 29, 1923.

1,653,671. Lighting Fixture; E. O. Schweitzer, Chicago, Ill. App. filed April 4, 1923. Of the wall or side bracket type.

1,653,672. Water Heater; R. L. Shriner, Weehawken, N. J. App. filed March 6, 1926. For domestic use.

1,653,724. Plug; C. Moline, Multnomah, Ore. App. filed May 7, 1926. Quick detachable plug to connect a flexible cord to a socket or receptacle.

1,653,731. Anodic Current Accumulator Battery; G. Reinstrom, Wandsbek, near Hamburg, Germany. App. filed April 7, 1926.

1,653,751. Electric Cigarette Lighter; S. Wagner, New York, N. Y. App. filed March 5, 1927.

1,653,776. Multiple-Point Plug; O. E. Marvel, Dayton, O. App. filed March 12, 1923. For handling a large number of circuits in a comparatively small space.

1,653,778. Antitheft Alarm Device; J. Nawarynski, Cleveland, O. App. filed April 18, 1927. For sounding an alarm when a window is raised.

1,653,784. Winding for Electrical Machines; L. Roebel, Mannheim, Germany. App. filed April 16, 1927. The construction of the coil heads or connectors interconnecting spaced bars of coils disposed in slots on the periphery of dynamo-electric machines.

1,653,797. Electric Stove; E. D. Brand, London, Ont., Canada. App. filed Oct. 16, 1924. Heavy duty.

1,653,801. Dry Cell; H. de Olaneta, New Haven, Conn. App. filed Aug. 18, 1920.

1,653,810. Electric Light Fixture; J. Markel, Buffalo, and C. W. Logan, Kenmore, N. Y. App. filed March 31, 1927.

1,653,823. Contact Device for Key Switches; R. Pudelko, Zug, Switzerland. App. filed Oct. 6, 1924.

1,653,833. Connector for Battery Terminals and Other Electrical Conductors; H. E. Atkinson, Traverse City, Mich. App. filed Sept. 17, 1925.

1,653,845. Cooling of Dynamo Electric Machines; P. Faber, Baden, Switzerland. App. filed June 18, 1925. A cooling system having an independently propelled fluid-circulating machine for supplying cooling fluids to the machine, and automatic means for protecting the machines upon failure of the cooling fluid supply.

1,653,855. Catenary Suspension System; J. Holzel, Pasing, near Munich, Germany. App. filed Dec. 13, 1926.

1,653,868. Burglar Alarm; H. J. Murray, Brooklyn, N. Y. App. filed Jan. 17, 1920.

1,653,872. Method of Manufacturing Electrodes for Batteries; D. Pepper, Philadelphia, Pa. App. filed Dec. 1, 1924.

1,653,879. Electrolytic Cell; West Orange, N. J. App. filed Oct. 22, 1924.

1,653,895. High Tension Cable Joint and Method of Making the Same; L. Emanueli, Milan, Italy. App. filed Nov. 19, 1926.

1,653,941. Electrical Switch; C. A. Brown, Lorain, O. App. filed March 8, 1926. Wherein it is desired to operate a set of electrical contacts quickly, so that sparking at the contacts will be reduced.

1,653,946. Electric Step by Step Motor; H. Clausen, Cricklewood, London, England. App. filed June 13, 1924.

# New Trade Literature

**Hydraulic Pumps and Motors.**—The American Fluid Motors Company, Philadelphia, is distributing a catalog on Hele-Shaw hydraulic pumps and motors. This catalog describes and illustrates the application of high-pressure hydraulic power on a variety of machinery drives, including presses, broaching machines, testing machines, cranes, mechanical stokers and a wide variety of other heavy machinery.

**Automatic Switching Equipments, Meters and Relay.**—Bulletins GEA-189A, GEA-862 and GEA-859, issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively the automatic switching equipments for indoor alternating-current reclosing feeder service; types M-5 and M-12 direct-current, indicating demand meters; and type PD-3 current differential relay.

**Low-Temperature Coal Distillation.**—Catalog KSG-2, issued by the International Coal Carbonization Company, 200 Madison Avenue, New York City, a subsidiary of the International Combustion Engineering Corporation, covers the KSG process for the low-temperature carbonization of coal.

**Outdoor Station Equipment.**—Bulletin GEA-748A, issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the G-E bus supports for outdoor service, the G-E standard pin-type insulators, the separable post-type insulators and connectors and fittings for tubular conductors.

**Electric Fans.**—The Robbins & Myers Company, Springfield, Ohio, has issued its miniature fan catalog No. 1355 for 1928 covering the various types of "R&M" desk, wall and ceiling fans.

**Wire and Wire Products.**—The Hoffman Publications, Inc., 471 Fourth Avenue, New York City, has issued a leather-bound 1928 edition directory, index and buyers guide on wire and wire products.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Sydney, Australia (No. 28,823), for small and medium size electric motors, and another (No. 28,824) for fractional horsepower motors.

An agency is desired in Wellington, New Zealand (No. 28,822), for electric ranges.

Purchase is desired in Leghorn, Italy (No. 28,771), of commercial electric refrigerators.

Purchase is desired in Auckland, New Zealand (No. 28,851), of electric fixtures and appliances.

Purchase is desired in Meiningen, Germany (No. 28,848), of floor-polishing and scrubbing machines and vacuum cleaners.

Purchase is desired in Colon, Panama (No. 28,852), of small floor-tile polishers.

An agency is desired in Vienna, Austria (No. 28,882), for portable electric tools.

Purchase is desired in Montreal, Canada (No. 28,853), of immersion water heaters.

Purchase is desired in Johannesburg, South Africa (No. 28,942), of hand and miners' electric lamps, flash-light [illegible] and railway warning signals.

Purchase is desired in Prague, Czechoslovakia (No. 28,943), of traffic control signals.

Electrical World

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## *An Unsatisfactory Official Summary*

IT IS difficult to come to any definite conclusion from the meager summary of the Federal Trade Commission's report on "the supply of electrical equipment and competitive conditions," at least so far as the electric power industry is concerned, and it is equally hard to escape the thought that perhaps there was a reason for bringing out the summary at this particular time. Viewed in the abstract, the presentation appears reasonable in spots, while in other places it is open to serious questioning and doubt. What is said of holding companies may be true of some of them, but certainly not of all of them. That they are not subject to regulation is, of course, well known, as is also the fact that rates for service of underlying companies are based in many states "on the capital honestly and prudently invested." Inasmuch as the Federal Trade Commission held hearings and supposedly delved for facts, a statement to the effect that certain things are alleged about speculative fluctuations in prices ought to have been substantiated. Whether the commission is just to the holding company or not can be revealed only by reference to the complete report. Until that is printed and available, therefore, judgment must be held in abeyance.

* * * *

## *State Commissions Roused to Defend Themselves*

SENATOR WALSH of Montana, in arguing his case against public utility companies, holding companies and management corporations before the Senate committee on interstate commerce in Washington this week, was certainly not at his best, for if he then and there unbosomed himself of all he had in mind, the case against the utilities is not very strong. Although very little that is tangible was presented, it is nevertheless generally conceded that some sort of investigation will be recommended. What the extent and scope of it will be will soon be determined after all sides have been heard. That it will be thorough and economic in scope is perhaps too much to expect, but that it will be only mildly sensational has already been demonstrated. The investigation, it must be remembered, will start as an inquisition from above and not because of mutterings of discontent from the users of the service. Hence it will in all likelihood be lacking in popular appeal.

The attempt to prove that the ultimate consumer is unprotected from extortion because, as Senator Walsh contends, state public service commissions are not functioning effectively will probably be the rock on which any political investigation will founder. Although the commissions as a body were at first somewhat backward in their own defense, they discovered in Senator Bruce of Maryland a valiant champion. He was quick to disagree with Senator Walsh and contended not only for the integrity and probity of the commission of his own state, but also espoused the cause of untrammeled state regulation of intrastate utility service. The commissioners when they subsequently had opportunity to speak for themselves proved worthy of Senator Bruce's defense and made their own position perfectly clear. Thus it would appear that if Congress sticks to its last it will limit the Walsh investigation of utility companies to interstate commerce, and inasmuch as electricity and gas are for the major part consumed in the state where they are manufactured, any committee will have to watch its steps closely if it is not to encroach on the rights of the several states.

* * * *

## *The New Phase in Co-operation*

FOR years electrical men have been talking about co-operation—as a theory and a principle. In fact, there has been so much talk that we are almost weary of the word. It would seem, however, that as a policy and a practice we are only now beginning to find the meaning of it all in any broad industry sense. This was the lingering impression that one brought away last week from the dinner to W. W. Freeman, when he received the medal for co-operation given under the James H. McGraw Award in recognition of his achievement in reorganizing the directorate of the Society for Electrical Development to represent officially the four major national associations and the leagues.

Owen D. Young crystallized the point in characteristic fashion when he said in his address: "Men work as individuals when they can. They co-operate when they must." And there one has the reason why in this electrical industry co-operation is right now apparently passing from its talking phase into a more purposeful phase of practical application. It is an intriguing thought. As Mr. Young pointed out, no man desires to co-operate until he is compelled to accomplish ends beyond his grasp as an individual. As far as he can he goes ahead alone. Then comes a time when to attain his aim he must have the help of others whom he cannot individually control. There is only one way in which he can influence them, and that is by the give-and-take process involved in co-operation.

The electrical industry has been following this very course. The onrushing growth of the popular demand for electric service of all kinds has brought great prosperity and opportunity. Power companies, manufacturers, jobbers, contractors and dealers have been able to go forward with their own plans in their own way. The co-operation that has been developed within the industry has been more social and fraternal than practical. But now comes a new era. The electrical industry at last begins to realize that it has a selling job to do and that in the great marketplace all electrical men must work together if they are to prevail against the strength of other industries. And so we see this reorganization of the S.E.D. and the convening of an industry sales conference, and a distinguished gathering pays tribute to the man who makes it possible. Co-operation is getting to its work.

* * * *

## *Communication by Sight and Sound*

RESEARCH work in communication has annihilated space and time. It is now possible to hear and see simultaneously independently of distance, and this laboratory accomplishment will become a commercial reality in a short time. The demonstration of home television by Doctor Alexanderson has followed as a logical step the spectacular television demonstrations of last year. It is true that the commercial application of laboratory results must await the solution of many technical and economic problems, but past experience proves that these problems will be solved.

The art of communication is developing very rapidly because of the advent of the vacuum tube and of other facilities introduced by radio inventors. New methods and better methods of communication may be expected, and yet the fundamental aspects of present services will remain. There need be no fear that the telephone and the telegraph will be relegated to the scrap pile, for they are essential. New equipments and new methods will be incorporated with these fundamental devices to give better service. Vision added to sound will make possible communication of a quality undreamed of in present commercial installations. The day approaches when people in any part of the world may see and hear people in any other part of the world. May not this in time result in the stabilization of world affairs and the creation of worldwide understanding?

* * * *

## *The American Engineering Council and Electrical Engineers*

ORGANIZED in 1920 for the purpose of making engineers articulate in public affairs, the American Engineering Council has not been so effective as it might be did it receive heartier and more devoted support. It has been handicapped, for example, by the refusal of the civil engineers to join with the other national bodies in making the council the point of contact between engineers and the federal government, thereby enabling the latter to obtain very much needed advice and factual information from disinterested rather than from interested sources, reliable as the latter have proved themselves to be. And yet, despite handicaps, the American Engineering Council has managed to build up an excellent reputation for performance and achievement. Its studies and reports on the elimination of waste in industry were noteworthy accomplishments, as were also the reports on Muscle Shoals, coal storage and the productivity of labor.

Most of our social and political problems are now economic in nature, and on such issues the engineer, with his bent for investigation and his analytical mind, is most competent to instruct and advise. That he has not done so more effectively or played a more telling part in political life is a reflection on himself and his profession. Certainly, opportunities innumerable abound, and government needs enlightened guidance. The cost of the Council is not very great, less than $50,000 a year, and that is spread over numerous national and local engineering bodies which compose the membership. More could be done if greater funds were available, but what the American Engineering Council covets first of all is the active interest of engineers everywhere in its work, together with their suggestions. Thus aided and encouraged, the work itself is sure to command financial support.

An electrical engineer has just been elected president of the Council, and while this fact does not take one ounce of responsibility from the shoulders of the other engineering professions, it is a challenge to the electrical engineers of the nation to uphold the faith the public has in their almost matchless and magical capabilities.

* * * *

## *The Demands of Tomorrow*

THE mutuality of interest between equipment manufacturers and electric light and power companies and the co-operation in research, design and development that has been evidenced as a result of this interest are the best assurance of continued progressiveness on the part of both groups. The advance that has been made is so amazing as to appear consummately successful, yet, at the same time, all the boasted efficiency and perfection of design is pitifully inadequate. Today's merits are tomorrow's shortcomings.

To look through the shadows of the future to the accomplishments of a new present is often, because of the variable and unknown factors of the physical, economic and social elements, a task impossible of accurate performance. Certain things may be taken for granted, however, with but little likelihood of ultimate discredit. It is the co-operative effort of manufacturers and utility men that will lead to the several solutions.

The unconscionable waste that carries 50 per cent of the heat in the steam into the discharge canal will be reduced to a major degree. The expenditure necessary to provide protection for equipment of all kinds against the weather through the provision of sheltering structures will be reduced. The devices for interrupting circuits will offer far better service, design and maintenance features than today's best accomplishments for achieving that purpose. The use of pole lines and open wire construction in city and suburban districts will become obsolete, and their discardment will take place without incurring the costs and complexities involved in present underground practice. The crudely laborious methods of testing meters will yield to machine-like accuracy of calibration and increased speed of adjustment. Motor characteristics will be varied to permit system power factors approaching unity with minimized deviation. Industrial plants, offices, homes and highways will be illuminated, not spot-lighted. The cost of the equipment necessary to provide service to an industrial customer will be curtailed by improved design and reduced requirements for apparatus.

The business of providing electricity for light, heat and power is only just entering the stage of simplification which follows the preceding eras of invention and development in the history of every engineering application. In general, there will be lessened complexity in types, quantity, size and installational requisites. Maintenance and supervision will be minimized in all apparatus characteristics. Costs will be reduced. It is as futile to discount the ultimately necessary thing as it is to deny today's inadequacies.

## *Industry Sales Conference Charts Its Course*

AFTER two months in which its six functional committees have been at work, the Industry Sales Conference held its second meeting last week to chart the course it is to follow in developing a sales program for the electrical industry. The first meeting merely analyzed the market problem and decided that a broad sales plan should be set up looking first to the development of the great market in the residence field now largely blocked by the inadequacy of house wiring. The reports of these committees are not yet released for publication in detail, for they have been referred to the executive committee of the conference for co-ordination and budgeting, but their general tenor has been announced. The conference will recommend immediate action in two directions:

First, a national movement of locally organized selling campaigns to merchandise the idea of adequacy in house wiring and to sell outlets and equipment for use in them, power companies to be responsible for local leadership, with the co-operation of leagues.

Second, a broad educational work among all contractors to promote better standards of estimating, cost keeping and business methods, that house wiring may be raised to a higher plane of competition for adequacy and completeness of equipment rather than by price paring.

The fact that these committees as well as the full conference itself are representative of the four major groups of the industry makes the work of this body of particular interest and portent. For the first time the entire industry is engaged in a commercial planning job. An embracive program is in the making that will present not only an opportunity, but a purpose, a plan, a proposed organization to do the work and a budget of expense, all carefully co-ordinated with the activities of other industry agencies. This sales program will be before the industry this summer and will undoubtedly receive searching analysis and criticism at the conventions. If the plan is good, this fall may see the start of a progressive market-building enterprise on a scale that will be new to electrical men. And present indications seem to justify the hope.

* * * *

## *No Further Need for Doubt*

MILLIONS of domestic users already connected to the power companies' lines represent, in the aggregate, one of the principal fields for future load and revenue. Very definite data taken from experience are presented in this issue of the ELECTRICAL WORLD by Harry A. Snow, who shows that there is no difficulty in greatly raising the national average above the present paltry one kilowatt-hour per day. He points the way to practical domestic load building with three of the major household appliances—the electric range, electric refrigerator and motor-operated oil-burning furnace. The data and conclusions drawn are based on a series of tests on typical installations in Detroit homes. Taking the average annual consumption of 540 kw.-hr. per residence customer in Detroit, the individual and collective effects of adding the electric range, refrigerator and oil-burner loads are shown. The results bring into sharp relief the conclusive evidence that residence consumption can be increased 50 to 500 per cent by the use of one or all of these devices.

Furthermore, the analysis of load characteristics shows that the use of these three appliances does *not* put excessive demands upon the power system, unduly increase the system peak or entail heavy investment in additional capacity. Quite the contrary is shown in fact. In the specific case of the electric range less than half the class demand of one thousand ranges comes on the system peak. The electric refrigerator has a most desirable yearly load curve, and the oil burner shows decidedly off-peak characteristics in its operations. The combined loads of these three appliances puts an entirely different complexion upon the domestic use of energy. Consumption per customer is increased from 540 kw.-hr. to 2,820 kw.-hr. per year, while the maximum demand per customer is only 913 watts and as a class the domestic user is operating at a 35 per cent load factor.

When it is considered that, as a group, a thousand domestic customers, each equipped with a range, a refrigerator and an oil burner, in addition to lighting and miscellaneous uses, have a maximum demand of only 913 kw. and will consume 2,820,000 kw.-hr. annually, the residence load becomes indeed attractive.

* * * *

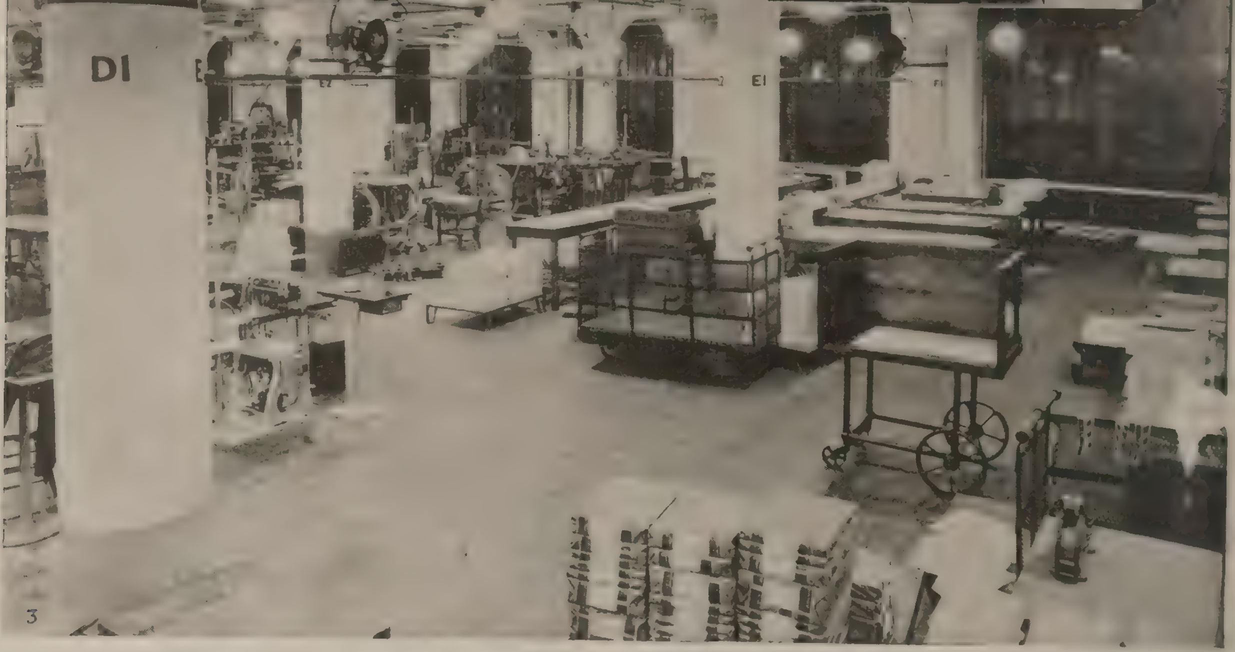
## *The Manufacturer in the Federal Trade Commission Report*

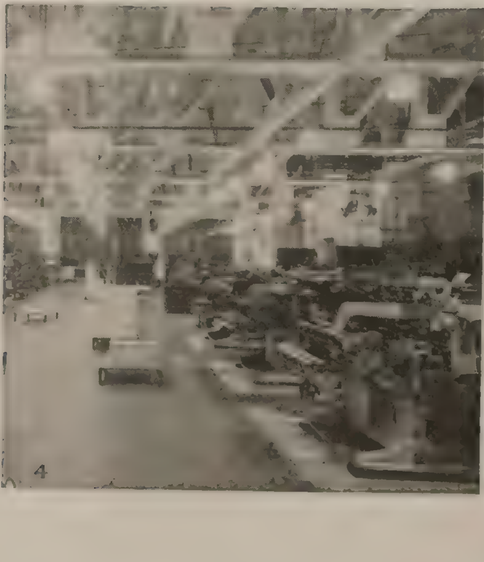
THE perennial debate on the relative positions of large and small manufacturers in the electrical industry will hardly come to a close because of the publication of a summary of the second section of the Federal Trade Commission's report on the electrical industry. But no one can deny that the opinion expressed emanates from an inquiry as neutral as could well be instituted, and as such the conclusions merit fair-minded consideration.

The report says that despite the permanent position of the three large manufacturers in the electrical market, the bulk of the business is being done by the small manufacturer; that though the prices of these large manufacturers are regarded by the trade as maximum levels above which others cannot hope to sell, it is the general belief among the small companies that the large ones compete actively in price, quality and service; that though the large companies "undoubtedly have the power to crush," this power has not been used in recent years, and that the elements in the competition of the large companies most difficult to meet are the lump-sum bid, the quantity discount and the consignment of motors. In the fractional-horsepower-motor field prices have been reduced to levels at which many have been unable to compete, but many state that "other small companies rather than the very large ones are their sharpest price competitors." The report justifies the direct inference that the general price policy of the large manufacturers is fair and that they have brought a stabilizing influence to the market. It makes particular point of the contributions to progress that have been made by the General Electric and Westinghouse companies through research. In conclusion the commission pays a tribute to the trade associations of the electrical manufacturers for the influence they have exercised in keeping the activities of the industry in line with the anti-trust law.

This kind of a pronouncement by this responsible governmental authority cannot be accepted as a complete answer to all questions as to the economic position of the small and large manufacturers in our industry. But it serves as a very definite brake upon the complaints of men who place upon the large companies too much blame for their own lack of success in the competitive market.

# *Correct Illumination Vital to Industry*





PROPER lighting is as essential to industrial customers as the adequate utilization of electric power. Production may be increased, material spoilage reduced and employee morale sustained.

An increase of production of 370 per cent is claimed through the installation of properly designed fixtures in a hosiery mill. A belting manufacturer raised his output nearly 20 per cent by an expenditure which, when reduced to a payroll basis, represented a cost increase of but 1 per cent.

No. 1. An excellent example of uniform lighting effect in silk mill practice.

No. 2. The lighting of this jacquard loom is indicative of the practice which requires illumination in both horizontal and vertical planes.

No. 3. The illumination of the warehouse and pressroom of this printing establishment is one of the best examples of uniformly distributed lighting in New England.

No. 4. Pressroom illumination must be of correct intensity and incorporate glare-free characteristics if quality and speed are to be maintained.

# High-Voltage Cable Problems

Heating and cooling stresses must be considered as well as electric stresses. Loss tests should be based on load cycles. Further data obtained regarding ionization phenomena

By T. N. Riley
*Cable Engineer, Standard Telephones & Cables, Ltd., London*

In testing materials subject to mechanical stress it has been well established for many years that a load that can safely be applied if steady may rapidly produce failure if variable, and many tests have been made to establish the safe stress for alternating loads of various kinds. In cable work, for example, a great amount of work has been done on lead sheathing to develop a type of sheath that will prove satisfactory in situations subject to vibration. In applying these principles to the cable dielectric, however, it is surprising that engineers have concentrated their efforts so greatly on one variable factor only and have relatively neglected a second and equally important one. They have, for example, studied almost exclusively the time for which a cable would operate without failure when subjected to alternating electrical stresses of different magnitudes and have neglected to take into account that under service conditions the applied current loading, and therefore the temperature, is also continuously varying. The results obtained under test conditions in which one factor only is varied may therefore be totally different from those obtained when the second factor is taken into account.

The heating and cooling of a cable in service may cause changes in the physical structure due to any one of the following causes: (1) Expansion of the compound leading to permanent distortion of the sheath in an initially well-impregnated cable. (2) Redistribution of the compound in the dielectric after expansion as in (1), particularly where the cable is laid on a slope. (3) Relative movement of the cores and filling or separation of the cores in a multi-core cable.

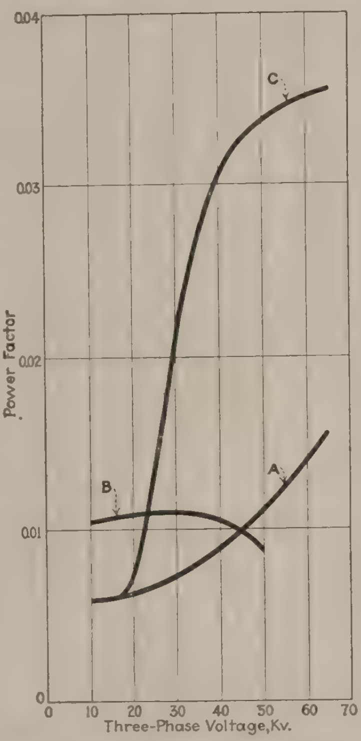


FIG. 1—BEHAVIOR OF A 33,000-VOLT CABLE OF THE BELTED TYPE DURING DIELECTRIC LOSS TESTS

Curve *A* shows the variation when first manufactured. Curve *B* shows results when the cable is heated to 70 deg. C. Curve *C* shows the power factor when tested after heating.

If the cable is to be satisfactory in service, its structure must be such that these changes cause little or no alteration in its electrical behavior, and the logical tests to apply are those that are most sensitive to such physical changes. Altogether undue emphasis has been placed on high-voltage tests, which are relatively insensitive to small physical changes and would reveal no definite deterioration except after such prolonged application of voltage and load as would be impracticable in a factory test. Moreover, to be effective, a pressure considerably in excess of the working pressure must be applied, so that the test no longer closely represents working conditions.

The dielectric loss test is much more sensitive to physical changes, and although such tests have been made, they have hitherto been directed rather to measuring the actual value of the losses under specified pressures or at specified temperatures than to measuring the variation of the losses produced by physical changes in the cable. In this respect current practice has reversed the real order of importance of the tests. It is admittedly desirable that the power factor should not be too high, but it is still more important that it should not increase in service when the cable is subjected to variations of load. In spite of this it is the exception in cable specifications to find any provision made for testing the power factor after one or more cyclic changes of load such as the cable must experience in service.

The behavior of a 33,000-volt cable of the ordinary belted type during such a test as is advocated is illustrated in Fig. 1. Curve *A* shows the variation of power factor with voltage when first manufactured. It will be noticed that up to double the working voltage the power factor does not exceed 0.015, so that the cable would pass any normal specification. A similar test taken when heated to 70 deg. C. (Curve *B*) shows a power factor below 0.011 up to 50 per cent over the rated voltage. This is again a satisfactory test, and as dielectric loss tests are usually carried no further, the cable would normally be passed into service.

If, however, the test is repeated on cooling after the heat run, Curve *C* is obtained showing a very marked increase in power factor over the initial value from the working pressure upward. Even then the power factor as an absolute value is not excessive, but the marked increase of loss after the heat run indicates that some change has taken place in the cable structure due to the load.

If this increase of loss is localized, it may represent appreciable damage to the cable at every period of cool-

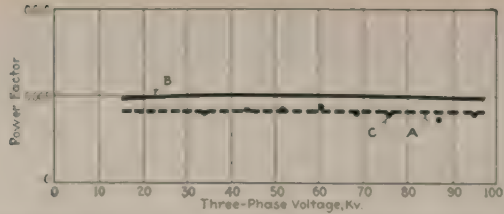


FIG. 2—TEST RESULTS ON A 33,000-VOLT H-TYPE CABLE WHICH HAS A STABLE CHARACTERISTIC

Curve *A* is immediately after manufacture. Curve *B* is the test when heated on load. Points on *C* are taken when the cable is cooled after heating.

ing on light load—damage that will be cumulative and will eventually lead to breakdown. It is known, for example, that most breakdowns of high-voltage cable for reasons other than mechanical faults have occurred during light-load periods.

The cable the test results of which are given in Fig. 1 would pass all normal tests in the factory, but would be unsatisfactory in service unless its normal load were so light as never to raise its temperature appreciably and in consequence never to cause the harmful physical changes. This would, of course, be an uneconomical condition of operation.

The test results on a cable for the same voltage which has a stable characteristic is shown in Fig. 2. As before, *A* is the test immediately after manufacture, and *B* is the test when heated on load. On cooling, again the values of power factor obtained at each voltage are practically identical with those obtained in the initial test—that is, are nearly constant at all voltages.

This indicates two things that are of importance in ensuring freedom from trouble in service: first, that the dielectric loss remains low both on load and on cooling without any progressive increases, and second, that there is no ionization and therefore no burning of the papers or oxidation of the compound to be feared in service.

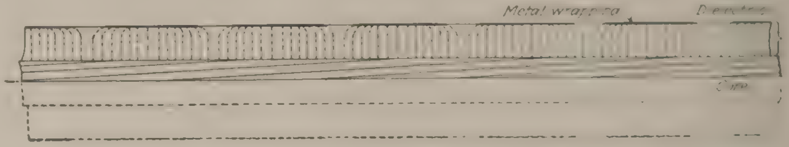


FIG. 4—DIAGRAM SHOWING EFFECT OF GAPS IN METALLIZED SHEATHING

### Type of Cable Effects Results

What type of cable will give characteristics of this order? In the first place, the flatness of the initial power factor voltage curve is typical of an insulation in which all stresses are radial—that is, of a single-core cable or the equivalent three-core cable in which each core has a metallized surface. If tangential stresses exist, the surface leakance current tends to increase more rapidly than the capacity current as the voltage rises and to cause an increase of power factor, which gives the power factor voltage characteristic a curve upward, even when there is no ionization. This is evident in the belted type of three-core cable, but is also indicated to a smaller extent in three-core cables having an equipotential sheath if that sheath is not continuous but is formed by spaced tapes. In this case the current paths from the edges of these tapes are tangential to the laminated insulation and the power factor is raised. This is illustrated in Fig. 3, where the spacing is exaggerated for clearness. The consequent rise of power factor is more marked at the lower frequencies, where the capacity current is smaller.

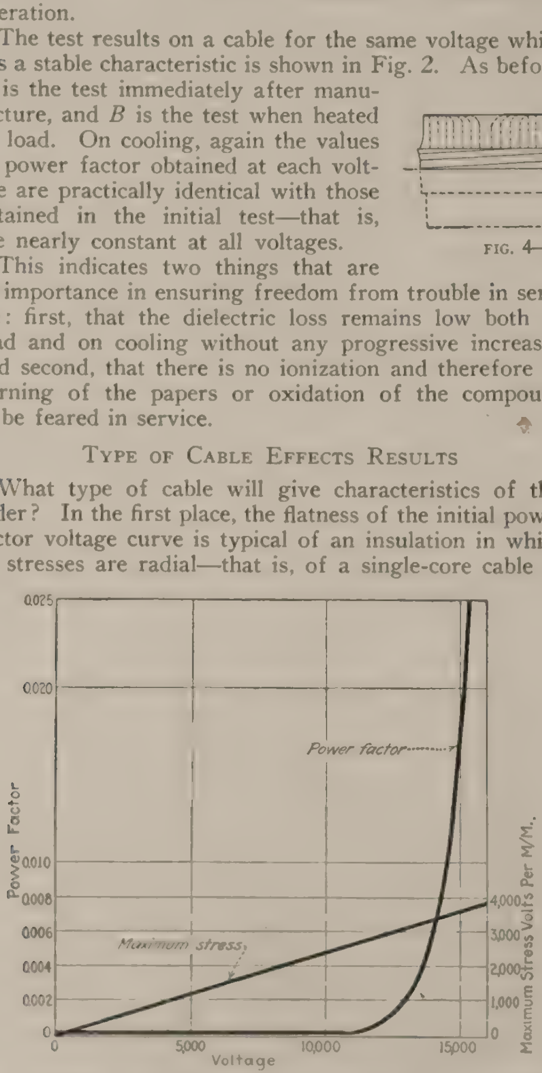


FIG. 3—POWER FACTOR-VOLTAGE CHARACTERISTICS OF UNIMPREGNATED CABLE WITH AN EQUIPOTENTIAL SHEATH

The dielectric must be free from all voids or air spaces—that is, it must be fully impregnated. If voids exist, then as soon as a certain stress is reached there will be an internal discharge across them, leading to a rapid increase in power factor. For cables up to 11,000 volts working pressure having the insulation thicknesses usual in English and American practice this ionization pressure is usually above the working pressure and even imperfectly impregnated cable will not give rise to trouble. Above this figure the higher working stresses necessary to keep dimensions reasonable render this immunity unattainable.

The power factor voltage characteristic of a cable made up with dry paper having no compound at all is shown in Fig. 3. It will be noticed that the power factor is exceptionally low up to the point at which ionization starts, and it then increases very rapidly.

It is necessary to choose suitable paper and compound and to dry them thoroughly in order to make certain that the dielectric loss shall increase very little with temperature. Residual moisture has a very marked effect in causing high initial power factor together with a rapid rise of power factor with temperature. This can, however, be eliminated by careful drying of both compound and paper under vacuum before they are brought together. It is also important in this connection to avoid exposure of the dielectric to the atmosphere after impregnation and before lead covering. The choice of a suitable paper and compound is a rather more complicated question. Take first the paper. Apart from its electrical characteristics, it must, of course, have mechanical strength. At one time only manilla papers were satisfactory in this respect, but at the present day chemical wood-pulp papers can be obtained that are equally satisfactory in this respect. The basic fiber is therefore of only secondary importance, and from a cable-making point of view the vital considerations are its structure, affecting its oil-absorbing power and dielectric strength, and its chemical purity, affecting its intrinsic power factor after removal of moisture. On both these points a large amount of research has been carried out in the Standard Telephones & Cables laboratories. Fig. 5 shows power factor temperature characteristics on a series of papers after subjection to equal drying. It will be noted that a large number have more or less similar characteristics, but of these only No. 18 is also suitable as regards absorption and dielectric strength.

It has been shown by Luigi Emanueli that the dielectric strength of paper is partly dependent on the air resistivity of the paper and that in general the dielectric strength increases with the air resistivity. This is true only so long as the higher air resistivity results from close packing of the fibers leading to a dense structure and not from extra beating of the pulp, which hydrolyzes the cellulose and gives a non-porous paper of the greaseproof type. The latter type of paper may have 25 per cent less dielectric strength than the former for the same air resistivity and thickness.

### EFFECT OF INSULATING OIL

In selecting oils three factors have to be taken into consideration: (1) The power factor-temperature characteristic when new. (2) The change produced on prolonged heating or subjection to electrical stress. (3) The viscosity as affecting the movement of oil in the cable in service.

Comparative power factor-temperature characteristics of a series of oils as supplied by the refiners, except that all have been vacuum dried, are shown in Fig. 6. All these oils are mineral oils having a petroleum origin, but the difference in behavior is remarkable. There is also a considerable variation in the quality of two consignments of the same oil as is indicated by the two curves labeled No. 10. There is a considerable need for further research on the part of oil refiners into the methods required to give good electrical characteristics, as little accurate knowledge appears to exist on this point.

The rate of deterioration of the same oils after heating for different periods in air at 100 deg. C. is shown in Fig. 7. It is noteworthy that the relative position of some oils is reversed after long heating, hence a low initial test is no criterion of suitable quality. The oils are not, of course, heated in air in service, but those oils the structure of which is likely to change when heated in air are also most likely to change on exposure to heat and electrical stress in service. It is also noteworthy that the change produced is in general irreversible: whereas actual carbonized matter can be removed by filtration or centrifuging, that factor which causes high power factor cannot be so removed and the oil appears to be permanently deteriorated (see Fig. 8).

The viscosity of the oil is very closely associated with the type of cable structure to be employed in insuring that the power factor-temperature characteristic does not change on cooling after load. If the complication of a hollow-core cable with standpipes and oil reservoirs is considered justifiable for very high pressures, a low viscosity is desirable, but if the normal type of solid structure is employed, the viscosity should be as high as possible, provided always that the actual setting point at which any change of state occurs is below the temperature at which the cable will normally be handled in manufacture and laying.

Up to the present the question of how to get a satisfactory cable up to the point at which its manufacture is completed has been discussed. Next to be considered is how it will behave on load.

When the dielectric is heated, the compound must expand, and in expanding it will expand the lead sheath. The latter is plastic, and as the cable cools again it retains its shape while the compound contracts, so that small voids must be formed inside the sheath. If these voids are subject to electrical stress above a certain value, ionization will occur and the power factor will rise. The narrower the spaces across which the potential is applied the higher will be the stress required to set up ionization. Hence the change of power factor is greater in the ordinary type of three-core cable, where the stress may at certain instants be along the layers,

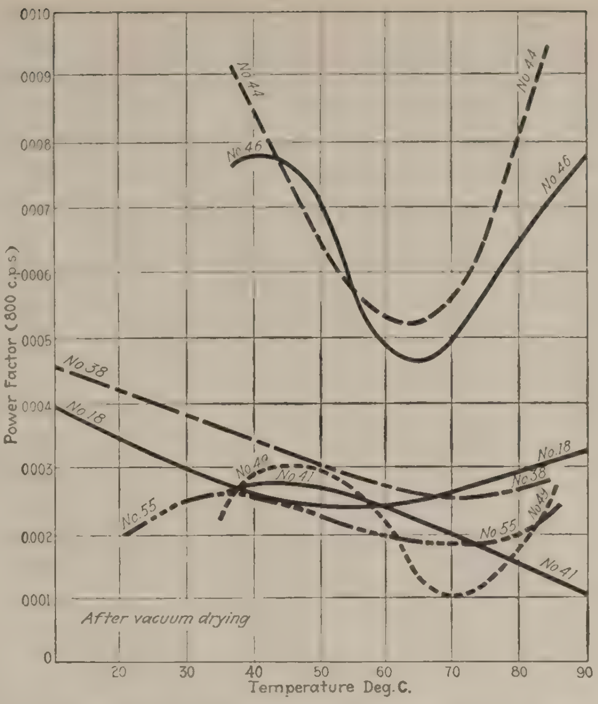


FIG. 5—POWER FACTOR-TEMPERATURE CHARACTERISTICS OF PAPERS

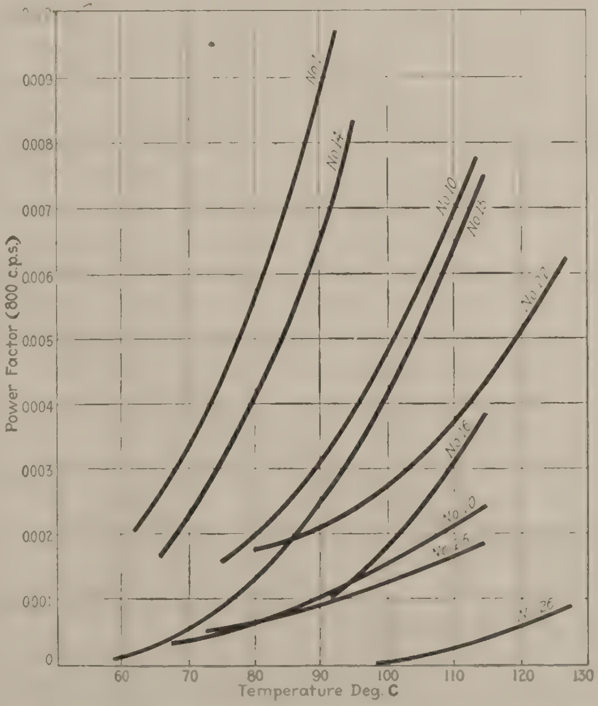


FIG. 6—POWER FACTOR-TEMPERATURE CHARACTERISTICS OF NEW OILS

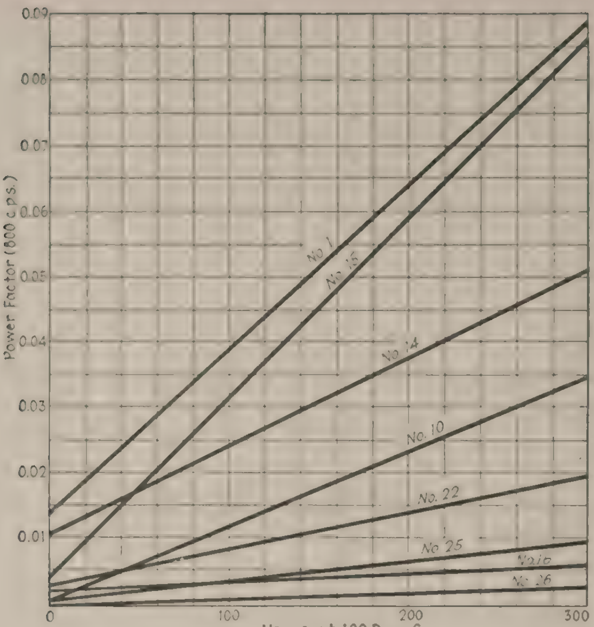


FIG. 7—POWER FACTOR-TEMPERATURE CHARACTERISTICS OF OILS SHOWN IN FIG. 6 AFTER HEATING IN AIR TO 100 DEG. C.

than it can be in single-core cable, where the stress is always radial, and the gap cannot be greater than the thickness of the paper employed. Single-core cables, in fact, show this phenomenon to only a small extent. To prevent it altogether some means must be found of preventing the formation of voids in the dielectric.

One method of doing this is, of course, to employ a hollow core or other oil duct in the cable together with a thin oil so that all expansion occurs into reservoirs at intervals and oil is supplied from these on contraction. This has been applied in some recent lines at exceptionally high pressures, and in such cases the necessary complication may be justified. Some attempts have also been made to apply it in cable of ordinary structure without a definite oil duct, reservoirs being provided at the joints. This is of very doubtful value, since the rate at which oil can flow along a tightly wrapped core is too slow to prevent local expansion if the cable temperature rises rapidly on a sudden increase of load.

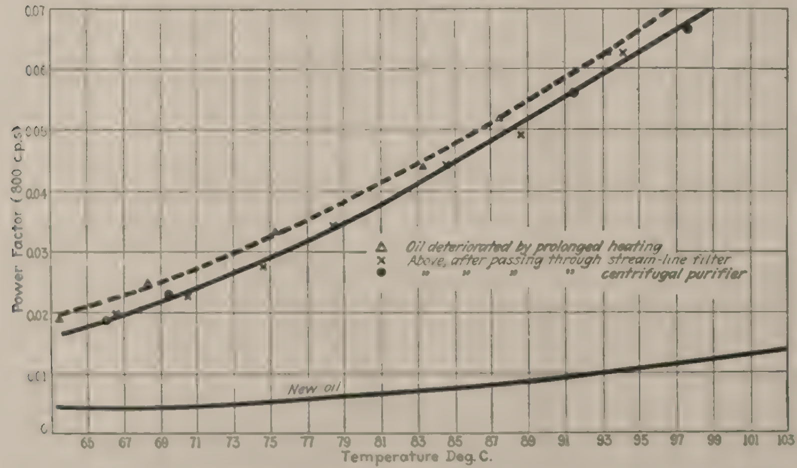


FIG. 8—POWER FACTOR-TEMPERATURE CHARACTERISTICS OF OILS AFTER VARIOUS METHODS OF PURIFICATION

If oil ducts are not used, the risk due to voids can still be eliminated if it can be arranged that they are formed in a part of the dielectric not subject to stress, as, for example, in the worming of an H-type cable having continuous metallized wrappings over the cores. As far as can be judged by experiment, this is actually what happens with such cables. The compound expands on heating and the lead is distended. On cooling, the core wrapping, which is denser and more highly absorbent than the filling, tends to retain the compound at the expense of the filling, so that any voids are formed in the latter where they can do no harm. The result is that the power factor characteristic before and after heating is unchanged and if initial impregnation is good it is independent of applied pressure (see Fig. 2). Such cables are giving satisfactory operation in service in cases where the ordinary belted type has failed, at a much less cost and complication than would be required to secure the same end by an oil-filled duct.

It should be noted that sheath expansion cannot be avoided by reinforcing it in any manner by an external armor. If the impregnation is initially complete, the extension necessary to provide the additional space required for the hot compound is well outside the stretch that can occur up to the elastic limit of the usual armoring materials. The distortion produced is therefore permanent even in an armored cable.

It is possible that in the future other methods of securing stability in service may be discovered, but whatever methods are employed, it will be necessary to add, to the tests used at present in the factory, a test giving a better criterion of stability in service. The comparison of power factor voltage characteristics before and after a load run affords such a test.

## Compressed Air Combats Anchor Ice

THE FORMATION of anchor ice in the Oswego River at the dam of a manufacturer thereon has been of such a serious nature at various times as to necessitate a shutdown of the plant for a considerable period. In an endeavor to correct and prevent this condition, the corporation, which now controls the water power rights in this river and supplies power to the manufacturer, has recently installed an unusual system for the disposal of anchor ice by means of compressed air.

The two dams belonging to the company have been equipped with this device and the satisfactory qualities in maintaining service at the intake have been demonstrated. The essential feature of the apparatus consist of heavy brass pipes imbedded in concrete near the bottom of the fore bay, through which compressed air may be released at intervals. One set of 4-in. extra-heavy brass pipes is located directly behind the trash rack and extends across the whole frontage of the refuse interceptors. Another series of pipes is located about 35 ft. upstream and 1 ft. above the floor of the fore bay and likewise extends across the entire distance. Compressed air under 100 to 155 lb. pressure is released by means of a specially designed pop-valve and the first rush of air contributes largely to the satisfactory displacement of trash and the breaking-up of the ice. The $\frac{3}{16}$ in. holes in the pipes are on $1\frac{1}{2}$ in. centers to allow the escape of air in several directions permitted by the embedded pipe.

Material raised from the bottom by the use of this equipment and ice floating on the surface of the water in the fore bay are permitted to discharge through a secondary spillway located at the side of the dam and extending about 6 ft. below mean water level. Heavier material which has been dislodged from sub-surface positions remains in partial floatation in the turbulent water and passes over this discharge passage. In operation, air is forced through the pipe at such time-intervals as may be necessary, according to conditions of temperature and refuse accumulation.

Because of the efficiency of this device in clearing up the conditions for which it has been designed, it is not necessary to have such a fine mesh or spacing for the bars of the trash rack. This enables a less expensive type of rack to be used and does not restrict the flow of water in the event of corrosion formation on the rods or bars.

## Costly Alterations Avoided by Use of Fan Ventilation

By Maurice D. Smith*

SOME difficult problems of providing adaquate ventilation in an underground transformer room were solved recently in a manner that may benefit others who encounter a similar predicament.

The transformer room, which was seven feet underground housed three 75-kva. transformers supplying a power load and two 100-kva. transformers in parallel, supplying a dense lighting load. Under normal operating conditions sufficient cool air would have been supplied through the manhole cover and entrance shaft, but all five transformers were carrying an overload. The power transformers were overloaded during the day. As soon as their load started to decrease the lighting load came on and continued the heat generating effect before enough cool air circulated and cooled off the room, walls, and power transformers. This process continued and maintained a high temperature in the room. As the time of day when the power and light loads overlap had not been reached, it was felt that steps should be taken immediately to prevent a transformer failure when the peak occurred. This, of course, would have meant a service interruption to several large customers.

The first thought was to provide additional ventilating ducts that would admit air to the transformer room and allow the hot air to escape through the entrance duct and manhole cover. This would have necessitated breaking the street pavement and building a duct from the bottom of the manhole to the curb line. But the expense was rather high and besides the entire system, including and adjacent to the transformer room, was to be connected to a network within a few months. This would involve the installation of additional transformers in a room near the one in trouble to feed part of the load now carried by it. The transformer capacity was to be reduced from 425 to 300 kva.

In view of these facts, it was felt that some temporary expedient should be adopted. Upon close investigation it was found that a spare 5-in. lateral duct existed, from the room to a nearby pole. The thought then occurred, "Why not utilize this duct as an exit for the hot air and feed cool air in through the entrance duct and manhole cover?" This was done, and the temperature dropped over 30 deg. F., giving a safe operating temperature.

### Forced Ventilation Used

The method employed was to extend the spare lateral ten feet up the pole and to connect the other end through a hose to a blower capable of moving 10,000 cu.ft. of air a minute. The blower was driven by a 110-volt motor connected to one of the lighting transformers in the transformer room. A cylindrical shaped tube of canvas was made, with wooden supports at each end to give it shape. This tube was inserted in the entrance duct up to within twelve inches of the floor. The air was sucked through the holes in the manhole cover down the shaft and then forced out through the lateral duct by the blower.

Recording thermometers installed for two weeks indicated that the proper temperature was being maintained for safe operating conditions. From then on it was necessary periodically to inspect the blower motor, to oil the bearings, and make sure it was still functioning. In this manner it was possible to save several hundred dollars that would have been expended for additional ventilating ducts that would have been required for a period of three months. Also, the public was saved the inconvenience of having the street open for a week while construction work was in progress, with the unavoidable amount of traffic hindrance at a busy street intersection.

## "Safety Net" Plan Produces Results

APPLICATION of a "safety net" plan of preventing accidents and finding the cause and remedy for accidents has met with decided success in the organization of the Washington Water Power Company, Spokane, Wash. Enlarging upon the recommendation of the State Department of Labor and Industries for safety inspectors, the Washington Water Power Company discontinued its former safety committee of employees and department heads. In its place, a central safety committee, composed entirely of department heads, was installed. Working with this new committee, a group of 32 safety inspectors keep in constant touch with safety standards of the company, each in his separate group. The inspector makes immediate investigation of an accident in his group and assists in fixing responsibility and in recommending remedies for the prevention of a similar accident.

The safety inspectors report to J. B. Fisken, safety engineer and ex-officio secretary of the central committee. "The 'safety net' has brought in better results than the usual plan of a safety committee," states Mr. Fisken. "We receive many more safety suggestions, and, by having department heads on the committee, better action is secured in getting them adopted. Further, we now have active, aggressive safety leaders in each important group of the organization, which covers sixteen counties in our territory."

The term "safety net" is original with the Washington Water Power Company as applied to the type of safety organization worked out in Spokane.

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# Substation Motor Inspections

FIRST ARTICLE

By O. M. Ward

Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

FOLLOWING is the motor inspection report form which is used in substation maintenance work on the system of the Milwaukee Electric Railway & Light Company. Motor inspections are made monthly. This form is mimeographed on a sheet 8½x5½ in. In addition to provision for filling in specific information, the form includes certain notes for the guidance of the inspector. These notes are:

MOTOR INSPECTION REPORT

Station..........Motor Drives..........Date..........

Motor hp..........Volts..........Frequency..........

Field Connections..........Main Connections..........

Air Gap Top.......Bottom.......Right.......Left.......

A.C. Rings.......  .......Commutator..........

No. of Brushes Changed, including those changed since last inspection ..........

Brush Spacing..........Conditions of bearings..........

Was Bearing Oil Changed.........Ground Test..........

Starting Apparatus........Size of Protecting Fuse........

Was rotor removed for cleaning and painting..........

> "This inspection report is to be used for all motors except motors or motor generators.
>
> "By 'air gap right' is meant the right-hand side of unit when looking toward the motor from the end which gives clockwise rotation. Ground tests to be made with a voltmeter on 600-volt d.c. if possible. Give meter number, meter reading and voltage of test. This test to include armature, field and leads, unless otherwise stated."

Space is left on the form following the notes for remarks by, and signature of inspector.

# Structural Steel Installed by Welding for $79 a Ton

AN ANALYSIS of the cost of electric arc-welding on the Derry (Pa.) building of the Westinghouse High Voltage Insulator Company, presented by Gilbert D. Fish, of New York City, consulting structural engineer of the Westinghouse organization, before the Affiliated Technical Societies of Boston, indicates the advantages of this application of power. The Derry building is of mill-type construction, one story in height and covers two acres. The total steel tonnage was 337. The purlins were made continuous and designed accordingly, the saving in steel on this item paying for the extra welding with a good margin to spare. The detail design was of "stark simplicity," and the major structural items included 135 18-in. I-rafters on 30-ft. span and six 24-in. I, 115-lb. rafters on 52-ft. span. Each rafter was connected to the column at each end by a single side angle welded to the rafter before erection and to the column after erection. The welding of the angles to the rafters on the ground before erection permitted the shipment of rafters from the mill to the site as plain material, with ordinary mill tolerances in length. It is estimated that the Derry steel work cost about 12 per cent less than the alternative design for riveting. The cost analysis is appended.

ANALYSIS OF STEEL COSTS IN ARC-WELDED BUILDING

| Item | Estimate | Average Per Ton |
|---|---|---|
| Steel on cars at building .......... | $17.070 | $50.66 |
| Erecting and painting ............ | 6,232 | 18.49 |
| Welding and special engineering .. | 3,280 | 9.73 |
| Complete structure ............ | $26,582 | $78.88 |

APPROXIMATE SUBDIVISION OF ITEMS

| | |
|---|---|
| Plain material on cars at building, 200 tons at $42.20... | $8,440 |
| Fabricated material on cars at building, 137 tons at $63.00 | 8,630 |
| Erecting and painting, 337 tons at $18.49.............. | 6,232 |
| Ground welding, 858 ft. at $1.45.................... | 1,240 |
| Welding in place, 1,402 ft. at $0.88.................. | 1,240 |
| Welding sketches and special engineering.............. | 800 |
| Contract price ................................ | $26,582 |

# Short-Circuit Ratio Is Significant

By Leonard A. Doggett

Professor of Electrical Engineering Pennsylvania State College

THE short-circuit ratio of an alternating-current generator is defined as the ratio of two quantities, *A* to *B*, where *A* is the field current necessary to produce rated voltage on open circuit, and *B* is the field current necessary to produce full-load current on short circuit.

This ratio which has been used in connection with alternators for some years discloses much concerning any alternator. For the majority of alternators now is operation, this ratio runs from 0.5 to 1.4. A short-circuit ratio close to unity is very common in American alternators, while German and French machines are built with short circuit ratios as low as one-half. A low short-circuit ratio means a narrow air gap, less field copper, and, in general, a less expensive machine. Conversely, a high short-circuit ratio means a long air gap machine with good inherent regulation. Roughly speaking, the ratio of the weight of the rotor copper to the weight of the stator copper approximates the short-circuit ratio.

From the point of view of excitation, low values of short-circuit ratio call for a big percentage variation of field current as load comes on. Thus the exciter has a very large variable load, while, with high values of short-circuit ratio, much less change of exciter load is met. An analysis of some hundred alternators shows what may be demanded in a quantitative way of the exciter.

For unity power factor loads, the field excitation at no load will have to be multiplied by 1.9 to give rated voltage at full load, when the short-circuit ratio is 0.6; but only by 1.2 for a short-circuit ratio of 1.4.

For 80 per cent power factor lagging loads, the field current must be multiplied by 2.5 at full load for a short-circuit ratio of 0.6; by 1.5 with a short-circuit ratio of 1.4. Expressed as formulas, these results are

$$\frac{\textit{Field Amperes at Full Load}}{\textit{Field Amperes at No Load}} = \frac{K}{\sqrt{\textit{S.C. Ratio}}}$$

For unity power factor, *K* runs from 1.4 to 1.5.

For 20 per cent lagging power factor, *K* runs from 1.8 to 2.0. Of course, these results will be slightly modified by the saturation and leakage reactance of the particular unit under investigation.

A significant statement as to the trend of the short-circuit ratio may be found in the following quotation from page 1,248 of the November, 1927, A.I.E.E. *Journal*, as follows: "On account of the stability characteristics desirable for operation with a 220-kv. transmission line, the Conowingo generators have a short-circuit ratio of 1.25, which is somewhat higher than has been found satisfactory for nearly all other hydro-electric developments."

## Utility Research Indicates

# Appliance Load Values

Tests show electric ranges, refrigerators and oil burners of great potential importance in raising average annual consumption. Residence service can be made high load factor business

By Harry A. Snow

*Assistant Controller Detroit Edison Company, Detroit, Mich.*

THE average residence customer of the Detroit Edison Company is steadily increasing his use of electric service. In 1917 the average residence customer consumed 319 kw.-hr., whereas for 1927 this figure will be about 540 kw.-hr. In studying the very important problem of the possible continuance of the growth in residence consumption it was decided to determine the characteristics of electric service to three types of appliances, which are rapidly increasing in popularity but which are not yet in wide general use—namely, the electric range, the electric refrigerator and the electric motor used to operate oil-burning furnaces. The use of electric current in these three appliances is large as compared with the use of current in other appliances such as laundry irons, toasters or washing machines, which are used for only a few hours each month, and their effect on average annual consumption is of great potential importance.

Integrating watt-hour meters were installed on 53 electric refrigerators, 55 oil burners and 194 electric ranges located in single homes. The range meters carried demand attachments. Curve-drawing meters were installed on a limited number of refrigerators and oil burners and on three groups totaling 198 ranges located in apartment houses.

This special metering has made it possible to determine annual consumption, daily and yearly load curves, maximum demands, load factors and diversity factors for the three appliances. Special operating characteristics were also observed.

### Electric Household Refrigerators

In Detroit electric household refrigerators consume 34 per cent more current during the warm summer months than they do during the cooler winter months. For July, August and September, with a mean outdoor temperature of 68.5 deg. F., a group of 53 refrigerators, including eight different makes, showed an average monthly consumption of 51 kw.-hr., as compared with 38 kw.-hr. per month for December, January and February with a mean temperature of 27.4 deg. F.

Electric refrigerators consume a little more current during the daytime than they do at night, because of the higher temperatures generally prevailing during the daytime and because of the opening of refrigerator doors for the admission of food, etc. The daily load curves on 195 refrigerator motors, averaged together, gave an average consumption from noon until 6 o'clock at night 12 per cent more than the consumption during the hours from midnight until 6 o'clock in the morning.

It does not seem to be customary to shut off electric refrigerators during the winter months to save electricity by taking advantage of natural refrigeration. Only one of the 53 refrigerators under test was shut off for the winter. However, it does seem customary to shut off the refrigerator when the house is to be unoccupied for a time. During the summer vacation period the monthly consumption of individual machines under test was erratic, probably because of this fact. In certain specific instances it was known that the absence of the house-

TABLE I—1,000 RESIDENCE CUSTOMERS' DAILY LOAD RECORDS, MARCH

| Time | 1,000 Refrigerators, Kw. | 1,000 Oil Burners, Kw. | 1,000 Ranges, Kw. | Lighting, etc. 1,000 Customers, Kw. | Total, Kw. |
|---|---|---|---|---|---|
| 12:30 a.m. | 62 | 26 | 30 | 18 | 136 |
| 1:00 | 60 | 24 | 20 | 12 | 116 |
| 1:30 | 58 | 24 | 14 | 10 | 106 |
| 2:00 | 56 | 28 | 7 | 8 | 99 |
| 2:30 | 54 | 30 | 7 | 8 | 99 |
| 3:00 | 52 | 34 | 7 | 8 | 101 |
| 3:30 | 54 | 36 | 7 | 8 | 105 |
| 4:00 | 54 | 40 | 7 | 8 | 109 |
| 4:30 | 54 | 42 | 10 | 10 | 116 |
| 5:00 | 50 | 40 | 13 | 14 | 117 |
| 5:30 | 50 | 46 | 19 | 30 | 145 |
| 6:00 | 52 | 52 | 26 | 46 | 176 |
| 6:30 | 52 | 56 | 79 | 58 | 245 |
| 7:00 | 52 | 56 | 132 | 72 | 312 |
| 7:30 | 52 | 56 | 264 | 86 | 458 |
| 8:00 | 54 | 58 | 395 | 78 | 585 |
| 8:30 | 54 | 52 | 359 | 64 | 529 |
| 9:00 | 54 | 46 | 323 | 58 | 481 |
| 9:30 | 56 | 42 | 267 | 58 | 423 |
| 10:00 | 54 | 42 | 211 | 58 | 365 |
| 10:30 | 54 | 42 | 218 | 50 | 364 |
| 11:00 | 58 | 40 | 224 | 48 | 370 |
| 11:30 | 60 | 38 | 253 | 46 | 397 |
| 12:00 noon | 58 | 38 | 283 | 38 | 417 |
| 12:30 p.m. | 58 | 38 | 264 | 34 | 394 |
| 1:00 | 60 | 36 | 244 | 38 | 378 |
| 1:30 | 62 | 34 | 214 | 38 | 348 |
| 2:00 | 62 | 34 | 184 | 40 | 320 |
| 2:30 | 62 | 32 | 171 | 42 | 307 |
| 3:00 | 62 | 30 | 158 | 44 | 294 |
| 3:30 | 60 | 30 | 211 | 48 | 349 |
| 4:00 | 62 | 30 | 264 | 48 | 404 |
| 4:30 | 62 | 32 | 389 | 66 | 549 |
| 5:00 | 62 | 32 | 514 | 98 | 706 |
| 5:30 | 62 | 34 | 587 | 138 | 821 |
| 6:00 | 62 | 36 | 659 | 156 | 913 |
| 6:30 | 64 | 38 | 537 | 160 | 799 |
| 7:00 | 66 | 38 | 415 | 164 | 683 |
| 7:30 | 68 | 38 | 280 | 160 | 546 |
| 8:00 | 66 | 36 | 145 | 154 | 401 |
| 8:30 | 64 | 36 | 112 | 146 | 358 |
| 9:00 | 64 | 36 | 79 | 136 | 315 |
| 9:30 | 62 | 36 | 72 | 124 | 294 |
| 10:00 | 60 | 34 | 66 | 104 | 264 |
| 10:30 | 60 | 32 | 59 | 82 | 233 |
| 11:00 | 60 | 30 | 53 | 58 | 201 |
| 11:30 | 62 | 30 | 46 | 42 | 180 |
| 12:00 midnight | 64 | 28 | 40 | 30 | 162 |
| Average load | 59 | 38 | 186 | 63 | 346 |

TABLE II—AVERAGE ANNUAL CONSUMPTION RESIDENCE SERVICE

| | Refrigerator, Kw.-Hr. | Oil Burner, Kw.-Hr. | Range, Kw.-Hr. | Lighting, Etc., Kw.-Hr. | Total, Kw.-Hr |
|---|---|---|---|---|---|
| January | 34 | 48 | 123 | 61 | 266 |
| February | 40 | 42 | 105 | 53 | 240 |
| March | 42 | 27 | 133 | 46 | 248 |
| April | 46 | 23 | 122 | 45 | 236 |
| May | 46 | 11 | 135 | 40 | 232 |
| June | 46 | 2 | 119 | 37 | 204 |
| July | 55 | 0 | 112 | 33 | 200 |
| August | 46 | 0 | 121 | 34 | 201 |
| September | 53 | 4 | 140 | 37 | 234 |
| October | 52 | 14 | 127 | 45 | 238 |
| November | 43 | 34 | 128 | 52 | 257 |
| December | 39 | 53 | 115 | 57 | 264 |
| Total | 542 | 258 | 1,480 | 540 | 2,820 |

holder on his annual vacation was the cause of abnormally low monthly consumption.

The average annual consumption of the group of 53 electric refrigerators, all of which were of a size suitable for use in an ordinary middle-class residence, was 542 kw.-hr. per year. The average electric input to the motors during operation was 249 watts. Of the 53 refrigerators, 32 were driven by $\frac{1}{4}$-hp. motors, 19 by $\frac{1}{6}$-hp. motors and two by $\frac{1}{8}$-hp. motors. This gives a weighted average motor rating of 0.216 hp. or 161 watts.

Recording instrument records indicate that the refrigerator motors were in operation on the average 24.9 per cent of the time. The operation of automatically controlled refrigerator motors is intermittent, but the load on the power station produced by a large group of refrigerators will be a steady load, except for the daily and seasonal variations heretofore described.

### The Refrigerator Load

A group of 1,000 refrigerators, similar in make-up to the group of 53 tested at Detroit and operating under similar conditions, would consume 542,000 kw.-hr. per year, with a maximum demand for the group of 89.3 kw. occurring on a summer afternoon and a demand on an assumed December peak of 55.4 kw. (at the customers' meters). This corresponds to an annual load factor of 69.3 per cent for the group and to a diversity existing between the individual members of the group of 2.80. A further diversity which amounts to 1.61 is found in comparing the group maximum with the assumed December peak.

The month-to-month records of the consumption of electricity by individual refrigerators show that consumption has a tendency to be somewhat erratic. In certain cases it was known that the refrigerator had got out of adjustment and was using more or less current than normal. Automatic control apparatus must be more dependable than it is at present to make the current consumption continuously normal to the refrigerator duty.

Electric motors for operating oil burners for domestic furnaces consume a maximum of current during the cold winter months and no current at all during the warm months of July and August. Tests on 55 oil-burner motors operating thirteen different makes of oil burners installed in Detroit homes showed an average consumption of 53 kw.-hr. per month in December and no consumption at all during July and August. The average consumption per motor for the year was 258 kw.-hr.

RELATION BETWEEN ENERGY CONSUMPTION AND NUMBER IN FAMILY

| Number in Family | Average Monthly Kilowatt-Hours | Number in Family | Average Monthly Kilowatt-Hours |
|---|---|---|---|
| 2 | 121 | 6 | 175 |
| 3 | 127 | 7 | 176 |
| 4 | 133 | 8 | 214 |
| 5 | 150 | | |

The daily load curves from curve-drawing meters on 205 oil burners, averaged together, showed a decided morning peak from 6 a.m. to 8 a.m. There was a much smaller peak at 7 p.m. and a period of relatively low consumption during the night. The morning peak was sufficiently high to reduce the daily load factor to the rather low value of 65 per cent.

The average annual consumption of electricity by the oil burners under test was 258 kw.-hr. Compared with the annual consumption of a refrigerator, 542 kw.-hr., or of a range, 1,480 kw.-hr. per year, the oil burner seems to be of secondary importance, but even at that, the addition of an oil-burning furnace will increase by 50 per cent the use of current by an average customer.

### Oil Burners Vary

The motor sizes for the oil burners under test ran all the way from $\frac{1}{12}$ hp. to $\frac{1}{4}$ hp. and the variation in consumption among different makes of oil burners showed as wide a variation. The average motor rating (on output) for the group under test was 140 watts, and the electrical input to the motors during operation was 172 watts. Since the load on the motors during operation is substantially constant, the kilowatt-hours consumed in a given month will be a measure of the number of hours during which the motor was in operation. The average motor was in operation 41.5 per cent of the time in December and not at all in August.

A group of 1,000 oil burners would consume 258,000 kw.-hr. per year. The peak load for the group would occur on a December morning between 6 and 8 o'clock and would amount to 116 kw. The group would be taking 58.6 kw. between 4 and 5 p.m. of the same day, a time which may be assumed as the time of the peak load on the system.

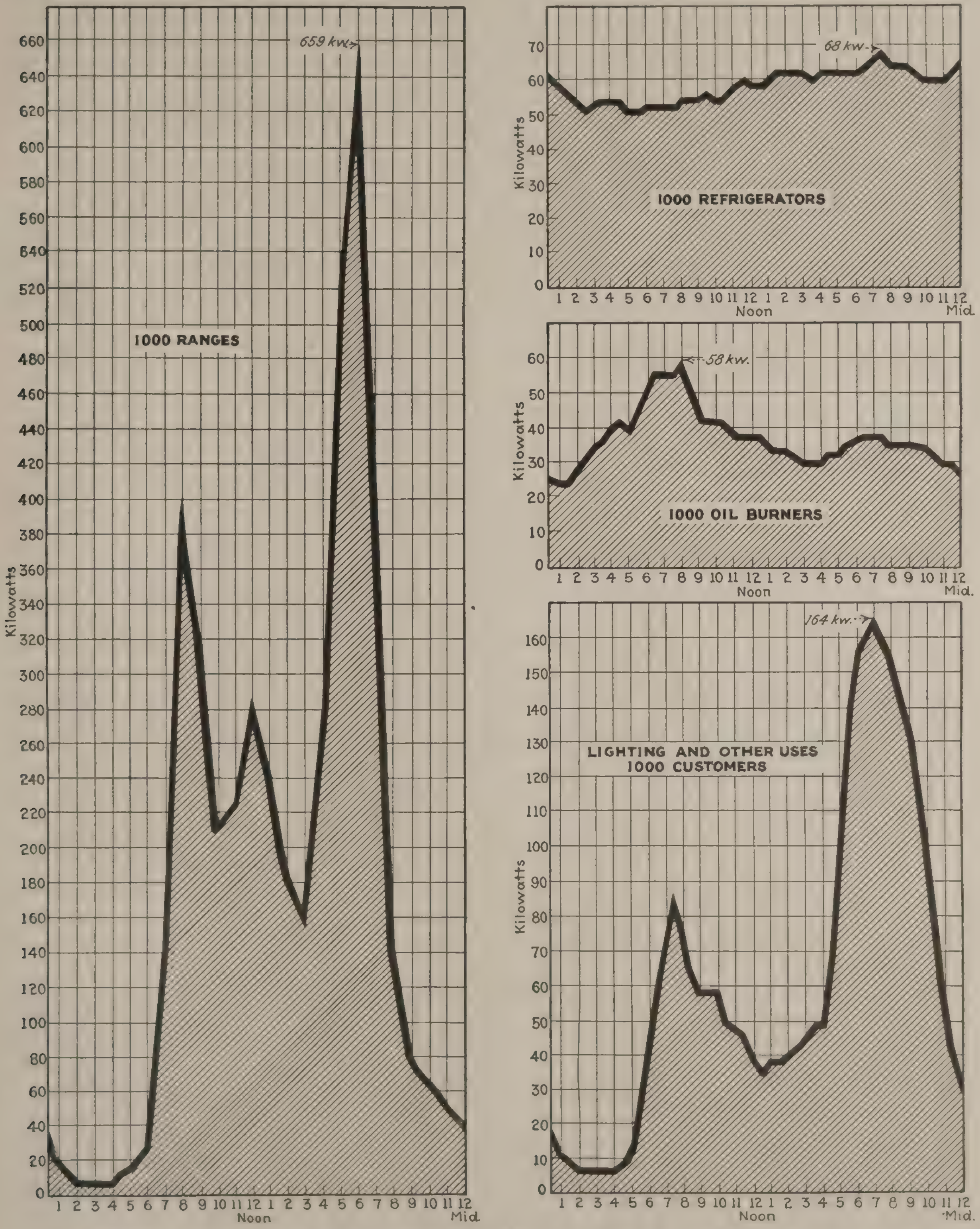
The annual load factor for a single oil burner is not high, 17.1 per cent, but the load factor for a large group is a little better, 25.4 per cent, because of the intermeshing of the demands of the individual machines.

Even during the time of the morning peak only about two-thirds of a large group of oil burners are simultaneously in operation, giving an individual diversity of about 1.5. The peak of the oil-burner load comes in the morning, and the afternoon demand is only about one-half of the morning peak. If it be assumed that the system peak comes at dusk of a December day, a large group of oil burners will have a diversity of about 2, as compared with the system peak.

### Influences of Weather

It is obvious that the electrical consumption of a large group of oil burners is dependent upon the outside temperature. Extreme cold weather increases the consumption and warm weather reduces it. The data given in this study are consistent with temperatures prevailing in Detroit during the past winter. The electrical consumptions of different designs of oil burners are markedly different, varying as much as 4 to 1 and the data given in this report apply only to a group embracing the same selection of burners as was made for this test. An attempt was made to have the group selected for test representative.

Domestic electric ranges consume a maximum of current in September (140 kw.-hr.) and a minimum of current in the short month, February (105 kw.-hr.), but the annual load curve does not show a pronounced seasonal shape. The total consumption for the year was 1,480 kw.-hr. Consumption tests were made on 194 ranges installed in single homes which averaged a little less than seven rooms to the house, and the results were modified after a study of the consumption shown by



*Composite Load Curves of 1,000 Residences Produced by Three Major Appliances and Lighting*

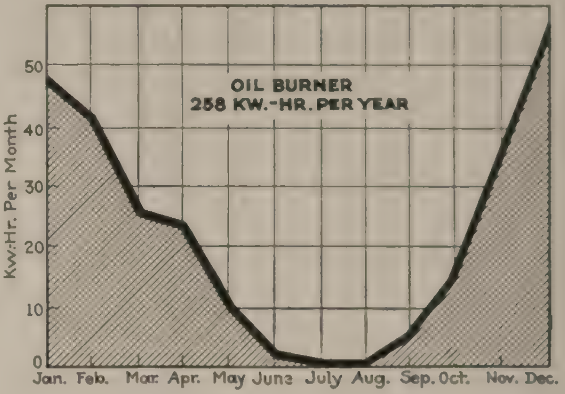
Range load produces three peaks, the greatest at the evening meal. Refrigerator load increases from early morning until after dinner, but is fairly uniform. Oil-burner load has its peak around 7 to 8 a.m., but is relatively high load factor. The peaks of the major appliances never coincide with one another or with the system peak.

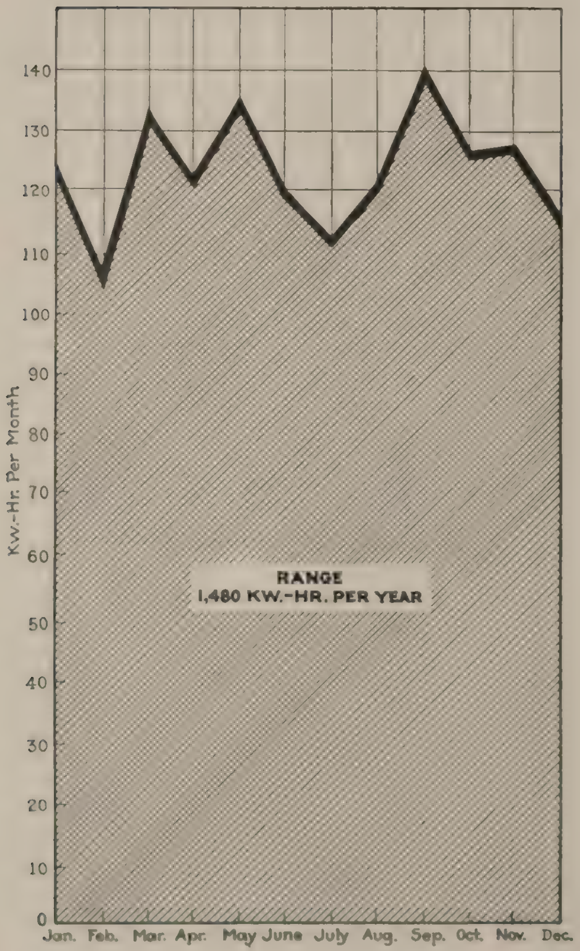
three groups totaling 198 ranges installed in apartment houses.

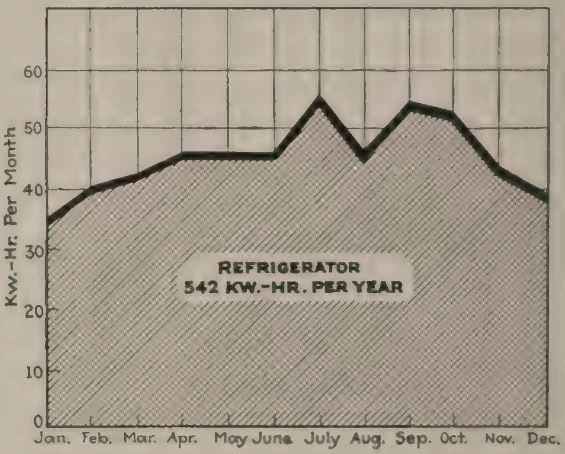
A study of 1,134 daily load curves from 198 electric ranges in apartment houses showed three distinct peaks corresponding to the three meals of the day. Of these, the highest peak occurred at the time of the preparation of the evening meal at 6 p.m. Rating this peak at 100 per cent, the breakfast peak at 8 a.m. was next in importance with 65 per cent and the noonday lunch peak, at 12 noon, was lowest with 47 per cent.

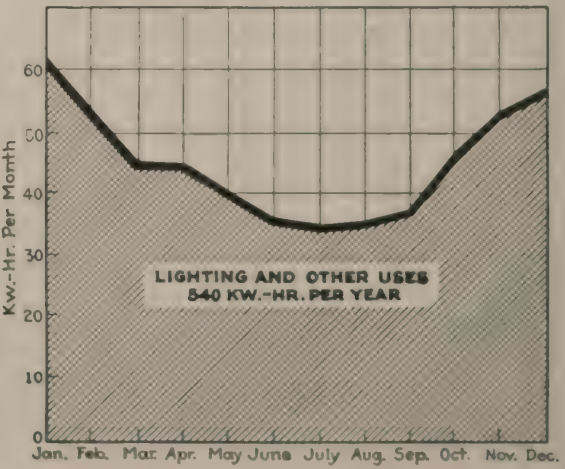
The load curve for Sunday was markedly different from the load curve for an average work day in that the peak came at 11 a.m. when the Sunday dinner was being prepared and this peak was apt to be higher than any other peak established during the week.

Peaks of current consumption by individual electric ranges are of short duration and erratic in occurrence. Maximum demand attachments on the meters installed on the 194 ranges in single homes showed readings of 5,200 watts per range as the individual maximum demand. The average individual demand of the smaller ranges in the apartment houses was somewhat less, an average for the large and small ranges being about 4,700 watts.







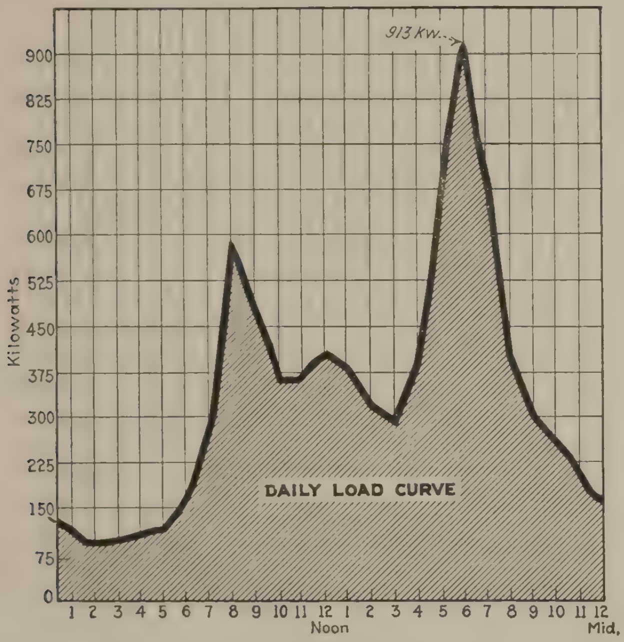


*Average Annual Consumption Produced by Range, Oil Burner, Refrigeration, Lighting and Small Appliances*

The range consumption varies between 105 and 140 kw.-hr. a month, dropping to its lowest mark in winter, almost an equal amount during vacations, with a smaller drop in the spring. The maximum occurs in the fall. Oil burners, lighting and miscellaneous uses have valleys that reach their lowest elevation about July, oil burners reaching zero at this time and lighting and other miscellaneous uses about half the winter consumption. Refrigerator consumption ascends during the summer, having a slight depression around vacation time.

A single range shows a high individual demand, yet because of the short duration and the erratic occurrence of range load peaks, the peak load of a large group of ranges will come down to 728 watts per range. This produces the high individual diversity of 6.46. Stated in another way, a group of 1,000 ranges will each, at one time or another, draw as much as 4,700 watts, but at no time will the 1,000 ranges, as a group, take more than 728 kw., or 728 watts per range in the group. This high diversity characteristic of range service suggests the possible economy of a distribution system having heavy secondaries and a few large transformers.

Range service as a class has its peak load in September, when the class load is about 17.5 per cent higher than in December and January. Also the peak load for range service comes at 6 p.m., a little later than the usual system peak, which is rarely later than 5 p.m. Assuming that the system peak occurs between 4 and 5 p.m. on some day in December, range service has a class diversity of 2.17 as compared with the system load. Thus, although each individual range at one time or another draws as much as 4,700 watts and a large group of ranges has a class maximum of 728 watts per range, the demand of a large group of ranges between 4 and 5 p.m. on a day in December is only 336 watts per range.



COMPOSITE DAILY LOAD OF 1,000 RESIDENCE CUSTOMERS
Using energy for lighting, range, refrigerator and oil-burning furnace.

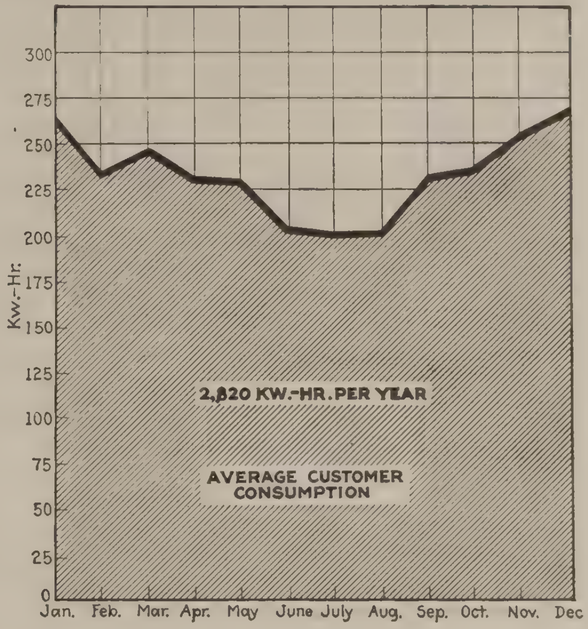
It is true that the annual load factor of one range is very low. A maximum of 4,700 watts and an annual consumption of 1,480 kw.-hr. produce a load factor of less than 4 per cent, but it is also true that a group of 1,000 such ranges has a fairly good annual load factor because of the high diversity among the demands of individual ranges. A class demand of 728 kw. (of which only 336 kw. comes on a system peak occurring between 4 and 5 p.m. on a December day) and an annual consumption of 1,480,000 kw.-hr. give an annual load factor of 23.2 per cent for the large group. Range service requires heavy distribution lines, but it is not so hard on substations, transmission lines and power houses.

In the case of the ranges installed in single houses the number of persons in each family was determined. The table on page 144 shows the relation between the consumption of current and the number of people in a family.

In general, it may be said that an electric range consumes 100 kw.-hr. per month plus 10 kw.-hr. per person for all of the people in the family served by the range.

The operation of electric ranges, unlike the operation of electric refrigerators and oil burners, is not automatic, but reflects the meal habits of the users of the ranges. The figures given are accurate for the single homes and apartments in Detroit.

The illustrations show daily and annual load curves for refrigerators. oil burners and ranges and for the use now made of electricity by the average residence customer in Detroit. The daily load curves are typical of the month of March, as being an average month where seasonal variation is present.



AVERAGE ANNUAL CONSUMPTION PER RESIDENCE CUSTOMER
Using three major appliances. Note comparatively small valley during summer months.

The data for the present use of electricity by the average residence customer do not quite represent use for lighting and small appliances only, because there are a certain number of the larger appliances in use, but the error made in assuming that these data do represent lighting and small appliance consumption is not of importance. Starting with the assumption that the average residence customer does not possess a refrigerator, an oil burner or an electric range and assuming further, rather fancifully perhaps, that he can afford to and does purchase a range, a refrigerator and an oil-burning furnace and so superposes their requirements for power on top of his previous requirements for lighting and other incidental uses, we arrive at the conclusion that the customer's consumption would be increased from 540 kw.-hr. per year to 2,820 kw.-hr. per year and that his daily and annual load curves would be as shown here. If all existing small customers were to be transformed into customers like this, public utility companies would have to look to their distribution systems, and possibly to their rate schedules.

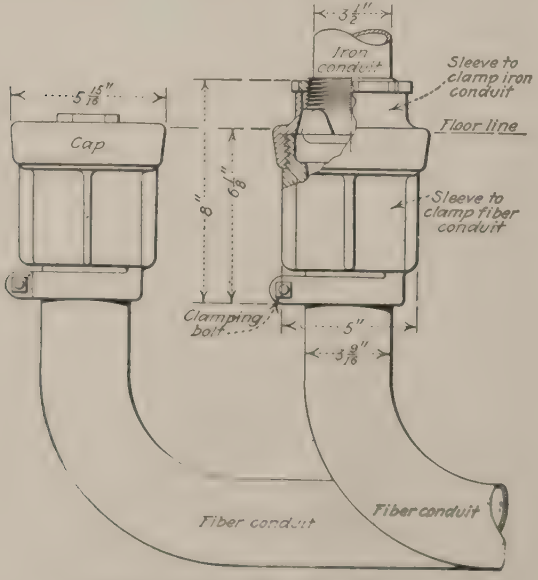
# Conduit Costs Reduced With Threadless Fittings

By Willis H. Backer
Assistant Electrical Engineer
Electric Bond & Share Company, New York

THE development of a fitting that may be used with fiber duct material and thus permit the substitution of less expensive construction for the commonly used iron conduit has led to major economies in the building of generating stations and substations, as well as in outdoor switchyards. Power and control cables, with the exception of single-phase alternating-current cables, formerly required iron conduit ranging in size from ½ in. to 4 in. The cost of engineering and construction of so many sizes of pipe offset the savings obtained through the use of the particular size required for power field leads, control, etc.

CONDUIT CONNECTORS INSTALLED, BEFORE POURING CONCRETE

In almost all cases the conduit is buried in concrete, so that the mechanical strength need not be great and fiber duct, which is less expensive than metal, may be considered for this duty. On some properties the engineers have standardized on 2-in. and 4-in. sizes. This permits savings in engineering costs, and the material may be obtained without delay and may be installed in the early stages of construction. For example, in addition to engineering cost reductions there is a saving in material costs.



A FIBER-TO-IRON CONNECTOR FOR 3-IN. CONDUIT

COMPARATIVE COSTS FOR IRON AND CONDUIT INSTALLATION

| | 2 In. | 4 In. |
|---|---|---|
| 1,000 ft. of iron pipe | $258.00 | $793.00 |
| 1,000 ft. of fiber conduit | 85.00 | 124.00 |
| | $173.00 | $669.00 |
| Fittings required: | | |
| 47 at $3.70 | $173.90 | ....... |
| 69 at $9.60 | ....... | $662.40 |
| | $0.90 | $6.60 |

# Intelligent Analysis vs. Expedients to Avoid Trouble

By G. B. McCabe
Technical Engineer Electrical Operating Department,
the Detroit Edison Company, Detroit, Mich.

IN ANY large operating organization, practices and methods grow up and are continued. Some may be good or bad; some may be the fruit of intelligently analyzed experience or the accumulated result of small carelessnesses. This condition has manifested itself numerous times on underground systems in which the handling of cable and the art of making joints and installing potheads have been transmitted from journeyman to apprentice without much supervision from technical authority, and in which the cable voltage has been increased in only comparatively small jumps. It is necessary that cable workers should be acquainted not only with the mechanics of good work, but also, in adequate degree, with the electrical conditions that are the reasons for those mechanics. It is quite conceivable that an apprentice who learns to make a good joint thinks he should not leave any sharp points of solder or loosely applied tapes because they spoil the looks of the job and are a disgrace to a good workman. He should know, also, that points of solder and soft insulation definitely weaken the joint.

In order to make such points as this clear to the men who do the actual work, the electrical operating staff of the Detroit Edison Company has prepared a lecture on underground cable which has been delivered twice to groups of operating and construction men. It was first given last spring to the 200 cable installers and splicers, and last December it was presented before 350 construction, operating and maintenance men, the majority of whom are directly concerned with the installation of cable terminals. The subject was covered exhaustively, from the manufacture of the cable to the last joint in the manhole. All details of installation, handling on reels, pulling in, joints, pothead terminals, etc., were discussed. The effects of short bends, of moisture on the hands of the splicer, of dirt on the insulating tape, of loose tape wrapping, of voids left in joints and many other points were demonstrated with high-voltage breakdown tests. Lantern slides illustrating both good and bad practices were shown.

It was felt that this information, presented in words, pictures and experiments, could not but have good effect, even in an organization where good workmanship is the rule and not the exception. This idea is borne out by the fact that there has been a diminution in the already small number of cable joint failures since the talk was first given last spring.

# "Caveat Emptor" Policy

## Suicidal if Applied to Investor*

Some tendencies on the part of investment bankers and utilities show disregard of the rights of the ultimate provider of necessary capital

By JOHN W. STEDMAN
*Vice-President Prudential Insurance Company of America*

THE annual aggregate permanent investment in public utility bonds of the life insurance companies incorporated in New York and New Jersey is so substantial a factor as to be worthy of being taken into account when drafting an indenture. Purchases in the years 1924, 1925 and 1926 totaled more than $360,000,000.

I am unfamiliar with the laws governing the investment of life insurance funds in other states, but I would direct your attention to the fact that the statutes of New York and New Jersey prohibit a company from entering into an agreement of reorganization without the approval of the Insurance Commissioner, the legislative intent being to control any change in the character of the company's investments. As the modification clause, which makes conditional upon the vote of a percentage of the bondholders, instead of unconditional, the promise in the bond to pay principal and interest on a fixed date, is, to repeat, an incipient reorganization in the furtherance of a compulsory debt-readjustment at some time in the future, it is apparent that the life insurance buyer of bonds which may be so modified, must, before confirming each purchase, obtain consent from the authorities at Albany and Trenton. Obviously, such a course of conducting one's business would be so grotesquely impracticable as to be out of the question.

*Much attention is paid to public relations between the utility and its consumers. Less is heard of public relations between a company and its shareholders. In certain respects, the latter relations are more important than the former.*

*The suggestions here presented by the representative of one of the nation's largest investors merit careful consideration both by the utility and by his banker.*

A discussion of the objections on the part of the investor to the modification clause, as used more particularly in public utility indentures, leads me to speak to you about another closely related matter, which, though understood by the lawyers who advise you, is, I have found, unknown to many of you. A bond in its form, that is, in the manner in which it is worded, may be negotiable or non-negotiable. Right here and now, please get rid of the commonly held but fallacious notion that a bond is a negotiable instrument merely because, being payable to bearer, it is transferable by delivery. Briefly, in the language of laymen, a bond, to be negotiable in form, must promise unconditionally to pay to order or to bearer a certain amount of money, with specific interest, on demand, or on or before a fixed date. Should there be in the bond any reference stating or implying a purpose to subject the bond to the terms of the mortgage or indenture, the unconditional character of the obligation is impaired and its negotiability destroyed.

You gentlemen and the borrowers of capital have been revelling for about two years in a sellers' market. In such a period it is not surprising that the strong wine of success and prosperity should go to your heads, making you disregard some of the reasonable needs of the investor, making you forget that the capacity of the buyer is not boundless and that his appetite can in time be dulled by constantly boosted prices. This was the reason for the painful attack of indigestion last June, from which the bond market did not recover for perhaps six weeks. Such a setback, it seems to me, should serve as a wholesome reminder to the banker who has heeded only the dictates of the borrower, and to the borrower who has taken a grasping and short-sighted position, that consideration for the requirements of the investor, especially the large long-term institutional investor, will, in the long run, prove best.

### DUTY TO BORROWER AND INVESTOR

In contrast to the selling-agency type of distributor, there are also some that feel that they owe one distinct duty to the borrower and another to the investor. Their duty to the former, they believe, consists in giving advice as to what form of financing should be adopted to preserve or enhance most effectively the credit of the company, in paying a price for the new securities which conscientiously measures the underwriting risk, and in fixing a redemption price which, taking into account the term and character of the obligation, will penalize neither the borrower nor the investor. Their duty to the latter they express very simply as insistence upon adequate protection, either in credit or in security, buttressed by the inclusion in the indenture of all legitimate provisions such as I have already described.

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*From an address delivered at the sixteenth convention of the Investment Bankers Association of America.

On the subject of competitive bidding for railroad bonds and equipment trust certificates, it has occurred to me that you might be interested in learning the views of a professional investor on a large scale of collective capital, who has had the opportunity of watching the fate of all offerings submitted to him in different kinds of markets. In a weak and demoralized market, the borrowing corporation never realizes a fair price unless its banker comes to the rescue. In a slow and falling market, the successful bidder or group of bidders, having too narrow a margin of profit at even the very full retail price they fix, are not sufficiently fortified to hold this price in the face of a general decline; and, failing to make many sales because the investor is not attracted, they are forced to offer their holdings at lower and lower figures. The price or basis at which the bulk of the issue is finally disposed of is a false criterion of the railroad's credit, and as such injures the market for its securities. Needless to say, it is the large investor who, in picking up a bargain, rings down the curtain on a drama of melancholy futility.

### Price Depends on Market and Bidders

On the other hand, in an active and rising market, the bidders, time and again, pay approximately the price—and often above the price—at which similar securities are offered in small lots, in the expectation that in a few weeks an advance in the general level of quotations will reconcile the investor to paying the dealers' profit, and as often as not their expectations are realized. Not infrequently a dealer, either in the class I have characterized as consisting of those of various resources, who originate no business and may or may not employ salesmen, or in the class made up of those who are engaged in "hunting for investments for the investor," in a desire to control the marketing of a new issue, yet knowing the danger of operating on too narrow a margin of profit, will approach the large institution with the proposition that the institution become a silent partner by agreeing to buy a very substantial part of the issue at one-quarter of 1 per cent profit, but at a price or basis a little below the true index of the credit of the railroad. When it comes to determining what basis is indicative of the railroad's credit, one of two things always happens: either the dealer and the institution see eye-to-eye, in which case their bid is invariably topped, or they disagree, the institution dropping out and the dealer joining with others in buying the issue at a fancy figure. In either event, the large and careful investor is disappointed.

The trouble with the speculative or over-optimistic bidding obtaining in an era of intense competition is the resulting frequent failure to get a substantial part of the issue into the strong-boxes of permanent investors. To sum up then: it would seem that the interests of the borrowing corporation, and, to a lesser degree, of the investor, would be best served by limiting public supervision to the fixing of minimum prices and by allowing the borrower liberty in negotiation and the benefit of the judgment of experienced bankers. In function the banker is often likened to the distributor of the products of farm, factory, mill and mine; but is not such a conception superficial, in that it overlooks the fact that one who deals in credit is required to give advice and counsel? Competition in the distribution of a consumable commodity has its place in the economic scheme of things, but to compel the well man, seeking preventive advice or treatment or the sick man seeking a cure, to engage the doctor or surgeon who offers his services for the lowest fee, is manifestly preposterous.

In concluding, I might observe that the present practice of houses which originate new financing of allotting to the members of the selling group an aggregate amount of bonds considerably in excess of the face amount of the issue is both a confession of the speculative and temporary character of a substantial portion of the initial sales and an attempt to neutralize its effect by creating an artificial shortage to absorb the inevitable subsequent re-selling. Just how to discriminate, more successfully than has been done in many instances within the last year, in favor of the legitimate permanent investor is, I appreciate, a difficult problem. The firms in the fourth and fifth groups, which I have defined as those who originate no business but who may or may not employ salesmen, will not wish to have their profits decreased through curtailment of their allotments for the purpose of permitting the houses of issue to place larger amounts directly with the large investors. Yet might it not be feasible to arrange it so that the principals withhold for a week, for the account of each participant in the selling group, a certain percentage, say, 10 per cent, of his allotment, to be devoted to making sales to such investors? This suggestion has, perhaps, undesirable features, but are they not outweighed by the attainment of the end sought?

My parting message is that you be not content with a knowledge of the elements which go to make up credit and security, but make yourselves more familiar with the legal aspects of your business, which affect not only yourselves, the borrower and the trustee—your lawyers are sure to safeguard you and them—but also the investor.

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## Have Put Houses in Order Financially

By J. F. Owens

Vice-President & General Manager Oklahoma Gas and Electric Co., Oklahoma City, Okla.

THERE IS every reason to believe that the marvelous growth of the electric industry which obtained in 1927 will continue throughout 1928. Many companies have taken advantage of the condition of the money market to put their houses in order financially and thus enter the New Year in splendid shape. It is evident that, while the industry as a whole is preparing to meet all demands that may be made for increased output and is in a position to finance improvements necessary to meet these demands, there is noticeably an abandonment of what, in some quarters, amounted to a somewhat reckless enthusiasm that, if continued, cannot but result in the payment of prices for properties that will be doubtful of justification, even by mortgaging future earning power. Altogether, I believe the industry is healthier and in a stronger position than at the beginning of 1927.

Much was done last year to acquaint the public with the basic facts of the industry, on the theory that the public is fair when it knows the facts. A vast majority of electric companies in the United States enjoy good public relations as a result of having continued a frank, open, above-board policy toward the public.

So thoroughly has this policy proved itself, that it is a rare thing to find a utility executive not following it. As long as our electric companies adhere to this policy there need be no fear for the future of the industry.

# How Standardization Procedure Affects the Industry

By A. Penn Denton
President Denton Engineering & Construction Company, Kansas City, Mo.

THE electrical industry is undertaking today a program in market building that will require the closest co-operation among all branches of industry if we carry it through to completion. This market building, while primarily a sales problem, has to do with the adequate rewiring of sixteen million homes which are now using electricity so incompletely. The National Electrical Code provides us with many types of interior wiring with which to wire these homes, but with all of these methods we have not reached a place in the development of our industry where it can be said we have no further need for progress in the art of wiring.

The electrical wiring standards of the present code have been 35 years in the making, and yet it has been only within the last four years that a procedure has been adopted by the industry whereby order has replaced haphazard revision of old standards and the making of new ones for wiring installations.

Our electrical industry has not yet realized the possibilities of this new procedure. It is still concerning itself with many old ideas and traditions in code making which should have been discarded years ago. Every type of wiring given us in the code today will prove helpful to our industry in extending our market for a wider use of electrical service. Our standardization procedure from this time on must protect each type of wiring according to its merits and at the same time permit of new developments and progress of the art. Under the old order of code revision the separate industry groups did not work together in providing the public with the best possible electrical service. For that reason many of the wiring standards of the code were too often commercial issues which seldom represented the best co-ordinated thought of our engineers and commercial men.

The basic factor underlying the standards for wiring installations of the code is safety from the standpoint of the fire and life hazards. No attempt was made for years to provide in the code due consideration for use and occupancy features of the different wiring methods. Rapid strides have been made in improving all kinds of building materials and construction, while those interests responsible for improved wiring methods lagged far behind other industry development. The public demand in all sections of the country for better and safer wiring has within recent years brought continually to the attention of our electrical committee of the National Fire Protection Association the need for recognition in the code of the "Where" and "How" all types of wiring may be used. The administrators of our code are asking for this treatment of future standards, while the manufacturers, the central-station companies, and the contractors are beginning to realize the great importance of such treatment.

We have, therefore, reached the place in our program for an orderly improvement in the revision work of the code, where each group of our industry must recognize its individual responsibility. Our interior wiring situation demands the co-ordinated efforts of all industry groups. The wiring standards must all be protected for the public good. This means that no group or single interest within a group may exploit some type of wiring for personal or selfish reasons. No one interest can control and it will be only through a united industry effort following the splendid procedure which we now have set up that will provide the safe, efficient and adequate wiring installations of the future so necessary to the success of our building the great future electrical market.

The electrical field service of the N.F.P.A. has accomplished much in the aid it has given the electrical committee, and particularly the article committees, but this field service work must be greatly supplemented by individual group action along these same lines. There is an immediate need for a code and standards staff in the National Electrical Manufacturers Association. The same need exists in the National Electric Light Association, the International Association of Electrical Inspectors and the Association of Electragists, International. All of the group staffs for code and standards work can materially strengthen the united and constructive participation of its own organization in bringing about an orderly control of our wiring situation for the good of all. All of these staffs need to be strong, friendly, courageous, far-seeing and free from bias toward or against any unit within their particular branch of the industry.

Let each group of our industry take unto itself the responsibility which rests upon it. May we frankly discuss these problems in our electrical field service committee for our common good. Then and only then can we hope to build that public confidence which, in the last analysis, is all important to the future expansion and growth of the electrical industry.

# Cost of Adding Coal Handling Facilities

THE INSTALLED cost of a coal-handling system added two years ago to an Eastern Tidewater central station has recently been itemized by the engineers of the public utility company for which the work was done. The major equipment consisted of an unloading tower of 300 tons per hour capacity, a 600-ton per hour Bradford breaker, a 36-in. Stephens-Adamson belt conveyor system, two 100-ton per hour bucket elevators and two 200-ton per hour Merrick weightometers. The overall capital outlay for this work totaled $233,467, as itemized in the accompanying table:

ITEMIZED COST OF COAL-HANDLING INSTALLATION

| | |
|---|---|
| Unloading tower, Boston Steeple tower type, Mead-Morrison 55-ft. boom, 375-hp. hoisting motor, 80-hp. trolley motor, 30-hp. propelling motor, 1.5 ton grab bucket | $60,003 |
| Bradford breaker, 125-hp. motor, breaker and cleaner type, complete with foundation, supports, and housing | 31,913 |
| Conveyors and weightometers | |
| 36-in. belt conveyor, 372 ft. c. to c., $\frac{3}{16}$-in. 6-ply belt, 36-in. Sacon carriers and returns, 30-hp., 550-volt, 3-phase motor with push button and station control | 18,924 |
| 36-in. belt conveyor on steel channel stringers, inclined type, 137 ft. c. to c., size as above, 50-hp. motor, 2,300 volts | 6,435 |
| 36-in. belt conveyor, 7-ply, dimensions as above but 572 ft. c. to c., 50-hp. motor, 550 volts | 31,656 |
| Two 100-ton per hour bucket elevators, vertical link belt type, 93.5 ft. c. to c., each complete with 25-hp. motor and two reciprocating type feeders driven by 10-hp. | 12,418 |
| 30-in. belt conveyor, 30 ft. c. to c., 5-hp. motor | 3,850 |
| 30-in. belt conveyor, 124 ft. c. to c., 15-hp. motor | 6,705 |
| Two 30-in. belt conveyors, 61.5 in. c. to c., each complete with 10-hp. motor and control, T-rail track, etc. | 9,545 |
| Two 200-ton per hour Merrick weightometers for 30-in. belt | 8,368 |
| Miscellaneous equipment | |
| Trolley and feed wires for raw coal handling equipment | 5,255 |
| Structural steel and chutes for conveyors | 26,737 |
| Coal sampling crusher | 541 |
| | $222,350 |
| Contractor's compensation | 11,117 |
| | $233,467 |

# Water Heating—Good Business or Bad Business?

By L. B. Hutton

***Chief Engineer Southland Electric Power Board,*** *Invercargill, New Zealand*

SUPPLY authorities are constantly looking for new sources of revenue from the sale of electricity. It is not long since they discovered the value of the electric range load. But, wherever an electric range is sold, there arises the question of an adequate supply of hot water. Any house can do without an electric range, but no household can be without its hot water.

What more natural, then, than that the question of heating water by electricity should today demand the attention of electric supply authorities, and the tendency seems to be toward an exploitation of this form of revenue. There is just a question, however, whether it is the supply authorities who are exploiting the field or the water-heating field that is exploiting the supply authorities. The danger lies in the fact that water heating demands a low rate. Electric power for water heating can reach the consumer: (1) direct from the authority which generates it; (2) from the generating authority, through another authority which purchases in bulk, and retails it.

ELECTRIC POWER COSTS

| Size of Element in Watts | Cost per Year | Cost per Day | Units Available | | Cost per Unit |
|---|---|---|---|---|---|
| | | | per Year | per Day | |
| 500 | $25 | 6.85 c. | 4,380 | 12 | 0.57 c. |
| 600 | 30 | 8.2 c. | 5,256 | 14.5 | 0.57 c. |
| 700 | 35 | 9.6 c. | 6,132 | 17 | 0.57 c. |
| 800 | 40 | 11.0 c. | 7,008 | 19 | 0.57 c. |
| 900 | 45 | 12.15 c. | 7,884 | 21.5 | 0.57 c. |
| 1,000 | 50 | 13.7 c. | 8,760 | 24 | 0.57 c. |

Dealing with the first of these, if we take as a basis that firm power cannot be made and sold at much less than $20 a horsepower-year—equal to about $25 a kilowatt-year—and assuming that this lowest rate is granted for water heating, we find that the consumer's cost, on the flat rate—that is, purchasing the kilowatt—works out at about 0.285 cent per unit. This would be an exceptional quotation, but even if he bought the kilowatt at $50 for the year, his water heating would cost only 0.57 cent per unit. One can imagine that so popular would this service become that the generating station would gradually be called upon to supply more and more of its power at an unremunerative rate, for, even at $50, the return per unit is far below what the average domestic service unit is sold at today.

The accompanying table sets out the cost per year, per day and per unit for power purchased on a flat rate of $5 per 100 watts per year. It cannot be claimed that the 100 per cent load factor, as represented in the "units available" column, is unattainable, because the large reservoir water cistern, properly lagged, lends itself particularly to the high load factor. No housewife can put a 100 per cent load factor on an electric range; but thousands are already doing it on the water heater.

Then there is the second case of the municipality which purchases from a generating station in bulk on a kilowatt or kilovolt-ampere basis—perhaps on a flat rate, perhaps on a sliding scale. This might take the form of so much per kilovolt-ampere for the first 1,000 kva. and a smaller sum for the remainder. If we assume that a municipality purchases in bulk at $50 per kilovolt-ampere per year on a half-hour peak demand, and that for a certain year its peak reaches 2,000 kva., then it has at its disposal 17,520,000 units, and it proceeds to sell them to best advantage. It will be unable to sell them all unless its system load factor reach the ideal of 100 per cent and its system power factor be high; but it will always be aiming at this ideal. Provided it does not exceed the 2,000 kw. peak, the unit cost is:

| | |
|---|---|
| At 100 per cent load factor | 0.570c. |
| 90 per cent load factor | 0.634c. |
| 80 per cent load factor | 0.713c. |
| 70 per cent load factor | 0.816c. |
| 60 per cent load factor | 0.950c. |
| 50 per cent load factor | 1.142c. |

At whatever point one may start, the load factor of a system tends to build up, and the unit cost will consequently fall. The retailing supply authority, watching its conditions carefully, can make such arrangements from time to time as will enable it to sell its 2,000 kw. of power over and over again and the time will come when it can quote an absurdly low figure for off-peak water heating.

So far as the generating authority is concerned, therefore, it has arrived at the same point as in the first case considered—that of supplying direct to the consumer on a flat rate—and neither of the pieces of business can be considered eminently satisfactory.

There are many cases where generating and supply authorities are cursing their long-time contracts at low rates. The rates have been far too attractive, and business which would give a much higher return has had to be passed by. There are also many supply authorities which are faced with the need for extending their plants, the attractive rates quoted having accounted for all their present capacity.

NOTE—Wholesale power at or near a generating station might, in some cases, be had at a figure of $20 a horsepower-year at 100 per cent load factor. But this represents the extreme case and does not consider the heavy investments and losses involved in transmission and distribution of small loads to water-heater customers scattered over a wide area. Rates would be much higher than those quoted and yet many properties find it possible to make a profitable rate for water heating and one which encourages this business.—EDITORS.

# Southern Cement Mill Electrified

ALTHOUGH it is the practice of many cement mills to produce their own power, since the enormous amount of available waste heat permits economical generation, the new plant of the American Portland Cement Company at Foreman, Ark., will, when completed, be electrified throughout and will use purchased power, according to E. W. Vennard, commercial manager of the Southwestern Gas & Electric Company. The initial capacity will be 3,000 barrels a day, with provision for increased production. A connected load of approximately 4,500 hp. will be composed of motors ranging from fractional horsepower equipment to 800-hp. synchronous machines driving the tube mills. Approximately 16 kw.-hr. will be required to manufacture each barrel of cement, a total of 1,440,000 kw.-hr. a month.

The cement company, through its contract for purchasing power from the Southwestern Gas & Electric Company, avoided a potential expenditure of some $500,000 for a power station at the plant and receives energy from the utility at a lower rate than the equivalent of private generation, even though the fuel charge be neglected in the computation of the latter cost. Sustained service is offered by the extensive transmission line facilities of the supplying utility.

EXTERIOR OF THE GEORGE E. KEITH FACTORY NO. 11

# Improved Electrical Service

## in a Modern Shoe Factory

Plant of the George E. Keith Company illustrates latest practice in light, heat and power applications. Flexibility of operation assured by distribution system layout

By K. D. Hamilton

*Plant Engineer George E. Keith Company, Brockton, Mass.*

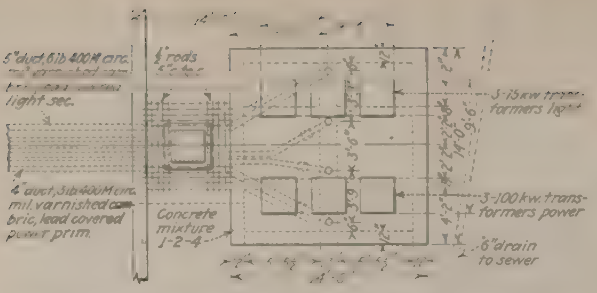
IN THE design of the George E. Keith Company's latest factory, designated as No. 11, at Brockton, the use of electricity was a dominant factor. For lighting and power service no other agency was open to consideration, owing to the well-known advantages of electrical illumination and the electric motor drive. Within the past decade the use of electric heating in specialized applications in shoe manufacture has attained remarkable headway, and this factory naturally affords many examples of this class of service.

The shoe industry has kept pace with developments in reinforced-concrete building construction, as appears from the accompanying illustration of Factory No. 11. This industry today appreciates the importance of investing in permanent construction, where maintenance cost can be reduced to a minimum and yet provide that flexibility of operation which is so imperative in shoe manufacturing, where styles are continuously changing, necessitating the removal of machinery from one portion of the building to another to keep pace with the ever-changing process that enters into the production of the shoe.

This factory (No. 11) differs radically from the ordinary reinforced-concrete building, although it has the appearance of a strictly concrete structure from the exterior, with the advantage of an extreme width of bay and window area, with exterior pilasters spaced 20 ft. apart on centers. The interior was designed to secure the advantages of slow-burning mill type construction, which allows a flexibility of movement of processes and machinery that is less apparent in a factory with concrete floors and large reinforced-concrete columns.

The interior posts are spaced on 10-ft. centers, the floor, however, consisting of 4-in. planks laid on heavy hard pine girders with an intermediate hemlock floor, topped by a high-grade factory maple wearing surface. This building is 400 ft. long by 60 ft. wide, consisting of four floors and a basement with a headroom of 12 ft. Its interior construction differs materially from that of the ordinary concrete factory, in that the wooden girders are hung from the concrete lintel by means of a special steel support. This allows us to obtain a maximum window area, throwing the daylight to the interior of the factory and allowing operators to use machines at distances from the windows that heretofore were considered impractical.

The shoe industry does not demand a heavy floor load, and for this reason the floors were designed to carry


5" duct, 6 lb 400 M circ.
light sec.
½" rods
4" duct, 3 lb 400 M circ. mil. varnished cambric, lead covered power prim.
Concrete mixture 1-2-4
3-75 kw transformers light
3-100 kw. transformers power
6" drain to sewer
14'-0"
9'-6"
3'-6"
14'-0"

DETAIL OF TRANSFORMER PLATFORM FOUNDATION WITH PRIMARY AND SECONDARY CONDUIT LINES

only 125 lb. per square foot. In addition to obtaining a light floor load, the wooden construction lends itself admirably to securing machines to the floors and to the boring of holes for piping. It also facilitates the movement of machinery. It eliminates the hard concrete floor, which does not provide an ideal working surface; does away with the noise and vibration that are so apparent with high-speed machinery on a concrete floor, and above all, provides a clean, smooth wearing surface, which is not continuously being disintegrated by pushing trucks over concrete. It also eliminates the dust that is frequently apparent where many racks are moving in a reinforced-concrete factory.

### Energy Consumption 2.57 Kw.-Hr. Per Pair Shoes

These features as briefly outlined tend to provide conditions wherein lighting costs are extremely low. Lights are used in this building only during extremely dark weather or in the winter, and then only for a few hours in the afternoon. The average energy consumption for heat, light and power in this structure, when operating at a capacity of 3,000 pairs of shoes per day, is 350,000 kw.-hr. per year. The electric service layout in this factory, as well as the machinery installation, is designed for a maximum capacity of 6,000 pairs per day, and under present operating conditions 450 male and 430 female operatives are employed. When operating at maximum capacity, this number of employees would be increased to approximately 1,200.

At the Keith company's steam plant switchboard connection is made with the system of the Edison Electric Illuminating Company of Brockton through a substation supplied by the latter. From the buses of the Keith board an 800,000-circ.mil steel armored cable 800 ft. long serves the factory, terminating at a main distributing switchboard in the basement of this shop. Energy is supplied to the factory at 600 volts, three phase, and the general scheme of electrical supply is shown in the accompanying diagram.

In this factory larger motors driving auxiliary equipment are supplied at 550 volts; motors used in individual driving of shoe machinery are rated at 220 volts, and lighting is at 110 volts, three phase. The lower voltage was used on the shoe machinery on account of the hazard 550 volts presents to the employees. The transformers required for 220-volt and 110-volt service are located in an inclosure in the mill yard, the primary and secondary connections being run in underground cable between the factory distributing board and the inclosure.

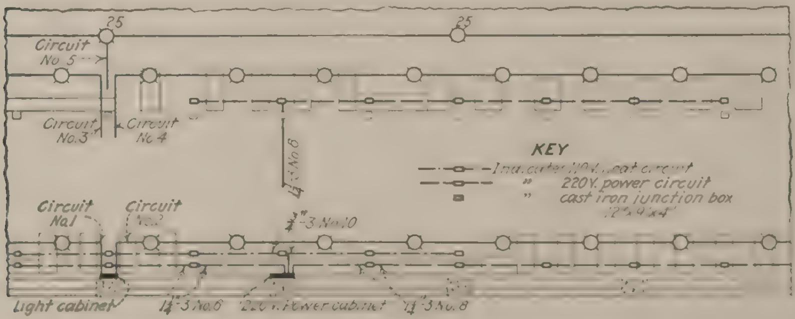
### Distribution Panels Centralize Control

The distributing switchboard has one incoming line panel controlling the main feeder into the building and is equipped with a voltmeter, a 500-amp. oil-circuit breaker, relays and watt-hour meter connections. A second panel controls a 550-volt auxiliary power feeder supplying energy to elevators, an air compressor, exhaust fans, etc., and also controls a feeder running to the power transformer bank primary terminals. Two 300-amp. oil-circuit breakers are in service on this panel. A third panel controls a feeder running to the lighting transformer primaries and a spare circuit for future additions. The remainder of the board is made up of panels controlling the 220-volt power and 110-volt lighting internal distribution feeders. Each panel is equipped with indicating as well as recording wattmeters to facilitate checking the amount of energy used and the loads in various departments and sections of the factory.

The lighting service is distributed throughout the factory at 110 volts, three phase, each circuit being balanced equally to obtain a uniform load on each phase. The transformers for these circuits are located on a separate foundation outside the building inclosed in a safety fence so that this hazard could be eliminated from the factory. These transformers consist of three 100-kva. single-phase transformers for the 220-volt power circuit fed on the primary by three 400,000-circ.mil cables, leading to them from the factory distribution panel, and have a secondary connection to the factory cables of six 500,000-circ.mil cables connected in parallel to give the necessary capacity.

The lighting transformers consist of three 75-kva. single-phase units fed by three No. 2 primary circuits and delivering to six 400,000-circ.mil secondary circuits. All of these lines are run underground in lead-covered cable, incased in conduit.

The wiring distribution throughout the entire factory is of the most modern type, all wires being run in conduits. Each feeder panel in the various departments controls the circuits to the motor equipment. These circuits are carefully designed to reduce voltage drop and to make the system as flexible as possible. A series of outlet boxes is provided at intervals of 10 ft., in order that future connections may easily be made from the individual machines. Each motor feeder panel controls a separate circuit in each department and a separate meter records the amount of power fed through that respective panel. These motor feeder panels

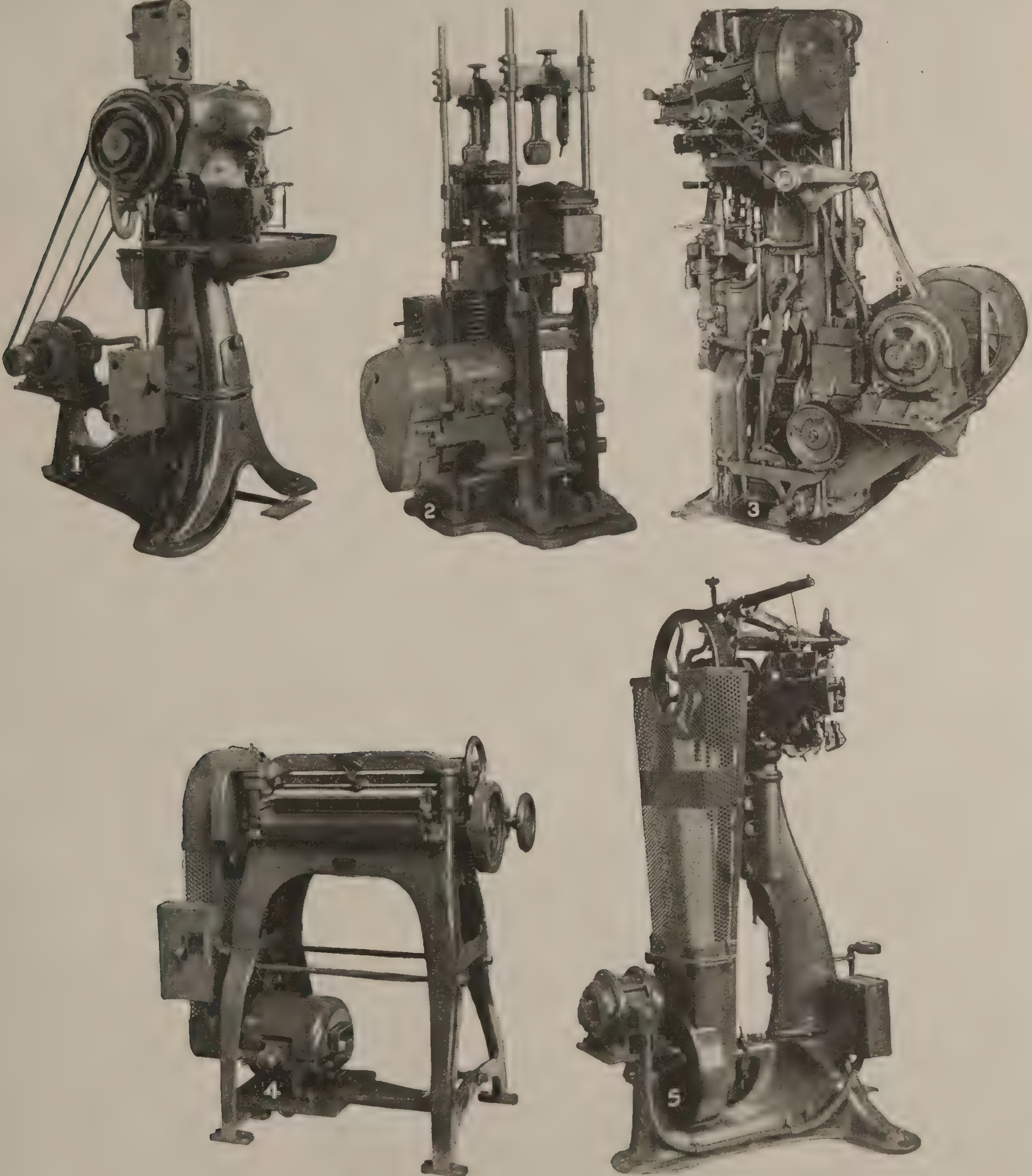


TYPICAL LAYOUT OF POWER AND LIGHTING CONDUITS

This drawing shows control of six main lighting circuits from lighting cabinet, and two power circuits and one heating circuit from power cabinet. Main units, R.L.M. reflectors, 150-watt lamps; watchman's circuit with dual control from ends of shop, 25-watt lamps and Alba shades are distributed at frequent intervals throughout the factory in order that they may be accessible at all times for future extensions, and several spare circuits have been left in each.

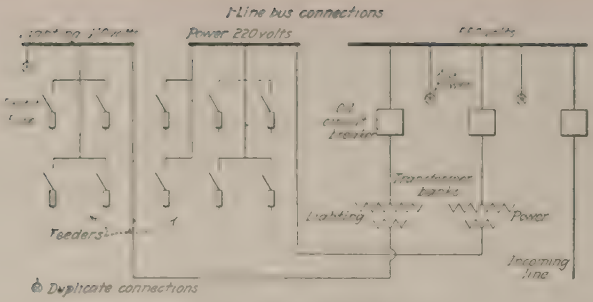
Circuits of 550 volts were chosen for the power tables because in this case the group drive was decided upon. These power tables are short benches with six sections each, with a machine set on each individual section, driven from a small shaft supported from the table frame in ball-bearing hangers. Each table is driven by a $\frac{3}{4}$-hp. motor through a chain drive to a sprocket on the shaft. These chain drives operate in oil at all times, which gives reduced maintenance cost and ease in the distribution of power. It eliminates belts and provides a drive on short centers, which conserves floor space.

The switching apparatus for the various motors de-



*Unit Drives Featured in Shoe Manufacturing*

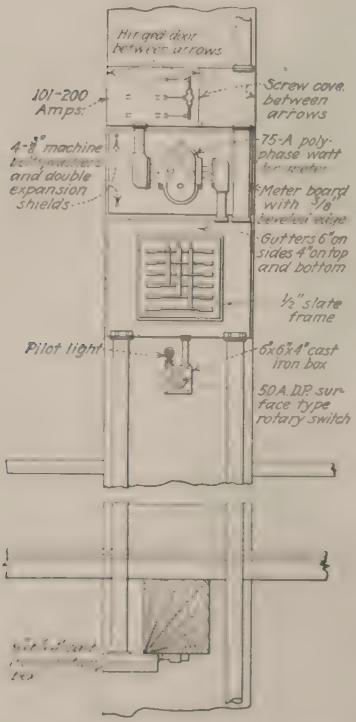
1. Motor-driven Goodyear outsole rapid lockstitch machine
Belt connections are used in these units
2. Motor-driven Goodyear sole-laying machine
3. Motor-driven heel loading and attaching machine
4. Summit splitting machine, motor driven
5. Motor-driven lasting machine



SCHEME OF ENERGY SUPPLY TO FACTORY NO. 11

pends entirely upon the circuit. Individual equipment on the shoe machinery itself is controlled through a simple snap switch at the will of the operator. The power table benches are operated by an oil switch located under the bench. Each switch controls an individual motor. Care has been taken to safeguard all equipment, by thoroughly grounding the various circuits and eliminating any possibility of breakdown of the electrical distribution. Overload coils and no-voltage release attachments are provided on all motors over 7½ hp. in capacity, so that they receive adequate attention in case of interruption of service.

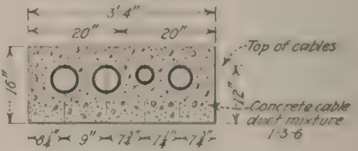
The size of the motors throughout this factory is extremely interesting, as the shoe machinery is of light construction and the rated horsepower capacity of each motor is relatively small. There are 220 motors driving individual machines with a rated capacity of 252.75 hp., bringing the average to approximately 1 hp. per machine. There are 116 fractional horsepower motors with a rated capacity of 21.69 hp. These motors run from ⅙ hp. to ¼ hp. capacity and are served from both 220-volt and 110-volt circuit. There are eight motors operating for service equipment at a capacity of 152.5 hp., making a total of 344 motors with a rated capacity of 426.94 hp. The installation of individual motors on each machine makes possible the lighting distribution system which we have in this factory, as it eliminates all overhead belting, shafting, hangers, pulleys, etc., which, as any operating man knows, detract from the penetration of light to the interior of the factory. The individual drive also allowed us to place machinery in the interior of the mill, which otherwise would have been impossible. The maintenance of these motors has required considerable study, but has been worked out in a most satisfactory manner. One might ordinarily expect, with 344 motors to maintain, in addition to about 700 in other parts of these factories, that the bearings and lubrication used and motor winding breakdown would be excessive. The secret is that the motors are thoroughly cleaned and oiled at least once a week, that no motor is seriously overloaded, and that fuse conditions are so designed that adequate protection is available for all motors at each instant.


Hinged door between arrows
101-200 Amps.
Screw cove. between arrows
4-⅜" machine
and double expansion shields
75-A poly-phase watt
Meter board with ⅜" beveled edge
Gutters 6" on sides 4" on top and bottom
½" slate frame
Pilot light
6x6x4" cast iron box
50 A. D.P. surface type rotary switch

DETAIL OF POWER CABINET, WITH SWITCH AND METER MOUNTING

In designing the power table drive, it might be interesting to know that in laying out stitching machinery of this type, we rate a motor as follows: The first horsepower will drive eight machines, and if additional machines are attached to the line, the next horsepower will drive ten sewing machines. In other words, eighteen machines require 2 hp. and each additional ten machines require 1 hp. additional.

The motor equipment for individual shoe machinery requires intensive study, as there are innumerable machines used throughout a shoe factory. The capacities of these motors run from a fractional horsepower of 0.02 to the larger sizes, which require at least 3 hp. The speeds of these motors vary, depending upon the application of the motor to the machine. Standard sizes, however, are adopted as much as possible, using 1,200 and 1,800 r.p.m. synchronous speed wherever practical.



DETAIL OF CONCRETE CABLE DUCT BETWEEN TRANSFORMER BANKS AND FACTORY NO. 11

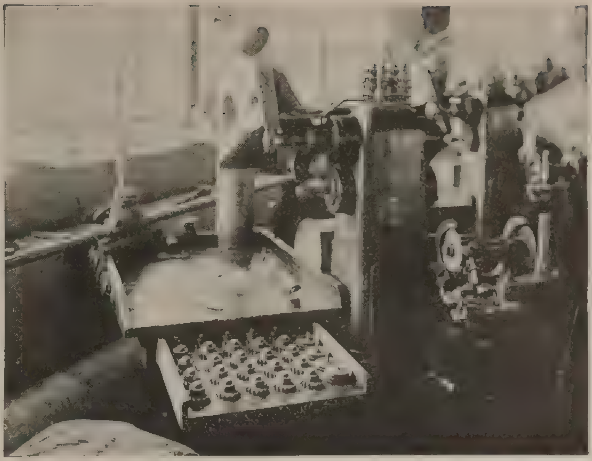
These motors are usually directly connected through a flexible coupling or by means of a chain belt or gear drive. Where the chain or gear drive is used, they are usually inclosed in a housing, which allows them to operate efficiently in a lubricating medium. The voltages vary to meet each factory condition.

The writer would recommend, however, that 220 volts be adopted as standard for all individual motor applications, and that 110 or 220 volts be used for heating circuits. The selection of equipment in this factory naturally brought up the question of the individual as compared with the group drive. The writer made an extensive study of the qualifications of both methods and found that each problem is an individual one for decision. In order to meet this problem accurately and satisfactorily, it is necessary to lay out a factory under both methods, estimate the cost of the installation of shafting, pulleys, hangers, belting and large motors, and compare them with the wiring, switches, installation and cost for individual motors.

There are other phases, however, that must be discussed: First, the type of machine to be operated. Is it one that is under continuous power, operating the entire length of the working day without interruption, or does it have an intermediate load that requires switching from continuous to intermittent operation? Second, can the machines be grouped so that one group can be operated continuously? Are the maintenance costs of repairing large motors, belting, shafting, hangers, pulleys, etc., greater than the maintenance costs of smaller motors? The diversity factor in the operation of a group drive is also an item for consideration.

The efficiency, as regards electrical characteristics, of a series of group motors of large size driving many ma-

PROTECTIVE MOUNTING OF POWER AND LIGHTING TRANSFORMER BANKS



ADJUSTABLE LIGHTING OF EDGE-TRIMMING MACHINE BY FLEXIBLE BENCH ARM UNIT

chines no doubt is considerably better than that of smaller motors. The power factor of several large motors operating at full load is also higher than that of many small motors operating under a similar condition. These items must be weighed carefully before making a decision. On the other hand, there are advantages of the individual motor over the group drive, such as flexibility of installation and the possibility of turning a machine at an angle with the line of the building so that the light may be focused directly against the point of operation, which would be impossible with the belt drive, because the machines must be either parallel or at right angles with the line shafting.

The reduction of light throughout the entire mill by the use of overhead equipment has a direct bearing on the choice of the individual motor drive. Then again, there is the matter of breakage of machine parts, which does not occur so frequently with the individual motor, especially on high-speed machinery. Should a machine break down with an individual motor, the fuse which is set exclusively for the motor capacity will blow and shut the machine down. With a belt drive, however, a large belt will frequently pull the machine over and cause additional damage. It is only by carefully weighing one condition against the other that the industrial engineer can decide which is the better method of distribution. Each problem is individual; frequently it is found in certain industries that the utility, flexibility, type of load, etc., may more than offset reduced efficiency and low power factor.

There is a solution, however, in the shoe factory, as in many other industries, for lower power factor, and that is by installing corrective apparatus, such as synchronous motors or static condensers in the line to build up power factor. One of the most satisfactory methods is to drive the large exhaust fan with a synchronous motor. The exhaust fan is a steady load and frequently represents 60 per cent of the entire load in the shoe factory because of its capacity. By installing a synchronous motor on the exhaust fan, ideal conditions are obtained for improving power-factor conditions, especially when a penalty clause may exist in the contract for purchased power. This assists in operating a privately owned generating plant by reducing copper losses and lessening the operating load on the generator.

### Illumination Involves Unusual Problems

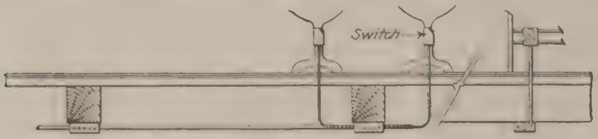
Another interesting feature of the modern factory is the lighting system. Those familiar with shoe factories appreciate its importance, but how many such plants are inadequately lighted. Many shoe factories are low studded; the ceilings are not painted white; belting, pulleys, hangers and other equipment interrupt the flow of light from the exterior. The factories are dirty and the machines are not placed in such a location as to obtain adequate light on the point of operation. All of these items were taken into consideration when designing this factory. With high headroom, white ceilings and elimination of obstruction of flow of natural light,

THE 900-KVA. SUBSTATION OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF BROCKTON, WHICH SERVES THE GEORGE E. KEITH COMPANY

TYPICAL LIGHTING INSTALLATION, KEITH SHOE FACTORY; ALL OVERHEAD BELTING ELIMINATED BY MOTOR DRIVE LAYOUT

the machines were placed in such a manner that maximum intensity of light comes at the point of contact, and the overhead system of distribution was used throughout.

With 12-ft. headroom, it was possible to space R.L.M. reflectors with 100- and 150-watt units at sufficient intervals to eliminate shadows and provide adequate foot-candles at the point of operation. We eliminated all drop cords and the high maintenance cost which goes with such an equipment. This method distribution was used throughout all departments, except in those operations where high intensities were required, such as hand work in the cutting department and in the fitting room on the sewing machines. Here individual lights were used throughout, but of the more modern design which employs a flexible arm supported from a bracket on the bench. These individual lights were of 10-watt capacity on the stitching machinery and 25-watt capacity in the cutting room. This gave adequate illumination, and in some cases as high as 10 or 15 foot-candles were required on the work. This may seem excessive, but where high-grade quality work is demanded, sufficient illumination is imperative.



METHOD OF RUNNING POWER AND HEATING CONDUIT TO MACHINES

MOTOR RATINGS FOR INDIVIDUAL SHOW MACHINERY DRIVES

George E. Keith Company Factory No. 11
(All United Shoe Machinery Company)

| Machine | Motor HP. | Motor R P M |
|---|---|---|
| Beating and slashing—Goodyear welt | 1/3 | 1,200 |
| Blacking—Crest heel | 1/3 | 1,800 |
| Buffing—Naumkeag | 2 | 1,800 |
| Burnishing—No. 2, Goodyear impression stitch | 1/4 | 1,800 |
| Cementing—Model A, U. S. M. C. channel | 1/3 | 1,200 |
| Channeling—Goodyear Universal | [illegible] | 1,750 |
| Drier—Model A, U. S. M. C. bottom | [illegible] | 1,800 |
| Embossing—Model C, U. S. M. C. | 1/4 | 1,800 |
| Finishing—Xpedite | 3/4 | 1,800 |
| Folding—Model A | 1/8 | 3,600 |
| Grinder—Model D, U. S. M. C. | 1/4 | 1,800 |
| Grinding machine—Model M. heel trimmer knife | 3/4 | 1,800 |
| Grooving and beveling—Model C, Goodyear welt | 1/4 | 1,800 |
| Heel breasting—Model B, Imperial | 3/4 | 1,200 |
| Heeling—U. S. M. C. wood | 3/4 | 1,800 |
| Indenting and burnishing—Goodyear welt | 1/4 | 1,800 |
| Jointing—Model D, Goodyear | 1 1/2 | 1,800 |
| Lasting—Consolidated hand method | 1 | 1,800 |
| Lasting—Model A, U. S. M. C. staple side | 1 | 1,800 |
| Lasting—No. 5, U. S. M. C. | 1/8 | 1,200 |
| Laying—Model E, Goodyear improved sole | 1/2 | 1,200 |
| Laying—Model G, channel | 1/3 | 1,200 |
| Leveling—Acme | 3/4 | 1,800 |
| Leveling—Goodyear welt and turn | 3/4 | 1800 |
| Leveling—Model A, Goodyear automatic sole | 2 | 1,800 |
| Loading and attaching—Model B, McKay automatic heel | 2 | 1,150 |
| Marking—Model A, U. S. M. C. | 1/6 | 1,800 |
| Moulding—Model B, Goodyear twin sole | 2 | 1,200 |
| Nailing—American lightning | 3/4 | 1,200 |
| Nailing—Loose | 3/4 | 1,800 |
| Nurling—Model A | 1/4 | 1,800 |
| Opening—Model G channel | 1/4 | 1,800 |
| Pulling over | 1 | 1,800 |
| Remover—U. S. M. C. screw | 1/6 | 1,200 |
| Rounding—Model B, Goodyear heel seat | 1/6 | 1,200 |
| Scouring—Model C, heel | 1 | 1,800 |
| Scouring—Model N, heel breast | 3/4 | 1,800 |
| Scouring—Model R, heel | 3/4 | 1,800 |
| Separating—Hadaway stitch | 1/4 | 1,800 |
| Setting and Wheeling—Model B, Goodyear edge | 1/3 | 1,800 |
| Sewing—Model K, Goodyear welt | 3/4 | 1,200 |
| Slugging—Universal | 3/4 | 1,200 |
| Stamping—Model C, Regent | 3/4 | 1,750 |
| Stapling—Model B, Goodyear upper | 1/6 | 1,200 |
| Stitching—Model G, U. S. M. C. sole | 1 | 1,800 |
| Tacking—Boston | 3/4 | 1,800 |
| Trimming—Ultima heel | 3 | 1,800 |
| Grinder, IHT | 1/3 | 1,800 |

The manner of distribution of this lighting service is unique in that it is controlled from a central feed panel on the main switchboard to distributing panels throughout each department. In this way the foreman of each room has control of his lighting system and can operate it economically. It is not subject to the whims of each individual operator. In determining the intensity of illumination required at the point of operation, tests were made in other factories and the system was designed to meet these operating conditions. The overhead system has worked out satisfactorily and has reduced maintenance costs in comparison with the use of individual drop or flexible arm units. The maintenance of this system reduces itself to cleaning reflectors and lamps, adjusting fuses and inspecting distribution panels at regular intervals or as necessity may demand.

SUMMARY OF LAMP SIZES USED IN GEORGE E. KEITH FACTORY NO. 11

Factory, Four Stories and Basement, 400 x 60 Ft.; Head Room, 12 Ft.

| | Watts Rating of Lamps | | | | | | |
|---|---|---|---|---|---|---|---|
| **Watts rating of lamps** | 10 | 25 | 50 | 75 | 100 | 150 | 300 |
| Basement (switchboard, lasts, miscel.) | 0 | 44 | 141 | 0 | 69 | 6 | 0 |
| First floor (trimming, lunch room) | 0 | 14 | 26 | 1 | 24 | 117 | 0 |
| Second floor (finishing, dressing) | 0 | 0 | 22 | 2 | 39 | 121 | 0 |
| Third floor (gang room) | 0 | 0 | 32 | 5 | 0 | 147 | 0 |
| Fourth floor (stitching, cutting) | 466 | 136 | 67 | 3 | 38 | 38 | 0 |
| Totals | 466 | 194 | 288 | 11 | 170 | 429 | 0 |
| Night lights and stairways | ... | ... | 112 | ... | ... | ... | ... |
| Outside lights | ... | ... | ... | ... | ... | ... | 9 |
| Grand totals | 466 | 194 | 400 | 11 | 170 | 429 | 9 |

Total connected lamps inside and outside factory, 1,679.
Total connected kilowatts (lighting), 114,385.
Total connected lamps inside factory, 1,670.
Total connected kilowatts inside factory (lignting), 111.685.
Approximate connected interior lighting load in watts per square foot, average, 0.93.

ENERGY RATINGS OF ELECTRICALLY HEATED SHOE MACHINERY

George E. Keith Company Factory No. 11
(United Shoe Machinery Company)

| Name of Machine Heated | Symbol | Watts |
|---|---|---|
| Burnishing machine—No. 2: Goodyear impression stitch | BSB–No. 2 | 75 |
| Drier—Model A, U. S. M. C. bottom | UBD–A | 1,525 |
| Embossing machine—Model B | EMB | 325 |
| Finishing machine—Xpedite | XHF | 600 |
| Heater—Glue, U. S. M. C. | ZUH | 300 |
| Lockstitch machine—Model A, Goodyear outsole rapid | ROS–A | 564 |
| Marking machine—Model A, U. S. M. C. | HPM–A | .... |
| Nurling machine—Model A | KM–A | 205 |
| Sewing machine—Model K, Goodyear welt | WTG–K | 448 |
| Stamping machine—Model C, Regent | RPS–C | 325 |
| Stitching machine—Model B, sole | SSB | 63 |
| Winding machine—Goodyear rapid bobbin | RBW | 125 |

# Industry Active in 1928

### Review of business paper editors finds conditions sound. Intensive selling and lower production costs are chief factors in situation

BUSINESS is sound and 1928 will develop along the lines of 1927, when intensive selling and pressure to lower production costs were the most important factors, according to the consensus of one hundred editors of trade, industrial and professional journals in answer to a questionnaire sent to them by the National Conference of Business Paper Editors and the Associated Business Papers. There are no indications of a slump, but rather definite indications of increase in several lines. No excess inventories are reported either in wholesale or retail, except in a few specialties where the market has been over-estimated. Farm buying power will be larger in 1928.

Indexes of trade which measure week-to-week activities, such as electric power used, output of pig iron and steel ingots, building construction and freight loadings, are slightly greater than or slightly less than those of 1926. Power used in 1927 increased 7 per cent over the previous year. Pig iron totaled 36,300,000 tons, putting 1927 in eighth place among big years. Steel ingot output was about 8 per cent less for 1927 than for 1926, making 1927 fifth among years of largest output. Total construction was down, but up 2½ per cent in industrial building and 11 per cent in heavy construction.

In a review of the year the editors found increased pressure to reduce production and selling costs, higher specialization in machinery, widespread replacement of obsolete and inefficient machinery, aggressive market finding, and reduction in size and intensive development of jobbing areas. There is likewise a genuine desire to keep wages at their present level in all the basic industries, and manufacturers and merchants are seeking to continue with narrow profit margins without reducing wages or raising prices. Some trades show softening in prices, but most trends indicate prices of 1928 will be about the same as 1927. Volume of railroad freight declined, especially in the latter part of 1927, but, in common with other trades, there is expectation of an increase in freight during 1928. Gross revenue of bus lines was 25 per cent higher in 1927 than in 1926, and total pay rolls were up 30 per cent. Volume of waterborne freight was slightly greater in 1927 than in 1926, and tonnage rates held steady. In the automotive industry expenditures for new plants were larger in 1927 than in 1926, due especially to one or two very large construction enterprises and the remodelling of the Ford plant. New construction in the textile field increased, with an accompanying fact that many obsolete plants were modernized or dismantled. Rehabilitation of private power plants continued through 1927, and promises to be still more active in 1928. In general, the close of 1927 finds the industries of the United States with stocks which deviate little from the volume at the close of 1926, reflecting continued hand-to-mouth buying.

# Exterior Holiday Lighting Spreads Cheer

CHRISTMAS decorations, in the form of outdoor electric lighting, have become an old story to many people in the electrical field, and the decorations probably do no more than contribute to the general community spirit of Christmas.

But Christmas decorations, like everything else, take on distinctive qualities and attract particular attention when done in an unusual way. Even the Pennsylvania Railroad puts a Christmas tree in each one of its stations, probably to show that, after all, it is run by human beings. Some utility executives believe that all central

ONE OF THE HOMES IN CLEVELAND WHICH TOOK PART IN ELECTRIC OUTDOOR DECORATION DURING THE HOLIDAY SEASON

stations should make a very marked display of Christmas decorations for very much the same reason—that the men behind the central stations are men who are active in the community and have a deep interest in the community spirit. Since decorating its buildings in this way one utility has received a number of very favorable comments and one or two letters from business men in several of the cities where its offices are located. These comments emphasize the manner in which the scheme of decorations was carried out.

A department store in Cleveland won the first prize awarded commercial buildings for holiday decoration. The exterior was draped with lighted evergreen festoons and pendants from the cornice and illuminated Christmas trees with their bases on the second floor level.

# Radio Interference Interception

By B. E. Ellsworth

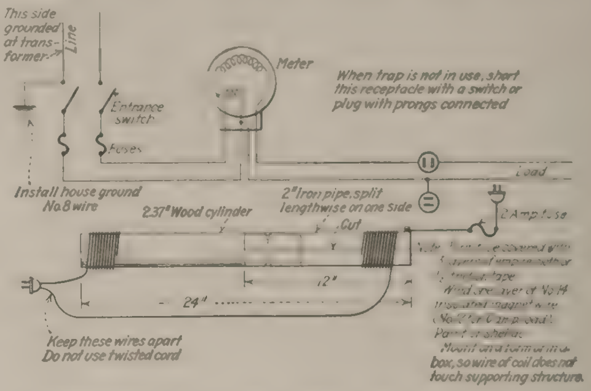
Electrical Engineer Iowa-Nebraska Light & Power Company
Lincoln, Neb.

RADIO interference can reach a radio set from the source of trouble by direct radiation (the X-ray is a good example) and over the electric service wires. To minimize that interference spread by service wires, why not put a wave trap or filter at the entrance switch? The writer has had such a wave trap in his home for more than a year and it has worked so successfully that he feels that it would be of great benefit to others. A vibrator charger can be running at "top speed" in a house next door and radio reception is not affected. No exact figures can be given on the amount of the interference that will be intercepted as it depends upon the location of the house with respect to power lines and the type of interference.

There are various makes of traps on the market selling for $10 to $20 which undoubtedly will do the work as well or better than the one utilized, if they can be secured with sufficient current-carrying capacity for the load which they will have to carry. Doubtless there are traps on the market which have been approved by the National Board of Fire Underwriters. The purpose of this article is not to recommend any type or make of trap, but to emphasis that a trap can be procured and installed to the great benefit of set owners.

The trap used can be plugged into two convenience outlets near the meter, and uses no power. The material cost is approximately $3, it can be made by the average person in a few hours. The principle of this trap was not originated by the writer, but the plug-in feature seems to be original and is convenient in that the trap may be used only when necessary and can be considered as an appliance instead of a permanent wiring fixture.

The first step is to ascertain that there is a ground on one side of the service on the line side of the entrance switch. A piece of No. 8 wire or larger may be used for this purpose. Often a ground installed in this way will eliminate considerable radio trouble from distribution lines. The sketch shows the connections and construction of the home-made trap. It is assumed that this trap is to be used in an average private home. A large trap permanently wired in and enclosed in a steel box can be used in apartment houses, etc. A receptacle should be installed in series with the non-grounded lead from the meter for plugging in the trap. It will be necessary to substitute a short-circuiting switch or shorted plug to short this receptacle when the trap is not in use. The second receptacle is simply a tap to the grounded service wire, to ground the metal pipe in the core of the coil. The leads from the coil should be separated as much as possible and double-conductor cord should not be used for this load. The coil proper is wound on a combination wood-and-iron form. The iron part of the core is composed of a two-inch pipe a foot long with a slit cut lengthwise on one side to eliminate eddy currents. This form is covered with three layers of empire cloth or 1½-in. friction tape and wound full of No. 14 (No. 12 for 10-amp. load) magnet wire which should be shellacked or painted. This coil may be mounted in a wooden box.


This side grounded at transformer
Line
Meter
When trap is not in use, short this receptacle with a switch or plug with prongs connected
Entrance switch
Fuses
Load
Install house ground No. 8 wire
2.37" Wood cylinder
2" Iron pipe, split lengthwise on one side
Cut
2 Amp. fuse
12"
24"
Keep these wires apart
Do not use twisted cord
box, so wire of coil does not touch supporting structure.

CONSTRUCTION AND INSTALLATION OF TRAP FOR SYSTEM-PROPAGATED RADIO INTERFERENCE

# Letters from Our Readers

## Design Drawings Part of Contract Proffer

*To the Editor of the* ELECTRICAL WORLD:

The reply to your question on prospective purchasers appropriating designs and design drawings without payment, in the issue of Dec. 31, may be found in the Ten Commandments. A quotation and the blueprints accompanying it are a proffer of contract which the purchaser may accept or reject, but may not change. In other words, the quotation proposes to exchange a design and material for a definite amount of money—it does not offer a free gift of either.

Just what the "good of the industry" or the overhead cost of design has to do with the honesty of a particular transaction is not altogether clear. In a so-called buyers' market, where everything seems to go —on one side—it might be well to give the other side a hearing, even though the testimony needed expurgating. For example, sending out inquiries by multigraph, hunting for a sucker, accepting a palpably erroneous bid because the seller was "responsible," whipsawing bidders to unreasonable figures, radical changes after details are completed, etc.

It is not claimed that all buyers do all or indeed any of the above, but such things are as well known among the sellers as is the identity of those who do them.

R. D. COOMBS.

New York.

# Digest of Electrical Literature

## *Transmission, Substations and Distribution*

*Transmission Tower Diagonal Bracing.*—C. R. Young, W. B. Dunbar and E. B. Allan.—The authors report the results of a series of tests made at the University of Toronto in an endeavor to determine the deflections in various struts used in the fabrication of transmission towers. It was particularly desired to throw some experimental light on the effective length of bracing struts. A series of specimens were made up and tested to failure. Extensometers were atttached to the struts and furnished some of the desired information. The results, as plotted in deflection diagrams, offer a basis for comparing the value of several types of frames of different cross sections. The authors conclude that the effective or equivalent unsupported length of a strut, stayed laterally by an intersecting tension member, varies from about 73 to 117 per cent of the distance center to center of end connections. The advisability of not reducing the center-to-center length by more than 25 per cent, and preferably by not more than 20 per cent, is indicated as a result of the several tests made in the course of this investigation.—*The Canadian Engineer*, Oct. 11, 1927.

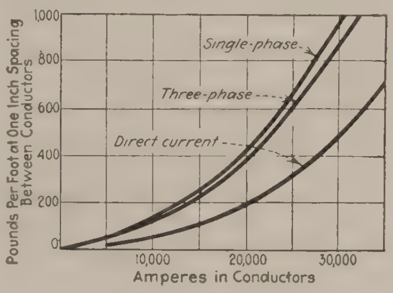
*Overhead Electric Line Design.*—William T. Taylor.—The various factors entering into the standard for safety and construction in the design of overhead open-wire construction are reviewed in this article. A comparison of English and American practices is given, with particular consideration for the standards of loading and the development of factors of safety for overhead work. The desirable economic characteristics of wood poles and structural steel towers has been developed. The figures given refer almost exclusively to American practice.—*Electrical Review, (England)*, Nov. 11, 1927.

## *Generation, Control, Switching and Protection*

*Super-excitation.*—D. M. Jones.—The speed with which the excitation of a synchronous machine can be made to counteract abnormal drops in line potential largely determines the effectiveness of the machine in increasing the stability of the system. The effectiveness of super-excitation in producing rapid changes in excitation so greatly exceeds the ordinary quick-response excitations as to be of a totally different order. In this article the author has described the newer method and has offered an approximate comparison with normal excitation, quick-response excitation and super-excitation for a 30,000-kva. 600-r.p.m., 13,800-volt, synchronous condenser. The features of this marked advance in excitation practice are stated to be the increase in the rate of rise of the exciter voltage from a basis of 400 to 600 volts per second to 6,000 to 7,000 volts per second; the rise in the maximum possible instantaneous voltage which can be applied to the alternating current machine field under conditions of system disturbance from approximately 320 volts to approximately 1,000 volts; and the use of the change in the output of the alternating current machine during the disturbance as a measure of the effectiveness of the excitation system.—*General Electric Review*, December, 1927.

## *Units, Measurements and Instruments*

*Short Circuit Effects Upon Current Transformers.*—G. L. E. Metz.—The author suggests that the time has come when current transformers, like oil circuit breakers, should be designed for definite short-circuit rating, and he offers some suggestions as to how this should be done. The destruction of a current transformer is said to be brought about by either the mechanical forces exerted upon the windings exceeding their disruptive limit, or by the temperature rising sufficiently to injure permanently the insulation. The design of supporting insulators and clamps must be such as to withstand the mechanical forces. The magnitude assumed between conductors spaced one inch apart is indicated in the accompanying curve. Analysis has been made of the various designs and types of current transformers available today and the author states that in the majority of modern designs, it is found that, under the most severe conditions, that is, when the magnetic core is saturated, the open-circuit secondary-induced electric-motive force rarely exceeds 400 volts. The total resistance of the circuit will be about 2 ohms, so that under no conditions is the secondary current likely to exceed about 200 amp. The accompany figure illustrates the force value between conductors.—*—Electrical Review (England)*, Nov. 25, 1927.



MECHANICAL FORCES BETWEEN CONDUCTORS

## *Hydro-Electric Development and Steam Equipment*

*Steam Generation.*—W. J. Kearton.—The theoretical considerations, the possible thermal efficiency and the future problems related to the practical application of the binary fluid principle, as applied to steam generation, are developed. The author foresees future problems as centering around the boiler. Thermodynamic considerations, involving both assumed and derived data, are offered for the mercury-vapor steam unit. The advantages enumerated by the author include: low pressure for high temperatures, with accompanying lower working stresses in parts subjected to the pressure; the favorable physical properties of mercury for the attainment of high thermal efficiency; the few stages required when using this material, due to its high molecular weight; and the freedom from decomposition when heating. The disadvantages are stated to be high cost, small heat content and poisonous character of the metal vapor.—*World Power (England)*, December, 1927.

*Continuous Combustion at High Pressure.*—E. C. Wadlow.—The problems of design and operation encountered in the development of an experimental high-pressure, single-jet gas burner, and of a similar high-pressure multi-jet gas burner are described in this article. As the furnace used was an auxiliary to other apparatus and proved equal to the work demanded of it, careful tests were carried out to determine its efficiency by measuring the heat distribution through exit passes and through furnace walls after combustion. Figures and details regarding the behavior of the plant when using high-pressure combustion are given. A pressure of 100 lb. per sq.in. was realized in the combustion chamber. The maximum temperature recorded at this pressure was 1,435 deg. C. This was maintained without difficulty.—*The Engineer (England)*, Dec. 23, 1927.

## *Illumination*

*Technique of Economic Studies of Lighting in Industry.*—J. W. Barker.—The psychological and illumination questions arising in economic studies of illumination in factories have been analyzed and as a result a procedure for such investigations is suggested. This includes those factors influencing production. Emphasis is placed upon the importance of the psychological control, which is necessary if results are to be accurate. Among the factors which have been identified as affecting speed and quality of industrial production and the general welfare of industrial operatives, are the following: direct effect of illumination, to increase facility of vision; secondary effects of illumination, to increase agreeable working conditions; the effect of changed supervision, incident to the taking of data required for deriving test conclusions; the effect of conscious control of production rate; the effect of temperature, humidity, carbon dioxide, etc. in the work rooms.—*Transactions of the Illuminating Engineering Society*, 1927.

*Specifications for Residential Lighting Equipment.*—These specifications have been designed to promote improvement in artificial lighting in residences through the employment of lighting equipment which will render convenient and effective illumination, with conservation of eyesight and enhanced decorative qualities. A simple but highly effective device has been prepared for the estimation of comparative glare values of light sources through the use of standards employing the usual commercial lamps.—*Report, Illuminating Engineering Society*, 1927.

*Light for Ornament.*—A. L. POWELL.—An exposition of the potentialities of light as a decorative medium. A number of uses are illustrated to indicate the interesting and attractive ways in which unusual light applications may be applied in order to secure artistic effects in the home, and in other locations where aesthetic illuminating effects are desired.—*Transactions of the Illuminating Engineering Society*, 1927.

## *Electrophysics, Electrochemistry and Batteries*

*Some Criticisms on Electric Resistance and Its Derivative.*—H. NAKAMOURA.—The confusion between electric resistance and differential-electric resistance is pointed out. As a result of investigation and mathematical determination, the author concludes that ordinary resistance is a mere quotient of the instantaneous value of the component, which is in phase with the current of the potential difference of any two points, to the instantaneous value of the current passing through there, and has no vectorial sense. The differential resistance is, however, the first partial derivative of the former with respect to the latter and has both sense and magnitude. The Wheatstone bridge and its variations, unless balanced with a galvanometer or telephone circuit by constant equipotential, measures the differential resistance and not the ordinary one. The alternating current bridge generally measures the differential effective resistance. When the current is small or its effective resistance is non-directional, differential effective resistance numerically approaches ordinary effective resistance.—*Journal of the Franklin Institute*, December, 1927.

*The Time Lag of Spark Gaps.*—Y. TORIYAMA.—An investigation involving a new method of measurement of the spark-lag phenomena was undertaken by the author with the use of a Braun tube. The methods of test consisted in connecting the deflecting plates of the tube to a spark gap in series with them and applying an impulse voltage to the gap and to the cathode of the Braun tubes simultaneously. An absence of time lag in the gap causes the impulse voltage to be applied to the cathode and to the deflecting plates of the tube at the same time so that the electrons emitted at the cathode are deflected by the electrostatic field of the plate and no spark is indicated on the fluorescent plate. When a spark lag exists in the gap, the cathode is excited as before, but the time lag preceding the charging of the deflecting plate is indicated by a spot on the fluorescent plate of the tube. The author concludes that the time varies with the dimensions of the gap electrode, and that ultra-violet rays from a quartz lamp cause a definite reduction in the period of time-lag phenomena.—*Journal of the Institute of Electrical Engineers, (Japan)*, November, 1927.

*The Relation Between the Secondary Electron Emmission from Nickel and Tungsten, and the Temperature.*—HEIICHI NUKIYAMA and HATSUO HORIKAWA.—The present investigation was undertaken in an endeavor to obtain further information regarding the secondary electron emission from several metals at moderately high temperatures. Three-electrode vacuum tubes were used in this series of experiments, and the construction of the valve, the evacuation, and the wiring diagram used are described in connection with the data obtained regarding anode current and voltage characteristics, the change in the apparent secondary electron emission with anode temperature, the relation between the critical, potential and the temperature, and similar pertinent phenomena.—*Technology Report of the Tohoku Imperial University, (Japan)*, 1927.

## *Miscellaneous*

*Super-Tension Cable Drums.*—The use of high-tension cables involves increased weight and length of conductor assemblies and has necessitated new practices for the successful and economical transportion of such materials to the point of utilization. A low body trailer especially designed for cable drum handling has been devised to meet the conditions involved in British practice. This equipment is said to possess the virtues of ease of operation, low labor costs, safety of operation, economy in time, and ease with which the cable may be laid directly from the trailer. Comparative figures are offered of relative transportation costs and results obtained through the use of various devices and types of transporting equipment.—*The Electrician (England)*, Oct. 7, 1927.

*The Integraph Solution of Differential Equations.*—V. BUSH AND H. L. HAZEN.—The authors describe a machine which constitutes a revision of a previously constructed device for the solution of differential equations involving a single integration. The revised machine is of such design that an equation involving two successive integrations, corresponding to practically any second-order differential equation, with all terminal conditions, can be solved. The need for a workable means for solving the differential equations, involving empirical and discontinuous coefficients which occur repeatedly in electrical engineering and physics, is recalled. In the machine described, such solutions are effected by means of suitable, interlinked, integrating devices, the result being plotted continuously as a function of the independent variable. Tests and simple solutions show the over-all error to be approximately 1 or 2 per cent. The various sources of this error are discussed.—*Journal of the Franklin Institute*, November, 1927.

*A New Propeller-Type, High-Speed Windmill for Electric Generation.*—E. N. FALES.—It is stated by the author that a recently developed airplane-type windmill, possessing the characteristics of improved lightness, efficiency and cheapness, as well as higher rotative speed, may be manufactured to compete with gasoline farm-lighting plants. The factors considered in this discussion are the development of a rational windmill theory, the difference between pumping and electric generating mills, the aerodynamic methods of analysis, the variables used in windmill design, the form of blade, methods of regulation, wind velocity, and energy content, for a typical year, choice of wind velocity range as based upon the calmest month, choice of windmill diameter and the available energy of the wind.—*Mechanical Engineering*, December, 1927.

*Inductive Signal Transmission to Trains.*—P. TATZ and A. KAMMERER.—A large amount of experimental research work is reported to have been done since 1919 to devise a fully reliable signal transmission system from the road to a moving train. Of the various methods tested, only the inductive method proved sufficiently promising to develop beyond the experimental stage. One section of the German Federal Railways has adopted this system as part of its standard equipment. Magnetic coupling between an alternating current excited solenoid on the locomotive and a stationary receiving solenoid, mounted on the road bed, the two forming a resonant circuit, is the basis of the system. A relay on the train is energized at all times except when passing over the signal point. To insure reliable operation, the ratio between holding and tripping force of the relay is made about three to one. A number of circuits are illustrated in this article and mathematically investigated as to their suitability for service. A second article discusses the shape of the resonance curves obtained. This system is energized by the customary small steam turbine on the locomotive which drives, in addition to the direct current lighting generator, a special alternating current generator.—*Elektrotechnische Zeitschrift*, Oct. 27, 1927.

# News of the Industry

## Walsh Resolution Meets Criticism

### Public Service Commissioners Defend Their Course and Uphold State Regulation—Testimony from Insurance and Banking Heads—Senator Lenroot's Argument

By Paul Wooton

*Washington Correspondent of* Electrical World

Vigorous opposition to the Walsh resolution — opposition of a character calculated to impress Congress more than any that could be exerted by the utilities themselves—has come from the utilities commissioners of the states, from investment bankers and from representatives of securities owners.

When Senator Watson of Indiana called the interstate commerce committee of the Senate to order on Jan. 16 he said that the committee must consider the advisability, necessity and expense of an investigation into the conduct of public utilities of the far-reaching character indicated in the resolution which he read. Thereupon Senator Walsh made a long statement in justification of a minute inquiry by a special committee of the Senate into virtually every phase of the public utility business. He asserted in the course of his argument that "there is a view entertained by not a few people that the state commissions are not really functioning as they should because these utility corporations are constantly contributing large sums to control elections, and in one way or another they thus control state conventions."

### Senator Bruce in Defense

This statement brought a vigorous rejoinder from Senator Bruce of Maryland, who said: "That is not true as far as Maryland is concerned, because our commission gives entire satisfaction to the people as well as to the utility corporations themselves." Senator Walsh is considered to have weakened his case when he said in reply: "Bear in mind that I do not undertake to assert that there is any truth whatever in the charge, but if we are going into this matter I think that should become the subject of inquiry."

Senator Wheeler of Montana, a member of the committee, asserted that he had been informed reliably that power companies desirous of competing with those affiliated with the large holding companies find the banks unwilling to finance them. Senator Walsh said that this might come within the purview of the investigation, but he evidently was not ready to emphasize that point as a member of the committee had raised the question whether the investigation was likely to lead into a probe of banking. Senator Walsh expressed the opinion that he did not think this would be the result. He also said that it was his intention in framing the resolution to exclude an inquiry into the conduct of telephone, telegraph and radio companies. He gave it as his view that those activities should be investigated but not as a part of the utilities inquiry, as such a scope would make it too broad.

### Commissioners Take Stand

A committee representing the National Association of Railroad and Utilities Commissioners made a special point of Senator Walsh's statement in a report which was submitted to the committee at its subsequent session. That report follows:

> The special committee representing the National Association of Railroad and Utilities Commissioners declare themselves in favor of placing at the disposal of any duly authorized agency of the Senate or of Congress any relevant information concerning public utility regulation within the possession of the several state commissions. They thoroughly believe that all facts in connection with utility operation and regulation should at all times be open to the public and its representatives. On behalf of such commissions they challenge the statement made by Senator Walsh at the hearing yesterday in which he made suggestions regarding the proper functioning of state commissions, at the same time disclaiming knowledge of any facts justifying such belief. They believe that any investigation fairly conducted cannot fail to justify the work that has been done by the state commissions and vindicate the principle of state regulation.
>
> The commissions declare themselves opposed to invasion by the federal government in any manner of the rights of the sovereign states in the control and the regulation of public utilities. Therefore these commissions are opposed to any action of Congress that might result in an invasion of state rights or the substitution of national for state utility control.

The foregoing statement was signed by Lewis E. Gettle, chairman of the Railroad Commission of Wisconsin, chairman also of the special committee; William A. Prendergast, chairman Public Service Commission of New York; W. D. B. Ainey, chairman Public Service Commission of Pennsylvania; Charles E. Gurney, chairman Public Utilities Commission of Maine; Amos A. Betts, Arizona Corporation Commission, and H. H. Corey, Public Service Commission of Oregon.

Mr. Gettle explained that the commissions are not opposed to a federal investigation of matters included in the resolution which involve interstate commerce and interstate transactions. On that point, however, Mr. Ainey called attention to the fact that the states are co-operating very successfully in the handling of the interstate problems.

Senator Walsh places principal reliance, in justifying the authority of Congress to undertake such a probe, on the theory that the securities of utility companies and of the holding companies pass in interstate commerce. He stated that "securities of the public utility companies are advertised in great financial journals and are sold upon the Stock Exchange and pass through the mails and by express and otherwise from one state to another." He cited a number of court decisions to support his theory that the passage of securities from one state to another constitutes interstate commerce.

Mr. Gettle stated that only 9 per cent of the total production of electricity is transmitted in interstate commerce. He, too, pointed out the success in arranging between states for the regulation of rates for electricity produced in one state and consumed in another. At another point in his testimony Mr. Gettle called attention to the fact that "public utility stocks and bonds have a far more extensive and comprehensive supervision than any other class of securities issued in the United States, and that if the purpose is to have federal regulation for the protection of investors, then it would spread out into an examination of all securities."

When Senator Walsh said: "Apparently what you are afraid of is that there will be some legislation that will interfere with the rights of the states in this matter," Mr. Gettle replied vociferously, "Yes, and every type of federal regulation that we have had any experience with has resulted in increased rates and diminution of power."

### Financial Chiefs Testify

Frederick H. Ecker, vice-president of the Metropolitan Life Insurance Company, pointed out that the life insurance companies number among their assets a billion dollars' worth of public utility securities. He pointed out further that the life insurance companies have in force $87,000,000,000 of insurance, which covers 62,000,000 individual lives. Because of those vast interests he urged that any investigation be one of fact finding and along the lines of a judicial inquiry. An investigation of a sensational character, he said, would have the result of depressing the values of securities and retarding the companies from securing the capital necessary for the further development of their properties.

Henry R. Hayes, president of the Investment Bankers' Association of

America, spoke along similar lines. Among other things he made the following reference to the utility industry:

> The public utility industry is now in a very desirable condition of prosperity. The reason for this is because, as a whole, it is economically sound throughout. It supplies "products" the usefulness of which is constantly growing and virtually universal and unlimited. Through its technical, managerial and financial progress it has consistently effected improvements and expansion to meet, economically and efficiently, the ever-increasing demands of the public. It is ever a pioneer, going continually into new fields, even today bringing electric service to the farmer in a degree not practical a few years ago. It is a vital part of the industrial, the civic and the home life of the nation, an integral factor in the country's prosperity, its creation and distribution of new wealth.

### SENATOR LENROOT'S ARGUMENT

The committee on Wednesday heard the argument of former Senator Irvine L. Lenroot, counsel for the Joint Committee of National Utility Associations. In submitting a comprehensive brief which has been prepared by leading utility lawyers throughout the country in opposition to the resolution, Senator Lenroot said that if the resolution prevailed in the Senate in its existing form, it would compel the proposed special committee to investigate not only the utility companies and the holding companies but every bank, insurance company and other corporation holding utility securities and that it would be the greatest and longest task ever undertaken, with the possible exception of the valuation of the railroads. Senator Lenroot called attention to a chart contained in the brief which showed that while all other commodities had increased in price, some as much as 120 per cent, since 1913, the average price of electrical energy had shown a decrease of 12 per cent.

Senator Walsh on Monday read into the record an interview in the Brooklyn *Eagle* with Owen D. Young, chairman of the board of the General Electric Company, in which he stated that the utilities would not oppose an investigation. Mr. Lenroot read a part of that interview in which Mr. Young declared that the utilities would not oppose an investigation by proper authorities when specific charges had been made. Mr. Lenroot insisted that no specific charges had been made against the utility companies and issued a direct challenge to Senator Walsh to show the contrary. He referred to the statement made the previous day by Chairman Gettle of the Wisconsin Utilities Commission in which he said he could not reply to rumor. "No facts have been placed in the record," Senator Lenroot said, "to show that such an investigation is needed or warranted. No prima facie case had been made out. Senator Walsh takes the position that the Senate should investigate in order to determine whether there is anything wrong." He added that the language of the resolution makes it mandatory upon the proposed special committee to investigate each and every company.

The Senate has no jurisdiction to investigate or legislate on most of the proposals contained in the resolution, Mr. Lenroot contended. Matters pertaining to interstate commerce and the violation of the existing federal statutes, however, would be proper subjects for investigation. Inviting the committee's attention to the clear line of demarcation between federal and state jurisdiction, he said that this was one of the most serious matters the interstate commerce committee ever had been called upon to consider. He asked if there was to be initiated a policy of centering in some bureau in Washington the duties belonging to the states. Another point the Senator made was that of all the corporation securities issued in the United States only 3 per cent were public utility securities and that fully 20 per cent of all securities, including the utility issues, are owned by holding companies.

Former Senator Thomas of Colorado appeared specifically on behalf of the Cities Service Company and argued along similar lines.

Owing to an important Democratic caucus, there was no session of the committee on Thursday.

## Commissioners of Four States Form Association

Members of the Public Service Commissions of Pennsylvania, New York, New Jersey and Maryland in a two-day meeting at Philadelphia have just organized the Middle Atlantic States Utility Commissioners' Association. William D. B. Ainey, chairman of the Pennsylvania commission, was elected president and Commissioner J. F. Harper of Maryland was elected secretary.

A paper on valuation was read by William A. Prendergast, chairman of the New York commission, and the subject was discussed in reference to the organic law and the interpretations placed on it by state and federal courts. Chairman Ainey reviewed the development of the electrical industry and conducted a discussion of problems, including those concerned with holding companies, with consideration of the relation of the commissions to the Walsh resolution and the proceedings of the Senate committee to which it was referred.

## New York Assemblyman Assails State Commission

Declaring that the New York Public Service Commission and its employees are acting in concert with private utility corporations to compel citizens to pay exorbitant costs for the use of electrical power, Assemblyman Cuvillier, a prominent New York City Democrat with independent proclivities, has introduced in the Legislature a resolution providing that the Assembly judiciary committee investigate all complaints and report back to the Legislature by March 2.

## Four Large Firms Combine as Engineers and Constructors

Formation of United Engineers and Constructors, Inc., with its main office in Philadelphia and branch offices in New York, Newark, Chicago, Los Angeles, Atlanta, Pittsburgh, Houston, Montreal, Rio de Janeiro and Buenos Aires, was announced on Tuesday, Jan. 17. The company thus formed will combine the U. G. I. Contracting Company of Philadelphia, the Public Service Production Company of Newark, Dwight P. Robinson & Company, Inc., of New York and the Day & Zimmermann Engineering & Construction Company of Philadelphia. "With a background of more than 45 years of successful work," says the announcement, "the company will operate in any part of the world under broad powers permitting participation in every form of engineering and construction activity." Dwight P. Robinson, widely known as an electrical engineer, executive and plant builder, will be president of the new company. Arthur W. Thompson, Thomas N. McCarter, Samuel T. Bodine, Paul Thompson, John E. Zimmermann and Mr. Robinson will be directors. The new company is launched with contracts in hand amounting to more than $100,000,000.

## N.E.L.A. Commercial Section Men Gather at Chicago

Eleven committees of the National Electric Light Association, Commercial National Section, are holding a series of meetings this week at the Edgewater Beach Hotel, Chicago. More than two hundred members had registered at the time the ELECTRICAL WORLD went to press, with Chairman J. E. Davidson presiding. The plans of the year are under discussion, with the most progressive program that has been undertaken in recent years before the gathering. The power, merchandising and wiring committees are particularly active. Detailed reports of these meetings will be published next week.

## Television Demonstrated by General Electric Company

A demonstration of television was made on Friday afternoon, Jan. 13, in Schenectady under the direction of Dr. E. F. W. Alexanderson, consulting engineer of the Radio Corporation of America and the General Electric Company, who with his assistants has been working on the problems involved in this new art for seven or eight years. Receiving sets, the development of recent months, were established in three Schenectady homes, and the motion pictures were sent through the air, accompanied by vocal transmission. One "announcer" was shown smoking a cigarette and commenting on its flavor, and a ukulele player hummed a song to the accompaniment of his instrument.

The receiving sets in private homes

were at the residences of E. W. Allen, vice-president of the General Electric Company in charge of engineering; Edwin W. Rice, Jr., honorary president of the board of the company, and Dr. Alexanderson. The experiment was entirely successful, and David Sarnoff, general manager of the Radio Corporation of America, described it as an "epoch-making development." Television sets were not ready for the market, he said, but he predicted that in five years television would be "an art and an industry in this country."

## California Light and Power Companies Cut Rates

Rate reductions applicable to domestic lighting, cooking and heating and commercial lighting were announced on Jan. 17 before the California Railroad Commission by attorneys for the Pacific Gas & Electric Company, Great Western Power Company, San Joaquin Light & Power Corporation and the Midland Counties Public Service Corporation. Details of the new rates and the amount of the reductions are to be announced later. It is understood that the new tariffs will be applicable about March 1.

## Policy for Muscle Shoals

*House Committee Adopts Five Principles to Govern Sale or Lease, Which Must Be in Entirety and Insure Fertilizer Production*

SALE or lease of the Muscle Shoals project in its entirety and a requirement that fertilizer must be manufactured at prices attractive to the farmer are among the principles which will govern any disposition of the properties by the government, it was decided on Jan. 13 by the House committee on military affairs. The full text of a resolution adopted by the committee, embodying these principles, follows.

1. That the property shall at all times be subject to the absolute right and control of the government for the production of nitrates and other ammunition components of munitions of war, and that Nitrate Plant No. 2 or its equivalent, or such other nitrogen-fixation plant or plants adjacent or near thereto as may be constructed, must be kept available therefor by the purchasers, lessees or users of the property.

2. That the purchasers, lessees or users of the property shall be obligated in the strictest terms to the manufacture and offer for sale to the American public of fertilizers in times of peace, of a volume of not less than 40,000 tons annually within fifteen years of the commencement of the term of the lease, and at prices and of kinds calculated to be attractive to the farmer.

3. That any proposal for the purchase, lease or use of the Muscle Shoals property of the United States government must be for the entire property.

4. In the consideration of any offers for Muscle Shoals, that it be a prerequisite that such offer contain a stipulation that the lessee, operating agency or owner, as the case may be, be required to return to, or account for, to the government, either in cash or by way of reduction in the price of the fertilizer manufactured, the profits from the sale of power which would have been used in the manufacture of fertilizer in case there had been no discontinuance in the manufacture thereof; that the manufacture of fertilizer may be discontinued only when there shall be such excess accumulation of fertilizer stocks as shall be in excess of the reasonable or prospective demands for such fertilizer, and such manufacture shall be resumed upon reduction to a reasonable degree of such accumulated stocks.

5. That any bid must contain such forfeiture or penalty provision as will protect and safeguard the interests and the rights of the government on account of any failure of the lessee, operating agency or owner, as the case may be, to fully keep and perform its obligations and undertakings under the contract.

## Truce Over Maryland Dispute Is Entered Into

The litigation between the Consolidated Gas, Electric Light & Power Company of Baltimore and the Northern Maryland Power Company for the right to serve Havre de Grace, Md., which was to have come before the Circuit Court at Elkton on Jan. 17, was postponed for 30 days, and negotiations between the two utility concerns to effect a compromise were begun. The fight between the two companies was taken to court on appeal by the Northern Maryland company from the Public Service Commission's decision last August granting the Baltimore company the right to serve Havre de Grace, despite the claim of its rival, now controlled by the Philadelphia Electric Company, that its field was being invaded. While the heads of the two utilities would not say so, local observers believe it possible that a compromise will now be effected through an exchange of territorial rights.

## Prominent Engineers Sponsor Tokyo Congress

Appointed by Secretary Herbert Hoover, as honorary chairman, 78 prominent American engineers, scientists and industrial leaders have accepted membership on the American committee of the World Congress of Engineers, to be held in Tokyo in November, 1929, according to a statement just issued by Elmer A. Sperry, chairman of the National Research Council. The permanent American committee will promote the aims and purposes of the movement and arrange for attendance of American engineers at the congress. Many of its members are closely associated with the electrical industry, including Thomas A. Edison, Samuel Insull, Gerard Swope, James H. McGraw, Michael I. Pupin, Edward Dean Adams, A. W. Berresford, John J. Carty, Gano Dunn, Bancroft Gherardi, E. M. Herr, Frank B. Jewett, John W. Lieb, C. O. Mailloux, E. W. Rice, Jr., H. T. Sands, Elmer A. Sperry, L. B. Stillwell, Calvert Townley, W. E. Wickenden, F. L. Hutchinson, D. C. Jackson, A. E. Kennelly, C. C. Chesney, Robert A. Millikan, Charles F. Scott and Elihu Thomson.

## Power Board Issues Wolf River Permit

*Savannah and Connecticut River Projects Get Licenses—Flathead River Promoter Ready for One—Conflict Over Feather River Development.*

A PRELIMINARY permit for the Wisconsin Power & Light Company, covering five sites within the Menominee Indian Reservation in Wisconsin, was authorized by the Federal Power Commission at a meeting held on Jan. 18. A license for a power site partly within the reservation was issued this company July 20, 1927. The remaining five sites, with a proposed installed capacity of 20,000 hp., have been reported on favorably by the Chief of Engineers and the Commissioner of Indian Affairs, with the understanding that the rights of navigation and the claims of the Indians for compensation are to be respected. The commission is of the opinion that the scenic features of the region, about which there has been agitation, can be safeguarded, and the permit will carry a special provision to this end.

A license was authorized for the Savannah River Electric Company of Greenwood, S. C., covering a 120,000-hp. project 220 miles above the river's mouth.

A license for the Northern Connecticut Power Company's project on the Connecticut River near Windsor Locks was granted. The installed capacity is to be 49,800 hp., and the plant will make full use of the power possibilities on the section of the river involved.

Walter H. Wheeler of Minneapolis has applied for a license covering a project on Flathead River and Flathead Lake in Montana. He proposes to develop power at five sites on Flathead River, using Flathead Lake as a reservoir. The aggregate installation at these sites would be 170,000 hp. This application conflicts with one of the Rocky Mountain Power Company.

The Pacific Gas & Electric Company has applied to the Federal Power Commission for a preliminary permit covering a project on the Middle and South Forks of Feather River near Quincy and Oroville, Calif. The application is in conflict with an outstanding preliminary permit held by the Oroville-Wyandotte Irrigation District on the South Fork. There is no conflict on the Middle Fork as the application made by Lars Jorgensen for a license on that stream has been rejected owing to the fact that he could not demonstrate where most of the power would be marketed. The Pacific Gas & Electric Company plans to construct four storage reservoirs with 252,000 acre-feet of storage on the Middle Fork. One storage reservoir of 108,000 acre-feet capacity is proposed for the South Fork. The project includes the erection of five dams. One is to be 370 ft., another 175 ft., another 108 ft., the fourth 50 ft. and the fifth 20 ft. high. There are to be eight power houses, in which it is proposed to install a total of 360,000 hp.

## Purchases and Mergers

*American Power & Light Seeks Control of Washington Water Power Company — An Oregon Merger Scheduled—Arizona Edison Changes Hands*

EARLY acquisition by the American Power & Light Company, New York, of control of the Washington Water Power Company, Spokane, is indicated by the announcement that the company first named has offered to exchange two and two-tenths shares of its six-dollar cumulative preferred stock for each share of Washington Water Power common. The Washington Water Power Company owns and operates eight hydro-electric power plants in Washington and Idaho along the Spokane River and at Lake Chelan.

Plans for merging smaller affiliated companies with the Pacific Power & Light Company, Portland, and for refinancing the new and larger Pacific Power & Light Company, recently announced by President Guy W. Talbot, have had to be postponed because of legal details which require more time, but it is expected that the merger will be consummated about Aug. 1. The plan calls for the incorporation of a new Pacific Power & Light Company to include not only the old company but seven smaller companies acquired in recent years by its holding company, the American Power & Light Company. These companies are the Sherman Electric Company, Moro, Ore.; Enterprise Electric Company, Enterprise, Ore.; Deschutes Power & Light Company and Deschutes Ice Company, Bend, Ore.; Grangeville Electric Company, Grangeville, Idaho; Yakima Steam Heating Company, Yakima, Wash., and the Inland Power & Light Company, Portland. Excepted from the merger are two distributing systems of the Inland company in Cowlitz and Clark Counties, Wash., and Columbia County, Ore., now being operated by the Northwestern Electric Company, Portland, in which no change of status is contemplated.

The People's Light & Power Corporation of New York has bought the capital stock of the General Power & Light Company of Chicago and its subsidiaries, which are in Western states and include the Arizona Edison Company. G. L. Ohrstrom & Company will, it is reported, finance the purchase.

The Insull power-company interests are negotiating for the Utilities Power Company of Meredith, N. H.; the Franklin Electric Company and the Northfield Electric Company of New Hampshire, but no confirmation that sale has been completed had been received from Augusta up to Thursday morning.

The Southern California Edison Company has asked the Railroad Commission for authority to purchase the Ojai Power Company, which operates in Ventura County.

The Nebraska Gas & Electric Company has taken over the Holmesville (Neb.) hydro-electric plant of J. J. Steinmeyer and F. B. Ryons for $145,000.

Douglas and Breckinridge, Okla., have sold their municipally owned light plants and distribution systems to the Oklahoma Gas & Electric Company. The vote in each municipality was unanimous. Drummond may follow suit.

Sidney, Iowa, served by the Iowa Service Company, has voted by 194 to 47 against establishing a municipal plant.

The Inland Utilities Company has offered $155,000 for the New Albany (Miss.) municipal light plant, and the Council will accept the offer unless 20 per cent of the voters demand a referendum.

Voters at Raton, N. M., by a vote of 1,285 to 130, have refused to sell its municipally owned electric light plant to the North Continent Utilities Corporation of Chicago.

Some citizens of St. John, New Brunswick, want to sell the city's hydro system to the New Brunswick Power Company, a subsidiary of the Federal Light & Traction Company of New York, and a fight may ensue.

## Plans of Northern Connecticut Power Foreshadowed

On receipt of the news that the Federal Power Commission has granted the Northern Connecticut Power Company the right to build a 50,000-hp. hydro-electric development on the Connecticut River at Windsor Locks, involving the construction of concrete dams on each side of Kings Island with canal improvements and a generating station south of the New York, New Haven & Hartford Railroad bridge, President Walter B. Schwabe informed a representative of the ELECTRICAL WORLD that if the grant is acceptable to the company an installation of four units, aggregating 33,000 hp., will probably be made initially, operating under a head of 30 ft. Nothing definite has been decided as to when construction will begin or how it will be financed. In round numbers the project represents an outlay of approximately $5,000,000, creating a reservoir extending up the river to Holyoke, Mass., and substantially improving navigation facilities.

## New England Credit Men Hold Fruitful Session

Alexander R. McDonald of the Pettingell-Andrews Company, Boston, was elected president of the New England Section of the National Electric Credit Association and Electric Credit Club of Boston on Jan. 17, the annual meeting being held at the University Club. Charles N. Nickerson of the Milhender Electrical Supply Company was elected vice-president and Charles A. Kane secretary and treasurer. At the business session excellent addresses were made by Fred Vose, national secretary, on "Collections"; C. R. Oliver on "Taking an Order," R. A. B. Cook on "Common Law Assignments," and Benjamin A. Atherton on "Receiverships," all three speakers representing Boston firms. Arthur Black, referee in bankruptcy for Suffolk County, Massachusetts, was guest of honor at a dinner following the business session, and an attractive entertainment program was included.

## Ontario Hydro to Go On

*Despite Defeat at "the Soo," Commission Plans to Serve Northwestern Part of Province—Great Lakes Company's Rights on the Montreal Disputed*

NOTWITHSTANDING the decision, recorded last week, of the voters of Sault Ste. Marie, Ontario, to accept the plans of the Great Lakes Power Company for additional energy, the Ontario Hydro-Electric Power Commission is going on with plans for the development of power to meet the industrial needs of the northwestern part of the province. These plans include the development of 12,000 hp. on St. Mary's River, from 125,000 hp. to 140,000 hp. on the Mississagua River and 30,000 hp. on the Montreal River, after which the commission plans to proceed to the Ottawa River to meet any demand in the north for a further supply of electrical energy. Commissioner Maguire expresses confidence that Sault Ste. Marie will regret its decision.

Premier Ferguson of Ontario has definitely declared that the Great Lakes Power Company has no power rights on the Montreal River, where the company is planning the construction of a power plant to supply Sault Ste. Marie. The Premier said: "I have made inquiries and find that there is no record of the Great Lakes Power Company having an assignment of the rights that went with the land grant to the Algoma Central Railway, and even if it had secured such an assignment, it would include no power rights."

## Philadelphia Electric's New Westmoreland Substation

The Philadelphia Electric Company is placing in service a large installation to be known as the Westmoreland substation. This station will serve as a switching center for the 66-kv. system and a connecting link between this system and the 220-66-kv. step-down station at Plymouth Meeting, which, in turn, will be the focal point of the 220-kv. transmission system involving the Conowingo hydro-electric station and interconnection with the Pennsylvania Power & Light Company and the Public Service Electric & Gas Company of New Jersey.

In addition to the 66-kv. development at Westmoreland, there will be a 13.2-kv. outdoor switching station supplied through 60,000-kva. step-down transformers from the 66-kv. system and a structure housing ultimately three 30,000-kva. synchronous condensers, testing facilities, an oil room and operating headquarters. The substation initially will consist of two 100,000-kva. lines from Plymouth Meeting, two 50,000-kva. lines each to the Richmond and Schuylkill stations and two 18,750-kva. lines to 13.2-kv. step-down transformers at the nearby Hunting Park distribution substation. By the fall of 1928 the 13.2-kv. bus and two synchronous condensers will be in service.

## A.I.E.E. Winter Meeting

*Transatlantic Telephony to Be Demonstrated—Lectures by Norinder and Swann—Edison and Fitz Medals to Be Presented to Coolidge and Carty*

SEVERAL events outside the routine technical program, excellent as the latter is, will add special interest to the midwinter convention of the American Institute of Electrical Engineers at New York on Feb. 13-17.

Telephone communication with the British Institution of Electrical Engineers, meeting simultaneously in London, will be established on Thursday morning, Feb. 16, at the telephone session, which will open with two papers on transatlantic telephony. President Bancroft Gherardi will exchange greetings with Archibald Page, president of the British society, and Dr. F. B. Jewett and Colonel T. F. Purves of the British Post Office, who were respectively in charge of the development in the United States and Great Britain of transatlantic service, will also be heard in both countries.

Dr. Harold Norinder of Upsala, Sweden, well known in this country for his studies of lightning discharges and other matters, will lecture on the cathode oscillograph on Tuesday afternoon. On the preceding evening there will be a lecture on "The Earth's Electric Charge" by Dr. W. F. G. Swann, director of the Bartol Research Foundation of the Franklin Institute and a high authority on subjects pertaining to electrophysics. Two of the most highly desired rewards for engineering accomplishment will be presented on Wednesday evening, when the John Fritz medal will be presented to General John J. Carty and the Edison medal to Dr. William D. Coolidge. The presentation ceremonies will include an address by Dr. Michael I. Pupin, who will outline the achievements of Dr. Coolidge; the presentation of the Edison medal by President Gherardi and the response of the medalist; the announcement of the John Fritz medal award by Chairman J. V. W. Reynders of the board of award, an outline of the achievements of General Carty by Mr. Gherardi, the presentation of the John Fritz medal by Robert Ridgway, chairman of the board when the award was made, and the response of General Carty.

Inspection trips to plants of the metropolitan light and power companies, the studio of the National Broadcasting Company, the Electrical Testing Laboratories and the Bell Telephone Laboratories will be held, most of them on Thursday afternoon. The annual dinner-dance is scheduled for Thursday evening at the Hotel Astor, and a smoker for Tuesday evening at the same hotel. Herewith the tentative program of the technical sessions is printed. It shows among included subjects dielectrics, interconnected power-system operation (in discussion of which five prominent engineering executives will describe different practices in the five territories they represent, covering effect on plant capacity and size of generating units, economies of operation, operating features, stability and reliability, load dispatching and load control, technique of interconnection operation, and physical facts as to interstate power), insulators, magnetism, electrical machinery, communication, automatic substations, control and protective apparatus, synchronizing devices and arc welding.

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## Alabama Power Company Has Budget of $15,000,000

A budget for 1928 totaling approximately $15,000,000 is announced by Thomas W. Martin, president of the Alabama Power Company. The major projects included in the company's construction program are the completion of Jordan Dam on the Coosa River, with 144,000 hp.; the completion of the Upper Tallassee Dam on the Tallapoosa River, with 50,000 hp., and the beginning of the new Warrior steam plant on the Warrior River, to have an initial installation of 80,000 hp., making a total

## Program of Winter Convention of the A.I.E.E.

NEW YORK, FEB. 13-17

### MONDAY, FEB. 13

*Morning.* — Registration; committee meetings.

*Afternoon.*—Electrophysics and Dielectrics: "Surge Impulse Breakdown of Air," J. J. Torok, Westinghouse Electric & Manufacturing Company; "Investigation of the Influence of Internal Vacua and Ionization on the Life Duration of Paper-Insulated High-Tension Cables," Alexander Smouroff, Electrotechnical Institute of Leningrad, Russia; "Approximate Method for Solution of Electrical Networks," E. A. Guillemin, Massachusetts Institute of Technology; "The Boltzmann-Hopkins Principle of Superposition," F. D. Murnaghan, Johns Hopkins University.

*Evening.*—Lecture: "The Earth's Electric Charge," W. F. G. Swann, director of Bartol Research Foundation, Franklin Institute.

### TUESDAY, FEB. 14

*Morning.*—Interconnection and Its Effect on Power Development: "Conowingo-Hydro-Electric Project of the Philadelphia Electric Company, with Particular Reference to Interconnection," W. C. L. Eglin, Philadelphia Electric Company; "Some Problems and Results from Interconnection in the Southeastern States," W. E. Mitchell, Georgia Power Company; "Some Aspects of Pacific Coast Interconnections," P. M. Downing, Pacific Gas & Electric Company; "Interconnection and Power Development in Chicago and the Middle West," H. B. Gear, Commonwealth Edison Company; discussion by Charles L. Edgar, James Lyman, A. C. Marshall, Farley Osgood, E. C. Stone, L. W. W. Morrow, W. S. Lee, C. F. Hirshfeld, G. N. Tidd, H. A. Barre and F. A. Allner.

*Afternoon.*—Miscellaneous Subjects: "The Saturation Permeameter," S. L. Gokhale, General Electric Company; "Manufacture and Magnetic Properties of Compressed Powdered Permalloy," W. J. Shackelton, Bell Telephone Laboratories, and I. G. Barber, Western Electric Company; "Effect of Humidity on Dry Flashover Potential of Pin-Type Insulators," J. T. Littleton, Jr., and W. W. Shaver, Corning Glass Works; **"The Cathode Oscillograph as Used in the Study of Lightning and Other Surges on Transmission Lines," lecture by Harold Norinder.**

### WEDNESDAY, FEB. 15

*Morning.* — Electrical Machinery: "Synchronous Machines—IV," R. E. Doherty and C. A. Nickle, General Electric Company; "Calculation of Armature Reactance of Synchronous Machines," P. L. Alger, General Electric Company; "Reactances of Synchronous Machines," R. H. Park and B. L. Robertson, General Electric Company; "The Thermal Volume Meter," C. J. Fechheimer and G. W. Penney, Westinghouse Electric & Manufacturing Company.

*Afternoon.* — Electrical Machinery (continued): "Recent Improvements in Turbine Generators," S. L. Henderson and C. R. Soderberg, Westinghouse Electric & Manufacturing Company; "Design and Application of Two-Pole Synchronous Motors," D. W. McLenegan and I. H. Summers, General Electric Company; "Heat Losses in the Conductors of a Direct-Current Armature," W. V. Lyon, E. Wayne and M. L. Henderson, Massachusetts Institute of Technology; "Effect of Transit Conditions on Application of Direct-Current Compound Motors," L. R. Ludwig, Westinghouse Electric & Manufacturing Company.

### THURSDAY, FEB. 16

*Morning.*—Communication: "Transatlantic Telephony — The Technical Problem," O. B. Blackwell, American Telephone & Telegraph Company; "Transatlantic Telephony—The Operating Problem," K. W. Waterson, American Telephone & Telegraph Company; "A New Horn-Type Loud Speaker," C. R. Hanna, Westinghouse Electric & Manufacturing Company; "Certain Topics in Telegraph Transmission Theory," H. B. Nyquist, American Telephone & Telegraph Company.

### FRIDAY, FEB. 17

*Morning.* — Control and Protective Equipment and Substations: "Automatic Control of Edison Systems," O. J. Rotty, United Electric Light & Power Company, and E. L. Hough, General Electric Company; "Protection of Supervisory Control Lines Against Overvoltage," Edward Beck, Westinghouse Electric & Manufacturing Company; "1926 Lightning Experience on 132-Kv. Transmission Lines," Philip Sporn, American Gas & Electric Company; "Vacuum-Tube Synchronizing Equipment," T. A. E. Belt, General Electric Company; "Use of Condenser-Type Bushing in Synchronizing," E. E. Spracklen, Ohio Public Service Company, and D. E. Marshall and P. O. Langguth, Westinghouse Electric & Manufacturing Company.

*Afternoon.*—Arc Welding: "Effects of Surface Materials on Metallic Arc-Welding Electrodes," J. B. Green, Fusion Welding Corporation; "Arc Welding—Influence of Surrounding Atmosphere on the Arc," P. Alexander, General Electric Company; "Arc-Welded Structures and Bridges," A. M. Candy, Westinghouse Electric & Manufacturing Company; "Welding and Manufacture of Large Electrical Apparatus," A. P. Wood, General Electric Company.

of 274,000 hp. additional in hydro and steam plants to be in operation by the end of 1928.

Other items will include the addition of 100,000 hp. in step-down primary substations, 200 miles of 154-kv. and 110-kv. transmission lines, 200 miles of low-tension transmission lines and 500 miles of distribution lines.

## Georgia Power Company Will Spend $12,750,000

The Georgia Power Company plans to spend approximately $12,750,000 in Georgia during 1928 — probably the largest expenditure for enlargement and improvement in service ever made in any one year by a Georgia public service company. While the sum named includes street railway and gas expenditures, the bulk of it is for the electric department. The program will provide an additional water-power plant, extension of transmission lines and distribution systems into new territory, wide improvements in street railway and gas service.

Among the major projects planned are a transmission line between Louisville and Waynesboro and one connecting Vidalia, Mount Vernon, Glenwood and McRae; the enlargement of the Boulevard substation in Atlanta and of the substation at Marietta, as well as the construction of several substations and other improvements in Macon, Athens, Rome, Brunswick and elsewhere.

The year 1927 brought the construction of the Burton power plant, completing developments on the Tallulah and Tugalo Rivers; the start of a new 110,000-volt line from Atlanta to the Martin's Dam plant of the Alabama Power Company, the completion of many local lines, and the establishment of 22 retail stores in as many communities.

## Los Angeles Bureau Forbidden to Erect Tideland Plant

Upholding the temporary injunction issued some months ago restraining the Bureau of Power and Light of Los Angeles from constructing a steam-electric power plant on the harbor lands of the city, the Superior Court of Los Angeles County on Jan. 9 made the injunction permanent. This is looked upon as a victory for the Southern California Edison Company, which had brought suit as a taxpayer in the city asking that this injunction be granted. In rendering the decision the court held that the money which had been illegally transferred from the bond fund of the city into the power revenue fund by the Power Bureau must be returned.

The city, apparently anticipating the decision of the court, has acquired another site, and it is understood that the project of a steam standby plant has not been abandoned by it, the court having sustained its right to invest portions of its revenue in such power stations.

## Many Topics Interest Men of Empire State

Financial and economic problems of the electric light and power industry as related to other enterprises were dealt with by H. O. Palmer, president of the Empire State Gas and Electric Association, at the annual meeting of its Electric Section, held at Hotel Niagara, Niagara Falls, N. Y., on Jan. 12 and 13. Water power had a prominent part on the program, the address of Paul S. Clapp, managing director of the National Electric Light Association, on that subject and the fallacies that the public entertain regarding it being heard with much interest.

The report of the apparatus committee, presented by V. J. F. Brain, covered the developments and recent applications of metal-clad switchgear with particular reference to the practices followed by the New York Edison Company. Representatives of the Allis-Chalmers, General Electric and Westinghouse companies discussed the progress of their respective organizations in this field. W. C. Fisher, chairman of the section, pointed out that while the advantages appeared to have been definitely proved, the cost item constitutes the most important deciding factor of use.

Load forecasting, network problems, material specifications, distribution records and desirable voltage practices were discussed by O. G. Whitecotton, chairman, and by sub-chairmen of the overhead distribution committee; various operating problems, design improvements and developments in tools and equipment were considered by T. R. Eilenberg in his report as chairman of the underground systems committee; ice troubles in hydro-electric practice and practical methods of combating them were canvassed by B. E. White of the hydraulic power committee; laboratory data related to lightning phenomena and flashovers were summarized and co-ordinated by W. L. Lloyd of the General Electric Company, speaking on the report of the transmission-line committee, of which S. H. Abbey was chairman, and the operating committee, under W. H. Kiefer, reported upon the condition of insulating oils. The radio co-ordinating committee, under H. F. Bower, also reported.

Paul A. Schoellkopf, president of the Niagara Falls Power Company, delivered the address of welcome. N. R. Gibson and W. K. Bradbury of that company outlined plans for the ultimate development of Niagara Falls and the preservation of its natural beauty. At the dinner and meeting of the Niagara Frontier Section of the American Institute of Electrical Engineers, on Jan. 13, to which members of the association were invited, Prof. Vladimir Karapetoff of Cornell University spoke of "Transients in Time and Space."

A. R. Tremaine of the Associated Gas & Electric Company, Oneonta, and V. J. F. Brain of the New York Edison Company were elected chairman and vice-chairman respectively.

# Briefer News

ELECTRICAL LEAGUE OF COLORADO ELECTS OFFICERS.—B. J. Rowan, executive assistant to the district manager of the General Electric Company at Denver, has just been elected chairman of the Electrical League of Colorado. E. C. Headrick and Dean D. Clark were re-elected secretary and treasurer respectively.

GATINEAU POWER TO COST ONTARIO CITY $8 A HORSEPOWER MORE THAN REGULAR SUPPLY.—The Ontario Hydro-Electric Power Commission has agreed to supply the city of Kingston with all the extra power it needs for the next eight years at $36 per horsepower. The present agreement between the city and the commission still has eight years to run and provides for the supply of power at $24 per horsepower. The new power to be supplied is part of the block which the commission has purchased from the Gatineau Power Company.

ELECTRICAL COMMITTEE OF N.F.P.A. WILL MEET FEB. 14.—The annual meeting of the electrical committee of the National Fire Protection Association will be held in the auditorium of the Consolidated Gas Company, New York, beginning at 9.30 a.m., Tuesday, Feb. 14, and adjourning on Friday of that week. E. Donald Tolles, executive secretary of the Electrical Supply Jobbers' Association, has been named as the representative of that body in succession to Thomas J. Creaghead.

IOWA SECTION, N. E. L. A., WILL HAVE GOOD PROGRAM. — Commercial men and "distribution men" will share the program of the Iowa Section, N.E.L.A., which will meet at Cedar Rapids on Feb. 2 and 3. Lighting, "refixturing," lamp sales, refrigeration, range sales, farm equipment, advertising helps, sales organization set-ups and laundry equipment will be commercial session topics, while the operating men will discuss farm service, transformer equipment, transmission and its regulation, inductive co-ordination, accidents, radio and metering. At the general opening session President C. S. Macy, S. C. Dows, Paul S. Clapp and C. A. Leland will be heard.

SACANDAGA DAM CONTRACT LET.—A contract for the nine-million-dollar Sacandaga dam, by which a body of water with an area as large as Lake George will be impounded in the Sacandaga River Valley at Conklingville, N. Y., to improve the river flow and provide power for industrial purposes, has entered its final stages by the letting of the contract for the construction of the dam to S. J. Groves & Son of Minneapolis for $1,307,086 by the Hudson River Regulating Board. The dam will be 1,000 ft. long, with a spillway 300 ft. long, and 85 ft. high. The contract calls for its completion by Dec. 31. Of the assessment 95 per cent will be paid by the power companies deriving benefit and 5 per cent by the cities of Albany, Troy, Watervliet and Rensselaer, which receive flood protection.

Joliet, Ill., Will Have New Utility Building. — The Public Service Company of Northern Illinois announces that work will begin in April upon a four-story unit of a proposed ten-story tower building at Ottawa and Cass Streets, Joliet, to provide office and sales department space. The unit will cost approximately $400,000, and the completed building will represent an investment of $1,000,000. The company hopes to have the unit completed within a year.

Duquesne Light Company to Cut Rates on Feb. 1.—Residential wholesale and retail consumers of electrical energy furnished by the Duquesne Light Company, Pittsburgh, will pay after Feb. 1 $700,000, or 3 per cent, less annually for the same service as formerly, according to an announcement by President A. W. Robertson. The revised code, Mr. Robertson said, is made possible by the great increase in the consumption of electrical energy and by economies in operation. It eliminates the necessity of checking the number of outlets or rooms in homes of seven rooms or less.

Double Industrial Hydro Unit at Fulton, N. Y., Will Have Rating of 100,000 Hp.—A large hydro-electric development on the Oswego River in New York State will be completed early this year with the linking into one unit of the power plants on both banks of the river at the upper falls dam at Fulton, N. Y. This plant, which is owned by the Oswego Falls Paper & Pulp Company, is planned to develop about 100,000 hp. from an 18-ft. head. It was made possible by the purchase two years ago of the American Woolen Mills power plant at the west end of the dam, which when completed will operate in unison with the Oswego Falls plant.

Supplementing New Hampshire Hydro Power with Steam.—The 14,000-hp. steam boiler installed by the Public Service Company of New Hampshire at Kelley's Falls in 1927 has given this station capacity to carry the electric load for Manchester, Keene, Nashua and Dover. Water power from the Piscataquog River is sufficient to operate the hydro plant at Kelley's Falls only three months of the year, but the steam installation will make it possible to provide the necessary power during the rest of the year. The Twin State Gas & Electric Company, Dover, N. H., is getting a good portion of its energy from the Kelley's Falls plant.

Conference of Utility Association Secretaries Outlines Purposes.—At the National Conference of Utility Association Secretaries held recently at Oklahoma City the organization, which has been functioning informally for about five years, adopted the name just given and issued the following statement of its objectives: "To study the possibilities, economy and effectiveness of service to the utility industry realized through its established associations; to disseminate those ideas of organization and administration of association affairs which have been proved of merit, and to promote a spirit of unity of purpose and co-operation of effort among the various state, regional and national utility associations."

Oregon's New Law Regulating Permits for Hydro-Electric Developments.—According to the Oregon State Engineer, intended results are now being obtained from the passage in 1927 of an act which provides for prohibition of filings on water resources of the state for purely speculative purposes. The new law, which limits passive applications to a six-month period, has brought about the cancellation of several preliminary permits for the development of electric power, among them one involving Marion Lake. The water rights of this project are still in the hands of the original filer, however, owing to his immediate action in filing preliminary papers with the Federal Power Commission.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

**National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 23-27. S. N. Clarkson, 420 Lexington Ave., New York.**

**New England Central Station Association of Power Engineers—Chamber of Commerce, Boston, Jan. 25. T. D. Bond, C. H. Tenney & Co., Boston.**

**Artistic Lighting Equipment Association—Winton Hotel, Cleveland, Jan. 25-28. G. P. Rogers, 711 Graybar Bldg., New York.**

**Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.**

**Iowa Section, N.E.L.A.—Roosevelt Hotel, Cedar Rapids, Feb. 2 and 3. H. E. Weeks, Davenport, Iowa.**

**American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16; St. Louis regional meeting, March 7-9. F. L. Hutchinson, 33 West 39th St., New York.**

**Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.**

**Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.**

**Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.**

**Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21; Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.**

**Oklahoma Utilities Association—Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.**

**Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.**

American Engineering Council Officers. — Besides the election of A. W. Berresford as president, noted last week, the following vice-presidents were chosen by the American Engineering Council at Washington: L. P. Alford, New York; O. H. Koch, Dallas; I. E. Moultrop, Boston, and G. S. Williams, Ann Arbor, Mich. John H. Finney, M. M. Fowler, H. A. Kidder, Farley Osgood, C. F. Scott and C. E. Skinner will represent the A.I.E.E. on the administrative board, and Alex Dow heads the representation from the A.S.M.E.

Carrying 110-Kv. Line Across the Connecticut River.—The first span of the New England Power Company's 60-mile, 110,000-volt transmission line from the Bellows Falls (Vt.) plant to Pratt Junction, Mass., is yet to be strung. This span crosses the Connecticut River and involves an engineering problem because of its extreme length. The wires will reach the first steel tower high up on Mount Kilburn on the New Hampshire side, a span of 2,080 ft. The entire line requires 375 67-ft. towers and the average span is 843 ft.

First Electrically Propelled Packetboat.—Another field for electric ship propulsion will be opened with the completion of an electrically propelled packetboat now being built for the Middlesex Transportation Company of New Brunswick, N. J. This boat will have a capacity of 250 tons of package freight and will operate at a speed of 12 miles per hour. It will run between New Brunswick and New York City and will supplement an extensive trucking business carried on by the owners. Electric equipment will be supplied by the General Electric Company.

Nebraska Farmers Drop Co-operative Plan for Private Service.—The Sunflower Farmers' Electric Light District in Nebraska, recently organized by land owners in the North Platte Valley for the purpose of issuing bonds and using the proceeds to build a distribution system for electrical energy to be purchased from the government development at Lingle, has been dissolved. Manager McFadden of the Western Public Service Company, which has lines through that section, offered to furnish the farmers with energy at stipulated rates, based on use, over the company's system, and this offer proved more attractive. The company agreed that for a bonus of $200 from each of at least 22 land owners it would build and operate the system and charge approximately town rates.

Progress in Kentucky in 1927.—In 1927, L. B. Herrington, president Kentucky Utilities Company, reports, that company built 30 miles of 66,000-volt, 97 miles of 33,000-volt and 48 miles of lower-voltage lines. A hydro-electric plant is under construction at Lock No. 7 on the Kentucky River and will be completed next summer. The company has also completed more than half of a double-circuit steel-tower line of 66,000-volt capacity, 36 miles long, between Morganfield and Earlington. When ready for operation, some time in March, this line will have cost approximately $280,000.——T. B. Wilson, vice-president Louisville Gas & Electric Company, says that the early opening of the company's hydro-electric plant at the Falls of the Ohio will be the biggest event on its 1928 program. Operation of the project will mean that Louisville will have available year-round navigation upstream as far as Pittsburgh, for the government's two-and-a-half-million-dollar dam was linked with the hydro project.

**Power Company and Skagit Municipal System May Be Connected.**—The Great Northern Power Company, which is developing hydro-electric power on the Wallace, Olney and Sultan Rivers in Snohomish County, Wash., has asked the Seattle City Council to consider interconnection between the company's line and the city's Skagit system, and the city will consider the proposal. The Great Northern Company has acquired water and land rights in Snohomish County and within the next 60 days expects to have a 2,000-kw. plant ready on the Lower Olney River. This will be enlarged to a 42,000-kw. installation, and ultimately the company hopes to develop 120,000 kw.

**Metaline Falls Project Strikes a Snag.**—The State of Washington cannot issue a permit for the development of hydro-electric power with restrictive qualifications, as requested by Hugh L. Cooper in applying for the right to develop a site at Metaline Falls, "Z" Canyon, in northeastern Washington, Assistant Attorney-General B. B. Adams has ruled. (See Electrical World for Jan. 7, page 71). The application, made for the Pend Oreille Lead & Zinc Company of Spokane, was for 7,000 sec.-ft. of water in the Clark's Fork branch of the Columbia River, with a provision that an additional 1,500 sec.-ft. might be used for 50 years and then become permanently available if not needed by the Columbia Basin irrigation project.

**New Plant for West Texas Utilities.**—Construction will soon begin on a West Texas Utilities Company power plant which, when completed with its full complement of three units, will cost more than $5,000,000. The plant will be built on Lake Pauline, 5 miles southeast of Quanah. The first unit will have a capacity of 20,000 hp., and when the plant is completed there will be a capacity of 60,000 hp. To the company's San Angelo plant a 9,000-hp. unit is being added. These, together with the 40,000 hp. now installed, will give a total rating of 109,000 hp. Four transmission lines will leave the plant. One of these will connect with the transmission line leading through Crowell to the central system of the West Texas Utilities Company. One will lead to Quanah, one to Childress and the fourth to Vernon, permitting interconnections with the Texas Electric Service Company at Wichita Falls and the Southwestern Light & Power Company at Lawton, Okla. The West Texas Utilities came into existence less than seven years ago at Abilene, Tex.

**Expansion at Asheville, N. C.**—The Carolina Power & Light Company will spend about $400,000 in Asheville, N. C., and vicinity for improvements and expansions in 1928, according to C. S. Walters, general manager of the company. This work does not include the large hydro-electric power plant which is being developed on the Pigeon River near Waterville, 50 miles west of Asheville, and is scheduled for completion in 1930 at a cost of $11,000,000, of which about $3,000,000 has already been spent. The appropriations for 1928 include $200,000 for transmission-line extensions and an equal amount for other equipment and for substations.

## Commission Rulings

**Railways Not Electrical Corporations.**—A complaint by the receiver of the Second Avenue Railroad Company in the city of New York with reference to rates for electricity charged by the Interborough Rapid Transit Company and the New York Railways Corporation has been dismissed by the New York Public Service Commission for lack of jurisdiction. The commission held that the transit companies furnishing electricity to the Second Avenue Railroad Company were not electrical corporations within the meaning of the New York statutes, although they sold part of their surplus power to electric railways. The commission said that in respect of the furnishing of electric service these corporations lacked the usual attributes of public service corporations and were not subject to the usual obligations of public service corporations; that it was not pretended that these corporations held themselves out as purveyors of electricity generally, or that they could be compelled to furnish electricity to the public generally, or that if they were to cut off service they could be compelled to restore it.

**Irrigation Company Ordered to Make Survey for Possible Power Plant on Site Controlled by It.** — In a ruling affecting the Public Water Company, which irrigates land in the Rogue River Valley, the Oregon Public Service Commission said: "Our engineers have made an examination of the utility property and have called the management's attention to the existence of certain potential water power at what is known as Bradshaw's Drop. It is the duty of the utility, in equity to its consumers, to expend every endeavor to increase its revenues wherever possible. Apparently no effort has been made to develop or dispose of this power, which in our opinion would be a source of considerable revenue. Obviously, good business management would have required this to be done long before. The utility will be required to make a survey of the possible development and disposal of this power and file a report within 90 days."

## Recent Court Decisions

**Franchise Rights Unimpaired Where City Refrained from Enforcing Tax Provisions.**—In an injunction proceeding by the Fort Worth Gas Company against a rival utility the Court of Civil Appeals of Texas held that the defendant's franchise rights were not impaired by the fact that the city had never enforced a forfeiture of franchise because of the rival company's failure to pay a tax on its gross earnings as required under the ordinance and had in lieu thereof assessed an ad valorem tax, nor by the further fact that the franchise had not been authorized by the voters in accordance with a provision in the city charter, since the company's state charter did not require any consent beyond that of the governing body of the city. (299 S.W. 705.)*

**Interpretation of Pennsylvania Statute Permitting Borough to Purchase Electric Utility.** — The statutes of Pennsylvania provide that a borough may purchase the works of any company furnishing electric light to it or the public at such price as may be agreed upon by the borough and the majority in value of the stockholders of such corporation, and that upon failure so to agree the borough may present a petition to the Court of Common Pleas asking for the appointment of viewers to assess the value of the plant and works so taken. The borough of Brookville attempted to condemn and appropriate the property and franchises of the Solar Electric Company. On appeal by the company from an order of the Court of Common Pleas dismissing its exceptions to the report of viewers, the Pennsylvania Supreme Court held that the statute did not directly or by necessary implication confer power to condemn and appropriate said electric light works, but was confined to the purchase of the works when there was a willingness to sell or authority to fix a price where this was in dispute. (138 At. 845.)

**Telephone Company Wins Important Wiring Case.**—A decision has just been made by the Massachusetts Supreme Court in favor of the New England Telephone & Telegraph Company and against the Massachusetts Department of Public Utilities and the Hotels Statler, Inc., in connection with the right of the company to insist on the wiring of telephone installations by telephone employees. The commission had ordered the company to provide service in the Statler Building over wires pulled through interior conduits by union workmen not employed by it. While complying with this order, the company maintained that its responsibility for its service and agreement with its own forces, not affiliated with the union organization, justified it in refusing to supply service over wires not pulled by its own employees, and also that the order of the commission was an interference with interstate commerce. The court coincided with this view and said that the order of the commission requires the company to become the owner of property which later it may be obliged to reject because incompatible with the service it undertakes to give.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## W. J. Canada Joins N.E.M.A.

W. J. Canada, who has served for the last few years as electrical field secretary of the National Fire Protection Association, has resigned to join the National Electrical Manufacturers' Association with headquarters in New York. Mr. Canada has been prominent in electrical circles for many years.

Following graduation from Sheffield Scientific School at Yale, he entered the testing department of the General Electric Company, but subsequently affiliated himself with the Ohio Electric Railway Company. Later in his career Mr. Canada took up safety work as electrical engineer of the Rocky Mountain Fire Underwriters' Association, resigning in 1913 to become associate physicist for the Bureau of Standards, Department of Commerce, where he made a special study of electrical life hazard. Subsequent connections followed with the American International Shipbuilding Corporation of Philadelphia and Stone & Webster before he became head of the engineering department of the National Electric Light Association in New York. In this connection Mr. Canada paid particular attention to questions of inductive interference, insurance, the safety code and work with special technical committees of the association. In his new position Mr. Canada will correlate and direct general engineering matters.

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**John M. Costello** has been appointed executive manager of the new Niagara, Lockport & Ontario Power Company, recently formed through the merger of the old Niagara, Lockport & Ontario Power Company and the Western New York Utilities Company, with headquarters in Batavia. Mr. Costello was identified with the old Niagara, Lockport & Ontario organization for sixteen years, having entered its employ in 1911 in the stores department.

**Owen D. Young**, chairman of the board of directors of the General Electric Company, was elected chairman of the Economic Foundation, succeeding Thomas W. Lamont, whose term as a member of the board of trustees has expired. The Economic Foundation is a trust established in 1923 to administer funds given or to be given for investigations in the field of economic, social and industrial science.

P. C. **Brooks** was elected a vice-president of Fairbanks, Morse & Company at a recent meeting of the board of directors. During a connection of 29 years with the organization, Mr. Brooks has held many positions of responsibility, and, in addition to his present office, he is president of E. & T. Fairbanks & Company, the scale manufacturing subsidiary of Fairbanks, Morse & Company. He is also vice-president of the Canadian Fairbanks-Morse Company, Ltd.

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## *J. C. Guild New Manager of Tennessee Utility*

Jo Conn Guild, Jr., who has been named general manager of the Tennessee Electric Power Company to succeed the late B. C. Edgar, as announced in the Jan. 7 issue of the Electrical World, is widely known in Nashville, Chattanooga and throughout the state and his appointment was no surprise to those who had followed his career in the public utility field. Upon leaving Vanderbilt University in 1908, Mr. Guild immediately engaged in construction work at the Hales Bar power plant, one of the outstanding engineering achievements of its character in the South at that time.

J. C. GUILD

Immediately thereafter, in 1913, Mr. Guild entered the employ of the Chattanooga & Tennessee River Power Company in Chattanooga in new-business development work, with special attention to the sale of electric power to the new and expanding industries in his home city. In 1915 he was made general manager of the company. In 1922 the Chattanooga & Tennessee River Power Company was consolidated with the Chattanooga Railway & Light Company and Tennessee Power Company into the Tennessee Electric Power Company, Mr. Guild becoming vice-president of the combined companies.

His contacts with the public in general early made Mr. Guild a firm believer in the policy of maintaining good public relations between the power company and the customers it serves. He frankly advocated the widest possible dissemination of information regarding the affairs, policies and progress of the Tennessee Electric Power Company through the press. The new executive has been closely associated with the late Mr. Edgar in all of the operating problems and policies of the company and is considered fully qualified by experience, ability and training to take over the managerial reins.

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**Matthew S. Sloan**, president of the Brooklyn Edison Company, addressed a group of bankers in Philadelphia on Wednesday, Jan. 18, and another group of bankers on Thursday, Jan. 19, in Pittsburgh. Taking as his subject the national legislative problems confronting the electrical industry in Washington, Mr. Sloan referred to the Walsh investigation, the Boulder Dam bill and the Muscle Shoals situation.

S. **Fred Smith**, for 36 years manager of the Salem (Mass.) Electric Lighting Company, has been appointed vice-president of that utility. Mr. Smith is a past president of the New England Division of the National Electric Light Association and is one of the most widely known managers of properties in the Tenney group. John L. Tudbury, manager of the Salem Gas Light Company, a recent addition to the Tenney list, has been made manager of the Salem Electric Lighting Company. He will remain manager of the gas company.

S. McN. **Johnston** has resigned his position as vice-president and general manager of the Pittsburgh Transformer Company. The illness of one of his children necessitated his residing in Phoenix, Ariz., temporarily and Mr. Johnston decided with regret to sever his connections with the electrical industry for a period in order to devote his efforts to his family. His many friends will regret his absence and hope the early recovery of his child will bring him back to electrical affairs. Mr. Johnston has been affiliated with the Pittsburgh Transformer Company for ten years and was a part owner until that company was purchased by the Allis-Chalmers Manufacturing Company in May, 1927.

H. **Hobart Porter**, president of the American Water Works & Electric Company, sailed Jan. 14 on the *Laconia* for a three-month cruise to South Africa. The tour, which will take Mr. Porter through the hunting country of South Africa northward to Cairo, is purely a pleasure trip.

M. L. **Hibbard**, who has been chief operating engineer of the Northern States Power Company for more than four years, has severed his connection with the Byllesby organization to affiliate himself with the Electric Bond & Share Company, New York. Though a Canadian by birth, Mr. Hibbard has spent the major portion of his engineering career in the United States. Following graduation from McGill University, he entered the test course of the General Electric Company at Pittsfield, Mass., but later returned to Montreal as an employee of the Montreal Street Railway. After engaging in consulting and construction work, he became superintendent of electric distribution for the Union Light, Heat & Power Company, Fargo, N. D., and after a period of four years removed to San Antonio as electrical engineer for the San Antonio Traction Company and the San Antonio Gas & Electric Company. He became identified with the Byllesby interests in 1911, when H. M. Byllesby & Company took over the Union Light, Heat & Power Company, to which he returned as general manager.

# Obituary

**William Schwanhausser**, chief engineer of the Worthington Pump & Machinery Corporation, died Jan. 15 in Peck Memorial Hospital, Brooklyn, N. Y., after an extended illness. A native of Bavaria and a graduate of the Polytechnic Institute in Mittweida, Saxony, he entered the employ of Osterheld & Eichmeyer, Yonkers, N. Y., after removing to this country, assisting in the development of engines, pumps, motors and other machinery. It was in 1885 that he took charge of the making of trade pumps for the Worthington works, then in Brooklyn. In the course of this association he introduced successfully the Worthington products in Europe, and in 1895 he was selected to direct the company's plant in Germany. Mr. Schwanhausser was 73 years of age.

**Henry T. Winchester**, electrical engineer, died suddenly Dec. 30 as the result of injuries sustained in an automobile accident near Detroit. A native of Boston and a graduate of the Massachusetts Institute of Technology, Mr. Winchester was formerly identified with Stone & Webster. He removed to Detroit and, at the beginning of the World War, took charge of construction at Camp Custer, Battle Creek, Mich. Later he was placed in charge of construction work at the Hog Island Navy Yard as division superintendent for Stone & Webster, but returned to Detroit as a construction and consulting engineer. Recently he was elected vice-president of the Apex Coal Company of Chicago.

**Ralph M. Obergfell**, associate electrical engineer of the Underwriters' Laboratories, Chicago, died Jan. 10, of pneumonia, after a brief illness. Mr. Obergfell was born in Chicago in 1888 and received his technical education at the Lewis Institute. Since 1914 he had been associated with the electrical department of the Underwriters' Laboratories with the exception of about a year and a half when he was with the American Expeditionary Forces in France. For the last few years he had been at the head of the electrical department in Chicago.

**George W. Mathews**, superintendent for the Foundation Company of New York, builder of the Insull power plant at Pekin, Ill., died of pneumonia Jan. 3 in his home in the latter city after a week's illness. He was 39 years old. Mr. Mathews had removed to Pekin last March to take charge of construction of the new power project and had made rapid progress with the work. He had been associated with the Foundation Company a number of years.

## *Prof. E. E. F. Creighton*

**Elmer E. F. Creighton**, electrical engineer with the General Electric Company, who was for years the company's expert on lightning protection, died Jan. 13 in Ellis Hospital, Schenectady. He had been identified with the General Electric Company since 1904 and during this period was a close technical associate of the late Dr. Charles P. Steinmetz. In the course of his engineering career Professor Creighton devoted much time to high-tension and lightning protection investigations, and during the last few years he had been engaged in special research work for the general engineering laboratory. An inventor of many protective devices for electrical systems, he held a total of 66 United States patents.

E. E. F. CREIGHTON

A native of California and a graduate of Leland Stanford University, Mr. Creighton rounded out his technical education at the Sorbonne in Paris and at the École Supérieure d'Electricité. Following his return from Paris in 1900 he again joined the staff at Leland Stanford to continue the teaching he relinquished to go abroad. One year later he transferred his interests to the East as head of the experimental department for the Stanley Electric Manufacturing Company at Pittsfield, and when the Stanley organization was taken over by the General Electric Company in 1904 he removed to Schenectady. From 1904 to 1906 Professor Creighton was assistant to Dr. Steinmetz, who was head of the electrical engineering department at Union College, and it was at this interval that an experimental laboratory, conducted by these two and others of the faculty, but designed to serve the needs of the General Electric Company, was established. The research work was continued at the college until 1913, when the laboratory was moved to the Schenectady plant of the General Electric Company, where it has since remained.

Professor Creighton was a fellow of the American Institute of Electrical Engineers and served on many technical committees, including that on meetings and papers. He was also a member of the American Society of Mechanical Engineers, the Society for the Promotion of Engineering Education, the American Electrochemical Society, the American Academy for the Advancement of Science, the American Physical Society and other technical organizations.

**W. C. Chappell**, electrical engineer, died late in November, 1927, in Monrovia, Cal., after a long illness. In the course of his engineering career Mr. Chappell visited Scotland, Austria, England, his native land, Canada and the United States. While in America he served as erecting engineer for the Columbia Electric Railway, in the same capacity with the General Electric Company in Philadelphia, and subsequently with Gay & Son, Los Angeles, as design engineer. Mr. Chappell was a member of the American Institute of Electrical Engineers.

**Lewis P. Mead**, president of the Mead Electric Company, Ltd., electrical engineers and contractors, Montreal, died at his home in that city Dec. 28, in his sixtieth year. Mr. Mead was born in Providence, R. I., and moved to Montreal in 1897 to take up the position of factory superintendent of the Eugene F. Phillips Electrical Works, Ltd. In 1910 he formed the Mead Electric Company, Ltd. He was for some years a lecturer in electrical engineering at the Montreal Technical School.

**Robert Miller**, general manager for the General Electric Company in the Rocky Mountain States, with headquarters at Denver, died Jan. 5, after a short illness. He was 48 years of age. Mr. Miller started with the General Electric Company in the East, was made sales manager at Salt Lake City in 1911 and about two and one-half years ago was advanced to the position he held at the time of his death.

**A. F. Meservey**, formerly general manager of the Fort Dodge (Ia.) Light & Power Company, died Jan. 3 in his home in Long Beach, Calif., where he had made his home since his retirement from active life twelve years ago. Mr Meservey was 77 years of age.

# Financial and Statistical News

### *Utility Markets Inactive*
### *Money Rates Firm*
### *New Financing Active*

PUBLIC utility securities for the most part have shared the inactivity which has characterized the greater part of the securities markets this week. Few price changes of any great significance are recorded, although averages are marginally higher than a week ago.

Money rates are again a subject of special interest in relation to current market movements. Hardening of rates at the beginning of the year is contrary to precedent. The tendency during recent years is the reverse, and factors governing the money market at this time of year would normally be expected to produce ease rather than firmness. The situation is, therefore, connected with the more or less uncertain effect of the expansion in brokers' loans, and this revives the question of the policy of the Federal Reserve banks in this connection. In any event, current firmness of funds and anticipation in certain quarters of increased firmness have had a definite slowing-up effect in the markets.

Bond prices continue in active demand with firming prices. The volume of new financing has again struck its pace, as indicated by the large number of new issues which have come forward this week and last.

## New Twenty-Million-Dollar German Loan to Be Floated

Negotiations for a twenty-million-dollar loan for the Westphalia United Electric Power Corporation of Germany have been closed and public offering is expected in the near future. Proceeds of the issue will be used for extensions to the plant.

## Week's New Issues Total Almost $50,000,000

The largest issue of the year up to the present is $36,000,000 of 5 per cent debentures, series A, of the Continental Gas & Electric Corporation. The issue, which was sold at 95½ and accrued interest to yield about 5.30 per cent, is for the purpose of retiring all of the company's outstanding securities except its 7 per cent prior preference stock and 110,000 shares of $7 preferred stock, series A, of the Kansas City Power & Light Company, a subsidiary.

An issue of $2,400,000 collateral trust 6 per cent bonds, series A, of the United Public Service Company was also sold this week. The funds are to be used for the purpose of acquiring additional subsidiary securities, as provided in the indenture. The United Public Service Company owns all of the capital stocks of a group of subsidiaries serving communities in Ohio, Indiana, South Dakota, Kentucky, etc. The bonds were sold at 98 and interest to yield over 6.20 per cent.

The National Electric Power Company sold an issue of $10,000,000 of 5 per cent gold debentures this week, to be used in the retirement of the company's 6 per cent secured gold bonds. The issue was sold at 94½ and interest to yield over 5.30 per cent.

Financing was carried out during the week also by one of the Duke-Price interests in Canada, the Saguenay Electric Company. This company sold $1,360,000 of 5½ per cent first mortgage and collateral trust bonds. Saguenay Electric has acquired a number of power and light companies in Quebec.

## Power Corporation Changes Set-Up

The stockholders of the Power Corporation of New York at their annual meeting on Jan. 10, held at the offices of the St. Regis Paper Company, voted to reduce the number of shares of both preferred and common stock. It was decided to reduce the total number of shares from 850,000 to 820,000. Under the old plan the company had 750,000 shares of common and 100,000 shares of preferred stock. Under the new plan the concern will have 750,000 shares of common and 70,000 shares of preferred stock. All of the directors of the company were re-elected to serve another year.

# California Commission Exercises Rigid Supervision

ANY existing feeling that the supervision of public utility commissions is not sufficiently rigid is refuted in so far as California is concerned by the commission's report, recently issued. Analysis of the report shows that since its inception the commission has denied applications to issue approximately $110,000,000 and dismissed applications to issue $116,500,000, or a grand total of more than $226,000,000. The result of this action is to protect investors and the consumers of public utility service, and it is evident that the commission is not evading its veto duty in regard to new issues. According to records, the commission granted permission for the issue of $252,323,000 of stocks, bonds and notes and other evidences of indebtedness during 1927, as against $158,012,000 in 1926.

Tabulations for the past year indicate that although a considerable volume of bonds was authorized, the year was especially favorable for stock financing, the amount of stock authorized increasing from $50,576,000 in 1926 to $151,562,730 in 1927. It appears from applications filed with the commission that not only was more stock sold, but the issuing companies were able to dispose of it more readily at higher prices and under better terms than previously. The amounts authorized during the past two years, exclusive of $247,000,000 which was for reclassification of the capital stock of the Pacific Gas & Electric Company and Southern California Edison Company, are classified by years and main groups as follows:

As usual, the bulk of the securities were authorized to be issued by gas and electric companies and for additions, betterments and construction purposes. While few new units of electric production capital were started during the year, a considerable volume of work and money was expended on construction programs, commenced in earlier years of generating expansion, the Southern California Edison Company proceeding with its Big Creek development and its Long Beach steam plant, Feather River Power Company with its Bucks Creek project, San Joaquin Light & Power Corporation with its Kings River development, Pacific Gas & Electric Company and Sierra & San Francisco Power Company with their Tuolumne development and the California Oregon Power Company with its Prospect plant on the Rogue River. The various applications filed with the commission indicate increasing expenditures for distribution facilities to meet demands for service from an ever-increasing number of consumers.

At the beginning of 1928 applications were pending before the commission involving requests to issue $43,734,803 of securities, and it appears from these undecided matters and from construction budgets filed by some of the companies that the commission will be called upon during the coming year to pass on a large volume of securities to enable the continuance of the development and expansion of California's public utilities which is demanded by the steady growth that has taken place.

LAST TWO YEARS' UTILITY FINANCING IN CALIFORNIA

| | Stocks | Bonds | Notes | Other Evidences of Indebtedness | Total |
|---|---|---|---|---|---|
| 1926 | $50,576,067 | $103,406,600 | $1,789,854 | $2,150,000 | $158,012,521 |
| 1927 | 151,562,730 | 197,334,300 | 3,126,163 | 300,000 | 252,323,193 |

## American Gas & Electric Sells All but Electric Utilities

The American Gas & Electric Company has sold several railway and bus properties in Portsmouth and Ironton, Ohio; Ashland, Ky.; Huntington, W. Va., and Wildwood, N. J. The company retains the electric light and power properties in these centers. The sale of these companies leaves American Gas & Electric with gross receipts of subsidiaries derived almost entirely from electric power and light operations.

## Common Dividend Increased by Middle West Utilities

Directors of the Middle West Utilities Company on Jan. 10 passed a resolution to the effect that, starting with the common dividend, payable May 15, quarterly distributions at the rate of $7 per share per annum will be made. This will mean that the 7 per cent preferred stock will go on an 8 per cent annual dividend basis beginning April 15. The regular quarterly dividend of $1.50 per share has been declared on the common stock (no par value), payable Feb. 15 to holders of record Jan. 31. This dividend rate has been paid since May 15, 1926, inclusive.

## Stock Exchange in New York Consolidation

The certificate of consolidation, made a part of the petition for the consolidation of the Niagara, Lockport & Ontario Power Company and the Western New York Utilities Company, Inc., under the name of the Niagara, Lockport & Ontario Power Company, states that the new corporation is to have 827,500 shares of stock, of which 500,000 shares will be preferred stock, par $25, and 327,500 shares of no-par-value common stock. Holders of preferred stock, par $100, of the Niagara, Lockport & Ontario Power Company are to receive under the proposed consolidation 4⅜ shares of preferred stock of the new company, in exchange for each share now owned. Preferred stockholders of the Western New York Utilities Company, Inc., are to receive $2.50 in cash and four shares of preferred stock of the new company, also the sum of 58⅓ cents in lieu of dividend for December, 1927. Holders of the 300,000 shares of common stock of the Niagara, Lockport & Ontario Power Company and of the 27,500 shares of common stock of the Western New York Utilities Company, Inc., are to receive common stock of the new company on the basis of share for share.

## Duquesne Light to Change Capitalization

Stockholders of the Duquesne Light Company will meet March 10 to vote on converting 250,000 shares of 8 per cent cumulative participating preferred stock, series A, of $100 par value, into 1,000,000 shares of common stock without par value, and converting the 250,000 shares of $100 par value common stock into 1,000,000 shares of no-par common, making a total of 2,000,000 shares outstanding. Stockholders of the company at the same time will vote on the proposal to increase the common from 2,000,000 to 4,000,000 shares and to issue $50,000,000 of 5 per cent cumulative first preferred stock.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 17 | Low 1927 | High 1927 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, 4% com.—no par | 149 | 140½* | 149* |
| Ala. Pwr., $7 com. pf.—no par | 114½ | 107 | 115 |
| Allis Chalmers Mfg., 6% com. | 116¾ | 115¼* | 120¼* |
| Aluminum Co. of Amer., com. | 122½ | 120* | 125* |
| Aluminum Co. of Amer., 6% pf. | 106¼ | 105½* | 106¼* |
| Amer. & Foreign Pwr., 7% pf.—no par | 107 | 105¼* | 108½ |
| Amer. & Foreign Pwr., com.—no par | 23 | 22¼* | 24¼* |
| Amer. Bosch Magneto, com.—no par | 21 | 20¼* | 22¼* |
| Amer. Brown Boveri Elec.† | 15 | 14¼* | 17* |
| Amer. Brown Boveri Elec., pf. $7 | 60 | 58* | 63* |
| Amer. Gas & Elec., 6% pf.—no par | 107 | 95½ | 108½ |
| Amer. Gas & Elec., com. †—no par | 119¾ | 117¼* | 123¼* |
| Amer. Lt. & Trac., 6% pf. | 115½ | 115¼* | 115¼* |
| Amer. Lt. & Trac., new com. | k174 | 164½ | 186 |
| Amer. Pwr. & Lt., 6% pf. | 109¼ | 109* | 109¼* |
| Amer. Pwr. & Lt., com. †—no par | 62¼ | 62¼* | 65¼* |
| Amer. Pub. Serv., 7% pf. | k 98½ | 88 | 104 |
| Amer. Pub. Serv., com. | k 70 | 65 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | 92 | 73 | 90 |
| Amer. Pub. Utilities, 7% pr. pf. | a 96 | 92 | 96½ |
| Amer. Pub. Utilities, com. | k 60 | 58 | 70 |
| Amer. States Sec., A | 4 | 2¼ | 5½ |
| Amer. States Sec., B | 4½ | 2¼ | 5½ |
| Amer. Superpwr., 6% ptc. pf.—25 | k 29¼ | 26¼ | 29½ |
| Amer. Superpwr., 6% 1st pf. | l 102½ | .... | .... |
| Amer. Superpwr., Class A†—no par | 37¼ | 37* | 38* |
| Amer. Superpwr., Class B†—no par | 38½ | 37½* | 38½* |
| Amer. Wtr. Wks. & Elec., 6% pf. | k102 | 99½ | 103½ |
| Amer. W. W. & E., com. new—no par | 57¼ | 57* | 61* |
| Anaconda Copper, cap. $3 | 55½ | 54¼* | 59¾* |
| Appalachian Electric Pwr., 7% pf. | 108½ | 100 | 109 |
| Arkansas Pwr. & Lt., 7% pf. | 107 | 101 | 108 |
| Assoc. Gas & Elec., $3.50—50 | 54 | | |
| Assoc. Gas & Elec., pf.—$6—no par | 98 | 85 | 98 |
| Assoc. G. & E., Class A, 10%—no par | 47¼ | 47½* | 51¼* |
| BABCOCK & WILCOX, 7% com. | 120 | 113 | 132 |
| Binghamton L., H. & P., $6 pf. | 103 | 93 | 103 |
| Birmingham Elec., pf. $7—no par | 109 | 105 | 111 |
| Blackstone Valley G. & E., 6% pf. | k107 | 103 | 110 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k128 | 98 | 133 |
| Blaw Knox, com.† | i 93¼ | 70 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f215 | .... | . |
| Broad River Pwr., 7% pf. | 105½ | 97 | 105½ |
| Brooklyn Edison, 8% com. | 214 | 206¼* | 219½* |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26 | .... | ... |
| Buffalo, Niagara & East. Pwr., com. $1.20—no par | l 33 | | |
| CALIFORNIA ELEC. GENERATING, 6% pf. | k 98 | 96 | 104 |
| California Ry. & Pwr., 7% pf. | h135 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | l109½ | 109* | 110½ |
| Central & S. W. Util., $7 pf.—no par | a102½ | 92½ | 99½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a106 | 98½ | 105½ |
| Central Ark. Ry. & Lt., 7% pf. | 102½ | 100 | 104 |
| Central Ill. Pub. Serv., $6 pf. | a 98 | 85½ | 100 |
| Central Ind. Pwr., 7% pf. | a 95 | 85 | 95 |
| Central Maine Power, 6% pf. | 95 | | .. |
| Central Maine Power, 7% | 106 | 102 | 110 |
| Central Pwr. & Lt., 7% pf. | 104½ | 100½ | 105 |
| Central States Elec., 7% pf. | 99 | 93 | 103½ |
| Century Elec., 6% com. | b142 | 142* | 142* |
| Chicago Fuse Mfg., com.—$2.50 no par | a 31 | 30 | 35½ |
| Cincinnati Gas & Elec., 5% com. | g 99¼ | 99½* | 100* |
| Cities Service, $6 pf.—no par ex. div. | k 95¼ | 87½ | 95½ |
| Cities Service, pf. B—no par ex. div. | l 8½ | 7½ | 8½ |
| Cities Service, pf. BB—no par | k 88½ | 81 | 88½ |
| Cities Service, com.—20 | l 54¼ | 54* | 56* |
| Cities Service, Bks. Shrs.—10 | m27¼ | 22¼* | 27* |
| Cities Service Pwr. & Lt., 7% pf. | 106¼ | 105¼* | 106½* |
| Cities Service Pwr. & Lt., 6% pf. | 96¼ | 95½* | 96¼* |
| Cleveland Elec. Illg., 6% pf. | 112 | 108 | 114 |
| Cleveland Elec. Illg., 10% com. | 350 | 285 | 370 |
| Columbia Gas & Elec., 6% pf. | 108¼ | 108* | 110¼* |
| Columbia G. & E. com. $5—no par | 91¼ | 89¼* | 92¾* |
| Columbus Elec. & Pwr., $2 com.—no par | 65 | .... | .... |
| Columbus Elec. & Pwr., 7% pf. | 107 | | |
| Columbus Ry., Pwr. & Lt., 6% 1st pf. | 107 | 98½ | 108 |
| Columbus Ry., Pwr. & Lt., 6½% pf. B | 105 | 96 | 106 |
| Columbus Ry., P. & L. com.—no par | 105 | 75 | 110 |
| Commonwealth Edison, 8% com. | a168 | 138 | 173 |
| Commonwealth Pwr., 6% pf. | 102 | 102¼* | 104¼* |
| Commonw'th Pwr., $2. com.—no par | 64½ | 62½* | 65¾* |
| Conn. Lt. & Pwr., 8% pf. | 121 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 112 | 119 |
| Cons. Gas of N. Y., pf. | 101¼ | 101¾* | 102¼* |
| Cons. Gas of N. Y., com. $5—no par | 121¼ | 119¾* | 125* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111 | 110¼ | 112¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e111½ | 110¼ | 114¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e110¼ | 112½ | 117 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf. | e125½ | 127 | 130½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 68¼ | 51 | 71 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | 100 | 106 |
| Consumers Pwr., 6% pf. | 104 | 100 | 106 |
| Consumers Pwr., 6.6% pf. | 106¼ | 103 | 107 |
| Continental Gas & Elec., 8% ptc. pf. | 110 | 103 | 110 |
| Continental Gas & Elec., 7% pr. pf. | 108 | 100 | 107 |
| Conti. G. & E. com. $4.40—no par | l225 | 210 | 265 |
| Crocker Wheeler, com.† | 25 | 23 | 38 |
| Crocker Wheeler, 7% pf. | 85 | 78 | 88 |
| DALLAS PWR. & LT., 7% pf. | 111 | 107 | 111 |
| Dayton Pwr. & Lt., 6% pf. | 108½ | 101 | 109¼ |
| Detroit Edison, 8% com. | 174 | 166½* | 176½* |
| Dubilier Condenser, com.—no par | k 3½ | 2 | 5½ |
| Duke Pwr., cap. | 139 | 139* | 145* |
| Duquesne Lt., 7% pf. | 115¼ | 115¼* | 115¼* |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 102 | 112½ |
| Eastern New York Util. com. | k 65 | 70 | 75 |
| Eastern States Pwr. $7 com. | 11 | 9 | 14 |
| Eastern States Pwr., pf. | 97 | 90 | 99 |
| East. Tex. Elec., 7% pf. | 107 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d262 | 217 | 267 |
| El Paso Elec. 7% pf. | 111½ | 105 | 112½ |
| Elec. Bond & Share, 6% pf. | l109½ | 109½* | 111½* |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 77¼ | 76¼* | 80¼* |
| Electric Household Util.† | a 15 | 11 | 15½ |
| Elec. Investors, 6% pf.—no par | 101 | 92 | 101 |
| Elec. Investors, com. †—no par | 40¼ | 40¼* | 43½* |
| Elec. Pwr. & Lt., ctfs. pf. | 107½ | 106¼* | 107¼* |
| Elec. Pwr. & Lt., ctfs., 40% pd. | 120½ | 120¼* | 121* |
| Elec. Pwr. & Lt., ctfs., com.—no par | 31½ | 28¼* | 31¼* |
| Elec. Refrig. cap.† | 11¼ | 11¼ | 13¼ |
| Elec. Ry. Securities, com.—no par | 6¼ | | |
| Elec. St. Battery com. $5.25—no par | 71¼ | 70¼ | 75¼ |
| Elmira Wtr., Lt. & R. R., 7% pf. | i105 | 99 | 105 |
| Empire Pwr., ptc.† | 30 | 27¼* | 30* |
| Engr. Pub. Serv., com.—no par | 35½ | 34½ | 35¼ |
| Eureka Vacuum Cleaner, com. $4 no par | 75½ | 74 | 79 |
| FAIRBANKS MORSE, 7% pf. | l106 | 107 | 112 |
| F. M., com. $3—no par | 36¼ | 32* | 36½* |
| Federal Lt. & Trac., com. $1.40 | 42¼ | 42* | 43½* |
| Federal Lt. & Trac., $6 pf.—no par | 100¼ | 98* | 101* |
| Florida Pwr. & Lt., 7% pf. | 106¼ | 101¼* | 106¼* |
| Ft. Worth Pwr. & Lt., 7% pf. | l113½ | 113* | 114½* |
| GALVESTON-HOUSTON ELEC., 6% pf. | 75 | 68 | 80 |
| Galveston-Houston Elec., com. | 30 | 26 | 32 |
| General Cable, Cl. A $1 no par | 58 | 57* | 59* |
| Gen. Elec. $3 com.—no par | 132½ | 130* | 138* |
| Gen. Elec., special 6% | 11 | 11¼* | 11¼* |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | k 35 | 31 | 47 |
| Gen. G. & E. (Del.) pf. A $8—no par | k122 | 113¼ | 123 |
| Gen. G. & E. (Del.) pf. A $7—no par | 107 | 98 | 110 |
| Gen. G. & E. (Del.) pf. B $7 | 105 | 105* | 106* |
| Gen. Pub. Serv., $7 cum. pf., no par | i110 | 102 | 112 |
| Gen. Pub. Serv., com., no par | 17¼ | 16¼* | 17¼* |
| Ga. Ry. & Pwr., 8% pf. | i125 | 119 | 125 |
| Ga. Ry. & Pwr., 7% pf. | i113 | 106 | 115 |
| Gt. Western Pwr., 7% pf. | l104 | | |
| IDAHO PWR., 7% pf. | 109 | 103 | 110 |
| Ill. No. Utilities, 6% pf. | k 96 | 88 | 97 |
| Ill. Pwr. & Lt., 7% pf. | 104 | 99 | 104 |
| Ingersoll Rand com. | 92 | 91* | 94* |
| Int. Combus. Engr. com. $2—no par | 51½ | 49* | [illegible] |
| Int. Combustion Engr., 7% pf. | 105 | 104½* | 105* |
| Int. Util., Class A—$3.50—no par | k 48½ | 24 | 53 |
| Int. Utilities, Class B—no par | 9½ | 9* | 10* |
| Interstate Pwr. pf. $7—no par | 97½ | 93 | 100 |
| Interstate Pub. Serv., 7% pf. | 102 | 98 | 104 |
| Iowa Ry. & Lt., 7% pf. | k 98½ | 97 | 100 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 105 | 97½ | 108 |
| Johns-Manville, com.†—no par | 116½ | 114½* | 123* |

Stock Exchange. aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington; kBid price [illegible] Saturday, Jan. 14. lBid price Wednesday, Jan. 18. mLatest quotations available. †Dividend rate variable. *1928

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 17 | Low 1927 | High 1927 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | k115 | 109 | 116½ |
| Kansas Gas & Elec., 7% pf. | l108½ | 107* | 109* |
| Kentucky Hydro-Elec., 7% pf. | a102½ | 94½ | 104 |
| Kentucky Sec., 6% pf. | k 91 | 83 | 90 |
| Kentucky Sec., 5% com. | 140 | 100 | 135 |
| Kentucky Utilities, 6% pf. | k101 | 95 | 101½ |
| LACLEDE GAS LT., 12% com. | k200 | 173½ | 267½ |
| Lehigh Pwr. Sec., com.—no par | 20½ | 19⅞* | 20⅞* |
| Long Island Ltg., 7% pf | 110½ | 110⅛* | 111* |
| Long Island Ltg., com.†—no par | 170 | 139 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 104½ | 98 | 105 |
| Louisville Gas & Elec., cl. A. $1.75 | 28⅝ | 28⅛* | 29* |
| MAN. ELEC. SUPPLY, cap. $5—no par | 50 | 50* | 54⅞* |
| Manilla Elec., com.†—no par | k 45½ | 40 | 60 |
| Maytag Mfg., com. .50—no par | 34 | 33⅛* | 34⅛* |
| Memphis P. & L., pf.—$7—no par | k109 | 107 | 111 |
| Metropolitan Ed., pf.—$6—no par | 104½ | 93 | 106 |
| Metropolitan Ed., pf.—$7—no par | 108 | 104 | 110 |
| Metropolitan Ed., com. $5—no par | k100 | 60 | 72 |
| Middle West Utilities, 7% pf. | a119¾ | 110⅛ | 119 |
| Middle West Util., 7% pr. lien | a128 | 117½ | 127 |
| Middle West Util., com. $6—no par | a129¼ | 108 | 125 |
| Midland Utilities, pr. ln. 6% pf. | a 95¼ | 91½ | 96¼ |
| Midland Utilities, 7% pf. A | a104 | 96½ | 103½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k 98½ | 98 | 101½ |
| Minn. Pwr. & Lt., 7% pf. | l108 | 107* | 109* |
| Miss. River Pwr., 6% pf. | 107½ | 94 | 108 |
| Miss. River Pwr., 3% com. | m 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | 108 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | 106 | 105* | 106* |
| Mohawk Hudson Pwr., com.—no par | 29½ | 29⅛* | 30⅞* |
| Montana Pwr., 5% com. | 104 | 102¼* | 106¾* |
| Montreal Pwr., 7½% com | f 91½ | .... | .... |
| Mountain States Pwr., 7% pf | 102½ | 97 | 103 |
| Mountain States Pwr., com † | 17 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110 | 98 | 110 |
| National Carbon, 8% pf. | a139 | 130½ | 139½ |
| National Elec. Pwr., A† | a 28 | 22 | 28¾ |
| National Lt., Ht. & Pwr., com | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 109½ | 108½* | 109½* |
| National Pwr. & Lt., com †—no par. | 22½ | 21⅞* | 23¼* |
| National Pub. Serv., 7% pf. | 99½ | 93 | 102 |
| National Pub. Serv., 7% ptc., pf. | 114 | 108 | 115 |
| National Pub. Serv., A com. $1 60—no par | 23 | 22* | 23* |
| National Pub. Serv., B com.—no par | 26½ | 24⅛* | 27½* |
| Nebraska Pwr., 7% pf. | l110½ | 110* | 111½* |
| Nevada-Calif. Elec., com. | k 34 | 25 | 36½ |
| New Brunswick Pwr., 4% pf. | k 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k104 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7. | 102¼ | 101* | 102¼* |
| New Orleans Pub. Serv.—7% pf. | 108½ | 103 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | k102½ | 101 | 104 |
| New York Power & Light 8% pf. nopar | 114 | .... | .... |
| New York Power & Light, 8% pf | 114 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com | k109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | k109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28⅜ | 28* | 28⅜* |
| Niagara, Lock & Ont. Pwr., 7% pf. | k115 | 110½ | 116 |
| No. Amer., 6% pf. 50 | 54¼ | 53¼* | 54¼* |
| No. Amer., com.—10 | 61⅝ | 58⅝* | 62⅛* |
| No. Amer. Edison, $6 pf.—no par | 104½ | 103¾* | 104½* |
| No. Caro. Pub. Serv., pf.—$7—no par | 103½ | 93 | 105 |
| Northeastern Pwr., com. | 19⅝ | 19¾* | 21⅛* |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 18⅝ | 18* | 19⅛* |
| No. Ont. Lt. & Pwr., 6% pf. | k 98 | 84 | 95 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 109¼ | 108½* | 109½* |
| No. States Pwr. (Del.), 8% com. | 124½ | 123* | 128* |
| No. Texas Elec., 6% pf. | 45 | 45 | 70 |
| No. Texas Elec., com. | 5 | 5 | 36 |
| OHIO BRASS, com. B $4—no par | k 95½ | 76 | 116½ |
| Ohio Brass, 6% pf. | k110 | 100 | 111 |
| Ohio Pwr., 6% pf. | 105 | 96 | 106 |
| Ohio Pub. Serv., $6 pf. | k103 | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | 110 | 103 | 111 |
| Ohio River Edison, 7% pf. | 108½ | 103 | 109½ |
| Oklahoma Gas & Elec., 7% pf. | 108 | . | .... |
| PACIFIC Gas & ELEC., 6% pf. | 27⅝ | 26⅜* | 27⅝* |
| Pacific Gas & Elec., 8% new com. | k 47⅝ | 31 | 50 |
| Pacific Pwr. & Lt., 7% pf. | l106 | 106* | 108* |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 78 | 75¼ | 80 |
| Penn-Ohio Edison, 6% pf. no par | 95 | 94½* | 96* |
| Penn-Ohio Edison, 7% pf | k107½ | 97½ | 104 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109 | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par. | l109½ | 109½* | 110½* |
| Penn Wtr. & Pwr., 8% com., new | e 72½ | 47¼ | 75 |
| Phila. Co., 5% pf.-50 | k 48½ | 40 | 51 |
| Phila. Co., 6% pf. -50 | 52½ | 52* | 52½* |
| Phila. Co., com.—50. | k149 | 85¼ | 153½ |
| Phila. Elec., 8% com.—25 | c 57½ | 46 | 58¼ |
| Portland Elec. Pwr., 7% pf. | 102 | 97½ | 102½ |
| Portland Elec. Pwr., 6% pf. | 86 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 75 | 55 | 70 |
| Portland Elec. Pwr., com. | 33 | 22 | 30 |
| Potomac Elec. Power, pf. | k111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | k 60 | 28 | 60 |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf., | l107 | ... | ... |
| Pub. Serv. of N. J., 6% pf. | 104¼ | 103¾* | 105* |
| Pub. Serv. of N. J., 8% pf. | 135 | 134* | 135* |
| Pub. Serv. of N. J., $2 com.—no par | 42½ | 41½* | 42½* |
| Pub. Serv. of No. Ill., 6% pf. | a111 | 101½ | 113¼ |
| Pub. Serv. of No. Ill., 7% pf. | a120¼ | 112¼ | 120½ |
| P. S. of No. Ill., com. $8—no par. | a159¾ | 140¼ | 161¼ |
| Pub. Serv. of No. Ill., $8 com. | k160 | 130½ | 160 |
| Pub. Serv. of Okla., 7% pr. ln. | k103 | 90 | 103 |
| Pub. Serv. Elec. & Gas, 6% pf. | 110 | 109* | 110* |
| Puget Sound Pwr. & Lt., 7% pf. | k108 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 99 | ... | ... |
| Puget Sound Pwr. & Lt., com. | 41¾ | 34⅛* | 41¾* |
| RADIO COPR. OF AMER., $3.50 pf. -50 | k 55¼ | 49 | 57 |
| Radio Corp. of Amer., com.—no par. | 100¼ | 88¼* | 104¼* |
| Rhode Island Public Service, pf. $2—no par | 30⅛ | 28¼ | 30¼ |
| Rochester Gas & Elec. 6% pf. D | k105¼ | 101 | 103½ |
| Rochester Gas & Elec., 7% pf. B. | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C. | 105¼ | 101¼ | 103¼ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | k111 | 105 | 112½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel Corp. | k 1 | 10cts | 10¼ |
| Sierra Pacific Elec., 2% com. | k 32 | 24½ | 31½ |
| Sioux City Gas & Elec., 7% pf. | 107 | 99 | 105½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l108 | ... | ... |
| Southeastern Pwr. & Lt., ptc. pf. | l 85½ | ... | .... |
| Southeastern Pwr. & Lt., com.—no par | k 43 | 29⅜ | 46 |
| So. Calif. Edison, 8% pf. | k 45 | 36½ | 40 |
| So. Calif. Edison, 7% pf. | k 28 | 27½ | 28½ |
| So. Calif. Edison, 6% pf. | k 26 | 24½ | 27 |
| So. Calif. Edison, 8% com. | 44 | 43½* | 44⅛* |
| Southern Cities Utilities, 7% pf. | k 70 | 67 | 90½ |
| Southern Cities Utilities, com. $4 | m 30 | 23½ | 42½ |
| Southwestern Lt. & Pwr., A $3 | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B. | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 88½ | 83 | 91½ |
| Southwestern Pwr. & Lt., 7% pf. | k110 | 103 | 113 |
| Springfield (Mo.) Ry. & Lt., 7% pf. | m102 | 95 | 102 |
| Standard Gas & Elec., 8% pf. | 66 | 65* | 66* |
| Standard Gas & Elec., 7% pr. pf. | 110 | 103 | 113 |
| Standard G. & E., com. $3.50 | 59 | 57⅛* | 59⅛* |
| Standard Power & Light, com. | 30 | 30* | 33⅛* |
| Standard Pwr. & Lt., 7% pf. | 104 | 98 | 105 |
| Staten Island Edison, pf.—$6—no par | 101½ | 99 | 103 |
| Superheater, $6 com.—no par | 163 | 170 | 185 |
| Syracuse Lighting, 7% pf. | k111 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 63 | 62⅛* | 63* |
| Tenn. Elec. Pwr., 6% pf. | 102½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109½ | 103 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 26 | 20 | 30 |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | l114 | 113½* | 115* |
| Tide Water Pwr., 8% pf. | 108½ | 105 | 111 |
| Timken Roller Bear., com.—$4 no par | 129½ | 126½* | 134* |
| Toledo Edison, 7% pf. | l109½ | 102* | 107* |
| Toledo Edison, 6% pf. | k105 | 95 | 105 |
| Toledo Edison, 6% com. | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | k 97½ | 96 | 99 |
| UNITED GAS & ELEC., 7% pf. | 101 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 74 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c115⅝ | 89½ | 118½ |
| United Lt. & Pwr., pf.—$4—no par | a 55 | 50 | 57 |
| United Lt. & Pwr., pf.—$6.50—no par | a 98½ | 87 | 97½ |
| United L. & P., com. A .48—no par. | 14⅛ | 13⅛* | 14⅞* |
| United L. & P., com. B .48—no par. | k 20 | 14 | 20 |
| Utah Pwr. & Lt., 7% pf. | l110 | 109½* | 111* |
| Utica Gas & Elec., 7% pf. | 105 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 98 | 93 | 100 |
| Utilities Pwr. & Lt., com. A $2 | 29 | 28⅛* | 29⅞* |
| Utilities Pwr. & Lt., com. B $1—no par | k 19½ | 13½ | 23¼ |
| VERMONT HYDRO-ELEC., 7% pf. | k 97 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k108 | 105 | 110 |
| WAGNER ELEC., 7% pf. | b 97 | 97* | 97½* |
| Wagner Elec., com.—no par | b 38½ | 37½* | 38⅞* |
| Washington Ry. & Elec., 5% com. | 464 | 180 | 475 |
| Washington Ry. & Elec., 5% pf. | 101½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | k178 | 136 | 182 |
| West Penn Elec., 7% pf. | 113⅝ | 111⅛ | 114½ |
| West Penn Elec., Cl. A $7. | 107⅝ | 106½* | 109* |
| West Penn Pwr., 7% pf | 115⅝ | 114½* | 116½* |
| West Penn Pwr., 6% pf. | 110 | 109⅛* | 113* |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf. | k103 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 102½ | 96 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com. -50 | 91½ | 88⅛* | 95⅞* |
| Weston Elec. Instrument, Cl. A $2—no par | 30⅜ | 30 | 34⅜ |
| Weston Elec. Instrument, com.—no par | k 12½ | 11 | 18⅜ |
| Wheeling Elec., 6% pf. | k103 | 95 | 104 |
| Worthington Pump, 7% pf. A | k 46½ | 44 | 61½ |
| Worthington Pump, 6% B | k 42½ | 37 | 54½ |
| Worthington Pump, com. | k 28½ | 20½ | 46 |
| YALE & TOWNE com. $5—25. | 75 | 73⅛* | 75* |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 14 *l*Bid price Wednesday, Jan. 18. *m*Latest quotations available. †Dividend rate variable. *1928.

## Canadian Companies Issue Annual Reports

The fourth annual report of the Ottawa & Hull Power Company, Ltd., recently issued, covering the twelve months ended Oct. 31, 1927, reveals a year of further satisfactory progress. Gross revenue for the twelve months amounted to $398,795. In the preceding period of fourteen months the gross revenue was $446,540, equivalent to a rate of $382,748 for twelve months. Expenses and taxes for the year under review were actually lower than those for the preceding period, which was longer by two months. Bond interest and preferred dividends were proportionately smaller. After these deductions there remained a surplus of $46,725. Gross revenue of the Ottawa River Power Company, Ltd., a subsidiary of the Ottawa & Hull Power Company, for the twelve months ended Oct. 31, 1927, amounted to $356,126, as against $274,953 in the preceding fiscal year, which comprised only ten months of operation. After deducting expenses and taxes, interest charges and depreciation reserve there remained a surplus for the year of $15,386, which was added to the previous surplus of $1,699, making a total of $17,086.

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BRAZILIAN TRACTION ON $7 BASIS.—Brazilian Traction, Light & Power Company, Ltd., declared a quarterly dividend of $1.75 on the present $100 par common, placing the stock on a $7 basis, against $6 previously. Stockholders approved an increase in the authorized common shares to $200,000,000, from $120,000,000, and issuance of additional common stock to stockholders at $100 a share on basis of one new share for each five held, to be followed by a four-to-one split-up of all the common. The new common will be of no par value.

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TOKYO STOCKHOLDERS RATIFY CONSOLIDATION.—Stockholders of the Tokyo Electric Light Company and the Tokyo Electric Power Company have ratified a proposal for the consolidation of the two companies. The consolidated organization will have a paid-in capital of more than $20,000,000 and a funded debt of about $100,000,000. The consolidated company is the largest corporation in Japan and one of the largest public utility operating companies in the world. It will operate at wholesale and retail in a territory comprising 13,000 square miles and having a population of 10,000,000, or nearly one-sixth of the population of Japan proper.

# 1927 General Production 2 Per Cent Over 1926

*Less than Normal Seasonal Decrease During December — Rolling Mills, Steel Plants and Automobile Industries Report Increased Operations Over November*

THAT the volume of general production during 1927 as a whole was about 2 per cent above that of 1926 is indicated by reports on electrical energy consumption received by the ELECTRICAL WORLD from approximately 3,000 large manufacturing plants scattered throughout the nation and in various industries, plants consuming more than 15,000,000,000 kw.-hr. of electrical energy per annum. The basic figures indicate that seven of the primary industrial groups—rolling mills and steel plants, leather and its products, textiles, lumber and its products, paper and pulp, rubber and its products, and the food and kindred products industries—turned out a volume of products greater than that in 1926, although in some of the groups the increased volume was very slight. On the other hand, five just as important industrial groups—ferrous and non-ferrous metal-working plants, automobiles, stone, clay and glass, chemicals and allied products and shipbuilding—were operating during the year as a whole at a lower rate than in 1926. When these various industrial groups are weighted in accordance with their importance in the national industrial structure, the rate of operations in general industry during 1927 is found to have been 2 per cent more than that of 1926.

The year closed with general industry operating at a rate of about 8 per cent greater than in December of last year. The low activity for December, 1926, was due largely to the depressing influence of operations in automobile manufacturing, both in the production of new cars and trucks and in the manufacture of automobile equipment and replacement parts. There was a very noticeable increase in the productive operations of these plants during the current December, an increase in operations of about 5.7 per cent being indicated. The rolling mills and steel plants also slightly increased their rate of activities during December, these two industrial groups—automobiles and rolling mills—being the only two industries to report an increased rate of operations during December over November. When the various industrial groups are weighted in accordance with their importance, the rate of operations of general industry during December is found to have been about 4.5 per cent less than in November, which is a materially smaller seasonal decrease than was witnessed during December, 1926.

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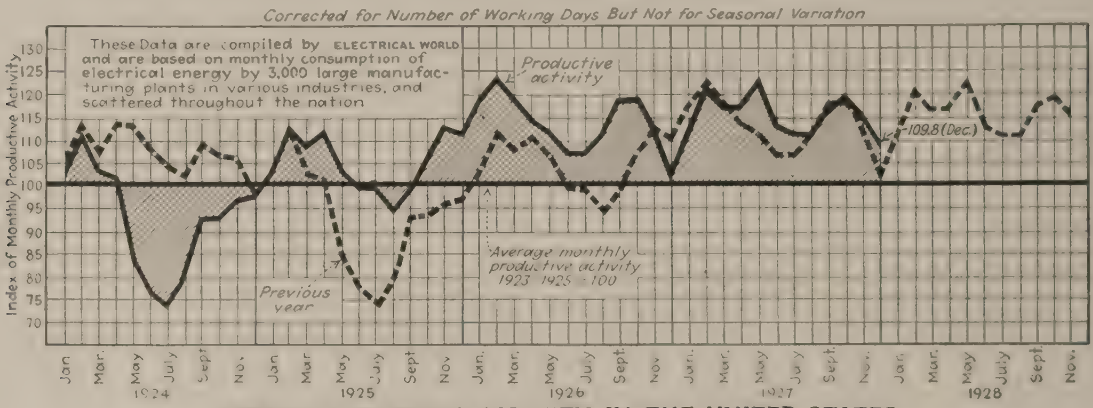
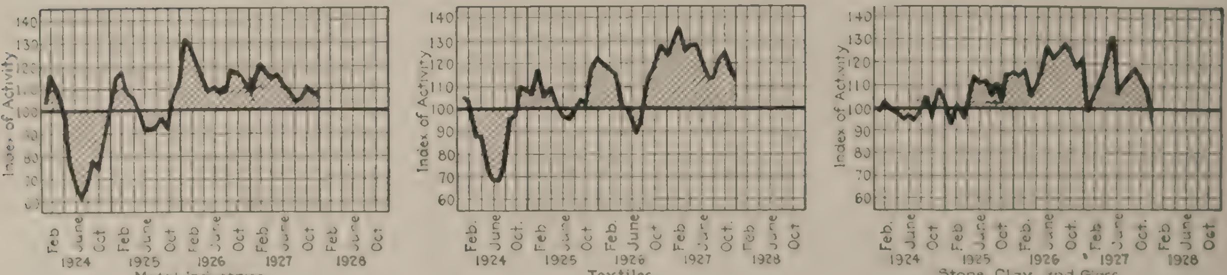
QUEBEC POWER STOCK ON $2 DIVIDEND BASIS.—Directors of the Quebec Power Company have declared a quarterly dividend of 50 cents a share on the outstanding 400,000 shares of capital stock, no par value, payable Jan. 16 to holders of record Dec. 31. This is equivalent to $2 per share on the old capital stock of $100 par value, which was recently split up on a basis of four new shares for one old share. A quarterly dividend of 2 per cent was paid on the old shares on Oct. 15 last.



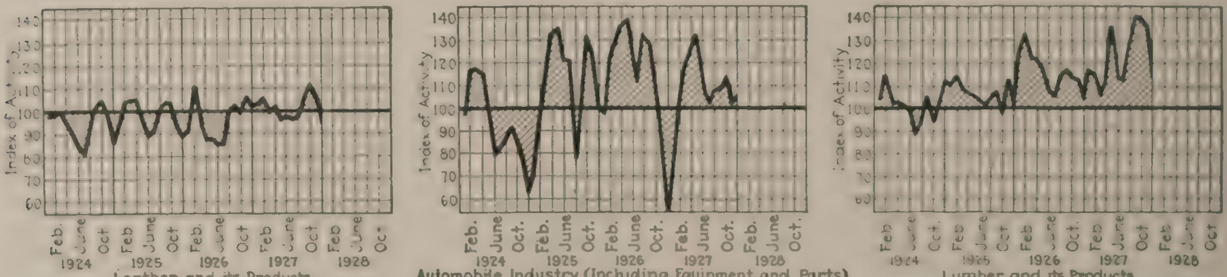
GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES



Metal Industries

Textiles

Stone, Clay, and Glass



Leather and its Products

Automobile Industry (Including Equipment and Parts)

Lumber and its Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

# Business News and Market Conditions

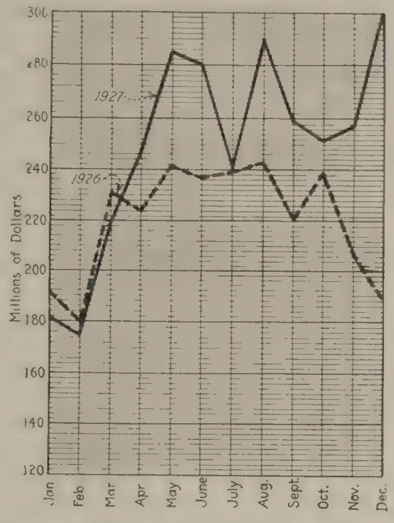
## Engineering Contracts Show Gain in 1927

*Increase of 14 per Cent Over 1926—December a Record Month with Contracts Highest for 1927*

ENGINEERING construction volume for 1927 reached $3,253,766,000, which is $400,000,000 more than in 1926, an increase of 14 per cent, according to the *Engineering News-Record* statistics. December contracts averaged $76,500,000 per week, which is a record. It is $11,000,000 more than the weekly awards last month and $29,000,000 more than December, 1926, average weekly contracts. Several outstanding projects contributing to this large total were a hydro-electric development in Missouri, several pipe lines and two subway contracts, all totaling about $70,000,000. An unusual amount of awards for commercial building in New York totaled $65,700,000.

The construction volume index number for December is 319. This compares with 228 for the whole of 1926 and 100 for 1913. This means that the actual volume of contract letting in December, 1927 (not the mere money value of the contracts let), is 219 per cent greater than the volume for 1913. The index number contains the increment of construction and indicates the rate at which contracts are being let, as compared with 1913 awards. The index number for the average construction volume in 1927 is 262.

Street and road contracts in 1927 show a gain of $40,171,000, or 8 per cent more than 1926, for projects of $25,000 or more. Total awards for this class of construction were $525,069,000, and this is about 16 per cent of all heavy construction awards in 1927, higher than in any preceding year. Since 1913 there has been a consistent gain in street and road contracts, except in 1917 and 1918. The year 1927 was just 100 per cent higher than 1920.



CONTRACTS AWARDED IN THE UNITED STATES

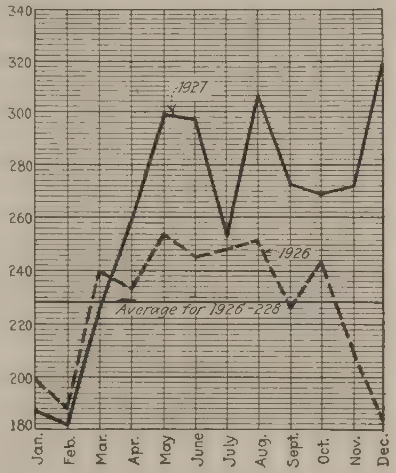
Actual building construction in 1927 was about 6 per cent less than in 1926, and, according to the Architectural Forum, building will continue in 1928 at least in the same volume, if not reaching even greater totals than in 1927.

## Competition Will Be Keen, but Business Active

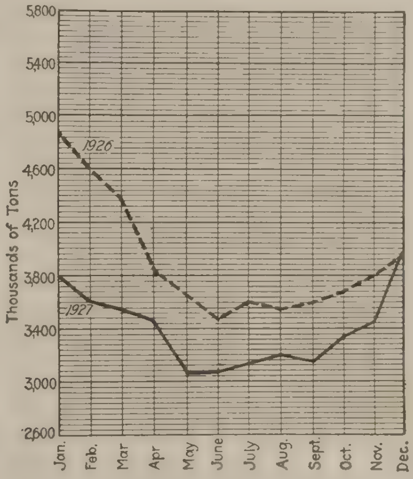
By E. F. LeNoir

*President Union Electric Manufacturing Company*

FOR the coming year competition will be keener, but business will be active and there will be a goodly volume which can be obtained by hard work and keeping on one's toes. The year 1928 will be no worse than 1927. In fact, I look for it to be a little better. The United States is too large and its contact throughout the world is such that we cannot have what every one is so



CONSTRUCTION VOLUME AS COMPARED WITH AN INDEX OF 100 FOR 1913



UNFILLED TONNAGE AS REPORTED BY THE UNITED STATES STEEL CORPORATION

In the chart at the left the actual volume of construction is compared and not the mere money value of contracts let. (*Engineering News-Record* statistics.)

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA DURING DECEMBER, 1927

Totals for 1927 and 1926 (Thousands of dollars—000 omitted)

| | New England | Middle Atlantic | South | Middle West | West of Mississippi | Far West | United States | Total for 1927 | Canada |
|---|---|---|---|---|---|---|---|---|---|
| Waterworks | $15 | $684 | $402 | $124 | $837 | $493 | $2,555 | *$53,189* | $91 |
| Sewers | ........ | 1,361 | 277 | 4,674 | 855 | 384 | 7,551 | *118,032* | 815 |
| Bridges | 5,025 | 1,868 | 2,810 | 4,387 | 942 | 733 | 15,765 | *143,645* | 338 |
| Excavations, drainage, etc | ........ | 493 | 25 | 385 | 180 | 721 | 1,804 | *42,005* | 1,053 |
| Streets and roads | 648 | 7,835 | 6,385 | 4,495 | 13,114 | 6,136 | 38,613 | *525,069* | 94 |
| Industrial buildings | 3,891 | 13,006 | 6,659 | 4,965 | 2,633 | 806 | 31,960 | *321,315* | 2,883 |
| Commercial buildings | 10,764 | 90,923 | 3,895 | 44,945 | 10,083 | 15,021 | 175,631 | *1,632,338* | 44,175 |
| Federal government | 655 | 1,200 | 444 | 29 | 643 | 758 | 3,729 | *50,763* | ..... |
| Unclassified | 652 | 16,755 | 9,152 | 2,723 | 70,663 | 291 | 100,236 | *367,410* | 1,627 |
| December, 1927 | $21,650 | $134,125 | $30,049 | $66,727 | $99,950 | $25,343 | $377,844 | *$2,853,847* | $51,076 |
| November, 1927 | 15,035 | 76,183 | 52,792 | 61,627 | 30,813 | 20,872 | 257,322 | ........ | 11,355 |
| December, 1926 | 19,746 | 65,051 | 19,572 | 57,709 | 30,858 | 36,667 | 329,603 | ........ | 3,647 |
| Total, 1927 | *234,274* | *988,994* | *290,465* | *775,955* | *593,417* | *370,661* | *3,253,766* | ........ | *180,763* |
| Total, 1926 | 246,595 | 856,327 | 288,891 | 724,428 | 414,962 | 322,644 | 2,853,847 | *3,253,766* | 143,686 |

NOTE.—Owing to five weeks of construction contracts being included in some months, as in September, the figure for the total contracts let, as shown in the table, does not agree with the figure as represented in the curve. In order to obtain comparable figures the curve is worked out on a four-week basis for each month.

often afraid of—a slump. Business is on a sound, hard-headed basis, which means hard work and lots of energy, and there is room for all of us to work and to live to make a profit. The only thing I fear is that some of the manufacturers will think it is necessary to reduce prices, but I believe that if the electrical industry increased its prices, it would increase business and naturally, of course, our profits. I certainly hope that the electrical industry will try to uphold prices in every way and eliminate freight allowances, rebates and all of the other extras which a great many are offering today.

# Market Conditions

NEW ENGLAND has no outstanding orders or inquiries to report, and the Eastern district generally is feeling the effect of hand-to-mouth buying, though prospects for early activity are bright. An increase in the inquiries and orders from industrial firms seeking electrical equipment is noted in the Southeast. Good business continues in the central region of the nation, its volume being large for the first of the year. St. Louis, however, reports very few orders of contract size in the district for which it is the marketplace. Small motors are being ordered in considerable quantity in California, and motors and heavy apparatus, including hydro-electric equipment, are in reasonable demand in Seattle.

## *Non-Ferrous Metals Quiet with Easier Prices*

Consumers of non-ferrous metals appear to be waiting for something to turn up, judging from the comparatively small volume of sales during the week ended Wednesday. None of the markets is dead, but the tonnage sold has been below the average. A sharp distinction can be drawn between the position of the important primary producers of copper and the so-called "custom" sellers. Without exception the former have been quoting 14⅛ cents, and that they had the courage of their convictions is proved by the fact that no copper was sold at this price during the week.

NEW YORK METAL MARKET PRICES

| | Jan. 11, 1928 Cents per Pound | Jan. 18, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14.05-14.125 | 14 |
| Lead, Am. S. & R. price | 6⅜ | 6¼ |
| Antimony........... | 10⅞ | 10¾ |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots............ | 6 | 5.95 |
| Tin, Straits........... | 56⅝ | 54¼ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price Jan. 11, 1928, 15⅜ cents

Zinc in fair volume was traded in during the week at 5.62½ cents. A few sales for May-June delivery brought 5.65 cents. The lead market was disrupted in the week, with offerings on Wednesday by a Middle Western dealer at 6¼ cents, St. Louis, five points less than that which any producer had theretofore been willing to accept for this metal.

## *Small Sales Prevail in Eastern District*

Curtailed orders rule in the Eastern district, and virtually every branch of the electrical industry is feeling the effects of a sluggish market brought about by hand-to-mouth buying. Prospects, however, are bright; sizable business appears ahead and is imparting a firm tone to the general situation. Inquiries are increasing both in volume and proportions as compared with the first two weeks of the month, but while a fair percentage is directed to central-station account, there are few immediate commitments in sight for heavy generating machinery or affiliated equipment. Substation and line equipment are developing an encouraging advance status in the New York market, and a leading manufacturer says that indications are that January sales will closely parallel those of the same month last year. About 93 per cent of current account, it is stated, is for outdoor-type apparatus. There is a fair movement in control equipment, according to a large producer, and the past few days are showing decided betterment. While the majority of present sales is for small account, the sum total is close to normal, approximately 50 per cent of current business being from prominent baking interests. A new cement mill in the St. Louis district is expected to place a large order for control equipment at an early date, and other important industrial projects are also maturing.

The Philadelphia market is operating under restricted buying, and industrial account is developing the majority of commitments. There is a fair demand for motors of medium capacity, with smaller units showing a tendency to lag. The business in wire and wiring materials is spotty and orders are light.

Construction activities in the Eastern district include the following: The Department of Mental Hygiene, Albany, N. Y., is asking bids until Jan. 25 for a cold-storage plant at the state hospital at Binghamton, including complete electrical work. The Mohawk-Hudson Power Corporation has acquired the Schodack Light & Power Corporation, operating at Castleton, N. Y., and vicinity, and plans line and other expansion in that district. The United Electric Light & Power Company, New York, has acquired an entire block of property on the Harlem River, adjoining its power plant at 201st and Academy Streets, for future expansion. The Pennsylvania Railroad Company, Philadelphia, is arranging the early construction of a cold-storage and refrigerating plant on Oregon Street, reported to cost in excess of $150,000, with equipment. Day & Zimmermann, Inc., Philadelphia, engineers, are taking bids until Jan. 31 for electric work, refrigeration, etc., for a cantonment and utilities at Graterford, Pa., for the Eastern State Penitentiary. The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is asking bids until Jan. 24, for electric wiring devices (Schedule 8320), electric heaters (Schedule 8321) and insulation material (Schedule 8324.)

## *New England Trend Uneven with No Outstanding Orders*

Little change during the past week as compared with the previous week is recorded for this district. No outstanding orders were reported, although sales are progressing and interest is quite marked along special lines. Industrial electric heating manufacturers are busy and report increasing interest; a number of heating furnace orders will be closed shortly. Industrial electric lighting is active, and present layouts reported by one prominent central-station group are far over the number last year. Line extensions are being planned for southeastern Massachusetts. Quotations for materials for service expansion are gaining.

Central-station supplies are less active, small-motor sales are steady, and industrial equipment is quiet. One manufacturer reports an inquiry for loom motors for individual drives; another records an encouraging trend toward sales among machine-tool manufacturers. Electric range sales are promising, and oil-burning equipment installations show a marked gain over last year for the past month.

Projects in view in this district are confined to hospital and institutional expansion. The Stone & Webster Corporation announces plans for the expansion of its southern Texas properties at a cost of $3,000,000.

## *Good Spring Trade Expected in St. Louis District*

Very little business of contract magnitude is reported from the St. Louis district. Sales of stock sizes in motors and transformers for general purposes have been better than last week. A decrease was shown in the shipment of building materials and line-construction hardware. Several central-station jobs are being figured on, and the feeling reflected by manufacturers is that spring business will be good.

Construction projects reported are as follows: New Orleans is considering an ornamental lighting system in the business district. The Canadian Ice Company plans an ice-manufacturing plant on Gentilly Street, New Orleans, to cost about $100,000. St. Louis is arranging an appropriation of $200,000 for improved lighting systems on a number of streets. The Southwestern Light & Power Company, Oklahoma City, will build a transmission line from Clinton to Arapaho, Okla. The Oklahoma Gas & Electric Company, Oklahoma City, plans an additional generating unit at its Horseshoe Lake power plant and will also enlarge the substation on Broadway, Oklahoma City. The Texas Power & Light Company, Dallas, plans extending its transmission system to Briggs, Tex., and vicinity. Fort Worth plans an ornamental lighting system on Magnolia Avenue and Camp Bowie Boulevard. The West Texas Utilities Company, Abilene, Tex., has authorized the immediate construction of a power plant at Lake Pauline, near Quanah, Tex., to cost about $1,500,000. The Gulf Public Service Company, Jacksonville, Tex., is considering a transmission line from Jacksonville to Troup, Tex. The Central Power & Light Company, San Antonio, plans extensions in the ice plant at Victoria, Tex., to increase capacity to 120 tons, to cost about $80,000.

### *Industrial Business Picking Up in Southeast*

Activities in the electrical field in the Southeast continue quiet, though there is an increase in the number of inquiries and orders from industrial firms. Central-station companies are marking time and placing only a reasonable volume of orders. The largest central-station order reported last week was for high-tension line-construction materials amounting to about $8,000. Other line-construction material orders included one for wire and cable totaling $2,274 and creosoted pine poles amounting to $2,100. House-type meters continued in reasonably steady demand, one company ordering $1,000 worth of this metering equipment last week. Another power company order called for switching equipment totaling $1,500. A textile electrification project in Georgia was reflected last week in orders for motors amounting to $4,700, wiring materials costing $4,100 and three 250-kva. transformers. Another textile mill in that state ordered $3,000 worth of inside wiring materials. A brick plant in the same state ordered one 333-kva. transformer and contemplates the immediate purchase of three 100-kva. transformers. The latter equipment may be ordered during the coming week. Purchases by contractors are generally small, though the larger contractors are buying a little better than the smaller. One contractor ordered this week $1,500 worth of conduit in one order.

Construction projects are as follows: The United Public Service Company, Chicago, plans extensions and improvements in the ice-manufacturing plants at Mobile, Ala., to cost about $100,000. The River Falls Power Company, River Falls, Ala., contemplates the construction of a power plant at River Falls, Ala., to cost about $150,000. The Southeast Georgia Power Company, Alma, Ga., will make extensions and improvements in its local power plant. Kingan & Company, Indianapolis, plan a cold storage and refrigerating plant on Peters Street, Atlanta, to cost about $100,000. The Mississippi Power & Light Company, Pine Bluff, Ark., plans a transmission line to Hazelhurst, Miss., and vicinity. The Tennessee Electric Power Company, Chattanooga, Tenn., plans an expansion and improvement program in 1928, to cost about $5,000,000, including power-plant and transmission-line extensions. Clarksville, Tenn., is considering an ornamental lighting system in the business district. The Union Carbide & Carbon Corporation, New York, plans an expansion program at plants in vicinity of South Charleston, W. Va., to cost about $4,000,000.

### *Motor Sales Are a Factor on Pacific Coast*

The week, according to one California manufacturer, has been distinguished by its orders for small motors, such as a $10,000 assortment of motors and parts for an oil-burner company, 275 1/20-hp. motors, valued at $3,500, for calculating machines, and 100 ¼-hp. motors and washing machines. The outstanding order of the week covered a 500-kw. rotary converter complete with transformer switchboard and accessories, total value $45,000, for a chemical company. Other wattmeter orders include 250 of residence type, value $3,000, for stock and installation in the Bay region and 220 watt-hour meters, also ten assorted transformers, sizes 15 kva. and 25 kva., for the Hawaiian Islands. The city of Seattle opened bids on valves and gates for the Diablo Dam, the low bidders being: Hendy, $12,798 for three butterfly valves, size 78 in.; Pelton, $24,980 for a 72-in. Johnson valve; Phillips & Davies, $120,000 for six caterpillar gates. The El Camino Irrigation District of Tehama County is requesting bids for six deep-well pumping plants complete. Alameda County has purchased $70,000 worth of Sturtevant ventilating equipment and motors, costing $14,000, for the Oakland estuary tube.

Sales of motors and heavier apparatus made last week in Seattle include about $135,000 for a 72-in. Johnson valve and for three caterpillar gates, one 8 ft x 10 ft. and two 15 ft. x 20 ft., for the Diablo Dam of the Skagit project of the city of Seattle; two switchboards, costing $15,000 each, for pulp and paper mills for the Zellerbach interests at Port Townsend and Hoquiam; 25 motors, from 50 hp. down, supplementing a former order for a hemlock mill in Tacoma; a 200-hp. motor and 10-in. pump to a sand and gravel company, and about 75 motors from 50 hp. down by several jobbers to dealers and to lumber mills for replacements. Pole-line distributors report one or more inquiries of consequence from a central-station company for poles and equipment for proposed transmission line, stating that sales are very light with indications for improvement fair. The city of Seattle within sixty days will buy about $20,000 worth of distributing transformers of from 250 kw. and down and $20,000 worth of weatherproof wire for local distribution.

Construction projects are as follows: The Texas-Louisiana Power Company, Fort Worth, plans a power plant and an ice plant at Duncan, Ariz., to cost about $125,000. Alhambra, Calif., is asking bids until Feb. 6 for the installation of an ornamental lighting system on a number of streets. Los Angeles has authorized an ornamental lighting system on Hillcrest Road, using pressed-steel standards. Los Banos, Calif., has plans maturing for an ornamental lighting system in the business district. Madera, Calif., has authorized an ornamental lighting system on F Street. Monrovia, Calif., has authorized an ornamental lighting system on a number of streets, using concrete standards. Riverside, Calif., has authorized an ornamental lighting system on Palm Avenue, Del Ray Court and other thoroughfares. Torrance, Calif., is completing plans for an ornamental lighting system on a number of streets in the business district. The Santa Ana County Supervisors have authorized plans for an improved lighting system on highways near Westminster, Calif., to cost $21,000. Caldwell, Idaho, plans an ornamental lighting system in the business district. Butte, Mont., is considering an ornamental lighting system on East Park Street. The Great Northern Utilities Company, Shelby, Mont., is considering an ice plant, to cost about $70,000. Albuquerque, N. M., has plans for an ornamental lighting system on South Second Street and West Copper Avenue. The Cascade Power Company, Brevard, N. C., has applied for permission for a hydro-electric power development on the Wenatchee River, near Wenatchee, Wash., to cost about $350,000. The Priest Rapids Ice & Cold Storage Company, White Bluff, Wash., plans a cold-storage and refrigerating plant.

### *Middle West Reports Excellent Business*

Good business has continued in the Middle West section this week. Its volume is appreciably large for the first part of the year, and indications are that it will continue. Industrial activity is noticeably good, building activity is getting under way nicely, and the railroads are coming into the market for equipment. Utility companies are figuring on large quantities of cable, and considerable purchasing of apparatus is going on, the sales including nine 20,000-kva. oil-insulated self-, water- and forced-oil-cooled, single-phase, 60-cycle power transformers; fifteen 2,222-kva. regulating transformers, one 150-kv. neutral kenotron cable-testing set, smoke uptakes and air ducts for three boilers complete with appurtenances, and meter-control equipment for three boilers complete with appurtenances. Cable manufacturers report an increase in the number of inquiries received, and pole-line hardware manufacturers are busy. Prices remain generally firm. Owing to a price war on lock nuts, bushings and outlet boxes, the established prices were cut considerably.

Current construction includes the following: Elgin, Ill., plans an ornamental lighting system on North Street, from Spring to Douglas Avenues. The Interstate Public Service Company, Goshen, Ind., has purchased the Midway Electric Company, Shipshewana, Ind., and plans extensions in transmission lines in that district. The Iowa Railway & Light Corporation, Cedar Rapids, Iowa, will build a transmission line from Gilbert to Story City, Iowa. Fordson, Mich., plans a municipal power plant. The Michigan Electric Power Company, Bad Axe, Mich., is arranging an expansion and improvement program in the "Thumb" district, to cost about $500,000, including transmission-line extensions. The Neligh Electric Light Company, Neligh, Neb., has approved plans for the construction of a power plant on Main Street, to cost $100,000. The Montana-Dakota Power Company, Minneapolis, is negotiating for the purchase of the distributing system at Williston, N. D., and plans extensions in the transmission lines. The Northern Ohio Produce Company, Cleveland, plans an ice and cold-storage plant on Woodland Avenue, to cost about $3,000,000. Elyria, Ohio, will build a power plant in connection with the proposed sewage-disposal system, to cost about $850,000. North Milwaukee, Wis., plans an ornamental lighting system on Villard Avenue. Stoughton, Wis., plans extensions and improvements in the municipal power plant. The National Ice & Coal Company, West Allis, Wis., has superstructure under way for an ice plant to cost in excess of $60,000.

# Activities of the Trade

## Changes in Allis-Chalmers Manufacturing Company

The Allis-Chalmers Manufacturing Company, Milwaukee, has opened a new district sales office at Phoenix, Ariz., covering Arizona, New Mexico and the northern part of Mexico. The office is at 308 Heard Building, with J. B. Cooper as manager. Mr. Cooper's headquarters were formerly in Los Angeles. A branch of the district office at Dallas has been opened at San Antonio, 619 Frost National Bank Building, with Earle R. Hury in charge. A branch of the Detroit district office is being opened at Grand Rapids, Mich., in the Weiss Service Building, with G. C. Culver in charge.

## Cutler-Hammer Company Opens Pacific Coast Offices

Since Jan. 1, 1928, the Pacific Coast offices of the Cutler-Hammer Manufacturing Company, Milwaukee, manufacturer of electric motor-control apparatus and allied lines, have been handled by its own sales organization at 970 Folsom Street, San Francisco; 229 Boyd Street, Los Angeles, and 2203 First Avenue, South, Seattle. The new sales district will be in charge of Fred H. Oberschmidt, a member of the Cutler-Hammer organization for more than fifteen years. Associated with Mr. Oberschmidt at the San Francisco headquarters office will be A. A. Tuffert and George P. Stone. Thomas N. Bristow will be in charge of the Seattle office and Edward G. Nelson of the Los Angeles office.

Complete stocks of standard items in the Cutler-Hammer line will be carried at all Pacific Coast offices. The company states that special arrangements have been completed whereby production and shipment of special equipment for the Coast, built in the Cutler-Hammer factories at Milwaukee and New York, will be given preferred attention. This is the second new sales district to be opened by the company within a short period. An office at Atlanta was recently established.

## National Carbon Company, Opens Branch Offices

The carbon sales division of the National Carbon Company, Inc., with general sales headquarters at Cleveland, has announced the opening on Jan. 3, 1928, of branch sales offices at the present brush service plants of the company in New York City, Chicago, Pittsburgh and Birmingham. The addresses of the newly established offices are as follows: 357 West Thirty-sixth Street, New York; 551 West Monroe Street, Chicago; Arrott Power Building, Barker Place, Pittsburgh, and 1824 Ninth Avenue, North, Birmingham. Complete sales and service organizations have been established at each office, and the customers of the company have been requested to address all orders and inquiries for carbon brushes and the other carbon specialties to the nearest branch sales office.

E. A. Williford, manager of the carbon sales division at Cleveland, announces the following appointments: J. A. Hammond, assistant manager in charge of carbon brush and specialty sales (Mr. Hammond will be at the headquarters office at Cleveland); E. R. Geib, assistant manager in charge of sales of illuminating carbons (Mr. Geib also will be at the headquarters in Cleveland); E. C. Friday, district manager in charge of the branch office at New York City; J. L. Green, district manager in charge of the branch office at Chicago; V. J. Nolan, district manager in charge of the branch office at Pittsburgh, and J. B. Collins, sales engineer in charge of the branch office at Birmingham.

The Gold Seal Electric Company, 250 Park Avenue, New York City, manufacturer of radio tubes, announces that it has taken over the business of the Gold Seal Electric Company of Cleveland, manufacturer of household electrical appliances. The company states that factories will be maintained in Cleveland, Ohio, and Newark, N. J., with executive sales offices at New York City.

The Chas. L. Ward Company, manufacturers' agent, 701 Midland Building, 1229 Baltimore Avenue, Kansas City, Mo., has added Western red cedar poles to its line, and has concluded an arrangement with B. J. Carney & Company, Minneapolis, to cover the states of Missouri, Kansas, Nebraska, Oklahoma, Arkansas and Texas.

The Rollway Bearing Company, Inc., Syracuse, N. Y., announces the opening of a Pittsburgh sales office at 614 Empire Building, Pittsburgh, in charge of Samuel Farrell, who for a number of years was in charge of the Youngstown (Ohio) office of the company.

The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, has recently added to its line of "Hotpoint" ranges the RA77 de luxe automatic electric range, the R102 and the R103 apartment-house models and the H52 kitchen heater furnished as an attachment to the R73, R74 and R77 ranges.

The Graybar Electric Company, Graybar Building, New York City, announces the following changes in its organization: J. F. Davis was appointed manager at Boston; A. R. Loughborough, manager at Pittsburgh; H. W. Dye, service and credit manager at Denver, replacing J. Hageman, who has been transferred to St. Louis; Louis Fiille has been elected secretary, and Martin Wagner, assistant secretary.

The Railway & Industrial Engineering Company, Greensburg, Pa., announces that E. L. Flowers, formerly in the New York office, has been transferred to the Boston office as district manager, superseding Patrick O'Moore, who has resigned.

The Black & Decker Manufacturing Company, Towson, Md., manufacturer of portable electric tools, has acquired the Van Dorn Electric Tool Company, of Cleveland, Ohio.

John G. Oliver, formerly connected with the Greensboro district of the Georgia Power Company, has been transferred to Gainesville in the same capacity.

# New Equipment Available

## Switch House Designed for Maximum Accessibility

A sheet-steel weatherproof switch house equipped with roof bushings for direct connection to disconnecting switches and overhead bus structures, with space for different-sized circuit breakers, potential transformers and secondary control and metering equipment, has been placed on the market by the Condit Electrical Manufacturing Corporation, Boston. No twists are necessary in the connections within the house or in those leaving it. All apparatus is easily accessible. Circuit-breaker tanks are readily removed through the rear doors. The front and rear of the control and metering panel are conveniently reached, facilitating the testing of connections, meters and relays. All auxiliary wiring is in conduit and test terminals are provided.

Automatic reclosing service can be furnished with either alternating-current or direct-current supply, the service being of one or more closing cycles with constant or varying time delay. Protruding channel-iron sills drilled for anchor bolts facilitate lifting and handling. The switch house is constructed of sheet-steel plates electrically welded, and the roof overlaps the four walls, affording a weatherproof construction.

## Single-Operator Welder

A single-operator welder rated at 300 amp., one hour, 50 deg. C. temperature rise, is announced by the General Electric Company as the latest addition to its standard line of welding equipment. This machine includes a four-bearing, ball-bearing motor-generator set with flexible coupling. With this equipment the manufacturers claim a rapid and simple interchange of motors may be made by the user. The generator is so designed that field control is unnecessary and is eliminated. The generator panel includes an ammeter and a voltmeter which have a metal front except for the glass over the scale, thus minimizing the possibility of breakage.

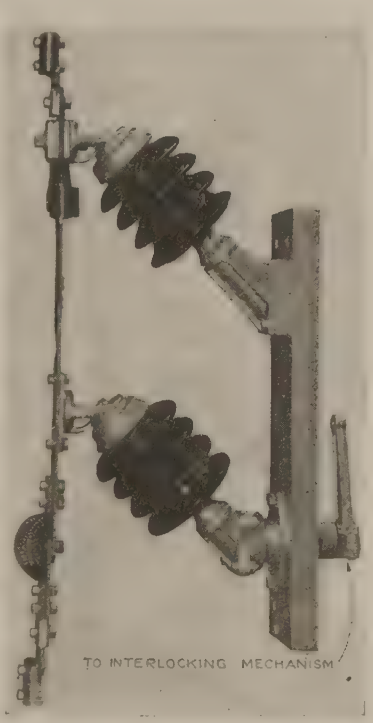
Belt, motor or engine drive may be used with the generator, which is designed for either stationary or portable use. The unit can be used as both a manufacturing and a repair tool.

## General-Purpose Motor

A starterless general-purpose squirrel-cage motor has been placed on the market by the Star Electric Motor Company, Newark, N. J. The new motor is said to be similar in every way to the standard single squirrel-cage general-purpose motor and retains all of the desirable features of that type. The unit is made in sizes up to 30 hp., and has synchronous speeds of 900, 1,200 and 1,800 r.p.m. for general industrial application. The starting current inrush is said to be within the National Electric Light Association requirements, without impairment of efficiency and power factor. Like all Star motors, this line is equipped with large ball bearings which offer long-life characteristics with low frictional losses.

## Outdoor Gang-Operated Disconnecting Switch

A gang-operated outdoor disconnecting switch, which is particularly applicable for installations where extra insulation is required, such as in substations located near the seacoast where salt air and fog tend to reduce the insulator flashover, has been developed by the Delta-Star Electric Company, Chicago. The switch illustrated is equipped with fog-type insulators having a very large leakage surface. The insulator units are of the same height and interchange with the standard petticoat "unit-type" insulators used for equipment of the same voltage rating.



GANG-OPERATED OUTDOOR DISCONNECTING SWITCH WITH FOG-TYPE INSULATOR

This switch is of the side-break type, requires but two insulators per pole and is furnished with double self-aligning full-floating contacts. The base dimensions are the same as the base dimensions of single pole-hook-stick-operated switches, thus making the change to this gang-operated switch a simple matter.

## Network Protector

The type CM-2 network protector, placed on the market by the Westinghouse Electric & Manufacturing Company, is said by the company to represent in several respects, a radical departure from existing standards in design and arrangement of network protector equipment.

The CM-2 protector includes, as standard equipment, a three-element polyphase relay, a single-phase phasing relay, a silver-faced contactor-type main circuit breaker isolated by liberal barriers, and an operating mechanism, which may be either motor- or solenoid-closing and can be equipped with either a 24-volt shunt trip or a 20 per cent drop-out undervoltage release trip. All control wiring and relays are mounted on a separate-hinged steel panel which may be swung out to give free access to the main panel. All control wiring is held in place by cleats on the back of the relay panel, thus making it simple to trace out circuits. The relays are mechanically held in place on the steel panel by the same screws that make the electrical connections to them. Any internal relay circuit may, therefore, be tested by removing the proper screws. The new scheme of control wiring in conjunction with the three-element high-torque polyphase relay and the phasing relay have provided positive assurance against any type of pumping, regardless of system conditions or primary voltage now known. The control circuits may be "killed" without disturbing the main unit by opening a two-pole knife switch and removing two-clip-type fuses which have been provided for protection of this equipment.

The new protectors are available in 800-amp. and 1,200-amp. sizes, both subway and open type, and later a 2,000-amp. protector also will be marketed. No major changes have been made in the 250-amp. and 500-amp. units, except the addition of the polyphase and phasing relays and the disconnecting features which permit isolating the unit from the system. In general, the basic features claimed by the company for the design of the new type CM-2 protector are improved operating characteristics, a minimum number of parts, accessibility, ease of maintenance, compactness, light weight and fool-proof operation.

SMALL TURBO-GENERATOR UNIT.—A direct-connected turbo-generator unit having a rating of 3 kw. has been recently placed on the market by the Westinghouse Electric & Manufacturing Company. This apparatus has been developed to meet the demand for a high-grade small non-condensing steam-turbo-generator lighting set for use with oil-well rigs, steam shovels, isolated pumping plants and for general outdoor construction work. The generator coils are specially impregnated, and all parts requiring such protection are heavily sherardized to meet conditions of applications such as marine service.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Dec. 24, 1927)

1,653,947. Electrically Controlled Indicating Instrument; H. L. Decker, Toledo, O. App. filed Aug. 23, 1926.

1,653,951. High-Frequency Coil; E. B. Featherstone, Toledo, O. App. filed Nov. 13, 1922.

1,653,961. Electricity Meter; F. Holden, Hampstead, London, England. App. filed April 22, 1926. In which a conducting bell or armature rotates in a body of mercury while being acted upon by a magnetic field.

1,653,999. Battery Connection; W. E. Goodwin, Cedar Bluff, Va. App. filed Sept. 21, 1926.

1,654,038. Lining for Dry Cells; C. P. Feibel, Lakewood, O. App. filed Dec. 15, 1924.

1,654,046. Process for the Production of Arc Light Electrodes; L. Kahl, Berlin-Dahlem, Germany. App. filed May 31, 1923

1,654,047. Strain Insulator; J. S. Lapp, Le Roy, N. Y. App. filed May 10, 1922.

1,654,085. Voltage Limiting Device; G. T. Lorance, New York, N. Y. App. filed Oct. 21, 1925. For limiting the voltage applied to a specific part of a transmission system.

1,654,097. Alternating Current Supply Means; W. J. Shackelton, Scotch Plains, N. J. App. filed Oct. 8, 1923. To reduce fluctuations in the voltage across the terminals of the secondary winding of a transformer when a variable voltage is impressed upon the primary winding.

1,654,139. Open Electric Furnace; P.L.J. Miguet, St.-Julien-De-Maurienne, France. App. filed Sept. 29, 1926.

1,654,143. Electric Terminal; T. C. Russell, Chicago, Ill. App. filed July 23, 1926. Adaptable in electrical heating devices, such as flatirons.

1,654,150. Illuminating Appliance; W. W. Thompson, Dorchester, Mass. App. filed July 16, 1923. For use in the sick room of a hospital.

1,654,162. Lighting Fixture; L. C. Doane, Meriden, Conn. App. filed Sept. 17, 1924.

1,654,177. Self-Centering Core for Dry Batteries; H. M. Koretzky, Hoboken, N. J. App. filed Dec. 31, 1924.

1,654,212. Insulator for High Tension Electric Current; W. Deutsch, Frankfort-on-the-Main, Germany. App. filed Feb. 4, 1924.

1,654,227. Dry Cell; H. Vignon, Paris, France. App. filed Nov. 4, 1925.

1,654,254. Connecter for Electrical Conductors; W. F. Hendry, Ossining, N. Y. App. filed Jan. 7, 1924. For use with push-button switches or the like and as a connecting clip or binding post.

1,654,273. Electric Hair Drier; W. G. Shelton, New York, N. Y. App. filed Oct. 4, 1924.

1,654,282. System of Control; R. E. de Camp, Wilkinsburg, Pa. App. filed Nov. 20, 1919. For controlling the sequence of operation of a plurality of electromagnetic switches for controlling the operating circuits of dynamo-electric machines.

1,654,292. Electric Heating Unit; A. D. Keene, Pittsburgh, and K. Ehrgott, East Pittsburgh, Pa. App. filed Feb. 10, 1925, for electric ranges.

1,654,302. Control Apparatus; H. R. Meyer, Wilkinsburg, Pa. App. filed July 15, 1920. For electric railway vehicles.

1,654,303. Automatic Transformer Switching System; C. McL. Moss, Pittsburgh, Pa. App. filed March 23, 1922.

1,654,305. Ventilation of Dynamo Electric Machines; S. G. Nottage, Murraysville, Pa. App. filed Aug. 6, 1925.

1,654,306. Laminated Core; P. Paszkowski, Irvington, N. J. App. filed Jan. 22, 1925.

1,654,308. Electrical Measuring Instrument; R. T. Pierce, East Pittsburgh, Pa. App. filed May 12, 1923. Alternating-current ammeter or voltmeter mechanism.

1,654,309. Circuit Interrupter; K. C. Randall, Edgewood Park, Pa. App. filed April 18, 1922. Governed by conditions in the circuit which it is desired to control.

1,654,315. Quick-Acting Thermal Relay; R. J. Wensley, Edgewood, Pa. App. filed April 6, 1923.

1,654,316. Circuit Interrupter System; W. R. Wickerham, Pittsburgh, Pa. App. filed Oct. 5, 1923. For use on systems of electrical distribution adapted to supply energy from a common distributing circuit to a plurality of feeder circuits.

1,654,317. Voltage Balancing Regulator; J. H. Ashbaugh, Pittsburgh, Pa. App. filed Jan. 2, 1926.

1,654,338. Supporting Means for Electrical Conductors; A. M. MacFarland, Wilkinsburg, Pa. App. filed Dec. 29, 1923. Embodied in resistance units and electric heaters.

1,654,350. Block Letter Sign; W. G. Shelton, New York, N. Y. App. filed Nov. 7, 1924.

1,654,360. Regulator System; J. H. Ashbaugh, Wilkinsburg, Pa. App. filed Oct. 4, 1924. Incorporating a short-circuit protective device.

1,654,373. Electrical Switch Mechanism; F. A. Holt, Elmhurst, N. Y. App. filed June 2, 1923. For use as a circuit controller in flashlights or the like.

1,654,382. Metallic Arc-Welding Apparatus; F. C. Owen, Fayetteville, N. C. App. filed Feb. 12, 1925.

1,654,394. Liquid Rheostat; C. C. Whittaker and D. C. West, Pittsburgh, Pa. App. filed Nov. 5, 1923.

1,654,419. Electric Furnace; A. E. Greene, Medina, Wash. App. filed Nov. 23, 1922.

1,654,467. Explosive Blow-Out Switch; J. P. Medlin, Great Falls, Mont. App. filed Nov. 25, 1925.

1,654,475. Connecter Device; C. W. Wyman, Claremont, N. H. App. filed April 8, 1922. For use in coal mining for the purpose of making running and fixed contact with the trolley wires employed in the entries of such mines.

1,654,483. Circuit Controller; J. M. Johnson, Kansas City, Mo. App. filed Oct. 17, 1921.

1,654,505. Automatic Station; S. G. Leonard, Lakewood, O. App. filed Dec. 29, 1925.

1,654,508. Flexible Cable; C. R. Boggs, Waban, Mass. App. filed Feb. 11, 1926.

1,654,511. Electrical Interlocking Mechanism; D. L. Galusha, Bronxville, N. Y. App. filed April 3, 1924.

1,654,518. Centrifugal Mechanism for Electric Switches and Other Apparatus; L. S. Walle, Scotia, N. Y. App. filed June 8, 1922.

(Issued Jan. 3, 1928)

1,654,521. Safety Toggle-Break Switch; E. E. Anderson, Chicago, Ill. App. filed Jan. 12, 1925. High-tension switch with a distant control.

1,654,523. Refrigerator Control Mechanism; W. E. Bihl, Chicago, Ill. App. filed June 8, 1923.

1,654,534. Electrical Insulator; E. A. Dean, Oak Park, Ill. App. filed Sept. 28, 1923. High voltage.

1,654,546. Electric Cable; F. S. Malm, Chicago, Ill. App. filed April 6, 1923. Submarine cable.

1,654,551. Fluid-Heating Device; K. Muhleisen, Philadelphia, Pa. App. filed Dec. 20, 1924.

1,654,562. Electric Flash Welding or Heating Machine; A. C. Taylor, Warren, Ohio. App. filed Oct. 3, 1923.

# New Trade Literature

POWER FOR IRRIGATION.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a special publication No. 1786, entitled "The Modern Power for Irrigation," which gives information necessary to estimate and install electrically driven pumps in any conditions encountered in irrigation projects, as well as the various phase of irrigation.

SWITCHING AND PROTECTIVE EQUIPMENT.—Bulletins GEA-570A, GEA-572, GEA-545B, GEA-841 and GEA-880 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its hand-starting compensators for squirrel-cage induction motors, automatic switching equipment for synchronous converters in mining service, automatic supervisory, selector-type equipment for control and indication of remote power apparatus, its CR7006-D 26 magnetic switch and CR4409 protective panels for providing overload and undervoltage protection for direct-current crane motors.

MOTORS AND GENERATORS.—Bulletins GEA-61A, GEA-63A, GEA-529A, GEA-858 and GEA-873 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate type CD constant-speed direct-current motors from 3 hp. to 200 hp., type GTE motors for gearless traction elevators, low-speed synchronous motors for direct connection to reciprocating compressors, low-speed direct-current commutating pole generators for direct connection to steam or internal-combustion engines and the improved brush holders for GE-70 and GE-80 railway motors.

BAFFLE WALL.—The Boiler Engineering Company, 931 Federal Trust Building, Newark, N. J., has issued a bulletin describing the "Beco" baffle wall. Drawings as well as photographs of typical installations are included.

LIGHTING UNITS, TRAFFIC SIGNALS AND AIRPORT LIGHTS.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-373A, GEA-313A, GEA-740A, GEA-742A and GEA-906, covering the "Novalux" ornamental units, forms 8 and 9; "Novalux" electric traffic signals, "Novalux" traffic signal control apparatus, and airport boundary lights, respectively.

STEELPLATE BLOWER.—Bulletin No. 3504 issued by the American Blower Corporation, Detroit, describes and illustrates the type SE steelplate blower. This bulletin supersedes bulletin No. 2004.

GROUND-RESISTANCE TESTER.—Bulletin No. 1165 issued by James G. Biddle, 1211 Arch Street, Philadelphia, covers the "megger" ground-resistance tester for testing the resistance to earth of all types of ground connections. A diagram of connections is included, and complete directions for the operation of the instrument are given.

CUT-OUTS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-732A, describing and illustrating the "D & W" oil-fuse cut-outs, type D.

SCREWS, BOLTS, RIVETS AND NUTS.—A catalog issued by the Pheoll Manufacturing Company, 5700 Roosevelt Road, Chicago, describes and illustrates its screws, bolts, rivets and nuts. This catalog contains reference tables, including the "American Standard Screw Threads" and the recently adopted standard dimensions and tolerances for screws, bolts, rivets and nuts.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase or agency is desired in Cairo, Egypt (No. 29,004), for electrical appliances, bells, switches, sockets, and general supplies.

An agency is desired in Cairo, Egypt (No. 29,005), for electrical appliances, plain and colored insulated wire, switches, sockets, shades, etc.

An agency is desired in Berlin, Germany (No. 29,006), for electrochemical specialties.

Purchase and agency are desired in Milan, Italy (No. 29,003), for electric hair-cutting machines.

An agency is desired in Auckland, New Zealand (No. 29,008), for electric household appliances.

An agency is desired in Hamburg, Germany (No. 29,079), for electric household appliances.

Purchase and agency are desired in Hanover, Germany (No. 29,002), for message-transmitting devices for hotels and electric laboratory stoves.

An agency is desired in Quebec, Canada (No. 29,001), for small electric household refrigerators.

An agency is desired in Milan, Italy (No. 29,044), for trolley wire.

Direktionsrat Deck, Elektrizitaetswerke in Wien, Mariannengasse 4, Vienne IX, is desirous of obtaining catalogs of various electrical household appliances including electric cooking devices.

The city of Riga, Latvia, plans a new power plant about the latter part of 1929 at Kremershof across the river Duna from Riga.

The city of Sherbrooke, Quebec, Canada, will construct a dam and a power house at Westbury, Quebec.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## Possibilities of Increase in Residential Energy Sales

ANALYSIS of operating statistics for 1926 of 70 systems in various parts of the United States, all but a few of them having more than 30,000 residential customers, shows a range of nearly six to one in the average annual energy consumption per residential customer. The smallest is 231 kw.-hr., the largest is 1,290. Regional averages fall between 335 and 455 kw.-hr. per residential customer, with the exception of the Mountain states, where the unusually high consumption reported by one large company materially raises the average. The weighted average for all the companies is about 400 kw.-hr. The national average for the entire electric light and power industry, taking into account the numerous small properties, is probably somewhat lower and seems to justify the generalization that the average residential customer in the United States takes about 1 kw.-hr. a day.

The highest sales per customer are in the West. Low long-hour rates possible with water power, combined with other favorable local conditions, probably go far to account for that condition. If small operations could be included the showing might not be so good.

The comparison between companies suggested by such a chart as the one here presented is not entirely fair. Its chief weakness lies in the lack of a universally accepted and accurate definition of "customer" or "consumer," hence the figures reported under this heading by different companies do not necessarily all mean the same thing. For that reason companies have not been designated. But in a national sense it makes little difference if some of the points are moved up or down, even so much as 5 per cent. The variation in the basis on which the returns may be made can scarcely amount to more than that. Another small change would be made by using the average number of customers rather than the number at the end of the year, if the former had been available.

The high results attained by some companies cannot be expected in all cases. Conditions differ. But as growth by the acquisition of new customers proceeds more and more slowly, greater attention is necessary to the problem of increasing consumption by those already on the lines. The advantages of electric service are well known; there is no lack of desire on the part of the public to avail itself of them. Long-hour use of electricity is of advantage to both buyer and seller.

But where this is not recognized and encouraged, the consumer is virtually subjected to a handicap against using those load builders that are competitive with non-electrical devices. If greater residential energy consumption is desired, and that generally means a more liberal use of oil-burners, ranges, refrigerators, and other off-peak devices, it must be conscientiously fostered by salesmanship and, in particular, by suitable rate structures.

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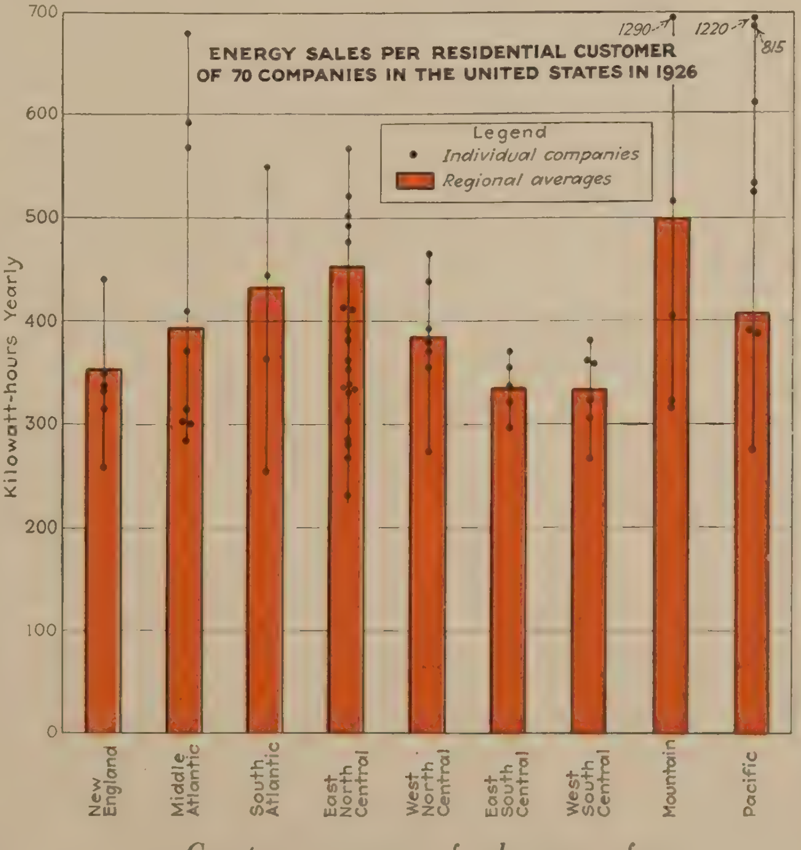
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.



*Company averages of sales range from 231 to 1,290 kw.-hr. per year*

# 1927 Industrial Operations in the Middle Atlantic States Were 0.7 Per Cent Under 1926

REPORTS on the consumption of electrical energy by the manufacturing plants operating in the Middle Atlantic States indicate that the rate of productive operations in 1927 as a whole was about 0.7 per cent under those witnessed during 1926. During the first quarter of 1927 industrial operations were continually under the same period of 1926, but during the remainder of the year operations have been at times slightly over those reported for the same months in 1926. In general the year closed with the rate of productive operations slightly over those at the close of 1926.

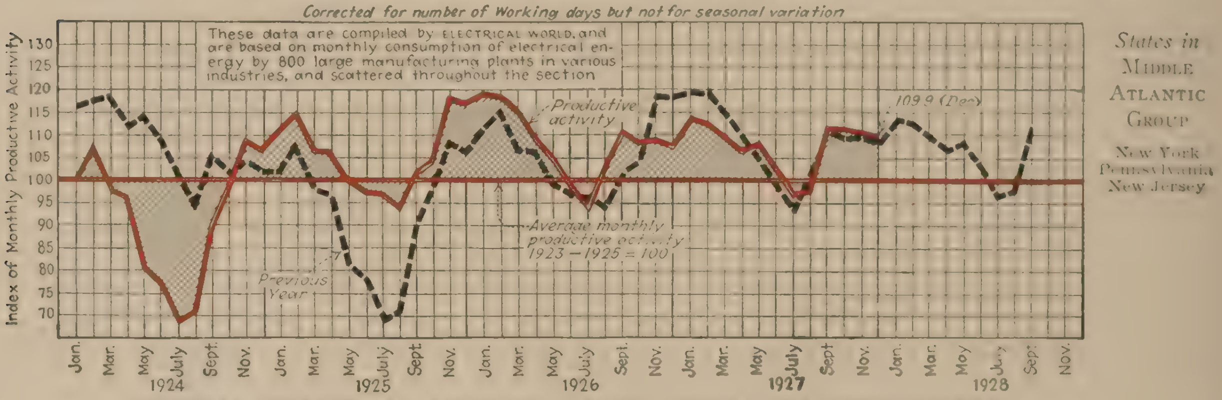
The leather and its products industry was the only primary industrial group in the Middle Atlantic States to report December operations over those of the previous November. The rolling mills and steel plants were operating at a rate 4.5 per cent under November, and the operations in the ferrous and non-ferrous working plants during December were 5.5 per cent under November. The textile industry reported December productive activities 7.6 per cent over December, 1926.

*Indexes of Productive Activity in the Middle Atlantic States*

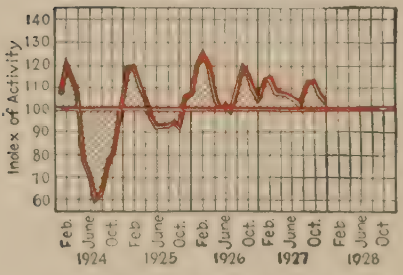
Figures Adjusted for Number of Working Days

| | Dec., 1927 | Nov., 1927 | Dec., 1926 | Average for Full Year, 1927 | Average for Full Year, 1926 |
|---|---|---|---|---|---|
| All industries | 109.9 | 110.4 | 107.3 | 107.5 | 108.4 |
| **Automobile, including parts and equipment** | **104.0** | **109.7** | **52.1** | **101.5** | **114.7** |
| Chemical and allied products | 107.3 | 114.3 | 106.2 | 108.4 | 114.3 |
| Food and kindred products | 97.0 | 101.0 | ..... | ..... | ..... |
| **Leather and its products** | **115.0** | **113.5** | **123.4** | **101.9** | **98.7** |
| **Lumber and its products** | **104.5** | **117.2** | ..... | ..... | ..... |
| Ferrous and non-ferrous metal working plants | 101.5 | 107.7 | ..... | ..... | ..... |
| Rolling mills and steel plants | 101.4 | 106.3 | 104.8 | 105.6 | 111.3 |
| Paper and pulp | 123.5 | 127.0 | 125.4 | 122.6 | 117.3 |
| **Stone, clay and glass** | **97.6** | **106.7** | ..... | ..... | ..... |
| Textiles | 120.0 | 121.2 | 111.5 | 108.4 | 102.2 |

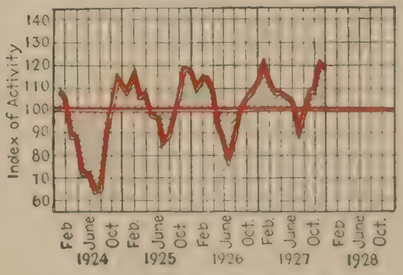
ELECTRICAL WORLD *Barometer of Industrial Activity in the Middle Atlantic States*



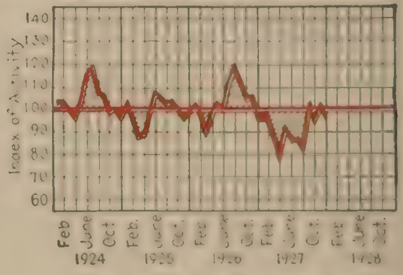
GENERAL INDUSTRIAL ACTIVITY IN THE MIDDLE ATLANTIC STATES



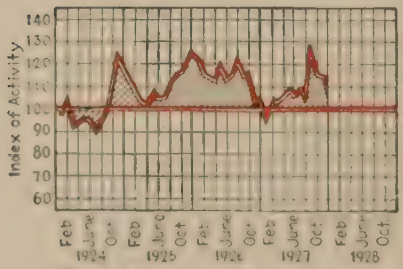
Metal Industries



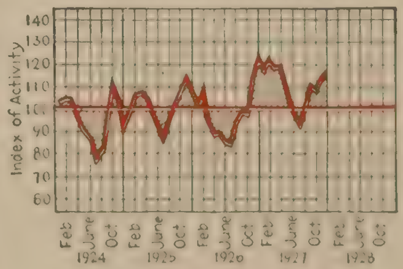
Textile Industry



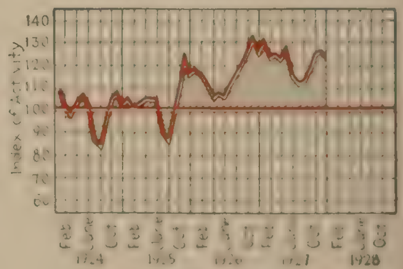
Food Industry



Chemical and Allied Products



Leather Industry



Paper and Pulp

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE MIDDLE ATLANTIC STATES

# Electrical World

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*Editor*

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## *"Just a Fair Living"*

IN THESE words Martin J. Insull, speaking at last week's public relations conference of the operating companies of the New England Public Service Company, at Augusta, Me., summarized the material results of hard work in the electric light and power industry. Pointing out that the tangible reward of shouldering big burdens to carry electric service to an ever-increasing public is only a fair living, the speaker declared that the chief incentive for such heavy toil is the satisfaction of "making two blades of grass grow where one grew before, which is the final reason for wanting to accomplish anything big and worth-while." The truth of Mr. Insull's phrasing may be questioned by those who have never looked behind the scenes into rooms where bankers, utility executives, department heads and operating engineers grapple with the problems of system development and service betterment, or by those who have missed the thrill brought by a comprehension of the devotion of staffs and employees to duty under conditions that tax human endurance to the extreme. It will not be scoffed at by those who realize the limited returns on capital associated with public utility activities, the joy in creating efficient organizations and *materiel* to serve all society electrically, and the privilege of sharing in the advancement of the most wonderful of the modern useful arts. These are compensations unknown to the profiteer, members of whose species are few and far between in the habitats of the light and power industry.

* * * *

## *Economic Factors Govern Bond Prices*

LAST summer the ratio between demand and supply of power and light bonds was temporarily deranged, and the supply on bankers' shelves accumulated inconveniently. Referring to the incident recently, a representative of one of the largest institutional investors in the country said to a group of bankers: "You gentlemen and the borrowers of capital have been reveling for about two years in a sellers' market. In such a period it is not surprising that the strong wine of success and prosperity should go to your heads, making you disregard some of the reasonable needs of the investor, making you forget that the capacity of the buyer is not boundless and that his appetite can in time be dulled by constantly boosted prices. This was the reason for the painful attack of indigestion last June."

Evidence is lacking that there has been any factor in the price rise beyond the economic relation between supply and existing or potential demand—accelerated, of course, by aggressive marketing activities. If insufficient attention be paid to the timing of new issues, so that too many are placed on the market at one time, what has been called indigestion will naturally occur. Fortunately, investment bankers have commenced to pay more attention to this point. But recent financing has been carried on at still lower rates than those ruling last summer, and new issues are being absorbed very readily. The price of money is determined by a combination of economic factors which authorities generally agree point to still lower levels for power and light financing, in view of the fact that these issues have been selling out of line in relation to railroad issues and possibly others of lower yield and that their merit is just now being appreciated. The rise in price does not seem to require any explanation involving artificial manipulation.

* * * *

## *Senator Walsh Restricts the Scope of His Resolution*

HEARINGS before the Senate committee on interstate commerce to determine whether or not there shall be an investigation of the electric light and power industry, and if so what the scope of that investigation shall be, were resumed on Tuesday last. Up to that time the public utilities had not been heard nor had any case been made against them. However, representatives of the state public service commissions were very outspoken and effective in their demand that Congress do not encroach on the rights of sovereign states in any investigation it may order. In fact, the burden of their testimony indicated that the state commissions have handled and can handle the situation satisfactorily in so far as the ultimate consumer and the rates he pays for service are concerned. Even where electricity crosses state lines, joint action by the commissions of the states involved has been effective. Investment bankers and large investors in public utility securities, such as insurance companies, have also urged the necessity of caution on the part of the interstate commerce committee lest public confidence in the financial stability of the public utilities be shaken and they experience difficulty in raising the billions needed for extensions and betterments of service in every part of the country.

The most significant event of the hearing up to the time mentioned, however, has been the fact that Senator Walsh, when confronted with legal objections to the elaborateness of the investigation he proposed, offered to modify his resolution and restrict its scope. Thus the entire situation may be changed. As a result the utility companies, which might previously have been expected to oppose the resolution even more vigorously than the commissioners, bankers and insurance companies had done, may find watchful waiting more effective than elaborate defense.

## *Aviation and Transmission Lines*

LANDING is one of the most difficult operations in aviation, particularly during forced descents. It will probably remain a great hazard unless some revolutionary development such as the neutralization of gravity by other than mechanical means comes about. Among the many dangers of a forced landing at night is the possibility that the descent may end by a collision with one of the electric transmission lines which are spreading over the whole country.

Near and around many flying fields this danger is now guarded against by placing red lights on a sufficient number of the poles to indicate the location of the line. It is not now practicable thus to indicate the positions and routes of transmission lines throughout their whole lengths, but such precautions are being asked for, and it is certain that the future will see not only a great increase in the number of such requests, but probably also the substitution of demands in the place of requests. Already one large interconnected system has been asked so to indicate some of its lines along traveled air lanes. It would not be impossible to mount a floodlamp and a small transformer on every transmission pole and tower in the country. But it would probably be impossible to operate any line so equipped satisfactorily. Furthermore, the power companies can hardly be expected to spend the money to do it.

However, is it necessary that the problem be solved in this way? Possibly a satisfactory solution is already at hand. Claude and other glow-tube illuminants are already finding large commercial applications. They require high voltages at the tube terminals. High voltages are available at the ends of the cross-arms on every transmission pole and tower. To the observer in the sky twenty years from now perhaps the earth at night will be an eerie sight to look upon, with varicolored glowing lines marking the routes of transmission. Or electromagnetic radiations from the transmission lines may be used through the medium of detectors on the airplanes to indicate proximity of danger.

* * * *

## *Definitions Needed for Industry Terms*

MANY words used by electrical men have not been defined. Such a word is "interconnection." It may mean a transmission system, a tie line, a network or a busbar for generating stations. A definite economic meaning is a transmission line between two electrical systems of different ownership in which energy may flow in either direction. Another modification would mean a line between two separately operated electrical systems in which energy may flow in either direction. If there is no provision for two-way energy flow between individual systems, the term "transmission line" should be used. As now used, "interconnection" gives as loose a conception of actualities as does "superpower" or "giant power."

"Load factor" and "capacity factor" continue to be used as economic yardsticks. But they are not so valid as in the days when electrical systems became connected together. On many properties energy is purchased in large amounts or is sold to other utilities in large amounts. In other cases generating-station equipment is used as a regulatory device for system voltage or power-factor control. These developments in operating practice call for a revision of old terms or the addition of new terms. A load factor and plant factor based on owned generating equipment and the energy it produces have value, but system load and plant factors wherein all generated and purchased energy and equipment are considered are of greater economic importance. Many utilities now mix generated energy, purchased energy and owned and interconnected generating capacity to give meaningless load and capacity factor values. Utility practice should be more uniform.

It is important that terms used in economic measures and comparisons be defined more rigidly. New and useful terms may be needed to measure values on the present extended systems. A study of these things would be worth-while work for the N. E. L. A. and A. I. E. E. committees most intimately concerned with the formulation of definitions. Electrical men should talk the same language and should be precise in their use of words.

* * * *

## *Criticism and Praise for the Commercial Section*

PROGRESS in the commercial thinking of the power industry has been very clearly mirrored at the group meeting of the N.E.L.A. Commercial Section committees in recent years. Last week eleven of these committees were in session in Chicago, with more than two hundred men in attendance. Out of this gathering come some very definite reflections.

No one can deny that the Commercial Section is on the march. It has been fortunate in the energetic leadership of a small group of men who recognize not only the opportunity but the responsibility that waits upon their action. And so, particularly in the last two years of Chairman Davidson's administration, there have been more purpose, more courage and more spirit in the work. But there still remains one very fundamental weakness in the situation that needs deliberation and attention. Frankly, there is far too great a willingness among the sales managers who journey to these meetings to devote themselves to the criticism of the programs offered by the chairmen of the committees, with a complete disregard on their own part of any obligation to contribute to the planning. The committee chairmen were well chosen this year. They have been conscientious in their efforts. But the lingering impression of last week's meetings was one of discouragement that these men, with bumper attendance, could secure so little active assistance and support out of their meetings from men eager-minded to improve the planning and promote its application.

Some gratifying progress was made, however, by several of the groups. The general merchandising committee made an outstanding contribution in bringing to a successful close a series of joint conferences with the national associations of the other retailers of electrical appliances, the purpose of which was to define some guiding principles by which to mold the oft-conflicting merchandising policies of both the power companies and the competing trades. Chairman Greenwood has rendered a splendid service by this achievement and deserves the thanks of the industry. His committee is also undertaking a broad laboratory and field study of the oil burner and is launching a national contest to promote residence consumption. The electrical advertising and power committees also are showing enterprise.

More than ever is seen the need for a commercial executive at headquarters who can assist committee work, support and stimulate the chairmen, develop a more orderly procedure and bring continuity of purpose and program. Chairman Davidson announced that such a man would probably be appointed within a few weeks. This is good news.

* * * *

## *Needed Betterments in Interconnection Practice*

As LOADS upon interconnected systems increase the pressure upon operators to furnish service of the highest grade over wide areas grows apace. Managers with vision are thinking intently about ways and means of improving practice. Fine work has been done in the past in this field, but in some cases development has been so rapid that erratic service and unfortunate interruptions have crept into operation, and these need to be taken in hand at once. If matters are allowed to drift, some power companies may have to discontinue interconnected operation in order to maintain the quality of service demanded by economic conditions in certain areas of major importance, and the art will be retarded by just so much.

Several lines of treatment are indicated, as our medical friends express it. Among these are improved communication, better records of intersystem procedure as apart from log-sheet data, the maintenance of increased local reserve capacity ready for immediate use, more intercompany visits and co-operative discussions by engineers and operators, interchange of written information and data along broader lines, provision for the education of load dispatchers in the more professional phases and larger problems of intersystem working, and the devotion of more engineering study to the problems of system ties and allied apparatus from the standpoint of service reliability.

It would take many pages to discuss each of these betterments thoroughly. Steps are being taken on many properties to eliminate the handicaps of inadequate communication under normal conditions, as well as to provide for emergencies. Too much indirect communication still hampers operators seeking to act promptly with complete understanding of conditions outside their own systems. Rapid progress is being made in the application of selective telephone equipment to carrier transmission over power wires, and good headway is also being made in the improvement of ordinary wire facilities between points hitherto reached circuitously. Space radio appears to have possibilities, at least in emergencies, but we shall know more about this in the near future. In the field of records, loose-leaf systems offer a means of more effectively preserving comments, notes and data bearing upon specific interconnection problems than the log sheet permits, and it would be helpful if a wider interchange of forms for such work took place.

Executives are responding in progressive companies to the appeal of more complete instrumentation in connection with tie-in service, and considerable work is being done on the problem of obtaining simultaneous load readings. Operators are getting better acquainted by personal contacts brought about through such means as the New England System Operators' Club, for example, and by at least occasional visits to neighboring dispatching offices. Reserve capacity is still too much neglected locally, many operating men apparently thinking that this can be cut to the bone under interconnection, whereas sudden reversed demands of the order of from 20,000 kw. to 60,000 kw. are not uncommon in large work, with their decidedly "bumpy" effect on regulation and frequency control. The installation of more than one high-powered transmission circuit on a single tower line is being questioned, and so it goes. These and other live issues need to be faced very frankly in view of their bearing upon quality of service. Protection against lightning is a vital problem in interconnection. In some areas 90 per cent of the tie-in troubles have been credited to Nature's heavy artillery, and the economic side of such protection in relation to load values presses for consideration.

* * * *

## *Midwinter Meeting of Leagues Shows Trend from Talk to Work*

SOME men have felt that the league conferences held each year at Association Island have provided too little time for the discussion of the practical problems of operating a local electrical league. The major purpose at "the Island" has been to interpret the league movement to the industry, and to the league men their responsibility to national policies. Therefore a midwinter conference of league officials was held last week in Chicago devoted entirely to questions of local administration and development. About a hundred men were present, representing thirty-five active leagues that are engaged in promotion work, scattered from Boston to Denver and from Winnipeg to New Orleans. It was an earnest, hard-working meeting that lasted two days and was enthusiastically voted a successful experiment.

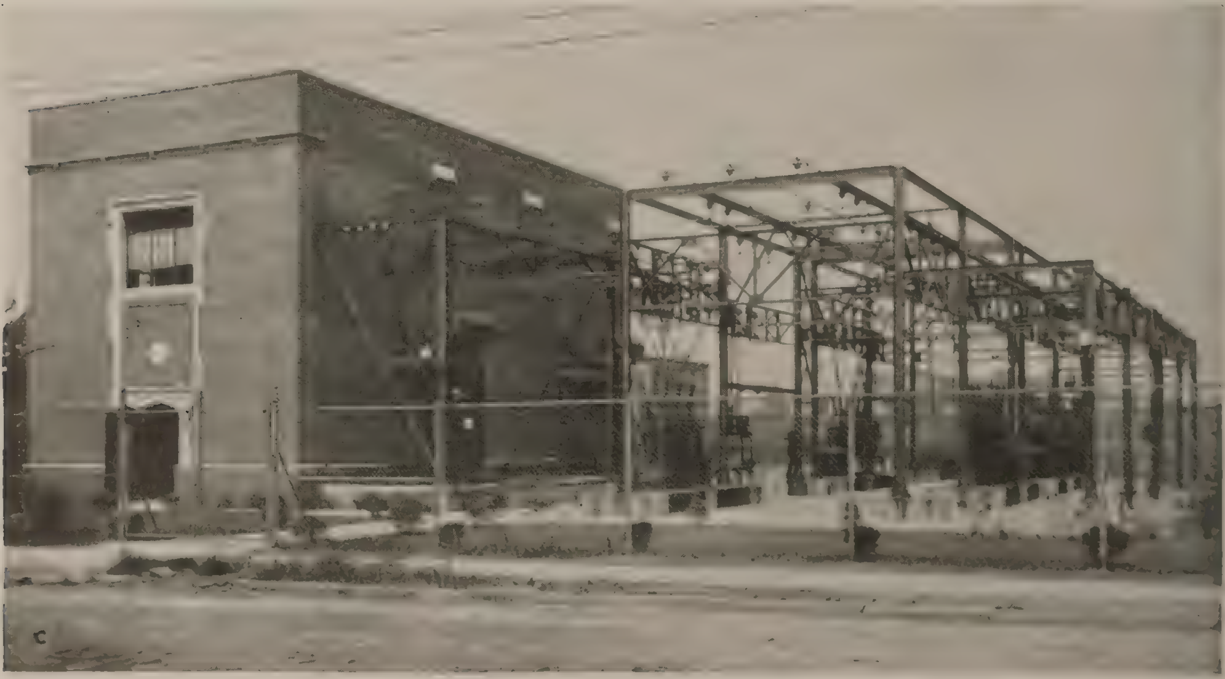
It would seem that here also co-operation is trending out of the talking stage into the working stage, and the league men are becoming less concerned with their local independence in policy and program and more interested in tying into national movements that offer practical opportunities for effective co-ordination in market development. A few years ago every league felt that to operate the "red seal" plan each city should set its own standard of adequacy in house wiring. But last week they voted to establish a national specification so that the idea may be nationally advertised and adapted to the thousands of house plans that now emanate from agencies doing a country-wide business. And the "red seal" plan is now being revised to remove former restrictions and facilitate its use, so that the leagues can put more power behind the present movement to make house wiring adequate. Here lies the chief immediate purpose in league thinking—which is as it should be.

Another encouraging sign was the frank discussion of the small house-wiring contractor as a league responsibility. He does not belong to the league at present. But it was agreed that the league must reach him and influence him to do a more adequate job. Also, there was a demand for more service from the members of the League Council, that these men should take responsibility for visiting all the leagues of their districts, to bring them the outside viewpoint and to study league problems more closely as of growing importance in the making of national plans. The council will take on this broader function. It was a meeting of unusual interest and very satisfying results.

# Modern Jersey Substations

THE Public Service Corporation of New Jersey has been engaged in a major program of substation building. High-voltage switching stations have been built with a view to future interconnections and extension of the 132-kv. transmission system. These substations use the supported bus structure design. A second type, designed for large city service, incorporates a control building with an outdoor installation. A third design serves small towns or isolated industrial plants.

A—Athenia switching station.
B—Outdoor substation for serving Princeton.
C—Bergen Point substation for local service.



# Economy of High Efficiency

## in the Medium-Sized Power Station

Method of analysis outlined. High-temperature steam justified. Effect of capacity factor and fuel cost is dominant

By Alfred Iddles

*Chief Engineer Day & Zimmermann Engineering & Construction Company*

*Many large power stations have warranted the installation of equipment that will give very high economy in operation. High pressures and temperatures, air heaters and economizers, water-cooled furnaces with high rates of heat absorption and other advanced practices have been used successfully. Prospects for the design and installation of many small stations make it advisable to evaluate these advances in the art for the smaller plants. In this article Mr. Iddles has outlined a method of attack in detail. The data will vary in an individual case and local conditions will modify conclusions, but the method of analysis is general and should serve as a guide to station designers. Mr. Iddles used specific data to make clear the method, and it is hoped that this article will stimulate design thinking for the medium-sized power station.*—Editor.

POWER plant design has received a great deal of engineering attention during the last ten years. With the increasing cost of coal it became economically possible and necessary to get higher efficiencies. Whereas before the war stations producing power at 2 lb. of coal per kilowatt-hour were considered very efficient, we now have large central stations that produce a kilowatt-hour for about 1 lb. of coal. The question often arises whether the higher investment and maintenance charges do not overshadow the reduced fuel costs of these highly efficient plants and whether it is advisable for small and medium-sized power plants to install the heat-saving devices used by these large modern stations. Quite often it is reasoned that if high efficiency pays for the larger stations, it must also be advantageous for the smaller plants.

So many variables enter into the production costs of electric energy that no direct answer can be given to these problems; each plant design should be considered on its own merits, subject to the variables applying to that plant, such as price of fuel, load, etc. Nevertheless it is possible to make fair comparisons between different plant designs and to predict fairly accurately which layout will be the most economical at various loads and fuel prices. It is the purpose of this article to show comparative production costs of various designs for a medium-sized power plant.

### Basic Assumptions for Design

Assume that a power plant is needed which has to produce 125,000,000 kw.-hr. per year and that the daily loads are about as follows: eight hours at 7,500 kw., thirteen hours at 16,000 kw. and three hours at 25,000 kw. With three 10,000-kw. turbo-generators the load can be carried very economically and in case of serious trouble to one of the units the peak load can still be carried on two machines. Three 1,000-hp. boilers would carry the peak load when operated at about 300 per cent rating and four boilers should be installed in order to have a spare.

### Fixing Steam Pressure and Temperature

In determining steam conditions pressures over 400 lb. will likely not be considered, since it would require reheating of the steam between the high- and low-pressure stages, which of course would be too complicated and costly for a plant of this size. Comparing production costs with steam at (*a*) 250 lb., 600 deg. F.; (*b*) 250 lb., 700 deg. F., and (*c*) 400 lb., 700 deg. F. ought to give a fair idea of which steam condition to select. The following conditions will obtain if these assumptions are made:

| | (*a*) | (*b*) | (*c*) |
|---|---|---|---|
| Steam consumption, lb. per kw.-hr. at 28½ in., vacuum | 11.25 | 10.3 | 9.9 |
| Heat in steam, B.t.u., per lb. | 1,313 | 1,362 | 1,356 |
| Heat in feed water, B.t.u., per lb. | 180 | 180 | 180 |
| Heat supplied by boiler, per lb. of steam | 1,133 | 1,182 | 1,176 |
| Heat supplied by boiler, per kw.-hr. | 12,780 | 12,200 | 11,640 |

With 13,000 B.t.u. coal and 75 per cent boiler efficiency 125,000,000 kw.-hr. per year will require:

(1) 125,000,000 × (12,780 — 12,200) ÷ (13,000 × 0.75 × 2,000) = 3,725 tons of coal more for 250-lb. 600-deg. F. steam than for 250-lb. 700-deg. F. steam.

(2) 125,000,000 × (12,200 — 11,640) ÷ (13,000 × 0.75 × 2,000) = 3,600 tons of coal more for 250-lb. 700-deg. F. steam than for 400-lb. 700-deg. F. steam.

(3) 125,000,000 × (12,780 — 11,640) ÷ (13,000 × 0.75 × 2,000) = 7,325 tons of coal more for 250-lb. 600-deg. F. steam than for 400-lb. 700-deg. F. steam.

The pumping of boiler-feed water to the 400-lb. pressure boilers would require 480,000 kw.-hr. per year more than pumping to 250-lb. pressure boilers; this necessitates the burning of about 300 tons of coal per year more to feed the high-pressure boilers, so that there will be required (1) 3,725 tons of coal more for 250-lb.

600-deg. F. steam than 250-lb. 700-deg. F. steam, (2) 3,300 tons of coal more for 250-lb. 700-deg. F. steam than for 400-lb. 700-deg. F. steam, (3) 7,025 tons of coal more for 250-lb. 600-deg. F. steam than for 400-lb. 700-deg. F. steam.

The differences in first cost of plants for the three conditions named occur mainly in the boilers, superheaters, boiler-feed pumps, piping and condensing equipment. These costs will be about as follows:

| | (*a*) | (*b*) | (*c*) |
|---|---|---|---|
| Four boilers and superheaters | $112,000 | $120,000 | $130,000 |
| Two feed pumps | 12,000 | 12,000 | 17,000 |
| Piping | 200,000 | 200,000 | 210,000 |
| Condensing equipment | 90,000 | 85,000 | 80,000 |
| Total | $414,000 | $417,000 | $437,000 |

Thus the difference in first cost of the plants will be:

$$b - a = \$3{,}000$$
$$c - b = 20{,}000$$
$$c - a = 23{,}000$$

The difference in investment charges and maintenance costs at 15 per cent will be as follows:

$$b - a = 3{,}000 \times 0.15 = \$450 \text{ per year}$$
$$c - b = 20{,}000 \times 0.15 = 3{,}000 \text{ per year}$$
$$c - a = 23{,}000 \times 0.15 = 3{,}450 \text{ per year}$$

The curves in Figs. 1, 2 and 3 have been constructed to show the actual decrease in production costs under the different steam conditions considered with different prices of coal and energy output. These curves give evidence that steam at 400-lb. pressure 700 deg. F. is the more advantageous unless coal is very cheap and the capacity factor very low.

### AIR HEATERS AND ECONOMIZERS CONSIDERED

For the reasons stated we shall consider only steam conditions of 400 lb. 700 deg. F. in the following computations and shall investigate whether it is advisable to install air preheaters or economizers, or air preheaters and economizers. We have then the following four cases:

Case I: Three 10,000-kw. turbo-generators.
Four 1,000-hp. boilers with superheaters.

Case II: Three 10,000-kw. turbo-generators.
Four 1,000-hp. boilers with superheaters.
Four air preheaters (assume 10,000 sq.ft. each).

Case III: Three 10,000-kw. turbo-generators.
Four 1,000-hp. boilers with superheaters.
Four economizers (assume 6,000 sq.ft. each).

Case IV: Three 10,000-kw. turbo-generators.
Four 1,000-hp. boilers with superheaters.
Four air preheaters (10,000 sq.ft. each).
Four economizers (6,000 sq.ft. each).

It is generally conceded that it is economical to heat the feed water with steam extracted from the turbines and to use motor-driven auxiliaries. Using this method for feed-water heating, we can proceed to calculate the steam requirements:

*Case I:*

The steam requirements to generate power will be as follows:

8 hours at 7,500 kw. × 9.9 = 74,300 lb. per hour
13 hours at 16,000 kw. × 9.9 = 158,400 lb. per hour
3 hours at 25,000 kw. × 9.9 = 247,500 lb. per hour

The live steam added at throttle for steam extracted to heat feed water to 270 deg. F. will be as follows: 8 hours at 6,000 lb. per hour, 13 hours at 12,850 lb. per hour and 3 hours at 20,000 lb. per hour.

Thus the total steam to the turbine throttle will be:

8 hours at 74,300 plus 6,000 = 80,300 lb. per hour
13 hours at 158,400 plus 12,850 = 171,250 lb. per hour
3 hours at 247,500 plus 20,000 = 267,500 lb. per hour

If 2 per cent is assumed for soot blowers and losses, then the total steam to be generated in the plant will be:

8 hours at 80,300 plus 1,600 = 81,900 lb. per hour
13 hours at 171,250 plus 3,425 = 174,675 lb. per hour
3 hours at 267,500 plus 5,350 = 272,850 lb. per hour

To generate this steam the boilers will probably be operated as follows: 8 hours, two boilers at 136 per cent rating; 13 hours, three boilers at 195 per cent rating, and 3 hours, three boilers at 304 per cent rating.

The efficiencies of the steam-generating units, will be about as follows:

| Rating, Per Cent | Efficiency, Per Cent | Steam Per Pound of Coal |
|---|---|---|
| 150 | 75 | 8.78 |
| 200 | 73 | 8.55 |
| 300 | 70 | 8.2 |

With these efficiencies the coal used per year for Case I will be as follows:

$$365 \times 8 \times \frac{81{,}900}{8.78} = 27{,}200{,}000 \text{ lb.} = 13{,}600 \text{ tons}$$

$$365 \times 13 \times \frac{174{,}675}{8.55} = 97{,}000{,}000 \text{ lb.} = 48{,}500 \text{ tons}$$

$$365 \times 3 \times \frac{272{,}850}{8.2} = 36{,}500{,}000 \text{ lb.} = 18{,}250 \text{ tons}$$

Total = 80,350 tons

*Case II:*

The steam to be generated is the same as in Case I, the efficiencies of the steam-generating units will be about:

| Rating, Per Cent | Efficiency, Per Cent | Steam per Pound of Coal |
|---|---|---|
| 150 | 81 | 9.48 |
| 200 | 79 | 9.24 |
| 300 | 77 | 9.0 |

The coal used per year with these efficiencies will be:

$$365 \times 8 \times \frac{81{,}900}{9.48} = 25{,}200{,}000 \text{ lb.} = 12{,}600 \text{ tons}$$

$$365 \times 13 \times \frac{174{,}675}{9.24} = 89{,}800{,}000 \text{ lb.} = 44{,}900 \text{ tons}$$

$$365 \times 3 \times \frac{272{,}850}{9.0} = 33{,}200{,}000 \text{ lb.} = 16{,}600 \text{ tons}$$

Total = 74,100 tons

*Case III:*

Steam requirements to generate power:

8 hours at 7,500 kw. × 9.9 = 74,300 lb. per hour
13 hours at 16,000 kw. × 9.9 = 158,400 lb. per hour.
3 hours at 25,000 kw. × 9.9 = 247,500 lb. per hour

Live steam added at the throttle for steam extracted to heat feed water to 210 deg. F. will be:

8 hours at 3,250 lb. per hour, 13 hours at 7,000 lb. per hour and 3 hours at 10,800 lb. per hour.

The total steam to the turbine will then be:

8 hours at 74,300 plus 3,250 = 77,550 lb. per hour
13 hours at 158,400 plus 7,000 = 165,400 lb. per hour
3 hours at 247,500 plus 10,800 = 258,300 lb. per hour

Adding 2 per cent for soot blowers and losses, then the total steam to be generated will be:

8 hours at 77,500 plus 1,550 = 79,100 lb. per hour
13 hours at 165,400 plus 3,300 = 168,700 lb. per hour
3 hours at 258,300 plus 5,160 = 263,460 lb. per hour

The efficiencies of the steam-generating units will be about:

| Rating, Per Cent | Efficiency, Per Cent | Steam Per Pound of Coal |
|---|---|---|
| 150 | 83 | 9.22 |
| 200 | 81 | 8.99 |
| 300 | 79 | 8.77 |

The coal used per year will therefore be:

$$365 \times 8 \times \frac{79{,}100}{9.22} = 25{,}050{,}000 \text{ lb.} = 12{,}525 \text{ tons}$$

$$365 \times 13 \times \frac{168{,}700}{8.99} = 89{,}000{,}000 \text{ lb.} = 44{,}500 \text{ tons}$$

$$365 \times 3 \times \frac{263{,}460}{8.77} = 32{,}800{,}000 \text{ lb.} = 16{,}400 \text{ tons}$$

Total = 73,425 tons

*Case IV:*

The steam to be generated is the same as in Case III; the efficiencies of the steam-generating units will be:

| Rating, Per Cent | Efficiency, Per Cent | Steam Per Pound of Coal |
|---|---|---|
| 150 | 86 | 9.54 |
| 200 | 84 | 9.32 |
| 300 | 82 | 9.1 |

The coal used per year will then be:

$$365 \times 8 \times \frac{79{,}100}{9.54} = 24{,}200{,}000 \text{ lb.} = 12{,}100 \text{ tons}$$

$$365 \times 13 \times \frac{168{,}700}{9.32} = 86{,}000{,}000 \text{ lb.} = 43{,}000 \text{ tons}$$

$$365 \times 3 \times \frac{263{,}460}{9.1} = 31{,}700{,}000 \text{ lb.} = 15{,}850 \text{ tons}$$

Besides the equipment which the plants in the four cases have in common, Case I has three high-pressure closed heaters; Case II has three high-pressure closed heaters, four air preheaters and larger fans and motors; Case III has four economizers and larger fans and motors; Case IV has four economizers, four air preheaters and larger fans and motors.

To house the power plant equipment for the four cases, the turbine room will be the same size in each case, but the size of the boiler room will vary about as follows:

Case I: 150 × 55 × 50 = 412,500 cu.ft.
Case II: 150 × 65 × 50 = 487,500 cu.ft.
Case III: 150 × 65 × 50 = 487,500 cu.ft.
Case IV: 150 × 65 × 50 = 487,500 cu.ft.

### Comparative Costs of Plants

The first cost of the power plant in each of these four cases will be a constant, *C*, plus an amount depending on each installation:

| | |
|---|---|
| Case I costs: | *C* |
| Three bleeder heaters with piping | $10,000 |
| | *C* plus $10,000 |
| Engineering and construction, 25 per cent | 0.25 (*C* plus 10,000) |
| Total | 1.25 (*C* plus $10,000) |

| | |
|---|---|
| Case II costs: | *C* |
| Three bleeder heaters with piping | $10,000 |
| Four air preheaters | 40,000 |
| Ductwork for air preheaters and insulation | 10,000 |
| Extra for larger fans and motors | 3,000 |
| Extra for larger building | 22,500 |
| | *C* plus $85,500 |
| Engineering and construction, 25 per cent | 0.25 (*C* plus 85,500) |
| Total | 1.25 (*C* plus $85,500) |

| | |
|---|---|
| Case III costs: | *C* |
| Four economizers | $70,000 |
| Extra for larger fans and motors | 2,000 |
| Extra for larger building | 22,500 |
| | *C* plus $94,500 |
| Engineering and construction, 25 per cent | 0.25 (*C* plus 94,500) |
| Total | 1.25 (*C* plus $94,500) |

| | |
|---|---|
| Case IV costs: | *C* |
| Four economizers | $70,000 |
| Four air preheaters | 40,000 |
| Duct work for air preheater and insulation | 10,000 |
| Extra for larger fans and motors | 4,000 |
| Extra for larger building | 22,500 |
| | *C* plus $146,500 |
| Engineering and construction, 25 per cent | 0.25 (*C* plus 146,500) |
| Total | 1.25 (*C* plus $146,500) |

In all probability the same number of operators and laborers will be required to operate the power plant in each of the four cases. The maintenance cost, however, will vary.

If *M* is the maintenance cost on the equipment, which all cases have in common, then the maintenance costs will be:

Case I: *M* plus $300
Case II: *M* plus $2,500
Case III: *M* plus $3,000
Case IV: *M* plus $4,500

The difference in energy required for auxiliaries depends principally on the loads on the forced and induced draft fans. The energy required for these fans will be:

Case I, Induced Draft Fans:
8 hours, two fans at 30 kw. = 480 kw.-hr.
13 hours, three fans at 45 kw. = 1,760 kw.-hr.
3 hours, three fans at 60 kw. = 540 kw.-hr.
Forced Draft Fans:
8 hours, two fans at 30 kw. = 480 kw.-hr.
13 hours, three fans at 40 kw. = 1,560 kw.-hr.
3 hours, three fans at 50 kw. = 450 kw.-hr.
5,270 kw.-hr. per day

Case II, Induced Draft Fans:
8 hours, two fans at 70 kw. = 1,120 kw.-hr.
13 hours, three fans at 85 kw. = 3,320 kw.-hr.
3 hours, three fans at 100 kw. = 900 kw.-hr.
Forced Draft Fans:
8 hours, two fans at 45 kw. = 720 kw.-hr.
13 hours, three fans at 55 kw. = 2,150 kw.-hr.
3 hours, three fans at 75 kw. = 675 kw.-hr.
8,885 kw.-hr. per day

Case III, Induced Draft Fans:
8 hours, two fans at 70 kw. = 1,120 kw.-hr.
13 hours, three fans at 85 kw. = 3,320 kw.-hr.
3 hours, three fans at 100 kw. = 900 kw.-hr.
Forced Draft Fans:
8 hours two fans at 30 kw. = 480 kw.-hr.
13 hours, three fans at 40 kw. = 1,560 kw.-hr.
3 hours, three fans at 50 kw. = 450 kw.-hr.
6,830 kw.-hr. per day

Case IV, Induced Draft Fans:
8 hours, two fans at 95 kw. = 1,520 kw.-hr.
13 hours, three fans at 110 kw. = 4,290 kw.-hr.
3 hours, three fans at 150 kw. = 1,350 kw.-hr.
Forced Draft Fans:
8 hours, two fans at 45 kw. = 720 kw.-hr.
13 hours, three fans at 55 kw. = 2,150 kw.-hr.
3 hours, three fans at 75 kw. = 675 kw.-hr.
10,705 kw.-hr. per day

If *E* is the coal required per year to generate the auxiliary power for Case I, then the auxiliary power for the other cases requires:

Case II:
$E$ plus $(3{,}615 \times 1.25 \times 365) \div 2{,}000 = E$ plus 825 tons of coal
Case III:
$E$ plus $(1{,}560 \times 1.25 \times 365) \div 2{,}000 = E$ plus 356 tons of coal
Case IV:
$E$ plus $(5{,}435 \times 1.25 \times 365) \div 2{,}000 = E$ plus 1,240 tons of coal

The total coal consumed exclusive of banking will then be:

Case I: 80,350 plus $E$ plus 0 = $E$ plus 80,350 tons per year
Case II: 74,100 plus $E$ plus 825 = $E$ plus 74,925 tons per year
Case III: 73,425 plus $E$ plus 356 = $E$ plus 73,781 tons per year
Case IV: 70,950 plus $E$ plus 1,240 = $E$ plus 72,190 tons per year

The fixed charges on the power plant installation will include interest on the investment, depreciation, taxes and insurance and will probably form an annual charge of 13 per cent on the money invested. The fixed charges in the four cases will then be:

Case I: 1.25 ($C$ plus 10,000) × 0.13
Case II: 1.25 ($C$ plus 85,500) × 0.13
Case III: 1.25 ($C$ plus 94,500) × 0.13
Case IV: 1.25 ($C$ plus 146,500) × 0.13

The total production costs consist of the following principal items: (*a*) fuel, (*b*) maintenance and supplies, (*c*) labor, (*d*) fixed charges.

The total production costs will therefore be:

Case I: (*a*) $(E + 80{,}350)$ tons of coal, (*b*) $(M + 300)$ dollars, (*c*) L, (*d*) $1.25\ (C + 10{,}000)\ 0.13$ dollars. Total, constant $K + 1{,}925$ dollars $+ 80{,}350$ tons of coal.

Case II: (*a*) $(E + 74{,}925)$ tons of coal, (*b*) $(M +$

2,500) dollars, (*c*) *L*, (*d*) $1.25(C + 85{,}500)$ 0.13 dollars. Total, constant $K$ + 16,400 dollars + 74,925 tons of coal.

Case III: (*a*) $(E + 73{,}781)$ tons of coal, (*b*) $(M + 3{,}000)$ dollars, (*c*) *L*, (*d*) $1.25(C + 94{,}500)$ 0.13 dollars. Total, constant $K$ + 18,350 dollars + 73.781 tons of coal.

Case IV: (*a*) $(E + 72{,}190)$ tons of coal, (*b*) $(M + 4{,}500)$ dollars, (*c*) *L*, (*d*) $1.25(C + 146{,}500)$ 0.13 dollars. Total, constant $K$ + 28,300 dollars + 72,190 tons of coal.

The difference in production costs of these plants for various coal prices, is given in the following table, which shows these costs above constant $K$:

| Price of Coal... | $1 | $2 | $3 | $4 | $5 | $6 | $7 |
|---|---|---|---|---|---|---|---|
| Case I.. | $82,275 | $162,625 | $242,975 | $323,325 | $403,675 | $484,025 | $564,375 |
| Case II. | 91,325 | 166,250 | 241,175 | 316,100 | 391,025 | 465,950 | 540,875 |
| Case III. | 92,131 | 165,912 | 239,693 | 313,474 | 387,255 | 461,036 | 534,817 |
| Case IV. | 100,490 | 172,680 | 244,870 | 317,060 | 389,250 | 461,440 | 533,630 |

The difference in production costs with various fuel prices is shown in graphical form in Fig. 4. All the foregoing calculations are based on an annual output of 125,000,000 kw.-hr., which for the size plant under consideration is about a 50 per cent capacity factor. In order to ascertain what the difference in production costs would be with a 25 per cent capacity factor, the graphs in Fig. 5 have been prepared.

### STOKERS OR PULVERIZED FUEL

Consider now whether it is advisable to install stokers or pulverized coal equipment for these four boilers. The opinion has often been expressed that burning coal in pulverized form will produce much higher efficiency than when burned on stokers. The results obtained with stoker-fired installations at the plants of the Brooklyn Edison Company, the Philadelphia Electric Company and at Hellgate show, however, that practically just as good results can be obtained with stoker-fired boilers as with pulverized coal. The heat balances for both kinds of firing show that the losses are about the same except that the stoker-fired boilers show more ashpit losses. These ashpit losses run especially high when the boilers are forced to high ratings. On account of these ashpit losses, we shall credit the pulverized fuel-fired boilers with 3 per cent less fuel consumption in the following calculations.

Comparing power plants built recently, we find that the boiler room of the bin-type pulverized-coal plant exceeds the boiler room of the stoker-fired plant about 20 ft. in height. The combustion chamber of the pulverized coal-fired boiler is also considerably larger than the combustion chamber of the stoker-fired boiler. The building and the boiler settings of the pulverized-coal plant will therefore be more expensive than those of the stoker-fired plant.

Since difference in cost will all be in the boiler house, we shall compare these costs only. The cost of the boiler house for the pulverized coal plant will be:

| | |
|---|---|
| Boiler house, building | $245,000 |
| Pulverized fuel equipment (no driers) | 100,000 |
| Boilers and superheaters | 130,000 |
| Boiler settings | 85,000 |
| Fans and motors | 18,000 |
| Ash-removal equipment | 15,000 |
| Steel plate work | 30,000 |
| Miscellaneous equipment | 130,000 |
| Total | $753,000 |

The cost of the boiler room for the stoker-fired plant will be:

| | |
|---|---|
| Boiler house, building | $195,000 |
| Underfeed stokers | 80,000 |
| Boilers and superheaters | 130,000 |
| Boiler settings | 55,000 |
| Fans and motors | 30,000 |
| Ash-removal equipment | 15,000 |
| Steel-plate work | 25,000 |
| Miscellaneous equipment | 125,000 |
| Total | $655,000 |

The pulverized-coal plant will thus cost $98,000 more than the stoker-fired plant, exclusive of engineering and construction charges.

The labor for the boiler room of the pulverized-coal plant will be as follows:

| | Per Month |
|---|---|
| Firemen, three at $160 | $480 |
| Boiler-room helpers, three at $125 | 375 |
| Coal-handling men, three at $125 | 375 |
| Coal-preparation men, four at $145 | 580 |
| Fan men, three at $145 | 435 |
| Locomotive crane engineer | 200 |
| Locomotive crane fireman | 160 |
| Ash man | 125 |
| Superintendence | 300 |
| | $3,030 |
| Or, per year | $36,360 |

The labor for the boiler room of the stoker-fired plant will be:

| | Per Month |
|---|---|
| Firemen, three at $160 | $480 |
| Assistant firemen, three at $195 | 435 |
| Boiler-room helpers, three at $125 | 375 |
| Coal-handling men, three at $125 | 375 |
| Ash men, two at $125 | 250 |
| Fan men, three at $145 | 435 |
| Locomotive crane engineer | 200 |
| Locomotive crane fireman | 160 |
| Superintendence | 300 |
| | $3,010 |
| Or per year | $36,120 |

In accordance with published results, obtained in modern plants of recent date, the annual charges for maintenance and supplies for the pulverized coal plant will be:

| | |
|---|---|
| Pulverized-fuel equipment | $7,500 |
| Boiler settings | 8,500 |
| Fans and motors | 900 |
| Ash-removal equipment | 750 |
| Miscellaneous equipment | 4,000 |
| Total | $21,650 |

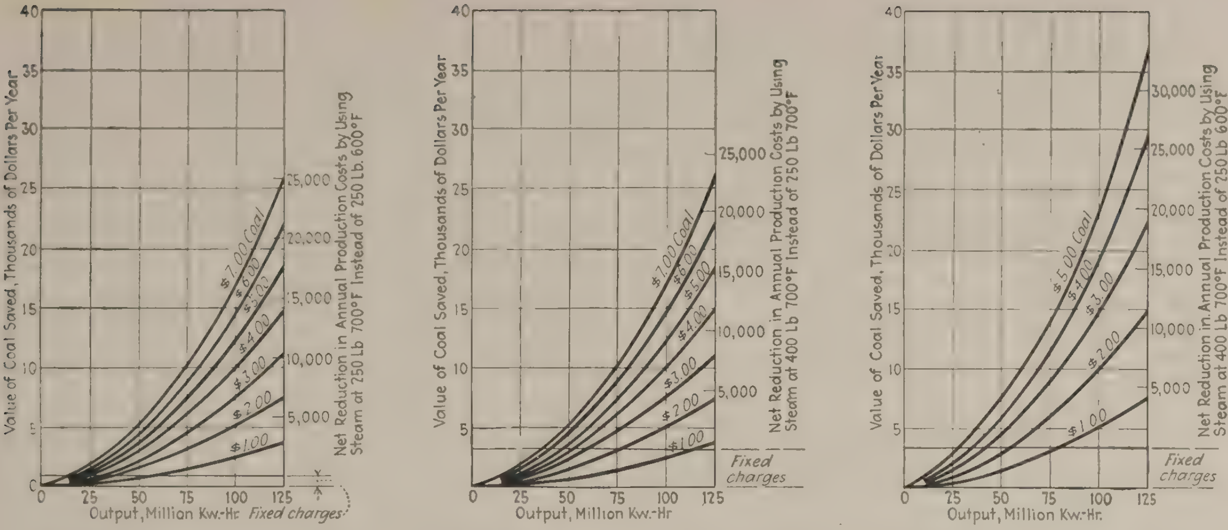
The annual charges for maintenance and supplies for the stoker-fired plant will be:

| | |
|---|---|
| Stokers | $7,500 |
| Boiler settings | 5,500 |
| Fans and motors | 1,500 |
| Ash-removal equipment | 1,500 |
| Miscellaneous equipment | 3,750 |
| Total | $18,750 |

The maintenance costs for the pulverized-coal plants are, therefore, $2,900 per year more than the maintenance costs of the stoker-fired plant.

The maintenance of the pulverized-coal plant is then:

Case I: ($M$ plus 300 plus 2,900) = $M$ plus 3,200
Case II: ($M$ plus 2,500 plus 2,900) = $M$ plus 5,400
Case III: ($M$ plus 3,000 plus 2,900) = $M$ plus 5,900
Case IV: ($M$ plus 4,500 plus 2,900) = $M$ plus 7,400



FIGS. 1, 2 AND 3—NET ECONOMY IN ANNUAL PRODUCTION COSTS EFFECTED BY DIFFERENT COMBINATIONS OF STEAM PRESSURE AND TEMPERATURE AT DIFFERENT YEARLY OUTPUTS

The energy required for auxiliaries in the boiler room of the pulverized-coal plant will be:

| | Case I | Case II | Case III | Case IV |
|---|---|---|---|---|
| Fans | 1,520,000 | 3,100,000 | 2,500,000 | 3,950,000 |
| Pulverized-fuel equipment | 1,950,000 | 1,800,000 | 1,770,000 | 1,730,000 |
| Coal handling | 80,000 | 75,000 | 75,000 | 72,000 |
| Total kw.-hr. per year | 3,550,000 | 4,975,000 | 4,345,000 | 5,752,000 |

The coal used to generate this energy will be: Case I, 2,200 tons; Case II, 3,100 tons; Case III, 2,700 tons; Case IV, 3,600 tons.

The energy required for auxiliaries in the boiler room of the stoker-fired plant will be:

| | Case I | Case II | Case III | Case IV |
|---|---|---|---|---|
| Fans and stokers | 2,000,000 | 3,200,000 | 2,600,000 | 4,050,000 |
| Coal handling | 85,000 | 80,000 | 80,000 | 75,000 |
| Total kw.-hr. per year | 2,085,000 | 3,280,000 | 2,680,000 | 4,125,000 |

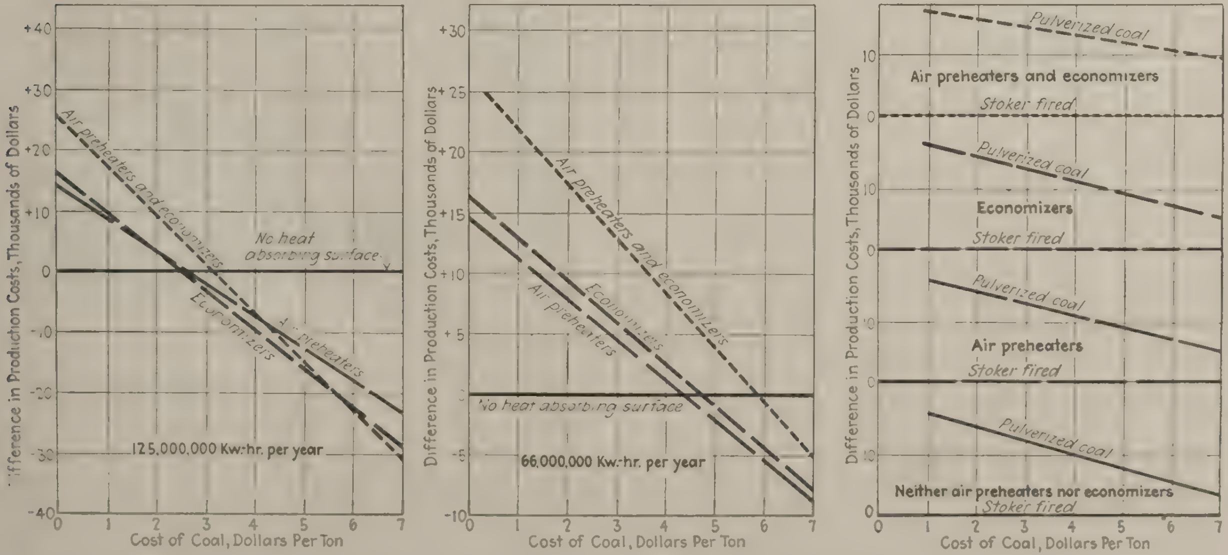
The coal used to generate this energy will be: Case I, 1,300 tons; Case II, 2,050 tons; Case III, 1,670 tons; Case IV, 2,580 tons.

The coal used for starting pulverized-coal furnaces will be about 200 tons per year, while the coal used for banking stoker-fired furnaces will be about 1,000 tons per year.

The coal used per year by the stoker-fired plant will be:

Case I: $E$ plus 80,350 tons
Case II: $E$ plus 74,925 tons
Case III: $E$ plus 73,781 tons
Case IV: $E$ plus 72,190 tons

The coal used per year by the pulverized coal plant will be:



FIGS. 4, 5 AND 6—ECONOMY OF HEAT-ABSORBING SURFACE IN FLUE GASES AT TWO CAPACITY FACTORS AND RELATIVE ECONOMY OF STOKERS AND PULVERIZED FUEL BASED ON PRODUCTION COSTS AND FUEL PRICES

Case I: $E$ plus 0.97 (80,350) plus 920–800 = $E$ plus 78,060 tons
Case II: $E$ plus 0.97 (74,925) plus 1,050–800 = $E$ plus 72,927 tons
Case III: $E$ plus 0.97 (73,781) plus 1,030–800 = $E$ plus 71,797 tons
Case IV: $E$ plus 0.97 (72,190) plus 1,020–800 = $E$ plus 70,244 tons

The fixed charges on the pulverized-coal plant will be:

Case I: 1.25 ($C$ plus 10,000 plus 98,000) 0.13 = 1.25 ($C$ plus 108,000) 0.13
Case II: 1.25 ($C$ plus 85,500 plus 98,000) 0.13 = 1.25 ($C$ plus 183,500) 0.13
Case III: 1.25 ($C$ plus 94,500 plus 98,000) 0.13 = 1.25 ($C$ plus 192,500) 0.13
Case IV: 1.25 ($C$ plus 146,500 plus 98,000) 0.13 = 1.25 ($C$ plus 244,500) 0.13

The total production costs of the pulverized-fuel plant then will be:

Case I: ($a$) $(E + 78{,}060)$ tons of coal, ($b$) $(M + 3{,}200)$ dollars, ($c$) $(L + 240)$ dollars, ($d$) $1.25(C + 108{,}000)\ 0.13$ dollars. Total, constant $K + 20{,}990$ dollars + 78,060 tons of coal.

Case II: ($a$) $(E + 72{,}927)$ tons of coal, ($b$) $(M + 5{,}400)$ dollars, ($c$) $(L + 240)$ dollars, ($d$) $1.25(C + 183{,}500)\ 0.13$ dollars. Total, constant $K + 35{,}480$ dollars + 72,927 tons of coal.

Case III: ($a$) $(E + 71{,}979)$ tons of coal, ($b$) $(M + 5{,}900)$ dollars, ($c$) $(L + 240)$ dollars, ($d$) $1.25(C + 192{,}500)\ 0.13$ dollars. Total, constant $K + 37{,}400$ dollars + 71,927 tons of coal.

Case IV: ($a$) $(E + 70{,}244)$ tons of coal, ($b$) $(M + 7{,}400)$ dollars, ($c$) $(L + 240)$ dollars, ($d$) $1.25(C + 244{,}500)\ 0.13$ dollars. Total, constant $K + 47{,}440$ dollars + 70,244 tons of coal.

The difference in production costs of these plants with pulverized fuel, for various coal prices, is given in the following table, which shows these costs above constant $K$:

| Price of Coal | \$1 | \$2 | \$3 | \$4 | \$5 | \$6 | \$7 |
|---|---|---|---|---|---|---|---|
| Case I..... | 99,050 | 177,110 | 255,170 | 333,230 | 411,290 | 489,350 | 567,410 |
| Case II..... | 108,407 | 181,334 | 254,261 | 327,188 | 400,115 | 473,044 | 545,969 |
| Case III..... | 109,197 | 180,994 | 252,791 | 324,588 | 396,385 | 468,182 | 539,980 |
| Case IV..... | 117,684 | 187,928 | 258.172 | 328,416 | 398,660 | 468,904 | 539,148 |

The difference in production costs between stoker-fired and pulverized coal-fired boilers, with various coal prices for each of the four cases, is shown in graphical form in Fig. 6.

These calculations, fitted to a medium-sized station, show in a general way whether or not it is economical to install costly equipment for the sake of increasing the over-all plant efficiency, and the following conclusions may be drawn from them:

1. The use of high-pressure high-temperature steam will show large returns on the investment unless the load on the plant is extremely low or the fuel very cheap.

2. It is not advisable to install air preheaters or economizers unless the price of coal is in excess of \$2.50 per ton when the plant has a capacity factor of 50 per cent, or unless the price of coal is more than \$4 per ton with a capacity factor of 25 per cent. The installation of economizers and air preheaters does not seem to be warranted with the price of coal below \$6 per ton at 50 per cent capacity factor or below \$9 per ton at 25 per cent capacity factor. Of course, it may become necessary to install air preheaters to assist combustion, as experience has shown that certain coals can be burned more successfully if preheated air is used.

3. With a saving of 3 per cent in the fuel bill, it is not economical to install the bin-type pulverized-coal equipment unless the price of coal is about \$9 per ton.

As mentioned before, each power plant should be designed to suit the conditions at which it must be operated, the load it has to carry and the fuel available. The latter quite often determines the type of combustion apparatus that must be installed.

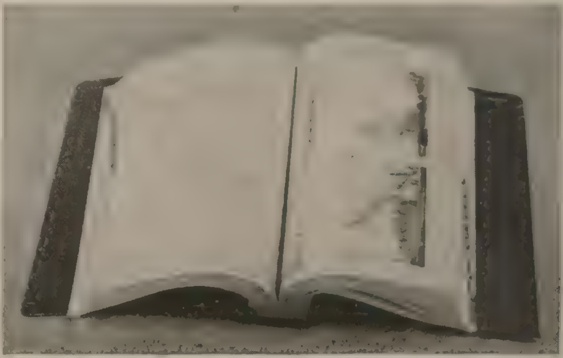
Many coals that are not suited for stoker firing can be successfully burned in pulverized form. The unit type pulverized-coal system has not been included in these comparisons. The results obtained with present installations show that efficiencies, operating costs and investment charges are very nearly the same as for stoker installation, except in cases of unusual coal conditions. The choice between stokers and unit pulverizers is, therefore, mostly determined by the fuel to be used.

Water-cooled furnace walls permit of operating with higher $CO_2$ and tend to reduce maintenance costs on walls and stokers. They also permit operating the boilers at high ratings and thereby reduce the number of boilers required for peak load operation. It is the latter faculty that chiefly determines the economic value of the water-cooled walls.

## Property Data Book Aids Operating Staff

THE use of a property data book listing all generating and substation equipment on the system of the Southern California Edison Company has been found to be of great value, particularly to the operating organization. The book is of standard 8½x11-in. size, bound in a loose-leaf leather binder and contains about 450 pages of maps, diagrams, pictures and tabulations printed on heavy white glazed stock, thumb-indexed.

The system used in compiling the book was to divide the material into three general classes; a map section, with a key map dividing the territory served into 31 sections, and individual maps of each section, showing power plants, substations and consumers' substations; a miscellaneous section, giving the symbols used throughout the book, typical schematic drawings of switch racks and elevations, and plans of substations for the standard distribution voltages used; and an alphabetical section, comprising non-tenths of the book, which contains exterior and interior views of each station or substation, a map of the property belonging to the company at the point, a colored single-line wiring diagram of the station and a list of the electrical equipment. In all, 208 stations and substations are covered in this manner.


PROPERTY DATA BOOK OFFERS COMPLETE SYSTEM RECORD

A department was created within the engineering department to compile the data book and to keep it up to date.

# Decreasing Radio Congestion

Single side-band transmission offered as a means of increasing number of transmitting stations without interference augmentation. Transmitting filters involved in plan following proved principles

By R. D. Duncan, Jr.
*Chief Engineer Wired Radio, Inc.*

MAINLY as an extension of the engineering development of wired radio broadcasting, the possibilities of side-band suppression, both at the transmitter and at the receiver, and the utilization of the carrier frequency and only one side band, in the range of frequencies employed in space radio broadcasting, have been investigated both theoretically and experimentally. The results confirm those obtained at the lower wired radio frequencies and indicate that by introducing changes in at least some of the existing space radio transmitting apparatus the frequency displacement between transmitting stations may be reduced from what it now is. The recommendations given herein are not put forth as a cure-all for present broadcasting ills. Instead, they are suggestions of a means which experiment has demonstrated to be of great practical value at the lower frequencies, both in broadcasting and in the general field of carrier communication, for partially alleviating the present state of frequency congestion. Filter circuits for side-band suppression have been used for several years in long-distance carrier-current telephony. In accordance with published reports they are also employed in the transatlantic radio telephone link. Space radio broadcasting should avail itself of the advantages offered by such improvements. The object of this article is to direct attention to the advantages and possibilities which would accompany the use of single side-band (and carrier) transmission in space radio broadcasting as compared with double side-band transmission now employed.

In the system of broadcasting by wired radio over electric light and power lines, developed by Wired Radio, Inc., because of the restrictions imposed by attenuation and general power loss on the lines, and of the requirement of high quality fundamental to broadcasting, the frequencies available for transmission are restricted to the range of approximately 25 to 70 kilocycles. As the program requirements demand three distinct channels, each with the proper frequency band, the working conditions which had to be met required operating as a minimum three closely associated transmitting stations within a frequency range of 45 kilocycles, and into the same load, viz., the line system. This latter would correspond in space radio to more than one transmitter operating into the same antenna. From the receiver standpoint there could be no cross-talk between channels or beat interference between carriers.

The problem was solved by the use of carrier and single side-band transmission in combination with master oscillator-driven transmitters. The former restricted the frequency range of each channel and the latter fixed the carrier frequencies of all channels. Single side-band transmission was obtained by the use of band frequency filter circuits at both the transmitter and receiver.

There is apparently no fundamental reason why single side-band operation would not be equally effective at space radio broadcast frequencies. When it is considered that three wired radio channels are operated on the same wire system within a frequency band of approximately 45 kilocycles, whereas a frequency displacement is space radio between individual broadcast transmitters, geographically within a range of 50 miles of one another, is of the order of 50 kilocycles, the apparent advantages of such a system in the way of permitting the operation of an increased number of transmitting stations in the present frequency range are manifest.

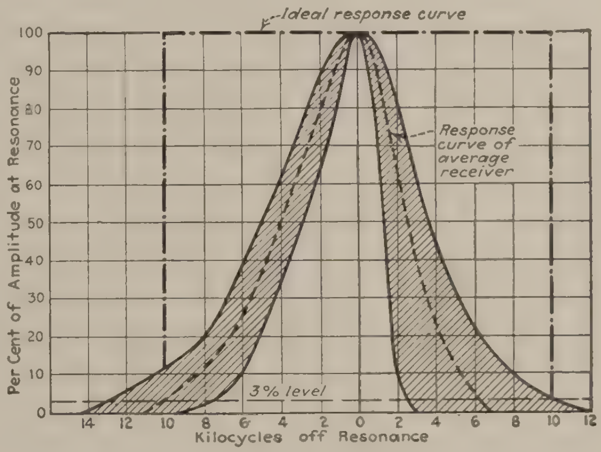


FIG. 1—FREQUENCY-RESPONSE CURVES OF BROADCAST RECEIVERS

Suggestions have been made from time to time as to the advantages of some form of synchronized or fixed frequency transmitter operation obtained by the use of harmonics of a master frequency and with the assistance of the piezo-electric crystal, for the purpose of eliminating indiscriminate fluctuation of the different transmitter carrier frequencies. Undoubtedly, improvements in this respect will be introduced regardless of the direction of other improvements or changes. Single side-band transmission, with the great advantage of conserving the frequencies required per transmitter, though known in theory and employed in other fields, for some reason has not received the use in space radio broadcasting which is merited.

The methods of single side-band transmission and reception may be better understood if a statement is made of some of the fundamental concepts of radio telephone operation when amplitude modulation is employed. These are as follows:

1. During modulation the current in the transmitting antenna consists of a series of discrete frequencies which normally extend above and below the carrier frequency; the latter is the only frequency present when not modulating.

2. The frequencies lower than the carrier are known as the lower side-band and those higher as the upper side-band frequencies. The frequency extent of the upper and the lower side bands is determined, among other factors, by the upper audio frequency limit of the modulating source.

3. The amplitudes of the side-band currents are determined principally by the degree of modulation and the impedance of the transmitting antenna at the particular frequency. Their maximum possible value with 100 per cent modulation is 50 per cent of that of the carrier frequency. Under operating conditions the average modulation is considerably less than 100 per cent and the side-band currents are correspondingly reduced in amplitude.

4. If the transmitting antenna is too sharply tuned; that is, if its impedance at the side-band frequencies is considerably greater than its resistance effective at the carrier frequency, the extreme upper and lower side-band frequency currents will be greatly reduced in amplitude, if not entirely suppressed. This is equivalent to the condition of absence of the higher audio frequency currents in the modulating source.

5. For perfect musical reproduction it is commonly accepted that an audible frequency range up to 10,000 cycles per second is required.

6. As a result of a wave impinging upon the receiving antenna or loop, a series of voltages corresponding to the carrier and different side-band frequencies is impressed upon the grid of the detector tube. The relative amplitudes of these voltages are determined by the frequency responsive qualities of the radio frequency amplifying circuits of the receiver.

7. By virtue of the rectifying action of the detector the interaction of the carrier frequency and each side frequency of the upper and lower bands produces a desired audible frequency current component in the detector output circuit. The pairs of component currents which have the same frequency add directly in their effect upon the audio frequency amplifier. One of the pairs, however, may be suppressed without affecting the quality of the audio response.

8. The suppression of one of the side bands at either the transmitter or receiver, or at both, will eliminate one of the pairs of audio frequency current components referred to in paragraph 7.

9. The presence of a second carrier frequency voltage at the detector input will interact with the first carrier and with its side-band frequencies to produce additional lower beat frequency components. The latter will be audible, providing that the difference frequency between the second carrier and the different components in the original frequency band is audible and is sufficiently amplified by the audio frequency amplifier of the receiver.

10. If the second carrier is itself modulated, still lower frequency components are produced in the detector output which further complicate reception.

11. The relative intensities of the two carrier frequency voltages, with their side bands, at the detector input are determined by the frequency responsive properties of the receiver and the field strengths of the two carriers at the receiving antenna.

From this brief analysis it is seen that the allocation of transmitting frequencies is governed, first, by the requirement of no audible beating between carrier frequencies, and, second, to a large extent, by the frequency-selectivity properties of the receiver. Since only the carrier and one side band are required at the receiver (of present types) for faithful reproduction, it is obvious that if one set of side bands of each transmitter were suppressed the frequency displacement between transmitting stations could be decreased from what it now is. The limit imposed in approaching the frequency bands of two transmitters to the point where the side-band frequencies or the carriers of the two stations produce audible beating is the frequency responsive properties of the average receiver.

Typical frequency response curves for a number of standard types of broadcast receivers are given in Fig. 1. These include single-control tuned radio-frequency amplifier sets, with and without the neutrodyne feature, the super-heterodyne type of receiver and sets with both battery and alternating-current source of tube power. The ordinates represent the ratio of voltage developed at the detector grid to the voltage applied at the input of the receiver, as a per cent of the maximum occurring at the frequency for which the set is tuned; the abscissas are kilocycles off the resonant frequency, which in this case was approximately 610 kilocycles. The shaded area in which all the curves lie accounts for the difference between sets, the dissymmetry in response for frequencies higher and lower than the resonant frequency, and for different conditions of signal volume gain for a given set. The ideal response curve for 10 kilocycles above and below the resonant frequency is shown in heavy line. The departure of the average receiver within its band pass range, from the ideal flat top response, is to be noted and would indicate a suppression of the higher audio frequencies.

Similar curves are obtained as the resonant frequency is increased, becoming considerably broader, however. At the very high frequencies the top may extend over 50 kilocycles. The latter condition leads to cross-talk interference and is a fault of some of the present types of receivers.

### Experiments Indicate Applicability of Plan

By experiment, it is known that if two transmitters produce equal field strengths at a receiving antenna, and there is to be no observable cross-talk, with the average receiver, the undesired signal voltage at the detector input must not exceed from 1 per cent to 5 per cent of the desired signal. Adopting 3 per cent as an average, it is seen from the accompanying illustration that with the worst possible conditions the frequency band of the receiver is approximately 25 kilocycles. The average receiver, shown in dashed line, gives a minimum 3 per cent response over a band of 17 kilocycles.

The present frequency displacement between transmitters in the New York City area in the range 610 to 760 kilocycles is shown graphically in Fig. 2a, for double side-band transmission, and assuming a side band extent of 10 kilocycles. Four transmitters are shown. The positions occupied by receivers of 30 and 20 kilocycle bands are also shown. In Figs 2b and c are shown two possible frequency arrangements with single side-band suppression at the transmitter. In the former all carriers are displaced 30 kilocycles and the upper side bands are suppressed. In the latter the carriers are alternately displaced 20 and 40 kilocycles and in alternate transmitters the upper and lower side bands are suppressed. The positions of receivers for the two conditions indicate that there will be no inter-transmitter interference. The arrangement of Fig. 2b and c permits of a 50 per cent increase in the number of transmitters in the same frequency range, with 10 kilocycles to spare.

By incorporating corresponding changes in the receivers; that is, by improving their frequency cut-off properties without, however, sharpening their response within the band pass range which may be accomplished by means of filters, a still closer grouping of transmitters is possible. The arrangement of Fig. 2d shows an alternate 15- and 30-kilocycle displacement between carriers and an alternate suppression of upper and lower side bands at the transmitters with receivers with a 14-kilocycle response. The transmitting stations in the same frequency range are double those in Fig. 2a.

Transmission and utilization of the carrier and only one side band is accomplished by means of band frequency filter circuits at the transmitter, or at both the transmitter and receiver. Considerable success has been had in the use of the coupled circuit type of filter,* as distinct from the so-called ladder type, for both low and high frequencies.

Several questions arise at this point. Is it practically possible to obtain the necessary cut-off required for side-band suppression with filters which are to be employed at the transmitter? Are they elaborate and costly and how would they be installed? May filters be employed over the entire frequency range now used in broadcasting? Is it practically possible to operate carrier frequencies at intervals of the order of 15 kilocycles with the exactitude which would be demanded by such a system?

### TRANSMITTING FILTERS ESSENTIAL

Transmitting filters have been constructed and operated at frequencies in the neighborhood of 610 kilocycles which have a 90 per cent amplitude cut-off with a 0.25 per cent change in frequency. Such a cut-off will give satisfactory single side-band operation. Filters of improved design are under construction with which a much sharper cut-off is expected. The filters need not be complex or costly. A desirable method of installation, where high powers are involved, appears to be that popularly known as the master oscillator-power amplifier system, wherein the unmodulated master frequency is supplied to an intermediate power amplifier where it is modulated by the audio frequencies. The output of this amplifier is fed into the transmitting filter where one side band is suppressed and the carrier and remaining side band supplied to the final power amplifier, which operates into the transmitting antenna. For the lower power stations the transmitting filter could be operated between the oscillator-modulator and the antenna.

It is not possible at the present writing to state definitely the frequency limit with which practical filter operation appears possible. As the frequency is increased the design of the filter has to be made with greater precision and more care is required in its construction and operation. There is apparently no reason, however, why satisfactory filter operation would not be obtained for frequencies of the order of 1,000 kilocycles. By throwing open the frequency range lower than 500 kilocycles for broadcasting the full benefit of filter circuit operation could be realized.

A 15-kilocycle or similar order master frequency could be generated and harmonics thereof supplied to the different transmitters within the same area. Theoretical consideration indicates that as long as the distances between the master generator of the harmonic-operated transmitters are not great, difficulties due to difference in phase and phase shift may not be expected. The supply of master frequencies to the different communities could well be a governmental function.

Successful multi-channel wired radio broadcasting has been obtained with comparatively simple terminal equipment, with a 17-kilocycle displacement between carriers and by means of single side-band transmission. Filters were employed in both the transmitting and receiving apparatus.

The close operation in frequency of transmitters was a fundamental problem in wired radio broadcasting and it was solved by considering the transmitting and receiving apparatus as parts of the same system, not as two entirely separate elements, and the entire system developed as a whole. The same course could be followed to advantage in space radio broadcasting. In the latter the vast number of receiving sets of different types and characteristics that are in use impose a limit upon what changes may be made. With the present receivers it appears that with certain changes in existing transmitters the frequency separation between stations geographically close to each other may be considerably lessened from what it now is. For example, if the frequency system of Figs. 2c and d were put in operation in the New York area similar changes could be made with stations on the Pacific Coast which occupy approximately the same frequency range. By systematically developing such a system and introducing such changes throughout the country, a relatively large number of frequency bands could be freed and room thereby made for additional broadcasting stations.

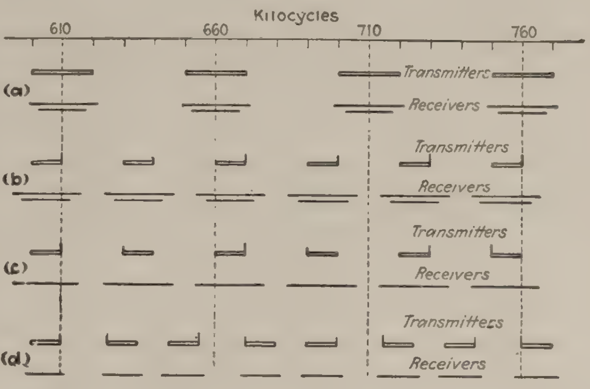


FIG. 2—SIDE-BAND WAVE SUPPRESSION WOULD DOUBLE AVAILABLE RADIO TRANSMITTING WAVE LENGTHS

The next logical step is an improvement in the receiver with a view to sharpening the frequency cut-off and flattening the response in the band pass range. Such changes will permit an additional closing of the frequency gap between transmitters. By the use of filter circuits of comparatively simple and inexpensive types, a receiver response varying less than 4 per cent over a band of 12 kilocycles and having a 90 per cent amplitude cut-off for a 0.65 per cent change in frequency in the neighborhood of 610 kilocycles has been developed for this purpose.

The present article is preliminary in character. At its writing, the first results of tests on apparatus indicate that a frequency separation of 15 kilocycles between carriers in the neighborhood of 660 kilocycles is possible with transmitters and receivers designed and constructed in accordance with the principles herein outlined, and at the most a separation of 30 kilocycles with the receiving sets at present in use. With comparatively slight improvements in the receivers a 25- or even a 20-kilocycle difference between transmitter carriers should be possible. It is hoped to discuss the system more in detail at some future date. The preliminary test results obtained, however, held such promise that in view of the present conditions in radio broadcasting it was considered advisable to make them public.

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*The mathematical theory of such circuits has been given by L. Cohen, *Journal of the Franklin Institute*, page 641, May, 1923.

# Motor Starting Current vs. Lighting Flicker

By H. L. Wallau

*Electrical Engineer Cleveland Electric Illuminating Co.*

WITH the increased use of combined light and power underground low-voltage networks, the question of the maximum draught of current which may be allowed to be suddenly imposed upon any portion of such a system is being given greater consideration. The value of this current draught is dependent upon the constants of the transformers and mains installed, the location of the equipment producing it with reference to the supply points, the power factor of the load so drawn, and, finally, the maximum voltage drop, due to such load, which will not result in objectionable flicker of the lights.

In determining limits, the location at which the maximum disturbance will be caused must be chosen. For one-way feed, this will be at the extremity of the main; for two-way feed mid-way between transformers, assuming all transformers and mains to be of the same sizes and characteristics. It has been experimentally determined that a 2-volt flicker is the maximum allowable in the lighting voltage.

Assume a three-phase, four-wire secondary. Consider first a one-way feed. Let the transformer and mains have constants as follows, expressed in ohms:

| | Resistance | Reactance |
|---|---|---|
| Transformer ........................ | Rt | Xt |
| Phase Wire ........................ | Rp | Xp |
| Neutral Wire ........................ | Rn | Xn |

For a single-phase motor operating between phase and neutral, let the sum of the resistance and reactance to the end of the main be expressed as $R = Rt + Rp + Rn$ and $X = Xt + Xp + Xn$ ohms. The power factor of the starting current of induction motors will vary somewhat, but 15 per cent is a fair average value. The regulation in volts may be approximately expressed by the formula:

$$\text{Volts Reg.} = IR\cos\phi + IX\sin\phi + \frac{(IX\cos\phi - IR\sin\phi)^2}{200},$$

in which $\cos\phi$. is the power factor at starting. This voltage drop is to be limited to two volts. The value of $I$ determined from the above formula corresponds to the locked rotor value of the motor current.

For single-phase motors operated across two-phase wires, $R$ and $X$ should be expressed as $2Rt \div 2\,Rp$ and $2Xt \div 2Xp$ respectively and the voltage drop allowable taken as $2\sqrt{3}$ volts.

For three-phase motors, $R$ and $X$ should be taken as $Rt \div Rp$ and $Xt \div Xp$ respectively, and the voltage drop as two volts. In most cases, at these low values of power factor, the right hand term of the equation becomes very small and the following expression may be used as a first approximation:

Volts Reg. $= IR\cos\phi + IX\sin\phi$. For loads of unity power factor, the formula simplifies to

$$\text{Volt Reg.} = IR + \frac{(IX)^2}{200},$$

but the last term may not be neglected.

For two-way feed, the limiting values of current as determined above should be doubled since each transformer will feed one-half of the load to a motor located mid-way between the two.

From the values of current so obtained, the allowable ratings of motors of different types may be determined.

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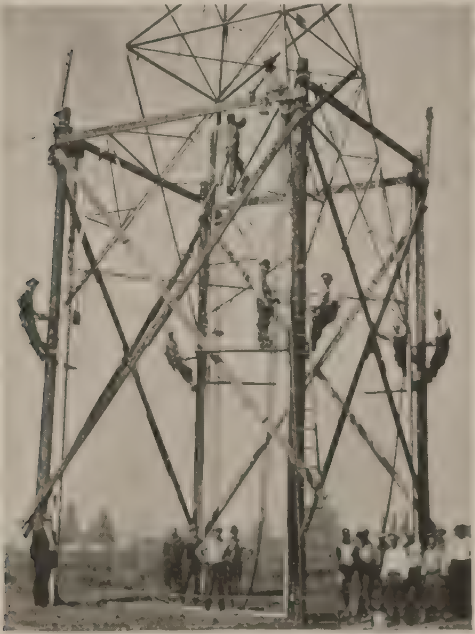
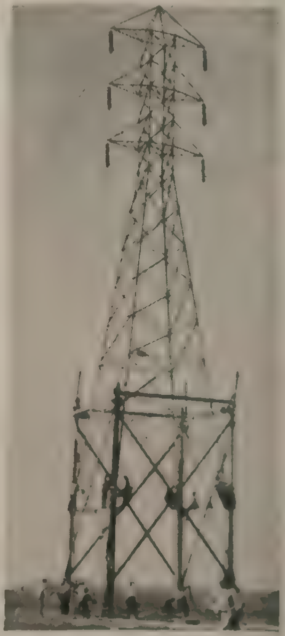
# Transmission Tower Raised in 30 Minutes

VERY often it is necessary to increase the height of transmission line towers on account of road or property improvements. In such cases the Los Angeles Gas & Electric Corporation raises the tower bodily with the line hot in the manner indicated in the accompanying illustrations. Four guyed gin poles are set at the four corners of the tower and five-ton chain blocks are used to lift the tower to the desired height, after which the steel tower extension is erected. In this manner an 80- to 100-ft. steel tower carrying a 130,000-volt line can be raised 20 ft. in 30 minutes.





# Comparison of Range Elements*

### Efficiency and performance of open and closed units determined by experiments with several types and under various conditions of service

By G. J. Mickler
*Sales Department Hydro-Electric Power Commission of Ontario*

An increasing desire for accurate information as to the relative merits of the more important elements with which ranges are equipped today led to the decision to select an element of each type, of the capacity generally regarded as the principal element on a range, to subject each to a heat run test and with the aid of electrical and thermal instruments to record the performance of each and picture the comparative records by graphic illustrations. The purpose of the tests was to illustrate the comparative efficiency and performance of open and closed elements and to give to those engaged in the sale and demonstration of electric ranges some material that would enable them to convince prospective customers of the ability of electric range elements to perform efficiently and economically the service for which they were intended.

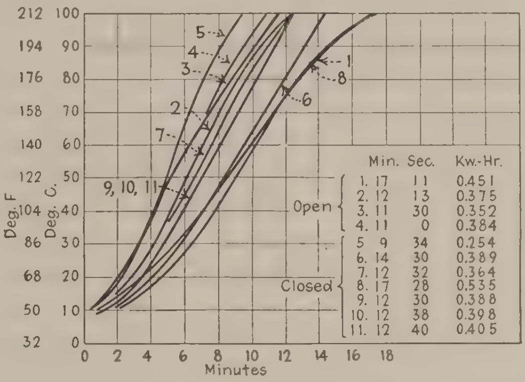
## Testing Equipment and Procedure

The set-up for the test consisted of a standard voltmeter, a standard ammeter, a resistance for voltage regulation, a standard Centigrade thermometer with an adjustable stand to permit the thermometer being raised or lowered at will, a hot plate frame equipped with a three-heat switch, an 8½-in. copper tea kettle and a standard Imperial quart measure as well as a 110-220-volt circuit regulated to maintain 115 volts with the element switch on high.

Tests were conducted on four so-called open elements, consisting of Nichrome coils laced through porcelain grooved blocks, each being of a distinct type—distinct because each manufacturer, in order to circumvent the patents of the others, is generally forced to adopt a design of his own. Investigations were also made of seven so-called protected elements—that is, the elements or heating coils which are protected either by a covering or tubing, or by a metal plate to relieve them of outside abuse. All of these elements were the products of reliable Canadian electric range manufacturers.

In this investigation one element was tested at a time using the following procedure: An Imperial quart of tap water was placed in the 8½-in. copper kettle, temperature of the water being usually 9 deg. C., and with the element cold—that is, at room temperature—the current switch was turned to high heat, the voltage adjusted to 115 volts, and the thermometer lowered to within about ¼ in. of the bottom of the kettle. Readings were taken of the temperature of the water at 1-min. intervals until the boiling point was reached.

When the water had been brought to a boil, the current was turned off and the element allowed to cool, usually over noon hour or over night, after which two quarts of water was placed in the kettle at 9 deg. C., and the operation was repeated, taking readings of the thermometer at 1-min. intervals until the boiling point was reached. In a similar manner, after the element was cooled again, three quarts of water was placed in the kettle at 9 deg. C., the current turned on and readings taken every minute up to the boiling point.



TIME REQUIRED TO BOIL ONE QUART OF WATER FROM COLD START

The performance of each of the eleven elements is indicated. The graph shows that closed element No. 5 boiled one quart of water in 9 min. 34 sec., with a consumption of 0.254 kw.-hr. Three open elements required 11 min., 11 min. 30 sec. and 12 min. 13 sec. respectively. The performance of open element No. 2 and closed elements Nos. 7, 9, 10 and 11 was practically the same. Element No. 4 consumed 0.384 kw-.hr., considerably more than that of some of the other elements. This one was very much overrated, offering a probable reason as to why it performed a little better than some of the others.

After this third test the element was considered a hot element—that is, about as hot as it would become in ordinary domestic service, provided it is not left on high heat without a utensil on top of it. Another series of tests was then carried on with this hot element, putting one quart of water at 9 deg. C. into the kettle, which had been previously cooled off. With the current in the element at high, temperature readings were taken of this quart until the boiling point was reached. In a

KILOWATT-HOUR CONSUMPTION OF ELEMENTS USED IN THE EXPERIMENTS

| Type of Element | No. | Kw.-Hr. | Type of Element | No. | Kw.-Hr. |
|---|---|---|---|---|---|
| Closed ............ | 5 | 2.284 | Open ............. | 4 | 2.742 |
| Closed ............ | 7 | 2.472 | Open ............. | 3 | 2.756 |
| Closed ............ | 10 | 2.491 | Open ............. | 2 | 2.795 |
| Closed ............ | 6 | 2.495 | Open ............. | 1 | 2.858 |
| Closed ............ | 9 | 2.647 | Closed ............ | 8 | 3.560 |
| Closed ............ | 11 | 2.706 | | | |

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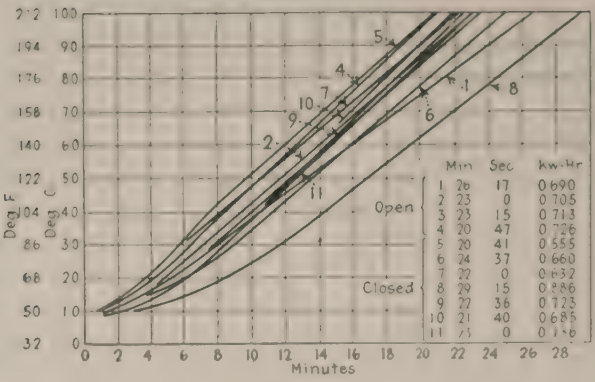
*Excerpts from an address before Association of Municipal Electrical Utilities at Niagara Falls, Ont.



| | | Min | Sec | kw-Hr |
|---|---|---|---|---|
| Open | 1 | 26 | 17 | 0 690 |
| | 2 | 23 | 0 | 0 705 |
| | 3 | 23 | 15 | 0 713 |
| | 4 | 20 | 47 | 0 726 |
| Closed | 5 | 20 | 41 | 0 555 |
| | 6 | 24 | 37 | 0 660 |
| | 7 | 22 | 0 | 0 632 |
| | 8 | 29 | 15 | 0 886 |
| | 9 | 22 | 36 | 0 723 |
| | 10 | 21 | 40 | 0 685 |
| | 11 | 23 | 0 | [illegible] |

TIME REQUIRED TO BOIL THREE QUARTS OF WATER FROM COLD START

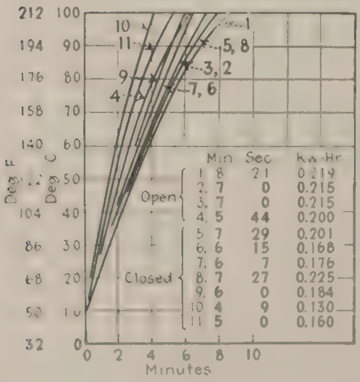
Element No. 5 arrived at the boiling point first. This graph gives another comparison between No. 2 and No. 7, the latter being one full minute ahead of No. 2, or roughly 5 per cent faster.

similar way two quarts of cold water and three quarts of cold water were brought to the boil on the hot element.

Upon the completion of this test, in order to find out the amount of residual heat in the elements after the current is turned off, three quarts of cold water was placed in the kettle, which was then placed on the hot element and the current turned off, and temperature readings taken every minute up to the point where there was no further rise in the temperature of the water. In the preceding tests the lid of the kettle was open to permit reading the thermometer at the lower temperature.

Another test was made to determine how long the boiling operation would continue after the current was turned off under three quarts of water which had been brought to the boil previously. In this case readings of the thermometer were taken until the temperature had dropped below 99 deg. C. In this case the lid of the kettle was closed and the thermometer inserted through an opening.

An additional determination was made on closed elements with a metal plate covering to show the effect of improving the contact between the surface of the element and the bottom of the kettle by pouring water on the cold element and also by pouring mercury on the cold element and comparing the results obtained when boiling one, two and three quarts of water on an initially cold element. The results were plotted, curves being drawn and calculations made to show the time required by each element to perform each function and the number of kilowatt-hours of energy expended. The graphs for the heating from a cold start indicate that some of the closed elements take a somewhat longer time to get started, whereas the open elements show a much more rapid temperature rise, since the coils are more or less free to exert their energy upon the kettle as soon as the current is turned on. One interesting point that it might be well to note is that No. 2 (open) and No. 7 (closed) elements, which are of practically the same rating, require the same time to reach the boiling point. These elements are manufactured by the same company and afford an interesting comparison of the speed of open and closed elements.



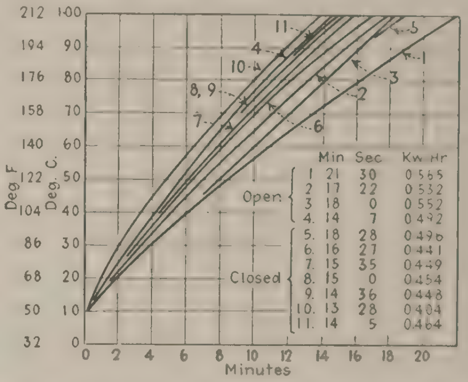
| | | Min | Sec | kw-Hr |
|---|---|---|---|---|
| Open | 1 | 8 | 21 | 0 219 |
| | 2. | 7 | 0 | 0.215 |
| | 3. | 7 | 0 | 0.215 |
| | 4. | 5 | 44 | 0.200 |
| Closed | 5 | 7 | 29 | 0.201 |
| | 6. | 6 | 15 | 0.168 |
| | 7. | 6 | 7 | 0.176 |
| | 8. | 7 | 27 | 0.225 |
| | 9. | 6 | 0 | 0.184 |
| | 10 | 4 | 9 | 0.130 |
| | 11 | 5 | 0 | 0.160 |

TIME REQUIRED TO BOIL ONE QUART OF WATER FROM HOT START

In this case the three closed elements are first followed by No. 4, the high-capacity element. It will be seen that No. 5, which was in front in the cold tests, is now pretty well to the back.

It might be well to explain that the reason No. 8 element shows such a poor performance is that with a kettle the bottom of which is perfectly flat and with an element that is not perfectly flat, the contact between the two not covering a very large area, the radiation from the element to the kettle and into the water constitutes a very slow process. Apparently the air space between the element and the kettle, and the possibility of circulation of air carrying off the heat, slowed up the operation very materially.

When plotting these curves it was found that elements with a cast-iron cover absorb a little more heat and give it off a little more readily than do open porcelain elements. On the graph for the temperature rise of three quarts of water on a hot element the temperature rise of one of the cast-iron elements is shown as 63 deg. C., or about 140 deg. F. The other cast-iron elements are somewhat lower and not very far away from a porcelain element, which brought water up to 122 deg. F. This may answer some of the arguments about the absorptive power of porcelain as compared with cast iron. The general opinion is that porcelain does not absorb heat and all the heat generated by the heating coils passes through the air into the kettle and into the water, whereas cast-iron elements take up and hold a lot of the heat given off by the heating coils. It is true they absorb a lot of heat, but they give it off very rapidly, once they get hot. Porcelain is slow to absorb the heat, and it is just as slow to give it off, although these curves show that the amount of heat absorbed by the porcelain may be almost as much as that absorbed by the cast iron in some cases. This depends, of course, on the amount of porcelain and the amount of insulation beneath it.



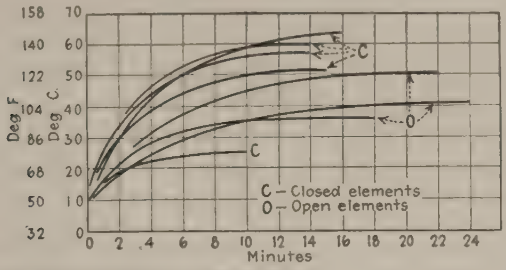
| | | Min | Sec | Kw Hr |
|---|---|---|---|---|
| Open | 1 | 21 | 30 | 0 565 |
| | 2 | 17 | 22 | 0 532 |
| | 3 | 18 | 0 | 0 552 |
| | 4. | 14 | 7 | 0 492 |
| Closed | 5. | 18 | 28 | 0 496 |
| | 6. | 16 | 27 | 0 441 |
| | 7. | 15 | 35 | 0 449 |
| | 8. | 15 | 0 | 0 454 |
| | 9. | 14 | 36 | 0 448 |
| | 10. | 13 | 28 | 0 404 |
| | 11. | 14 | 5 | 0.464 |

TIME REQUIRED TO BOIL THREE QUARTS OF WATER FROM HOT START

Closed element No. 10 is in the front, followed by Nos. 4, 11, 8, 9, 7 and 6. This series of tests on hot elements shows beyond a doubt that closed elements are considerably faster than open elements, due to their giving off evenly the heat stored in the element in the first part of the operation of bringing water to a boil. This is further illustrated by a comparison of the kilowatt-hour consumption, which shows that with two exceptions the kilowatt-hour consumption by closed elements is less than that of the open elements.

The same thing is true of the amount of heat absorbed by cast-iron plates.

The interesting feature of this subject is not that porcelain will absorb as much heat as cast iron but the demonstration of the value of the heat that is stored in an element and that in many cases is lost if economical operation of a range is not carefully studied. If it is desired to utilize all the heat that is given off by a range element, either open or closed, after certain boiling operations have been completed, and there are many times when it is just desired to bring water to a boil, the residual heat in an element should be made use of. That is to say, supposing the kettle to have been brought to the boil for making tea. When sufficient water has been drawn off the kettle for the tea, it should be filled up with cold water, and this kettle full of water placed on the hot element. These curves show that in about the time that it takes to eat a meal there will be enough hot water to wash the dishes in the average home. If you put warm water in the kettle of course the temperature would be much higher at the finish than it is when you put cold water on, but with cold water at the start, the temperature rise to from 122 to 150 deg. F. is as much as any one requires for dish-washing purposes.



TEMPERATURE RISE OF THREE QUARTS OF COLD WATER ON HOT ELEMENTS

The extent to which different types of elements store up heat when the current is turned on was indicated by placing three quarts of water over a hot one, turning the current off and observing the temperature rise of the water until a maximum was reached.

The table on page 199 gives the consumption of each of the individual elements used in the foregoing experiments. These figures give a fair comparison between the elements, as the duties performed can be considered diversified.

## New Voltage Standardization Booklet

BASED on a recent survey of electric voltages, a booklet has just been published by the voltage standardization sub-committee of the lamp committee of the National Electric Light Association, showing the lighting voltages in nearly 19,000 communities in this country. This is the first reissue of a similar booklet published in 1923; comparison with the latter shows considerable progress in voltage standardization toward the objective recommended by the lamp committee in 1923—that "the recommended standard practice be the selection of such a service lamp voltage as will supply the proper average voltage to 115-volt lamps," with 110-volt systems and existing 120-volt systems as recognized departures.

In the five years between the publications of 1923 and 1928, the number of communities having 115-volt service only advanced from 35.6 to 68.2 per cent of the total, while the 120-volt communities have increased only from 8.2 to 11.1 per cent and those served at 110 volts have decreased from 47.7 to 19.9 per cent. The total served at one of the standard voltages has increased from 91.5 to 99.2 per cent in number, or from 95.2 to 99.7 per cent when those using more than one voltage, but all standard, are included. Also, there has been a gain of 8 per cent in the total number and 11 per cent in the total population of the communities having only one single-standard lighting voltage reported for the entire city.

In the new publication, the old data were completely ignored and a fresh start was made; 3,517 towns of the earlier list, regarding which no information was received, were dropped, but 7,746 new ones were added. As the total population of the towns listed in both issues is approximately the same, it is evident that the new towns are relatively small.

Returns show frequent cases of small plants, and particularly municipal plants, having been sold or changing their source of supply to purchased energy, and indicate a general tendency toward the supply from larger, and therefore more economical, generating stations.

In the listing, the number of towns served by municipal plants has decreased from 1,732 to 1,200 and the populations so served from 4,347,500 to 3,351,300. There has thus been no notable change in the average size of towns served by municipal plants. It is noted that these plants are lagging in the nation-wide movement from 110 volts toward the central standard of 115 volts.

## Ground Return for Series Street Lighting

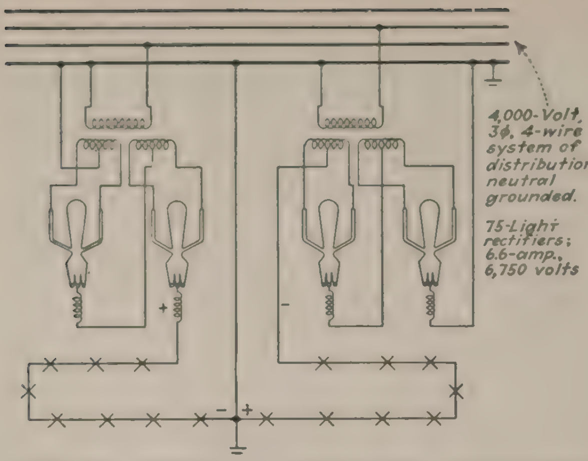
By J. A. Cook

*Superintendent Electrical Department Lynn (Mass.) Gas & Electric Company*

GROUND return for series street-lighting circuits is being successfully used by the Lynn Company in its recent extension of "White Way" lighting. One conductor per circuit is saved in the underground cable system. Two-wire service is continued in overhead territory, because the investment saving there would be very small and tree conditions make overhead wire return desirable.

The lighting units on the extension involve 2,500, 10,000 and 15,000-lumen incandescent lamps supplied by 20-kw., type "R.O." General Electric constant-current transformers mounted on poles on side streets adjacent to the underground district. A cable fault can readily be located, since the lamp immediately beyond the fault will be dim or out, and the lamp just before the fault will burn at full brilliancy. Each of the transformers has a control switch with operating solenoid connected in one of the existing street-lighting circuits leading to the station. A maximum of two transformers is connected per station circuit. When the operator energizes the outgoing street-lighting circuits the transformers are switched upon the commercial light and power 2,300-volt circuits at various points. This increment of street lighting service is, accordingly, obtained at low investment cost and entails the maintenance of only a short additional length of underground cable.

A more important use of the ground return is for the ornamental luminous arc lamps on main business thoroughfares. Ground return reduces the investment for these units, which is otherwise particularly heavy, since the arc lamps require uni-directional current of high voltage supplied by constant-current mercury-arc rec-


4,000-Volt, 3φ, 4-wire system of distribution; neutral grounded.
75-Light rectifiers; 6.6-amp., 6,750 volts
+
-
-
+

THREE-WIRE CONNECTION AND GROUND RETURN FROM ADJACENT SERIES CIRCUIT TERMINALS

tifiers installed in an attended station and frequently there is a long distance between the last lamp on the circuit and the station. The Lynn company uses 75-light General Electric rectifiers, each of which serves its load over a single No. 6 A.W.G. cable. At the last lamp on the circuit a solid connection is made to the cable sheath and also to a nearby water pipe. One side of the rectifier unit is similarly connected to ground. This system has been in satisfactory operation for about two years. Six units are in service with ground return.

Measurement of resistance of ground return on a typical Lynn circuit by voltmeter method shows the ground resistance to be only 0.71 ohm. The airline distance from the grounding point to the station is 6,000 ft. This length of No. 6 A.W.G. copper wire has a resistance of 2.4 ohms.

When these rectifier sets were first put in service, a certain amount of operating trouble was experienced on account of the higher voltage to ground sustained by the first ten lamps in each circuit nearest the station. In the usual wire-return circuit the point of ground potential is approximately midway in the circuits of lamps, and, accordingly, the maximum voltage-stress to ground corresponds to half the total circuit voltage. Circuits operated with ground return have low voltage to ground on lamps near the grounded terminal and full voltage on the other end.

Initial operation of these circuits demonstrated that the lamps, insulators and cutouts manufactured for two-wire circuits would not give satisfactory service on ground return circuits under Lynn conditions. In those cases known to the author, where ground return is used by other companies, street lighting standards had wooden shafts supporting the lamps. Such shafts contribute materially to the circuit insulation. The Lynn system uses King all-metal standards, which are solidly grounded to the cable sheathes and the water-pipe system, so that the full voltage to ground is impressed across the lamp insulator at the top of the standard. The General Electric Company increased the thickness of the lamp insulator by nearly one inch and provided absolute cutouts with a larger amount of surface insulation than was previously standard. The operating results compare favorably with those obtained by two-wire return.

The telephone company's representatives investigated to determine whether or not return of street light current through the ground produced objectionable inductive effects in telephone circuits. They found no disturbance and gave the installation their approval.

It is interesting to note that, where two circuits can be made to terminate adjacent to each other, the ground connection can be made on the negative side of one circuit and on the positive side of the other. Accordingly, the ground current is confined to the short distance separating the grounded lamps of the two circuits. The Lynn company did not install the system in this way, but it seems to be possible of successful application where soil has high resistance or where inductive effects may be detrimental.

## Brazilian Generating Station Inspires Rudyard Kipling

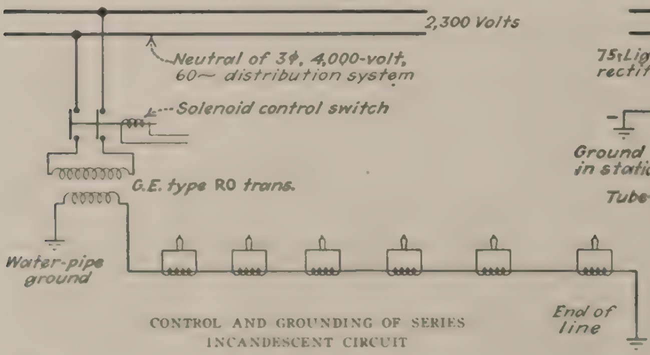
RUDYARD KIPLING visited an electric power house near Santos, Brazil, on a recent trip to South America, where he inspected a generator which, according to the eminent English poet and story writer, "spins upon the largest bearings in the world." It served as an inspiration for a two-stanza poem which is published for the first time in America in the current issue of the weekly magazine *Liberty* and is as follows:

Song of the Dynamo

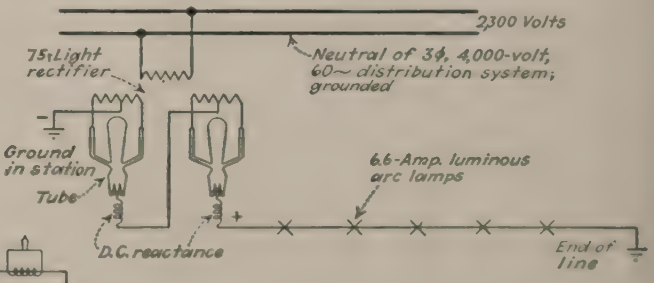
How do I know what Order brings
  Me into being?
I only know, if you do certain things,
  I must become your Hearing and your Seeing;
Also your Strength, to make great wheels go round,
And save your sons from toil, while I am bound!

What do I care how you dispose
  The Powers that move me?
I only know that I am one with those
  True Powers which rend the firmament above me,
And, harrying earth, would save me at the last—
But that your coward foresight holds me fast!

(Copyright, 1927, by Rudyard Kipling in the U. S. A.)



CONTROL AND GROUNDING OF SERIES INCANDESCENT CIRCUIT


2,300 Volts
75-Light rectifier
Neutral of 3φ, 4,000-volt, 60~ distribution system; grounded
Ground in station
Tube
D.C. reactance
+
6.6-Amp. luminous arc lamps
End of line

GROUND RETURN FOR RECTIFIED SYSTEM, SERIES ARC LAMPS

## Factors Affecting Accumulation of

# Depreciation Reserve

Life dependent upon definition of unit. Accounting for removal costs. Annuities for special short life installations. Interdependence of plant items with respect to life

By W. G. Cross

*Assistant Valuation Engineer Southern California Edison Company, Los Angeles, Cal.*

IMPORTANCE of the definition to be used when considering depreciation or any of its phases has been stressed previously in this series of articles. As has been noted, depreciation may relate to price, thus producing lessened market value; to serviceability, thus assuming a less efficient article of use; to physical structure, with a resultant weakened structure from the service angle or a structure containing less physical material and thus a lessened wearing life; and in a very great variance of ways to functional use, indicating decreased present value or lessened future life.

Not all replacement, repair, etc., caused by a wearing-out process may normally be considered depreciation from an accounting point of view, or even from the point of view of an engineer. The replacement of bearings in rotating apparatus is almost universally considered an operating expense or, at least, a type of expense which is not the fundamental wearing out of the item. Reference has already been made to the question of definition of the smallest unit to be used in accounting for depreciation, pointing out that a complete unit, ordinarily renewed by repairs, etc., may have a life much in excess of the individual parts which comprise such a unit. If the individual parts themselves were considered the unit, the life, or service value, would almost universally be less than that of the more inclusive unit and would require entirely different treatment.

Moreover, the practice of a utility or the regulating commission supervising the utility, may decide that, for accounting purposes, certain costs shall be considered operating expenses rather than expenses to be taken care of through a depreciation reserve. While it is customary to charge the costs incidental to the retirement of most items against the depreciation reserve, in the state of California it is specifically provided that the removal of meters and services, during the life of the item, shall be considered operating expense.

While it is fully realized that there are many utilities which may not desire to take care of replacements through a depreciation reserve, all such expenditures being handled as operating expenses, the discussion in these articles is based upon the premise that the cost of retiring plant at the end of its life may cause such a disturbance, if considered a portion of the operating expenses, as seriously to change the uniform character of such expenses. Thus it is rendered very difficult to forecast yearly operations and to set rates and collect revenues in such a manner as to provide for these fluctuating expenses. With such a thought in mind, a great many utilities accumulate a fund by means of annuities in such an amount that this fund, theoretically, will always have available sufficient money to reimburse the utility for the cost of the item at the date when it ceases to function usefully. As has been noted, the minimum item, or the unit, must be positively defined, for it is not logical to provide a fund to retire a boiler at the time when that boiler shall be considered to have completely ended its life, and then inconsistently withdraw funds from the reserve, at a period much earlier than the complete retirement, to take care of the retirement of the fire-brick linings or boiler tubes comprising a portion of such boiler.

Two factors pertaining to depreciation and the accumulation of a reserve have not, so far, been noted. They are the salvage value to be obtained from a unit at its expiration of life and the cost of physically removing or retiring the item. The reserve is usually designed to take care of both, that is, to reimburse the original "wearing value" or cost of the item, less its salvage, and to provide a sum of money sufficient to pay the cost of removal.

### Salvage Value and Removal Cost

In determining the wearing value, attention must be given to salvage value at the end of life. Three methods are in common use: one assumes that the salvage will practically be offset by the removal cost; another, that the estimated life may be arbitrarily lengthened, when computing the annuity, to make allowance for net salvage; third, an attempt may be made to compute the wearing value by estimating the probable salvage. The first method is not ordinarily considered a distinct method, but is rather assumed when a utility makes no allowance for salvage or removal cost in its depreciation calculations. It is very commonly used, however. The lengthening of lives for salvage is feasible, but is a somewhat indirect method. In general, comparatively little lengthening is required to take care of net salvage obtained, if handled on a net salvage basis. The third method, which makes an attempt to compute salvage, cannot, at best, be more than a vague estimate which is subject to conditions of price, future state of the art, business conditions, new inventions and almost every other conceivable contingency. It is doubtful if such a method produces results any more accurate than either of the previous types of estimates.

With respect to the depreciation reserve taking care of removal costs, the situation becomes somewhat complicated when removals take place prior to the expiration of the ordinary life of the material in question. The reserve, as accumulated, ordinarily is designed for the purpose of taking care of one removal. If a substation transformer, for instance, is moved between substations three or four times during its life, the reserve is, in theory, not adequate to take care of the expense thus involved, and such costs would properly go against operating expenses. In theory, this is true but, in practice, it is often difficult, from an accounting point of view, to distinguish an "interim" removal from a final removal. Such determinations might be made in the case of a small utility, but in a larger utility where thousands of items are involved, such a course is not always practicable. It is, therefore, often the case that the reserve is called upon to take care of these interim replacements. Under such conditions, the one handling the depreciation accounting must carefully consider the effect of such additional expenditures, and, possibly, make provision in the annuity. It will be noted that the cost of interim removal, which is mainly a labor cost, is similar in its aspects to partial replacement of a unit such as a boiler, but the reason why interim replacements are charged against the reserve is merely to facilitate accounting. The procedure is not entirely logical.

### Short Life Installations

A problem is presented in the case of engineering design, where, in order to give proper service, units must be installed under such conditions that the life will be greatly foreshortened. If it is known, for instance, that a certain pole line, or set of pole lines, is installed for the purpose of serving an industry which will be in existence only for five years, and that the location, perhaps, is such that very little salvage can be expected at the end of that period, special note must be taken of such considerations. It is, ordinarily, not practicable to set up a special reserve for individual pieces of property of this nature, as the accounting would become so complicated that it would be too cumbersome and expensive. If, on the other hand, average lives (including all the property of the company) are shortened, or other constants modified below those customarily used in utility work, regulatory bodies and such of the public as are interested in public utility matters are likely to look with suspicion upon such procedure, and refuse recognition of any adjustment which tends to increase the depreciation annuity, and thus increase rates which are based upon the cost of service.

Such conditions, however, are sometimes precedent to good service, and it is very interesting to note that the California Commission, in a decision dated Dec. 31, 1926,* noted that the company's engineers had used somewhat shorter lives than those previously accepted, in claiming an annual allowance for depreciation, and apparently looks with approval upon the change, stating that "rapid growth of the company's load is calling for the replacement of many pieces of equipment on account of lack of capacity before they are worn out in service. To quite an extent, it is more economical to install moderate-sized equipment and replace it before it is entirely worn out than to carry the extra investment in the larger equipment to avoid such replacement." If lives are not shortened, replacement should be charged to operating expenses, or some other provision should be made.

An error frequently made is that of neglecting the life relationship which obtains between various items of equipment in a plant. A concrete dam may perhaps be considered as of almost indefinite life, but if the hydroelectric project of which it forms a part is subject to a limited tenure of life, say, 40 years, not only should the annuity to retire the structure be accumulated on the short-time basis, but, presumably, some other large accumulation may have to be made to take care of the heavy costs of physical removal of this type of structure.

Again, a concrete power plant building is ordinarily thought of as having a long life, perhaps 40 years. In the case of modern steam plants, however, such a building is little more than a set of massive foundations for the generating equipment, with walls to keep out the wind and a roof to shed rain. The steam turbine equipment resting upon the foundations which form a large part of the building may be retired at the end of twelve years. It would be unreasonable to suppose that these same foundations would be satisfactory for such new type of equipment as might later be installed. The building's usefulness ceases at the time of retirement of the equipment. The author knows of no instance where generating plant buildings, either hydraulic or steam, have ever been used for a subsequent installation of hydro or steam generating equipment after the original installation has lived its life and been retired, and it is extremely improbable that such subsequent use could be made, except at the expense of engineering efficiency. As in the case of dams, the cost of removing these foundations may be very great. Obviously, therefore, the building life is not 40 years.

### Prolonged Life By Maintenance

The prolongation of life by maintenance is a subject requiring careful attention in discussions of depreciation and determinations of estimated lives. It is quite evident that not only can an item be used beyond the time when it would ordinarily be replaced by the process of making extraordinary repairs but it is further true that many utilities are forced, by financial circumstances, to do this very thing. Under such conditions, the question arises as to whether the additional amounts thus accumulated in the reserve should be utilized for making repairs. In general this procedure may be said to be defensible only when the condition is clearly apparent.

In the case of determination of accrued depreciation, it is commonly accepted that a certain amount of "normal maintenance" may exist without being considered as existing depreciation. Such maintenance, accumulating between visits of the repair gang, is that maintenance usually taken care of through operating expenses. In the case of "deferred maintenance," however, the question is more difficult. If normal operating expenses have not been expended and the property is in a state of repair lower than that which would normally be considered reasonable by a financially solvent operating company, it is quite evident that an estimate will have to be made for such a condition in adition to the other factors commonly entering in.

Another feature of interest is one that is never shown in actual calculations when determining accrued depreciation, but is none the less there and should have a certain amount of weight. In the case of generating plants, substations and other sections of plant where co-ordinated mechanical operation is required, it is distinctly true that the first few months, and sometimes years, of operation require a greater expenditure than the succeeding years, due to the fact that difficulties have to be met and overcome and the plant has to be "broken in." In many cases a plant is in better operating condition at the expiration of the first or second year than it was at the beginning of its service. It is very difficult to make an allowance for such a condition of appreciation mathematically, and, hence, it is seldom ever done. Depreciation by inspection is able to make some allowance for this condition by offsetting the appreciation against factors of wear and tear, but it is probable that the only way mental processes ever take care of this factor is by the indirect route of assigning a "going value" to a plant in complete operation. This seems to be a crude attempt to allow for the fundamental feature, but no better way appears to be offered.

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*_California Railroad Commission, re Los Angeles Gas & Electric Corporation, P.U.R., 1927, C-568._

The absence of definite terms of measurement for depreciation and remaining value often renders it difficult to determine the amount expressed in dollars which may exist in a property, but, if the fundamental conditions are consistently kept in mind throughout any set of estimates or calculations, a result can always be obtained based upon the particular premises involved, and it is only fair to qualify the answer with the statement that it is based upon those certain premises. Similarly, in matters connected with determination of depreciation annuities, there is but one fundamental end to be attained, and that is that the utility should be recompensed for its entire investment during the period of service in such a way that the company will remain whole when the article has ceased to function usefully.

# Reducing Distribution Losses

## SIXTH ARTICLE

## *Loss-Testing Equipment*

By J. B. Moorhouse
*Electric Distribution Engineer Central Illinois Public Service Company, Springfield, Ill.*

The field work involved in the reduction of transmission and distribution losses falls upon the shoulders of the division distribution man designated in the organization chart accompanying the first of these articles. In order that he may be prepared to make investigations completely, he must carry a number of electrical testing instruments, both indicating and graphic.

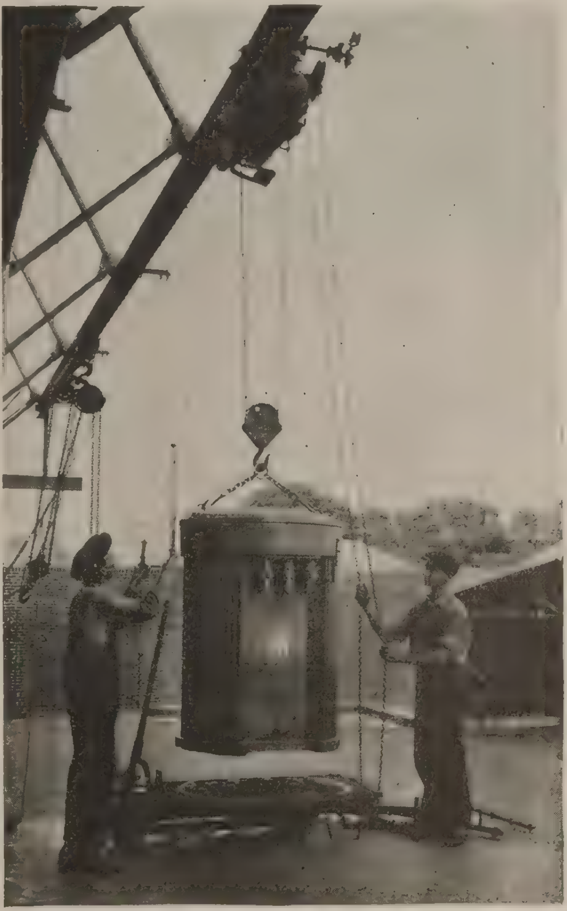
| Quantity | Article | Scale |
|---|---|---|
| 1 | Indicating ammeter | 0-5 |
| 1 | Indicating voltmeter | 0-150-300 |
| 6 | Graphic ammeters | 9-5 |
| 6 | Variable ratio current transformers | 25/50/100/200 |
| 8 | Graphic voltmeters | 90-130/180-260 |
| 2 | Potential transformers | 20:1 |
| 1 | Potential transformer | 60:1 |
| 1 | Line test set (Indicating ammeter and split core current transformer) | 0-35-125-250 |
| 2 | Ground current detectors | |
| 1 | Ground rod resistance test set | 0-40 ohms |
| 1 | Panel body truck ½ ton capacity.<br>Miscellaneous cable, rubber protection, tools, hand lines, etc. | |

A large number of instruments would require a heavy truck for transportation. This would be too slow and expensive. The few instruments which could be carried in a small car would be inadequate. To cover the situation, a ½-ton panel body truck has been used with the equipment listed in the accompanying table.

The distribution man in each operating division spends his entire time investigating losses. He is assisted by a man who takes notes used for the preparation and revision of distribution maps. The division meter man is also available when needed in checking questionable meter operation.

# Material-Handling Crane Saves Time and Labor

A 5-ton monorail electric crane installed at the distribution headquarters of the Los Angeles Gas & Electric Corporation has been found a great aid in loading and unloading distribution transformers and handling other heavy material used in overhead and underground construction work. As may be seen from the accompanying illustration, the crane has floor control for the motor for raising and lowering and chain control on the travel of the carriage. Transformers are placed on special loading skids so that the hand lift truck shown may be run under the skid and used for raising and moving the transformer about. The crane is also very useful for loading and unloading cable reels carried by trailers.



ELECTRIC CRANE LIFTING A 100-KVA. SUBWAY TRANSFORMER FOR LOADING ON TRUCK

# Electric Brooders Bring Good Revenue

### Survey shows cost of 2 cents per chick. One kilowatt-hour per chick required. Large load developed in western Washington

By J. C. Scott

*Agricultural Service Puget Sound Power & Light Company, Seattle, Wash.*

During the 1927 brooding season, from January to June, fully 1,500,000 chicks, or approximately 25 per cent of the chicks raised in western Washington, were brooded electrically. Complete data compiled by the Puget Sound Power & Light Company during the past brooding season on a number of electric brooders reveal some valuable information.

ELECTRIC UNDER-HEAT BROODER OF 1,000 CHICK CAPACITY OPENED TO SHOW INTERIOR

It was found that the average cost of electric current in the Puyallup district to bring one chick through the six-weeks brooding season was 2.1 cents. To obtain this figure 68 poultrymen, using 121 brooders of all makes, and 69,500 chicks were considered. A total of 70,675 kw.-hr. was required to brood the 69,500 chicks, or approximately 1 kw.-hr. per chick. The rate for the brooders was 4½ cents for the first 100 hours' use of the demand, and excess at 1 cent. A summary of results of the survey are given in the accompanying table.

A check of electric brooding costs in the Bellingham and Lynden (Wash.) districts showed the average cost for current to brood one chick for the entire brooding season to be 1.94 cents. This was based on 24 poultry farms and 45,400 chicks. In this instance, as in the Puyallup districts, the cost ranged from less than 1 cent to more than 3 cents to brood one chick. It required 40,173 kw.-hr. to brood 45,400 chicks, or 0.884 kw.-hr. per chick. The rate in this case also was 4½ cents for the first 100 hours' use of the demand and excess at 1 cent.

Poultrymen in western Washington have found that brooding with modern electric brooders produces better chicks and a more uniformly developed flock, reduces labor, care and attention, reduces fire hazard almost to nil and in most cases costs less than with fuel. Through its agricultural service division the Puget Sound Power & Light Company is actively developing the electric brooder load and expects 50 per cent of the 6,000,000 chicks raised in its territory during the spring of 1928 to be brooded electrically.

DATA ON ELECTRIC BROODING OF CHICKENS BASED ON 121 BROODERS AND 69,500 CHICKS

| | Max. | Min. | Average |
|---|---|---|---|
| Number of chicks per customer | 3,000 | 500 | 1,000 |
| Wattage of individual brooders | 1,200 | 500 | 750 |
| Kw.-hr. used during brooding season | 3,293 | 247 | 1,023 |
| Demand (kw.) per customer | 2.7 | 750 | 1.16 |
| Average rate paid per kw.-hr. (cents) | 3.5 | 1.45 | 2.1 |
| Customer's bill for brooding season | $62.23 | 8.89 | 21.60 |
| Number days brooding per batch of chicks | 60 | 30 | 45 |
| Kw.-hr. per chick | ...... | ...... | 1.015 |
| Cost per chick (cents) | ...... | ...... | 2.17 |

# Electrical Industrial Trucks Necessities at Grand Central Station

"Without our 50 drop-frame electrical industrial trucks," states H. A. Currie, assistant electrical engineer of the New York Central Railroad, "it would be impossible to operate the terminal and to care for even the normal amount of baggage. Hand trucks, no matter how many of them, could not possibly replace the electric baggage trucks."

Everything that is carried in a mail or baggage car is trucked from the train platforms on the electrical industrials. The mail averages 2,000 tons per day. Baggage amounted to 139,638 pieces in June of this year and 2,255 tons of newspapers were loaded. The tremendous task is accomplished quickly and well by some 50 vehicles, the majority of the drop-frame type but with five light-weight units for last-minute baggage service. The drop-frame trucks are built with platforms close to floor level, batteries being carried under one raised end and the motor under the other. Each has a capacity of 4,000 lb. The American Railway Express Company operates 42 drop-frame industrials in the same terminal.

The trucks used by the New York Central Railroad travel 115,000 miles a year, averaging 4½ miles a day apiece. A repair room is maintained in the terminal. Overhauling is done, not oftener than once in 2½ years. The battery room contains sufficient batteries to provide an extra set for half the fleet. These are kept constantly on charge, and as it requires but eight hours to impress a full charge the trucks are kept in 24-hour service by replacing the batteries in half of them at sixteen-hour intervals. Electricity for this service is supplied by the New York Edison Company.

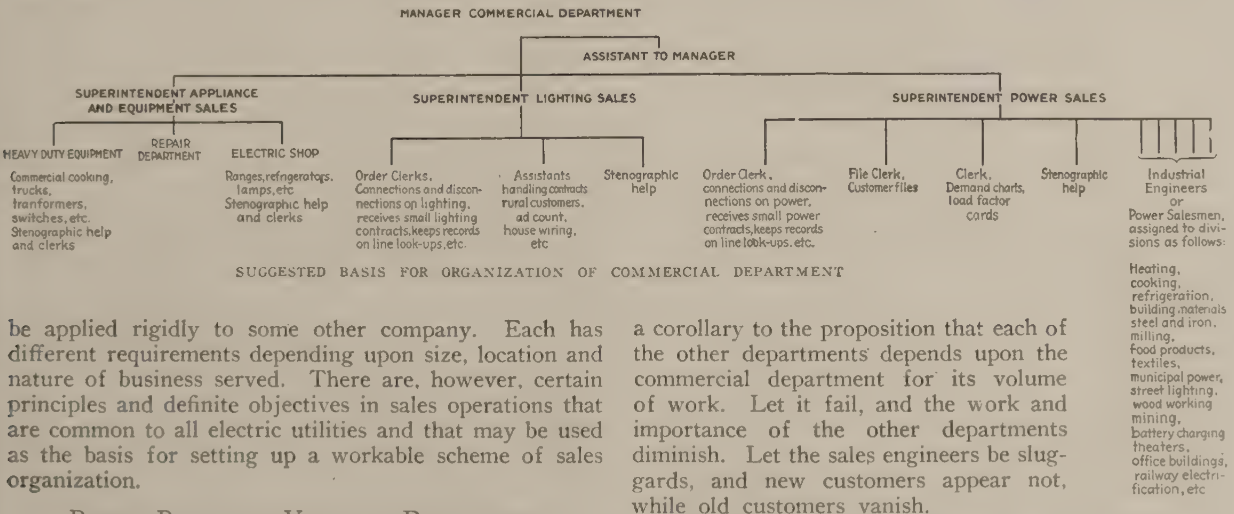
ELECTRIC DROP-FRAME TRUCKS SPEED TERMINAL MAIL AND BAGGAGE HANDLING

# Commercial Department
# Organized for Service

Principles and objectives of a central-station company's sales department. Formation of lighting, power and merchandise divisions that permits flexibility

By B. J. George
*Industrial Engineer Kansas City Power & Light Company, Kansas City, Mo.*

LOAD BUILDING and new-business development have become matters of vital importance to electric light and power companies within the last few years. What scheme of organization will prove most practical in rendering advisory service to customers and in adding revenue-producing business has been much discussed among utility men, who are confronted by the fact that many existing commercial departments have expanded and grown along lines of expediency rather than upon any definite program looking to a well-balanced and efficient sales organization. Obviously no set rules can be laid down nor could one company's plan of organization be applied rigidly to some other company. Each has different requirements depending upon size, location and nature of business served. There are, however, certain principles and definite objectives in sales operations that are common to all electric utilities and that may be used as the basis for setting up a workable scheme of sales organization.


MANAGER COMMERCIAL DEPARTMENT
ASSISTANT TO MANAGER
SUPERINTENDENT APPLIANCE AND EQUIPMENT SALES
SUPERINTENDENT LIGHTING SALES
SUPERINTENDENT POWER SALES
HEAVY DUTY EQUIPMENT
REPAIR DEPARTMENT
ELECTRIC SHOP
Commercial cooking, trucks, tranformers, switches, etc. Stenographic help and clerks
Ranges, refrigerators, lamps, etc Stenographic help and clerks
Order Clerks, Connections and disconnections on lighting, receives small lighting contracts, keeps records on line look-ups, etc.
Assistants handling contracts rural customers, ad count, house wiring, etc
Stenographic help
Order Clerk, connections and disconnections on power, receives small power contracts, keeps records on line look-ups, etc.
File Clerk, Customer files
Clerk, Demand charts, load factor cards
Stenographic help
Industrial Engineers or Power Salesmen, assigned to divisions as follows:
Heating, cooking, refrigeration, building materials steel and iron, milling, food products, textiles, municipal power, street lighting, wood working mining, battery charging theaters, office buildings, railway electrification, etc

SUGGESTED BASIS FOR ORGANIZATION OF COMMERCIAL DEPARTMENT

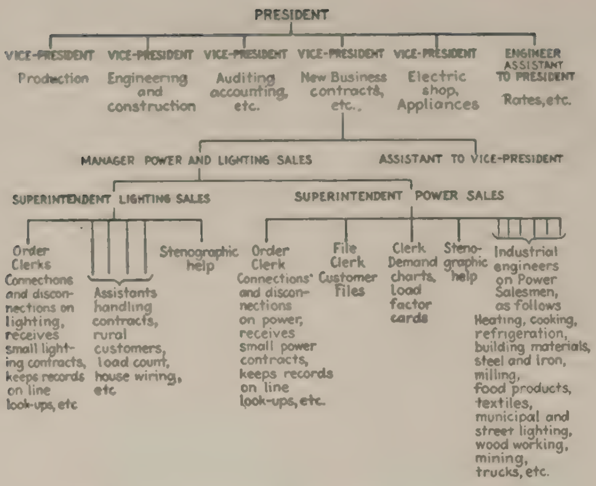
### Public Relations Value of Department

The commercial department of a public utility occupies a peculiar position in that it is the medium of contact between the utility and its source of revenue—its customers. It thus offers a point of contact with the public that is vital to the existence of the company. It must, of necessity, be correlated with the other departments of the utility—it must work hand in hand with the engineering and construction departments, since the engineering department supplies plans and estimates for line extensions pertinent to service to new or existing customers, the plans later being executed by the construction department.

Co-operation with the operating department enables the commercial department to be ready at all times to advise customers concerning the reliability, continuity and general satisfaction of the service rendered. The bookkeeping and collection departments supply the commercial department with information as to the billing and collection records pertaining to the customers' accounts. Likewise, each of the departments throughout the company supplies essential information and service to the commercial department. In fact, the department must look to every other department for its working material with which to approach the customer. This does not place the department in a minor position, but rather its co-dependence upon the other departments is a corollary to the proposition that each of the other departments depends upon the commercial department for its volume of work. Let it fail, and the work and importance of the other departments diminish. Let the sales engineers be sluggards, and new customers appear not, while old customers vanish.

A utility commercial department may be organized in a number of ways depending upon the volume and nature of the business handled. An ideal arrangement might consist of a chief-in-charge, under whom are three superintendents of lighting, power and appliance and equipment sales. Sometimes all three are grouped under one department head. In some cases one or more of the divisions may be under a chief, separate and distinct from the chief-in-charge of the remaining divisions. It must be realized that only in exceptional cases can there be an iron-clad, separate and distinct division among the functions of the subdivisions. An organization chart is good in so far as it is not permitted to bind and prohibit efficiency.

The lighting sales and power sales divisions handle all

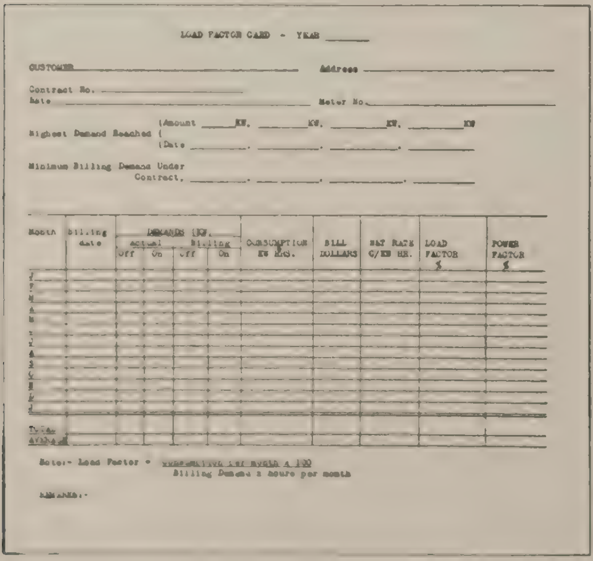

PRESIDENT
VICE-PRESIDENT
Production
VICE-PRESIDENT
Engineering and construction
VICE-PRESIDENT
Auditing accounting, etc.
VICE-PRESIDENT
New Business contracts, etc.,
VICE-PRESIDENT
Electric shop, Appliances
ENGINEER ASSISTANT TO PRESIDENT
Rates, etc.
MANAGER POWER AND LIGHTING SALES
ASSISTANT TO VICE-PRESIDENT
SUPERINTENDENT LIGHTING SALES
SUPERINTENDENT POWER SALES
Order Clerks Connections and disconnections on lighting, receives small lighting contracts, keeps records on line look-ups, etc
Assistants handling contracts, rural customers, load count, house wiring, etc
Stenographic help
Order Clerk Connections and disconnections on power, receives small power contracts, keeps records on line look-ups, etc.
File Clerk Customer Files
Clerk Demand charts, Load factor cards
Stenographic help
Industrial engineers on Power Salesmen, as follows
Heating, cooking, refrigeration, building materials, steel and iron, milling, food products, textiles, municipal and street lighting, wood working, mining, trucks, etc.

TYPICAL ORGANIZATION FOR LIGHTING AND POWER SALES

negotiations and contracts pertaining to their respective classes of business. The lighting sales department handles domestic lighting and house wiring. The power sales division is usually found to be more or less indistinctly divided into subdivisions pertaining to a certain class of customers, a certan class of industries or particular classes of applications of the product of the utility. The size of the company and the extent of its operations will, of course, largely determine the subdivisions. For example, ice and refrigeration industries, cement industries, apartment hotels, office buildings and theaters and industrial heating may be found in the widely ranged subdivisions. Each subdivision is delegated to one or more industrial engineers, who are to a degree specialists in their particular line and who co-operate with their fellow workers when problems interlink.

### Qualifications of the Power Salesman

The industrial engineer thus assigned to a particular class of business is enabled through attention to the articles in the technical press and attendance at conventions to keep up to the minute in his knowledge of the particular class of business assigned to him. The qualifications of a power salesman are a technical education, practical engineering training, a viewpoint of the industry, faith in himself, his company, its products and its ideals, a good address, courtesy, honesty and integrity of character and, above all, ability to judge men. In addition to the industrial engineers, there are, of course, the clerical force, stenographers and statisticians, the latter having to do more largely with the keeping of records as to demands, consumption, cost per kilowatt-hour and cost per unit output for the major customers.



LOAD FACTOR CARD - YEAR ______

CUSTOMER ______________ Address ______________

Contract No. ______________

Date ______________ Meter No. ______________

Highest Demand Reached (Amount ____ KW. ____ KW. ____ KW. ____ KW

(Date ____. ____. ____. ____

Minimum Billing Demand Under Contract. ____. ____. ____. ____

| Month | Billing date | DEMANDS (KW.) Actual Off | | Billing Off | On | CONSUMPTION KW HRS. | BILL DOLLARS | NET RATE C/KW HR. | LOAD FACTOR % | POWER FACTOR % |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Off | On | Off | On | | | | | |
| J | | | | | | | | | | |
| F | | | | | | | | | | |
| M | | | | | | | | | | |
| A | | | | | | | | | | |
| M | | | | | | | | | | |
| J | | | | | | | | | | |
| J | | | | | | | | | | |
| A | | | | | | | | | | |
| S | | | | | | | | | | |
| O | | | | | | | | | | |
| N | | | | | | | | | | |
| D | | | | | | | | | | |
| Total | | | | | | | | | | |
| Average | | | | | | | | | | |

Note:- Load Factor = Consumption per month x 100 / Billing Demand x hours per month

REMARKS:-

LOAD FACTOR CARD FOR RECORD OF LARGE CUSTOMERS

The appliance and equipment sales division is often divided into two subdivisions, one of which handles the sale of major equipment, such as switches, transformers, substations, motors, etc.; the other the retail salesroom, usually called the "electric shop," which handles the sale of domestic appliances—this to include district or territory salesmen and supervisors who handle the company's direct sale of appliances to residence customers.

The accompanying chart shows a scheme of organization of the commercial department that permits of a definition of duties and segregation of activities into logical groups, but which maintains all commercial activity under one head. This permits close co-operation and flexibility, which will allow a temporary shifting of trained men from one division to another when the work in a division makes assistance advisable. This is not always convenient where departments are widely separated under different heads. Especially is this so when jealousy is present.

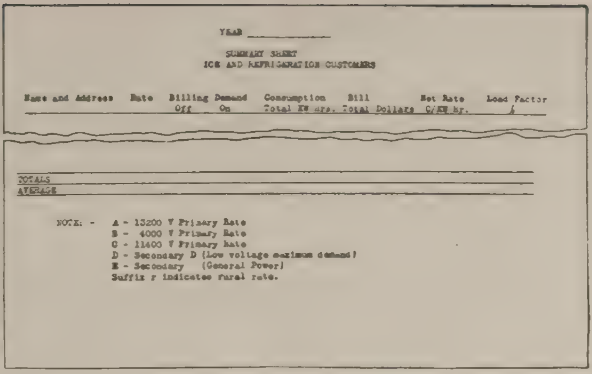
A second chart shows a plan of organization used in some cases. It differs from the first chiefly in that the domestic appliance sales department is under a separate chief; also in that the sale of heavy-duty equipment in the power sales department is handled by the individual power salesmen, whereas in the other the appliance and equipment sales division handles the sales in co-operation with the various power salesmen. The assignment of duties to power salesmen will, of course, depend largely upon the territory served. For instance, a utility in the East would have little work for a specialist on milling, but might have great need for one on textile industries.

The organization scheme should be decided upon only after careful study of conditions to be met. Once adopted, a copy of the chart should be available to all members of the department. It should show the responsibility and duties of every individual in the department. Nothing else will so assist a new member in grasping his duties and the routine of the department. Nothing will so easily assist to maintain a smoothly working machine. In addition, the department should have a manual describing briefly the work of the department, the routine orders and records, and the method of handling the business of the department.

It is essential in any organization that the head of the division select one or more of his men and train them to be able to take his place as division head in the event of promotion, sickness, vacation or resignation. The true test of management is whether or not the manager or superintendent feels that if he were suddenly called away for several weeks, his department could continue to function efficiently during his absence. The president of the company who posted the sign, "There is not a man in our employ whose services cannot be dispensed with immediately," had in mind the real criterion of organization.

The particular problems of the commercial department are: (1) to secure new customers and new business in order that the utility may grow; (2) to retain old customers and to anticipate their further needs as well as to show them how to use more of the service of the utility to their own economic advantage; (3) to act as a good-will agency, adjusting major complaints and placing the utility in a more favorable light of public opinion; (4) special work in carrying out expansion or reconstruction programs where direct negotiations with the customers are necessary. To illustrate, in changing from one frequency to another or from direct to alternating current, as is often found necessary, the equipment of the customer must be listed, contracts signed, arrangements made for providing new equipment, and the actual change supervised. In so far as it affects the customer, this is the logical duty of the commercial department.

To expedite the work of the department, certain tools are advisable. First, a well-organized filing system preferably handled by one individual in each division. Ample indexes and cross-indexes should be provided. Papers should be securely fastened in manila folders and filed chronologically. Data concerning the individual customers and prospects should be entered on a record card. In addition, a complete record of the demands, consumption and billing for certain customers should be kept monthly by the power and lighting sales departments. This should include all of the larger customers and representative smaller customers in various industries. The card records thus kept are valuable in considering new business and in answering inquiries about present customers. A "load factor card" affords valuable



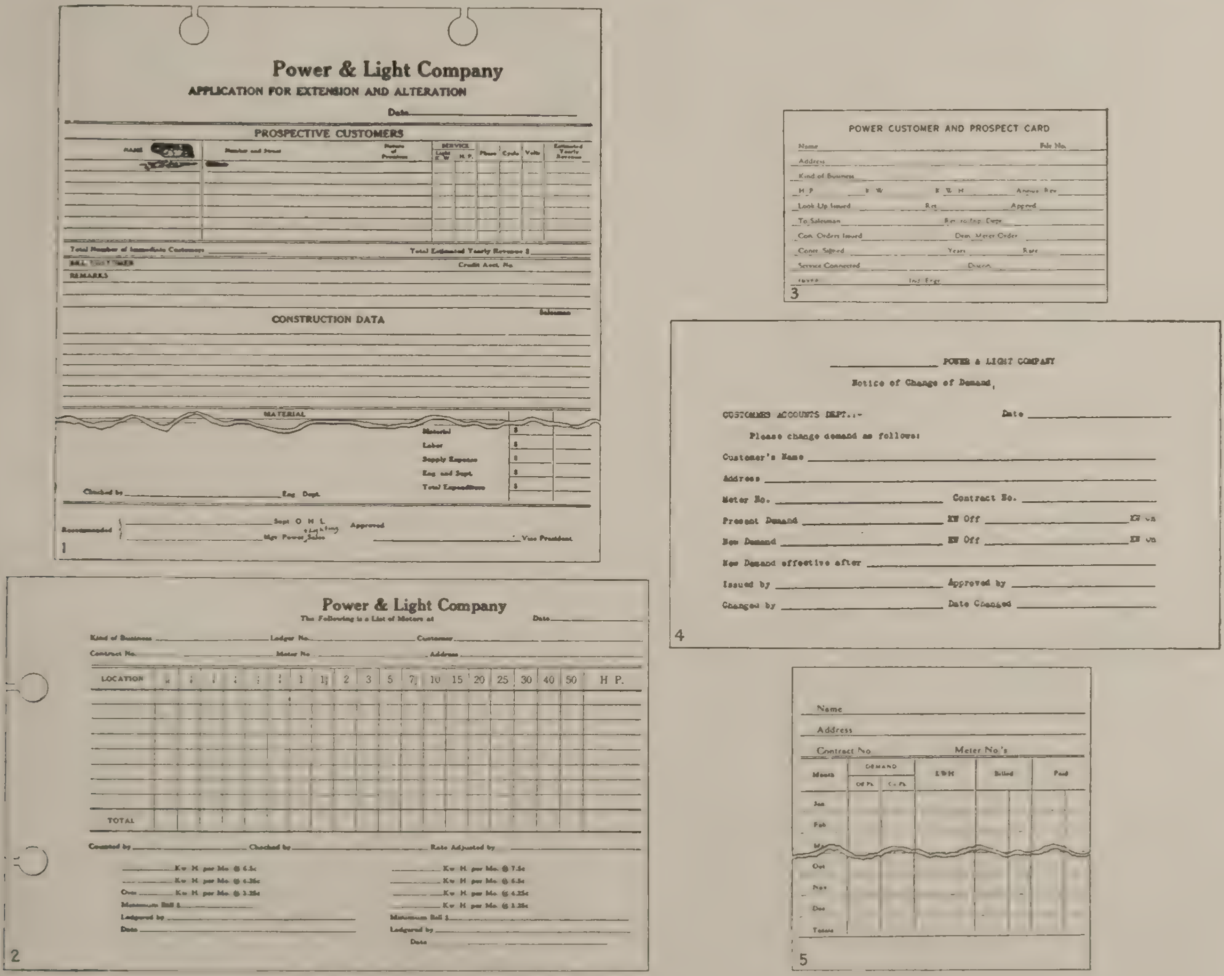
YEAR ____________

SUMMARY SHEET
ICE AND REFRIGERATION CUSTOMERS

| Name and Address | Rate | Billing Demand Off | Billing Demand On | Consumption Total KW Hrs. | Bill Total Dollars | Net Rate C/KW Hr. | Load Factor % |
|---|---|---|---|---|---|---|---|
| TOTALS | | | | | | | |
| AVERAGE | | | | | | | |

NOTE: - A - 13200 V Primary Rate
B - 4000 V Primary Rate
C - 11400 V Primary Rate
D - Secondary D (Low voltage maximum demand)
E - Secondary (General Power)
Suffix r indicates rural rate.

FORM OF SUMMARY FOR DIFFERENT CLASSES OF BUSINESS



Power & Light Company
APPLICATION FOR EXTENSION AND ALTERATION
Date ____________

PROSPECTIVE CUSTOMERS

| Name | Number and Street | Nature of Premises | Service Light K W | Service H. P. | Phase | Cycle | Volts | Estimated Yearly Revenue |
|---|---|---|---|---|---|---|---|---|

Total Number of Immediate Customers ________ Total Estimated Yearly Revenue $ ________
Credit Acct. No.
REMARKS
Salesman
CONSTRUCTION DATA
MATERIAL
Material $
Labor $
Supply Expense $
Eng. and Supt. $
Total Expenditure $
Checked by ____________ Eng. Dept.
Recommended ____________ Supt. O H L + Lighting
____________ Mgr. Power Sales
Approved ____________ Vice President
1

Power & Light Company
The Following is a List of Motors at ________ Date ________
Kind of Business ________ Ledger No. ________ Customer ________
Contract No. ________ Meter No. ________ Address ________

| LOCATION | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 1 | 1½ | 2 | 3 | 5 | 7½ | 10 | 15 | 20 | 25 | 30 | 40 | 50 | H P. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL | | | | | | | | | | | | | | | | | | | | |

Counted by ________ Checked by ________ Rate Adjusted by ________
________ Kw H per Mo. @ 6.5c
________ Kw H per Mo. @ 4.25c
Over ________ Kw H per Mo. @ 3.25c
Minimum Bill $ ________
Ledgered by ________
Date ________
________ Kw H per Mo. @ 7.5c
________ Kw H per Mo. @ 6.5c
________ Kw H per Mo. @ 4.25c
________ Kw H per Mo. @ 3.25c
Minimum Bill $ ________
Ledgered by ________
Date ________
2

POWER CUSTOMER AND PROSPECT CARD
Name ________ File No. ________
Address ________
Kind of Business ________
H P ________ K W ________ K W H ________ Annual Rev. ________
Look Up Issued ________ Rec ________ Approved ________
To Salesman ________ Ret. to Eng. Dept. ________
Con. Orders Issued ________ Dem. Meter Order ________
Contr. Signed ________ Years ________ Rate ________
Service Connected ________ Discon. ________
Issued ________ Ins. Engr. ________
3

________ POWER & LIGHT COMPANY
Notice of Change of Demand

CUSTOMERS ACCOUNTS DEPT.:- Date ________
Please change demand as follows:
Customer's Name ________
Address ________
Meter No. ________ Contract No. ________
Present Demand ________ KW Off ________ KW On
New Demand ________ KW Off ________ KW On
New Demand effective after ________
Issued by ________ Approved by ________
Changed by ________ Date Changed ________
4

Name ________
Address ________
Contract No ________ Meter No.'s ________

| Month | Demand Off Pk. | Demand On Pk. | KWH | Billed | Paid |
|---|---|---|---|---|---|
| Jan. | | | | | |
| Feb. | | | | | |
| Mar. | | | | | |
| Oct. | | | | | |
| Nov. | | | | | |
| Dec. | | | | | |
| Totals | | | | | |

5

*Forms Used in Commercial Department Work*

No. 1.—Request for estimate on extension or alteration of service indicating necessary information regarding existing conditions.

No. 2.—Record of customer's connected motor load used by billing department; a similar form is used for lighting.

No. 3.—File card for office record.

No. 4.—Notice to billing department of change in customer demand.

No. 5.—Form used to study customer's monthly demand and energy consumption.

data on a customer's record. This may be modified to suit the particular organization and its rate schedules. The data from the load factor cards should be totaled and averaged annually, classified as to industries and tabulated in a form similar to that shown. Copies of the total report thus prepared should be placed in the hands of each member of the department interested. It makes a useful reference book and permits comparisons of figures for different customers.

### USE OF TECHNICAL JOURNALS

The commercial department should have at its disposal copies of the various technical magazines, and the salesmen should be kept informed of current articles pertaining to their respective fields of work. Publications covering the various industries should be available. Close contact with the statistical department is valuable to the commercial department as augmenting its own data. Typical blanks used in power and lighting sales departments are shown in the accompanying group of illustrations. These cover practically all the usual requirements for information which is desired on standard forms or is needed for ready reference.

Routine visiting of customers is an important function of a utility sales organization. Customers as well as prospects should be visited as often as facilities permit. Some companies have in operation systems whereby each salesman reports in detail all calls. This may be and is useful in the sales of domestic appliances, but it is doubtful whether it will work or is necessary in power and lighting sales work. Too much time of the salesman is apt to be used in making reports. More money spent on transportation to expedite calls seems more logical. The writer believes that whereas written reports on major customers and prospects may be advisable, more can be accomplished by a conference between each salesman and his immediate superior once a month or oftener. The conference should cover the general field of the salesman's activities and should be supplemented by a written summary made by the salesman, giving briefly the status of each customer and prospect. Department meetings now and then are helpful if properly conducted and not allowed to become a place for trivial discussions on the part of those attending them.

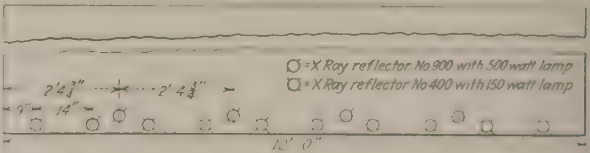
From time to time, either yearly or at most every two years, a summary of prospective load on both present and possible customers should be made either by a field survey made by the salesmen or by compilation from the records at hand as checked against the latest information available from the salesmen. By means of such a survey it is possible to concentrate upon the acquisition of the most valuable business, leaving the less valuable load as a secondary consideration. Only by means of such a survey can the work of the department be logically planned.

Consideration should be given to the fact that more and more the work of public relations is coming to be associated with the commercial department. Already in many organizations the commercial department handles most complaints as to billing and service. It may be advisable to add to the commercial department a fourth division to handle customer or public relations. The salesmen, who should be men of above the average intelligence, are constantly furthering public relations. Utility commercial departments could logically handle advertising, arrange plant visits, secure speakers on utility subjects, and otherwise work to win the good will of the public.

## Daytime Window Lighting Effective

TESTS made by the Tennessee Electric Power Company have proved that high-intensity show-window lighting is very effective during the daytime to dispel reflections. Data collected from the test are given in the accompanying table and show that the attractive power of the window was increased 93 per cent with high-intensity illumination.

These tests were made in one of the windows of Loveman's department store in Chattanooga, the lighting units being arranged as shown in the accompanying diagram. Regular night illumination is furnished by ten 150-watt lamps on 14-in. spacing. For high-intensity illumination four 500-watt lamps were installed, these being placed on 2-ft. 4¾-in. centers. For the daylight tests all of the lights were used. Tests have also been made on some of the other store windows in Chattanooga, using the regular fixtures for daylight use. All of these tests have proved conclusively that the attractiveness of the windows is materially increased.


= X Ray reflector No 900 with 500 watt lamp
= X Ray reflector No 400 with 150 watt lamp
2'4¾"
2' 4¾"
9"
14"
12' 0"

HIGH INTENSITIES USED FOR DAYTIME LIGHTING

RESULTS OF TEST ON HIGH-INTENSITY ILLUMINATION OF STORE WINDOWS

The tests were run on the following dates: Dec. 2, 3, and 6, 1926. The same display was used for all three tests.

| Time, P. M. | Lights | Number Passers-By | Number Passers-By Attracted | Passers-By Attracted, Per Cent |
|---|---|---|---|---|
| 2 to 2:30 | No lights | 948 | 109 | 11.4 |
| 2:35 to 3:05 | All lights | 929 | 177 | 19.0 |
| 3:10 to 3:40 | No lights | 1,177 | 117 | 9.9 |
| 3:45 to 4:15 | All lights | 994 | 191 | 19.2 |
| 2 to 2:30 | All lights | 976 | 184 | 18.8 |
| 2:35 to 3:05 | No lights | 978 | 70 | 7.1 |
| 3:15 to 3:45 | All lights | 1,111 | 100 | 14.4 |
| 2:30 to 3:00 | No lights | 1,146 | 69 | 6.0 |
| 3:15 to 3:45 | All lights | 1,230 | 148 | 12.0 |

| | |
|---|---|
| Average number passers-by per half-hour with lights on | 1,048 |
| Average number attracted per half-hour with lights on | 172 |
| Average number passers-by per half-hour with no lights | 1,062 |
| Average number attracted per half-hour with no lights | 91 |
| Average per cent attracted per half-hour with lights on | 16.6 |
| Average per cent attracted per half-hour with no lights | 8.6 |
| Increase in attractive power of window with all lights on over window with no lights on, per cent | 93 |
| Cost of lighting window for half-hour with full wattage, cents | *3.5 |
| Cost per increased persons attracted with high-intensity lighting over no lights, cents | 0.043 |

*These figures are based on a rate of 2 cents per kilowatt-hour.

# Distributing Goods Through a Bonded Warehouse*

By Charles L. Eidlitz

*Chairman Board of Governors*
*Electrical Board of Trade of New York*

WHAT is the loss to the industry because of slow-moving stock? Is there not a remedy or help for it? Assume, for argument's sake, that there are 1,000 jobbers and dealers in the metropolitan district. Each one must carry a stock of thousands of items, and many items must be carried in large quantities. This means two things—a large outlay of money to purchase the stock, and an expense for warehousing or stocking space. If a way could be found for relieving this condition in the industry, yet making the stocks immediately available to all the adjacent markets, would it not be a great saving all around?

The manufacturer, on the other hand, who distributes through these channels, must make up large quantities in order to furnish the stock to these many sources. Now a manufacturer, as a rule, is not very greatly interested in having his products on some man's shelf in a dust-covered or dilapidated condition, even if it is paid for. He wants his material sold and moved in order that the supply of new orders shall come in steadily. Yet, in many lines, the fact is that certain distributors buy their stock and then do not move it, owing to several reasons. They may not have the kind of trade that requires these lines, or they may be particularly active in some specialties, making very little effort to sell the other materials, or they may be lazy and incompetent, but the net result is that the manufacturer has thousands of dollars' worth of his material, paid for but still not being consumed, while other jobbers or dealers are calling for more and more on re-orders. And then, suddenly, these slow-movers are sold at a bargain or at a bankrupt sale by the company which has been unable to dispose of them through its ordinary channels for one reason or another, completely demoralizing the market.

It is quite possible that certain materials might find a better market in a different locality, such as Philadelphia or Chicago and, when these calls come in, if the manufacturer could gather up his surplus or slow-moving stock from the inactive jobbers or dealers, which he cannot do at the present time, and put it where it would be consumed, instead of having to manufacture more of it, his situation from a manufacturing standpoint would be greatly improved. I am confident that there is a solution to this problem of distribution and would suggest that some consideration be given to the establishment of a bonded warehouse, operated possibly by the Electrical Board of Trade, or some other agency. Manufacturers could ship in a quantity of material to take care of the requirements of the metropolitan district, under bond. The individual jobber and dealer would buy only a small supply, which would be shipped directly. Whenever they needed a stock, they could order it out of the bonded warehouse, and the manufacturer could give instructions as to the honoring of such orders. The warehouse would deliver, take a receipt and send the manufacturer the receipt, so that he could bill direct. The manufacturer would thus be in direct control of his goods, could shift them in any desired quantity to other neighborhoods, his investment would be smaller and the jobbers' money would not be tied up. There are innumerable banking, financial and other benefits that would result from this plan, to say nothing of reducing frozen assets by 50 per cent or more.

Of course, there are many details that must be worked out, but it does seem that there is enough in the idea to warrant giving it consideration. The cry nowadays is "simplification and economy in distribution." To my mind, the bonded warehouse is one answer to this distribution problem.

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*From an item appearing in the service letter, Vol. 4, No. 52, of the Electrical Board of Trade of New York, Inc.*

# Attractive Sales Quarters in Portland, Ore.

ONE of the most attractive merchandise salesrooms of any central station on the Pacific Coast is that of the Northwestern Electric Company in the new Public Service Building, Portland, Ore. High-intensity lighting is one of the special features. The sales floor is approximately 75 ft. x 100 ft. and has an average intensity of 22 foot-candles with 6 watts per square foot of floor area provided by eight 1,500-watt and 32 500-watt Ivanhoe "Celestialite" units.

Spacious windows and special attention given to show cases and arrangement of display give the whole room a pleasing ensemble effect.

APPLIANCE DISPLAY ROOM OF NORTHWESTERN ELECTRIC COMPANY, PORTLAND, ORE., HAS 22-FOOT-CANDLE LIGHTING INTENSITY

# Letters from Our Readers

## *Transmission Line Insulation*

*To the Editor of* ELECTRICAL WORLD:

It is impossible for engineers familiar with modern laboratory methods used in the testing and design of high-voltage insulators to read Mr. Austin's article, "Transmission Line Insulation," without comment.

It is a recognized axiom that laboratory data are only applicable in the solution of field problems when they account for all the factors which are encountered in the field without addition or subtraction. At the present time there are ample field data to prove that sustained high frequency does not exist upon transmission lines. Moreover, by a simple calculation it can be shown that the power necessary to maintain on a line high frequency of a sufficiently large voltage to cause insulator flashovers would be so great as to preclude such a possibility. Be that as it may, the weight of the evidence indicates that the existent surges are of a single impulse or highly damped character of relatively low frequency.

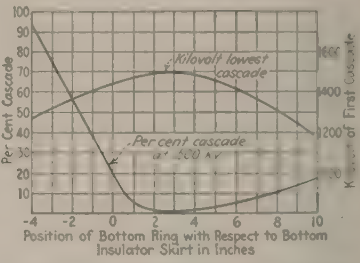
Unfortunately, much of the evidence presented in Mr. Austin's paper deals with the use of a sustained high frequency of 70,000 cycles. In this connection the author states: "This class of test has been questioned, but it must be remembered that where wood is used in series with an insulator this test will give lower values than an impact having a very steep wave front." It is not a matter of being "questioned." It just cannot be accepted as anything more than an interesting exhibition of a certain type of air breakdown, entirely unrelated to the problems at hand. Since sustained high frequency of 70,000 cycles does not exist in the field, laboratory results based on the use of such a source of power are of academic interest only.

Those who have made a study of the arcing characteristics of different types of alternating current and surges realize that the mechanics of breakdown of air gaps when subjected to a steep voltage wave front or 60 cycles is entirely different than with 70,000 cycles.

The failure of the air in the latter case is due to the persistence from cycle to cycle of ionized particles in the path of the discharge. This is not so with the two former types of voltage breakdown. Evidence of this is shown in Fig. 1* of Mr. Austin's article. Unfortunately, for the sake of comparison the tower clearances about the two strings shown are entirely different. It can be clearly seen, however, that by dampening the corona with cages about the conductor and by putting porcelain tips on the arcing horns of the string shown in the left of the photograph that the initial corona point is raised, which consequently tends to prevent the ionization of the air and resulting progressive failure. No doubt the flashover of the string as regards sustained high frequency may be considerably raised by such methods. As already stated, however, such an exhibition is of interest only as a bit of electrical phenomena. Furthermore, the different tower clearances prevent it from being, as the title states, "comparative test at 70,000 cycles." In view of these facts the value of the flashover results in Fig. 4 may well be questioned.

The impact tests shown in Figs. 10*, 11* and 12* cannot go unchallenged. These tests purport to be an impact of 1,280,000-volt peak. The voltage and energy of the impulse arc are stated, but no mention is made of the time taken for it to reach a maximum. Those in touch with matters of this nature will realize the importance of this factor. In Fig. 11* the protective device shown is so placed that its value is entirely lost. From the accompanying curve it can readily be seen that this device is dependent entirely on position for the character of its performance. This curve was arrived at only after repeated tests. Any one familiar with impact tests of this type understands how important it is for a number of tests to be given. It is perfectly possible to have a string of insulators equipped with protective devices which would clear an arc nine times out of ten and yet cascade on the tenth impulse. No single picture can possibly tell the whole story.

Mr. Austin's "counter-potential wire" is quite interesting, but apparently not very practicable. The scheme as outlined is to have the line insulators mounted on supports insulated from the ground. These insulated portions are to be bonded together by a wire paralleling the transmission conductors. The theory depends upon the idea that a surge will raise the potential of the insulator supports to a potential corresponding to the conductors because of the charge induced upon this "counter-potential wire." This action is supposed to prevent flashovers. In case of wood-pole construction some such effect might be produced under dry conditions. Unfortunately, Mr. Austin has ignored rain conditions despite the fact that most predatory surges take place under such conditions. Wet wood poles would convert Mr. Austin's wire into nothing more than a poorly grounded ground wire.



ARCING CHARACTERISTICS OF FOURTEEN NO. 7,500 INSULATOR UNITS IN SERIES

Mr. Austin increases the field of application of this device to include lines of steel tower construction. In Fig. 13† of his article is shown a steel tower, the top of which is insulated from the base by means of wooden beams. In the case of such towers the "counter-potential wire" is supposed to raise the voltage of the whole top of the tower to a potential comparable to that of the conductors.

Because of the large capacitance to ground of all the metal work involved and because of the fact that at the moment before the release of the bound charges on the conductors the top of the tower might actually be at a potential below or above ground it is not conceivable that the "counter-potential wire" would function at all as outlined. Rain, of course, would have the same bad effect as in the case of the wood poles.

The use of an insulated ground wire is undoubtedly a good idea under certain conditions. In fact, the whole idea is making use of the insulating effect of wood construction, which, while new, is worth attention.

It is unfortunate that the data contained in Mr. Austin's article are clouded by the methods of test used and the lack of recognition of contemporary research.

Locke Insulator Corporation,
Baltimore, Md.

D. H. ROWLAND,
Research Engineer.

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* ELECTRICAL WORLD, *Dec. 24, 1927.*

† ELECTRICAL WORLD, *Dec. 31, 1927.*

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

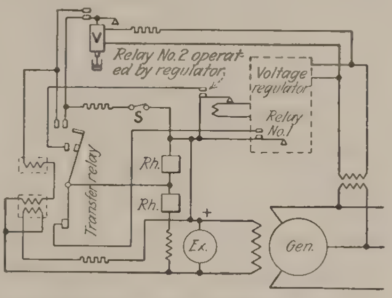
*Vernayez Hydro Station.*—The present capacity of this plant, which serves primarily to supply part of the Federal Railway electrification of Switzerland, comprises two 11,000-kva., 16⅔-cycle, single-phase generators and one 14,000-kva., 50-cycle, three-phase machine, driven by Pelton wheels under a head of 2,000 ft. of water. All three generators operate at 333⅓ r.p.m. The large size of the machines made it necessary to build the stator in four parts. The highly insulated and heavily braced winding gives a potential of between 15 and 16.5 kv., and was tested at 39 kv. Each of the six poles is held in the five rotor hub plates by means of special wedges, seated in carefully machined circular slots. The pole face is laminated and carries a strong damper cage. The pole winding consists of two concentric edge-wound copper strip coils. At 0.75 power factor and full load the single-phase generators have an efficiency of 92.7 per cent. Automatic $CO_2$ fire-extinguishing equipment is installed on each generator.—*Bulletin Oerlikon*, December, 1927.

*Combined Low Temperature Carbonization and Combustion.* — David Brownlie.—Two defects in electricity supply practices are mentioned in connection with steam generation, the loss due to latent heat in the condenser cooling water and the combustion of raw coal under the boilers. In discussing the combustion problem, the use of a combination of low temperature carbonization and combustion, which submits coal to suitable heat treatment previous to the use in the boilers and separates liquid products before burning both gas and fuel in the combustion chambers is advocated. A description of low-temperature carbonization plants which have been in successful operation for some time is followed by an exposition of some of the more recent developments of the basic processes involved. The new Bartling process is suggested as a most interesting development in low temperature carbonization of pulverized coal. This process has been used with a special separator for the elimination of solid particles from the gas.—*World Power* (*England*), December, 1927.

*The Effect of Heat Treatment on Cold-Drawn Steel Tubes.*—F. C. Lea.—The extensive use of cold-drawn steel tubes in modern machines and structures renders the adequate investigation of their properties a matter of considerable importance. Boiler tubes, it is stated, are not infrequently overstrained in order to increase their length and to make it possible to reuse them after being cut from the tube plate. The test investigation covers the statical and repetition-stress tests on carbon-steel tubes and includes compression tests, torsion tests, changes of density under heat treatment, hardness tests, the effect of repeated stresses, the effect of gradually increasing the repeated stress and similar factors of a significant nature.—*Engineering* (*England*), Dec. 23, 1927.

## *Transmission, Substation and Distribution*

*Protection from Overvoltage Due to Voltage Regulators.*—J. H. Ashbaugh.—In the event that regulator contacts become stuck voltage may be raised to a high value. This is often a direct result of excessive condenser capacity across the contacts. It is stated by the author that excessive capacity used for contact protection will produce a large current, which, together with a relatively high resistance, induces a welding action. As the tendency to weld increases with the amount of condenser capacity used, difficulties may be reduced by a curtailment of condenser capacity. Several methods and devices may be employed to eliminate this welding action with ensuing high-voltage conditions, but most of them have limitations. A scheme is now available for the protection of small stations whereby they may be assured of continuity of service without any hazard of overvoltage due to the failure of regulator contacts. The device is quite simple and may be added to any existing installation. It consists of adding an auxiliary rheostat shunting relay, actuated by the regulator, to which is transferred the regulating duty if the contacts of the regulator relay should stick together. This device has a time delay feature which prevents the transfer from taking place for transient voltage changes due to load variation. The time delay is adjustable to suit the individual station or load conditions. The transfer must be smooth and exceedingly fast. In case of overvoltage, the regulator brings the voltage back to normal with all the speed for which the vibrating regulator is noted.—*Electric Journal*, November, 1927.



TRANSFER RELAY PLAN PREVENTS REGULATOR OVERVOLTAGE

## *Generation, Control, Switching and Protection*

*The Application of Relays for the Protection of Power System Interconnections.*—L. N. Crichton and H. C. Graves, Jr.—A compilation of many of the new methods for relay protection required by superpower interconnections. The ideas have been obtained from various sources and represent present-day practices. The general requirements for such interconnections are mentioned, with particular reference to protection against phase-to-phase short circuits in those cases where the short-circuit current, under certain system conditions, is less than the full-load current under other conditions. The clearing of accidental grounds is discussed and a new study of the residual currents on systems of different types is given. The usefulness of certain inverse time limit relays on systems having dead-grounded transformer neutrals at all switching stations is indicated. A typical relay installation is offered as an example and is similar to that now being placed in service on a 200-kva. interconnection.—*Report American Institute of Electrical Engineers*, November, 1927.

*De-Excitation of Large Generators.*—R. Pohl.—Two basic methods are known to quickly de-excite large generators—the introduction of resistance and the motor method. The latter, in most instances, utilizes the exciter as a motor with its field reversed and is then combined with the former. Both methods are critically investigated in this discussion. It is stated that at the same voltage peak on the collector rings the methods are equally fast, providing that the exciter operates as main motor with moderate iron saturation. Conditions may be improved if the motor is provided with constant excitation and is highly saturated during the period of de-excitation. The important influence of the damper winding on large turbo-generators is investigated. It is shown to be permissible to open the inductor circuit directly on large generators without undue increase of the voltage on the collector rings. This gives a simple and effective means of de-excitation. — *Elektrotechnische Zeitschrift*, Nov. 24, 1927.

## *Motors and Control*

*Protection Systems in Coal Mines.*—E. P. Austin.—The practices involved in the wiring and protection, through relays and similar devices, in the coal mines of Great Britain are reviewed. Among the conclusions derived as a result of this investigation are: Neutral points should be grounded, leakage and overload protection should be used on each main feeder and sub-feeder, pumps and large haulages should have separate feeders so that faults on distribution cables will not affect these important units and fuses should be used only on single-phase, low-voltage circuits. It is stated that greater safety below ground would result if the existing rules were supplemented along the lines indicated so that there would be a definite uniform standard for every mine.—*Electrical Review (England)*, Dec. 23, 1927.

## *Electrophysics, Electrochemistry and Batteries*

*The Boltzmann-Hopkinson Principle of Superposition.*—F. D. Murnaghan.—The principle of superposition for dielectrics, discussed by Hopkinson, has been used for some time in experiments. The validity in regard to the several theories which have been advanced for dielectric behavior has been shown in only a few cases. One of these exceptions is the important theory of Maxwell. This paper shows that the principle of superposition is a necessary consequence of Maxwell's theory. It goes somewhat further and shows that the principle is valid for any theory which leads to a system of linear differential equations with constant coefficients.—*Journal American Institute of Electrical Engineers.*—January, 1928.

*High Voltage Insulators.*—W. Huter.—A detailed critical review of the various types of insulators and leads, such as are used today on high-voltage apparatus, including bushings and post insulators. Single-piece and two-piece air and compound filled porcelains are described and data given on the dielectric properties of filling compounds. The characteristics of oil-filled bushings are discussed in connection with the great improvement realized through the introduction of solid cylinders in series with the oil. Condenser type paper leads and multiple tube porcelain bushings are described. Examples of failures are offered for each type.—*Elektrotechnische Zeitschrift,* Nov. 3, 1927.

## *Units, Measurements and Instruments*

*33,000-Volt Cable Testing.* — M. Hochstadter and E. Bowden.—A review of present day high potential cable-testing practice and a suggested specification of factory and installation tests embodying a combination of the usual methods. The specification as offered is based upon a large amount of experience and it is considered that the conditions are wide enough to be met by all manufacturers with modern plant and reasonable care in design and manufacture and at the same time strict enough to safeguard the interest of the buyer in his endeavor to obtain a cable that can be relied upon to give satisfactory service. The factory test suggested includes dielectric resistance, pressure, capacity, dielectric loss, breakdown, bending and stability. The installation test includes pressure, dielectric resistance, current rating, and joint and terminal box pressure test. It is suggested that these tests be taken under conditions such that the wave form of the supply be as nearly as possible of sinusoidal shape.—*Electrical Review (England)*, Nov. 25, 1927.

## *Telegraphy, Telephony, Radio and Signals*

*Design and Application of Giant Loud Speakers.*—F. Trendelburg.—The author gives a mathematical explanation of the phenomena involved when mechanical energy is transformed into acoustical energy. The ideal sound emitting surface is a sphere, or, as the author calls it, a "breathing sphere." Approximations to it are cones, circular diaphragms and large square surfaces. Small cones and diaphragms require mechanical sound amplification by means of a horn. Characteristics of paper and metal horns are given, indicating their varying sensitiveness depending upon the sound frequency. It is claimed that for large sound energies, such as are required by public address speakers, the condenser type with an emitting sheet 20 x 20 in. gives best results with a minimum of distortion within a range of 50 to 8,000 cycles. Interesting semi-circular diagrams are given to show the directional sound distribution for two types of such speakers for frequencies between 200 and 7,000 cycles. Operating experiences with giant loud speakers are given. Tests made in a stretch of open country indicated that a hornless sheet speaker, as mentioned above, permitted the spoken word to be clearly understood over a distance of ½ mile. — *Elektrotechnische Zeitschrift,* Nov. 17, 1927.

## *Traction*

*Economies Effected by the Electrification of the Paulista Railway.*—S. B. Fortenbaugh.—Data for the electrified Paulista Railway of Brazil are offered, with comparisons of previous operating expenses for the same railway when using other means of motive power. The comparative figures thus included cover a period of several years and have been reduced to a train-kilometer basis and evaluated upon the same plan. As wood, coal and oil were all used under the previous operating conditions, unusually interesting comparisons have been developed.—*General Electric Review,* December, 1927.

*Electrical Equipment of Electric Road Vehicles.*—L. W. de Grave.—Features involved in the design and operation of electric trucks are considered in relation to operating economies and reliability. The relative merits of battery control through resistance and resistance control are discussed. The question of shunted-parallel fields, as well as brake interlocks, regenerative control, electric brakes and the specifications of controller contacts and fingers are considered. A brief consideration of the most economical operating procedure is offered. — *The Electrician, (England)*, Dec. 9, 1927.

## *Miscellaneous*

*A Study of the Compressive Strength Dispersion of Materials with Applications.*—John Tucker, Jr.—The express purpose of this article is to propound a theoretical fundamental theory for the compressive-strength dispersion of homogeneous isotropic materials and to substantiate these theorems by previously published relevant data, where available, and by specially prepared specimens where no data exists. The strength dispersion to which reference is made are those variations from the mean, exhibited in the ultimate strengths of individual test specimens made of a uniform material and under uniform conditions, for which there are no assignable or controllable causes. Basic experimental data, from which the ultimate strength dispersion parameters may be computed, are very meager, since a large number of multiplicate test specimens are necessary to determine these parameters with a satisfactory degree of precision. In order to obtain the necessary data, portland cement mortar and concrete were selected as the materials, and a number of test cylinders of these materials were made and tested in compression. As a result of this investigation, the author states that the strength dispersion has been found to be an essential factor in safe-stress determination, and that the strength-frequency curve is of the normal form, or very close to the normal form, and of such character as to permit its use in engineering calculations. —*Journal of The Franklin Institute,* December, 1927.

*Temporary Safety Grounding.*—A review of desirable practices in connection with temporary grounding methods as used by a number of the leading electric light and power companies. The grounding practices involved in connection with all types of electric equipment are included. As the result of the investigations of this committee it is concluded that every company should have a set of rigid rules and instructions for temporary grounding, adequate equipment should be provided and regularly inspected and maintained by a competent employees, instruction and training in grounding methods as approved should be given employees and temporary grounding should be performed under close supervision.—*Serial report Accident Prevention Committee, National Electric Light Association,* October, 1927.

*Physical Properties and Methods of Test for Sheet Brass.*—H. N. Van Deusen, L. I. Shaw and C. H. Davis.—An investigation undertaken to secure a simple and reliable method of test for thin-sheet non-ferrous metals. Considerable attention has been given to the Rockwell tester, which, as the result of this work, has been found satisfactory for use as a specification instrument for brasses 0.020 in. and thicker when used under standardized methods of test and calibrated in terms of a standard instrument.—*Reprint B-269, Bell Telephone Laboratories, Inc.*

# News of the Industry

## Walsh Modifies His Resolution

### Senator Himself Suggests Limitation Eliminating from Proposed Inquiry Intrastate Non-Subsidiary Companies—Cortelyou and Addinsell Testify

By Paul Wooton
*Washington Correspondent of* Electrical World

INDICATIONS are, as this is written, that the Senate committee on interstate commerce will conclude its hearings on the Walsh resolution before the end of the week. The prospects are that the committee will recommend an investigation of those phases of the electric and gas utility businesses which clearly come within the jurisdiction of the federal government, but the case made against even such an investigation is considered so strong that there is doubt whether the Senate itself will approve the resolution, however modified. Senator Walsh himself proposed the limitation, which is carried in a proviso he intends to add to his resolution. It follows:

"Provided that nothing herein contained shall be deemed to authorize the committee to inquire into the affairs of any corporation engaged wholly in intrastate business not being a subsidiary of or whose stock or operations are not held or controlled to some extent by another corporation."

Senator Walsh's proposal led to an animated discussion among members of the committee in which Chairman Watson, Senator Hawes of Missouri and Senator Sackett of Kentucky were the chief participants. Senator Watson said: "I think the terms of the resolution itself ought to fix its extreme boundaries and its widest limitations, and that they ought to be compelled within those boundaries of limitations to make this inquiry and not trust to the whims, if you will permit me to use that expression, of the members of the committee." Senator Walsh replied that the limitations of the resolution could not well be fixed more definitely. "I think you can safely trust to the good sense and the good judgment of the committee with respect to these matters," he said. Senator Hawes and Senator Sackett took issue with him, Senator Sackett objecting to requiring "an intrastate holding company to come into court to maintain its rights under the Fourth Amendment, without any reason or power, apparently, in the federal government to force it to do it." To this Senator Walsh replied:

"If their stocks were not sold in the market, that might be the case, but even so, in order to legislate with relation to the general subject of those that are engaged in interstate commerce, should we not have an opportunity to inquire about how they do their business? Maybe it would serve as a good guide for any legislation. They may operate their business so well and so efficiently and so securely that we ought to enforce a similar system upon other companies."

#### Cortelyou Gives Testimony

When the hearing before the committee was resumed on Friday, Jan. 20, former Secretary of the Treasury George B. Cortelyou, now president of the Consolidated Gas Company, New York, and chairman of the Joint Committee of National Utility Associations, testified. He explained that the utility companies disapproved of the proposed inquiry on three grounds—first, that no facts showing an investigation to be necessary have been presented; second, that the Walsh resolution is too broad in its scope, and, third, that Congress lacks jurisdiction to either investigate or legislate on most of the points raised in the resolution.

Mr. Cortelyou contended that the people have been the gainers whenever a group of power companies have combined for economic reasons. Improved service and lower rates have invariably followed, he said. Combinations became imperative when the demands of industry in general became so heavy that in many cases local supplies of capital proved insufficient to meet the increased demands, the witness testified. This drift toward consolidation of the smaller companies began during the World War and has been growing ever since. Many hundreds of millions of dollars more will be required, he said. Pointing out that municipalities and states impose strict regulations on the companies and require periodical and comprehensive financial and other reports, Mr. Cortelyou maintained that the industry is "almost constantly under what could be called investigation."

H. M. Addinsell, vice-president of Harris, Forbes & Company, New York bankers, after outlining to the committee the thorough investigations his firm makes before undertaking to sell utility bonds, expressed the opinion that such bonds are the safest and best securities available. He mentioned preferred stocks of public utilities also as safe. Senator Dill asked what the studies made disclosed as to the securities of holding companies, and the witness replied these securities were not so preferred a risk, since they came after the bonds and stock of the companies controlled. He expressed satisfaction with the policies of holding companies.

At a later hearing James A. Emery, general counsel of the National Association of Manufacturers, appeared in opposition to the resolution, on behalf of manufacturing industries "concerned in the nature of the power which the Senate is likely to grant to a committee of that body for the purpose of inquiring into the private affairs of individuals and corporations." Mr. Emery brought out the point that the investigation certainly would extend into investment trusts. He called attention to a decision by the Supreme Court which held that "a fishing expedition into the affairs of a stranger for the chance that something discreditable may turn up is forbidden."

#### Letter from O. D. Young

Senator Walsh presented to the committee a letter to him from Owen D. Young which indicated that the General Electric chairman had a different idea of congressional investigations from the one indicated in an article printed in the Brooklyn *Eagle* and which quoted Mr. Young. In his communication Mr. Young said:

"So far as the General Electric Company is directly concerned, if any charges are made by you or by other responsible persons through you against it, I have no objection to any resolution authorizing investigation of the General Electric Company, however sweeping its terms may be. A resolution to investigate the General Electric Company is a specific inquiry. When one starts to investigate an entire industry, however, that is another matter. The resolution, in my judgment, authorizing the investigation should be to investigate specific questions affecting the industry which are clearly set forth and defined. That is especially true if the inquiry relates to any question which may affect credit. To impair the credit of any industry would be a public calamity."

## New 80,000-Kw. Generator for Milwaukee

A turbo-generator with a rated capacity of 80,000 kw. will be installed this year at the Lakeside power plant, according to John Anderson, vice-president of the Milwaukee Electric Railway & Light Company. It will be the largest unit in Wisconsin and is expected to be in operation by Nov. 1. Including auxiliary equipment and necessary extensions to the power house, it will cost $1,461,000. Preliminary work on the extension of the building has been started. The new section will be 72 ft. long, 94 ft. wide and 75 ft.

high. With the addition the building will be 375 ft. long. The unit will be twice as large as any of the present generators at Lakeside. It will increase the capacity of the station to 227,000 kw.

## Boulder Dam Before a Senate Committee

*Senator Johnson Attacks Power Companies and the Joint Committee of National Utility Associations as Sources of Adverse Propaganda*

A FAVORABLE majority report on the Swing-Johnson Boulder Dam bill will be made to the House of Representatives after Feb. 1, Chairman Smith of the irrigation committee now thinks. The probability is that Representative Douglas of Arizona will make a minority report. The Senate committee on irrigation and reclamation has begun its consideration of the measure, and Governor Dern of Utah has repeated before it the plea he made to the House committee that legislation be withheld pending another attempt by the seven Colorado Basin states to reach an agreement. Governor Dern predicted that under a six-state agreement, such as is proposed by California, Arizona would get all of the upper basin water and California would get all of the lower basin water, thus completely depriving the upper basin states of their water rights.

The Muscle Shoals issue was injected into the discussion by Senator Dill of Washington. He wanted to know why, if the principle is established at Boulder Canyon of allowing the states to collect power royalties, the same idea could not be applied to allow Alabama to collect similar charges on the nitrates that may be manufactured at Muscle Shoals. Governor Dern said that he had not considered this question, but that he was not advocating any rights along the Colorado that could not be applied at other places.

Regarding a statement made by Governor Dern that the charges of power propaganda behind the opposition are a smoke screen, Senator Johnson asked the Governor if he was really acquainted with some of the propaganda that was being turned out. "Are you familiar with the things being turned out by the organization known as the Joint Committee of National Utility Associations, whose headquarters are at 420 Lexington Avenue, New York?" he asked.

Thomas Maddock, former State Highway Engineer of Arizona, and John L. Gust of Phoenix, representing the water users of the Salt River Project in Arizona, spoke in opposition to the bill. George W. Malone and C. P. Squires, members of the State Highway Commission of Nevada, said their state favored it, provided there was an assurance of reasonable revenue. Governor Emerson of Wyoming spoke in opposition to the measure as it now stands.

# Merchandising Holds Stage at Chicago

### N.E.L.A. Commercial Committee Members Discuss Plans and Hear of Progress Made in Many Directions to Formulate Proper Selling Policy

MERCHANDISING held the center of the stage at the three-day meeting held on Jan. 18-20 of the eleven committees of the N.E.L.A. Commercial National Section at the Edgewater Beach Hotel, Chicago. Chairman Greenwood of the general merchandising committee presented three features of unusual interest. He reported the satisfactory conclusion of a series of intertrade conferences which have been participated in by the national officials of the various retail trades merchandising electrical household appliances, the purpose being to develop a common understanding of some of the principles of merchandising policy in which there has been conflict between the power industry and the retail trades. Through these meetings certain fundamentals have been defined which are acceptable to all and which received the signature of the representatives of dry goods, hardware, furniture and druggists' associations. This agreement was approved by the executive committee of the Commercial National Section, but is not yet released for publication.

The merchandising committee also reported and received approval on the program to conduct a series of laboratory and field tests to determine the load and service characteristics of the oil burner. Laboratory tests will be conducted in an independent laboratory to which manufacturers may bring their equipment for test under standard specifications which will be established by a joint committee of the National Electric Light Association, the Association of Edison Illuminating Companies and the Oil Heating Institute. The field tests will be conducted in about six cities under the specifications and direction of this joint committee. The committee also announced the ten-thousand-dollar prize contest details of which are given on this page.

The power committee is at work on serial reports that will analyze competitive power conditions in a number of industries such as flourmills and woodworking plants. The electrical advertising committee reported the organization of two schools to be conducted in March, one at Harrison, N. J., and one at Cleveland, to provide a special course of training for central-station salesmen in developing electric sign load. The home-lighting committee indorsed the program of the Industry Sales Conference, which is now developing a sales plan for the electrical industry in the residence field. This committee has collected a compendium of experience in refixturing, which will soon be published as a serial report. The lighting service committee discussed the present slump in industrial lighting and the need of establishing continuity in the development work in this field. It is planning organized co-operation of the architects, and also to correlate the work of the lighting and power salesmen of the utilities, realizing that 50 per cent of the energy sales to some industrial customers consist of lighting.

The wiring committee also indorsed the program of the Industry Sales Conference and approved the program which the manufacturers are carrying forward in developing uniform ordinances throughout the country. A resolution was passed protesting against the delay in the approval of thin-wall conduit for use under the National Electrical Code and demanding a stronger official status for the representative of the N.E.L.A. on the electrical committee. The committee also recorded its disapproval of the inclusion of Safety Code rules in the National Electrical Code. The transportation committee discussed holding a national conference to consider possibilities for the development of battery-charging load, the particular purpose being to demonstrate to the power companies the importance of utilities using electric trucks in their own transportation service. The refrigeration committee approved an advertising program which had been developed by Chairman Richardson. The domestic range committee reported progress on development of a range sales manual and considered the development of an advertising campaign similar to that under consideration for refrigeration. The promotional rates committee held an experience meeting on the effect of the inducement type of rate on the increase of residence consumption. The industrial heating committee obtained an appropriation for the development of a motion picture.

Chairman Davidson announced that the appointment of a commercial executive to be added to the headquarters staff of the National Electric Light Association would probably be made within a few weeks. The attendance at this meeting was unusually large, 209 men being registered.

## "One More Kilowatt-Hour per Home per Day"

An immediate campaign to bring about the consumption of one more kilowatt-hour per home per day all over the nation has been launched by the general merchandising committee, Commercial National Section, N.E.L.A. At the present time the average individual residence consumption throughout the country is 400 kw.-hr. a year, or slightly over one kilowatt-hour per day. This produces an average annual revenue less than $30, which the committee thinks scarcely half enough.

At the suggestion of the committee, a fund of $10,000 is being subscribed, chiefly by the manufacturers of electri cal equipment and apparatus, to provide $9,000 in prize money and $1,000 for the expenses of the contest. Three first prizes of $2,000 and three second prizes of $1,000 are offered to member companies, grouped in three classes as follows, according to their present average annual energy sales to residence customers: Class A, 451 kw.-hr. or over; class B, 351 to 450 kw.-hr.; class C, 350 kw.-hr. or under. Cash prizes of $2,000 or $1,000 will therefore be won by the sales departments of the six power companies that in 1928 show the best and next best increases in average consumption per residence customer in their respective classes.

## Local League Officials Discuss Their Problems

A special midwinter conference of officials of local leagues was held last week at the offices of the Electrical Association in Chicago to provide an opportunity for the discussion of the practical details of league operation and development. Seventy-three league men were present, representing thirty-five leagues from Boston to Denver and from Winnipeg to New Orleans.

The discussion embraced a wide variety of league problems, such as central-station dealer financing, labor, ordinances, radio sections, non-electric members, the "curbstone" contractor, compensation of field men and how to keep members "sold." The most important theme was the "red seal" plan and the need for a national specification that will permit broader use of the "red seal" idea in national advertising and in house plans sold by the national services. The conference approved the program for uniform specifications.

In a general review of league experience, methods for promoting industrial, commercial and domestic lighting were discussed and the responsibility of the leagues for the education of the small housewiring contractor had particular consideration.

The four sessions were presided over by J. E. North, Cleveland; Burke Corcoran, Chicago; D. C. Birdsell, Philadelphia, and Earl Whitehorne, New York.

## East Central Division Takes Up Commercial Topics

Opportunities for building additional loads and methods of obtaining this business by central-station companies occupied the attention of about one hundred utility executives and commercial managers at a Commercial Section meeting of the East Central Division, N.E.L.A., at the Hotel Statler, Cleveland, on Jan. 23. Pointing to the low average kilowatt-hour consumption per domestic customer, T. O. Kennedy, vice-president and general manager Ohio Public Service Company, drew a picture of possibilities for load development, while H. W. Derry, section chairman, presented a graphical analysis of industrial electrification, showing that while approximately 73 per cent of the industry is electrified, only 44 per cent of industrial power is purchased from central stations. He dealt particularly with the use of process steam to generate power in industrial plants.

Discussing methods of rural electrification, J. B. Johnson of Elyria, Ohio Public Service Company, advocated that central-station companies become more active in selling electrical equipment to farmers and cited the fact that his company in ten months' co-operation with a farm implement dealer had effected the sale of $29,000 worth of such apparatus.

Commenting vigorously upon the necessity of selling additional wiring in old homes, G. E. Miller, sales manager Cleveland Electric Illuminating Company, pictured the difficulties that have been encountered, declaring that basically the cost to the customer is too high.

Progress in electric heat applications was outlined by W. E. Benning, Cleveland Electric Illuminating Company, progress in selling electric ranges by H. H. Davis, Northern Ohio Power & Light Company, and progress in selling domestic electric refrigerators by E. Schmidt, Toledo Edison Company.

At the section dinner a paper by Frank Newton, Commonwealth Power Company, on rates and formation of rate structures, with particular reference to their relation to commercial development, was read by M. W. Arthur in Mr. Newton's absence.

## North Central N.E.L.A. Engineers at Minneapolis

More than two hundred engineers attended the annual conference of the Engineering Section of the North Central Electric Association held at the Nicollet Hotel, Minneapolis, on Jan. 20 and 21. Chairman H. J. Underhill gave an outline of engineering development in the district, and Secretary John W. Lapham outlined the "Developments in the Industry in This Division."

Other addresses on the opening day were: "Relation of Accounting to Engineering," E. G. Kellett, Minneapolis; "Relation of Commercial Activities to Engineering Activities," Carl J. Johnson, Fergus Falls; "Relation of Engineering to Public Relations Activities," T. D. Crocker, Minneapolis; "Lightning and Its Effect on Transmission Lines," J. H. Cox, Westinghouse Electric & Manufacturing Company, and "United States Power Developments," Major H. S. Bennion, New York. Major Bennion spoke at the banquet. Leaders of technical group conferences were William Brown, F. R. Rice, George Loughland, W. J. Sorenson, R. A. Farmer, J. L. McEachin, W. L. Wadsworth and J. A. Colvin. Saturday's program included addresses by E. C. Markley, General Electric Company, on "Carrier-Current Communication Systems," and "Methods of Evaluation of Light and Power Properties for Taxation," by C. H. Nelson of the Minnesota Tax Commission.

## N.E.M.A. Hears About Inter-Industry Struggle

*Director of Institute of Steel Construction Chief Speaker at New York Meeting of Supply Division—Section Conferences All Week*

ONE hundred and twenty-five leading manufacturers in the electrical industry concentrated their attention on merchandising policies on Jan. 24, when the semi-annual meeting of the Supply Division of the National Electrical Manufacturers' Association opened at the Hotel Commodore, New York. The principal speaker, Charles F. Abbott, executive director of the American Institute of Steel Construction, Inc., described what he called "the third industrial revolution," meaning the inter-industry struggle for markets. The capacity of industry to produce faster than the market can consume, coupled with co-operative advertising campaigns which quickly change public taste, offers a problem which industries must meet with the soundest merchandising principles, Mr. Abbott said. Careful market research, selection and training of competent salesmen, co-operative advertising on a scientific basis, selling on service rather than price and organization of industry along co-operative lines were some of the guiding principles offered to the electrical manufacturers by him.

The meeting was opened by D. Hayes Murphy, vice-president of the National Electrical Manufacturers' Association in charge of the Supply Division. Managing Director Waller announced the appointment of W. J. Canada as N.E.M.A. engineer and the coming publication of a book to be called "The National Electrical Code—Its Purpose and Development."

H. T. Bussmann, president Bussmann Manufacturing Company, St. Louis, in describing the activities of the electrical Industry Sales Conference said that little or nothing has been done by the electrical industry up to the present time to give the public a complete picture of the value of electrical service and appliances. Before such a program can be accomplished thirty thousand contractors who are now facing a dwindling market must be educated to better selling and business methods, he said. The contractor must be taught to sell outlets not as outlets but on the basis of the service which such outlets will render. A marketing counselor is now needed, he held, to correlate the reports already made by the electrical industry sales conference and to build up a complete sales story.

S. L. Nicholson told the meeting of the establishment of harmonious relations between the manufacturers and the Underwriters' Laboratories in the past year.

An entertainment was held at the dinner-hour on Tuesday evening, followed by a theater party on Wednesday night. An extensive program of sectional meetings and activities was carried on throughout the week.

# Power Board Proceedings

*Far Western Projects Continue to Provide the Major Part of the Work, but Missouri, Virginia and Texas Are Heard From*

IN ADDITION to the authorization of licenses and permits noted last week (page 165) the Federal Power Commission at its meeting on Jan. 18 sanctioned a license for the Idaho Power Company of Boise covering two constructed projects on public lands on the Snake River. These are the Lower Salmon Falls plant near Gooding, an 8,700-hp. project, and the Swan Falls plant near Boise, a 12,000-hp. plant. They have been in operation for many years. They were built by other companies. Another license authorized was for Harry V. Gates of Hillsboro, Ore., and covers a 352-hp. project on Crooked River, Ore. The Seafoam Mines Corporation of Seafoam, Idaho, obtained a license covering a 240-hp. project on Fleet Creek.

The preliminary permit issued under date of Nov. 6, 1925, to the Oregon-California Hydro-Electric Company for projects on the Zigzag, Salmon and Sandy Rivers in Oregon was extended to Nov. 6, 1928. An extension until Dec. 3 was granted Arthur Moa of Ketchikan, Alaska, applying to his preliminary permit for a power project on Fish Creek in the Tongass National Forest, and an extension of eighteen months from May 26 was authorized for the project of the Red River Lumber Company of Minneapolis on Nat Creek, Shasta County, Calif. Three preliminary permits issued to George B. McClary of Chicago, covering projects on Rock River in Illinois, were canceled.

An application from the Southern Sierras Power Company of Riverside, Calif., for an extension until Dec. 31, 1929, of the construction time allowed on parts one and two of its project on Snow Creek in the Angeles National Forest was granted, as was extension of time for the completion of the project of the Escondido Mutual Water Company at San Luis Bay River, Calif. The commission denied the application of the Great Western Power Company of San Francisco for an amendment to its license covering its power project on the North Fork of the Feather River so as to "include other works incidental to the power project and the reconstruction of county roads and state highways." The time for beginning construction on the project of the Gold Basis Mining & Milling Company on the East Fork of the North Fork of the Yuba River was extended to July 1.

The commission assumed jurisdiction over a project on Eleven-Point River in Oregon County, Mo., where Jess Priest and W. H. Williams had announced their intention to construct a 60-ft. dam which would create a 20,000-acre-ft. reservoir. In connection with the declaration of intention of the Western Washington Electric Light & Power Company the commission also ruled that it should take jurisdiction. The proposed project is at North River near South Bend, Wash., where navigation is possible. It is planned to construct a dam 100 ft. high which will create a reservoir of 210,000 acre-ft. capacity.

The commission did not take jurisdiction over a small New River project of the Fields Manufacturing Company, Mouth of Wilson, Va. New River at that point is not navigable. The commission also declined to take jurisdiction over the project submitted by James C. Kennedy of Dallas covering a proposed development on Devil's River in Val Verde County, Tex., the Chief of Engineers holding that Devil's River is not navigable. It rejected an application for a license by the Sierra & San Francisco Power Company covering a constructed project on the South Fork of the Stanislaus River to include certain proposed extensions of the plan.

W. J. Prewett of Auburn, Calif., has applied for a preliminary permit covering a project on the North and Middle Forks of the American River. He proposes to build a dam 340 ft. high across the North Fork, forming a reservoir with 600,000 acre-ft. capacity, and to install 100,000 hp. This application conflicts with previous applications made by Walter L. Huber and the American River Water & Power Company.

The Virginia Public Service Company of Charlottesville has applied for a license covering a transmission line to connect the western and southern divisions of its properties. The line would traverse the Natural Bridge National Forest.

Robert R. Severin of Paisley, Ore., has applied for a license covering a small project on the Chewaucan River in Lake County, Ore.

The United Mercury Mines Company of Boise, Idaho, has applied for a permit covering a small project on the East Fork of the South Fork of Salmon River near Yellow Pine, Idaho.

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## Public Utility Course for Business Executives

A six weeks' summer course in public utility management and economics for business executives will be given July 9 to Aug. 18 next by the Harvard University Graduate School of Business Administration, Soldiers' Field, Boston, under Philip Cabot, professor of public utility management, and D. W. Malott, instructor in this subject. The course will cover various legal, economic, engineering and financial phases of management and will include a study of court and commission decisions covering valuation, depreciation and fair return, besides cases from company practice in methods of marketing, rate making, operation, finance, customer relations and the broad economic problems of production. Classes will meet for four hours daily, and the case method will be followed throughout.

The course is intended for executives and their assistants, statisticians, sales managers and production superintendents of utilities; members of regulatory commissions, investment bankers and teachers of law and business.

# Ask for Short-Wave Bands

*N.E.L.A. Representatives Request Commission for Exclusive Use of Two Groups at Least, but Preferably of Three, for Power Companies*

THIRTEEN officials of large light and power companies in Massachusetts, New York, New Jersey, Pennsylvania, Maryland, Illinois, Michigan and Georgia joined as representatives of the National Electric Light Association in submitting a statement to the Federal Radio Commission when that body last week at Washington held its hearings on short-wave assignments. Asserting that the electric power supply utilities desire "the exclusive use of only a very limited assignment of wave lengths in the interest of maintaining service and in no way for commercial gains," the N.E.L.A. committee made the following response to five specific questions asked by the commission:

1. The electric power supply utilities require space radio facilities as an emergency means of communication for dispatching purposes. Wire communication, whether it be by lines leased from commercial communication companies, by private telephone or telegraph lines, or by carrier current, or by any combination of these, is the primary means of communication in power company systems. However, the acts of God and other uncontrollable events which put out of service the transmission lines of the electric company also put out of service the wire communication in the same geographical area occupied by these transmission lines. In the interconnected electrical systems of today and tomorrow, as well as in local transmission systems, it is absolutely necessary that continuous communication be maintained between strategic points. Space radio offers the only form of communication which will operate between two given points during intervals when wire facilities are inoperative.

2. The prime importance of continuity of electric light and power supply to the large cities, the innumerable smaller communities and to the farm and factory is a subject not open to question or dispute. Dependent upon constant power supply besides the usual industrial and domestic consumers are water utilities, hospitals, signal systems, train-control systems, fire-alarm systems, traffic signals, street lighting and various other uses which directly affect the safety of public life and property. The disastrous effects of allowing a city or town to remain in total darkness for any length of time can be readily pictured. The electric light and power industry serves almost seventy million people, with the enormous capacity of over 30,000,000 hp. Companies serving 40 per cent of this population have already either adopted space radio for emergency communication or are planning to do so at the earliest possible moment.

3. Experience gained in tests over the past two years indicates that the exclusive use of at least two bands, one in the 133-150-meter (2,250-2,000-kilocycle) group, and the other at the second harmonic of the first, should be reserved for this purpose. A third band at 90 meters (3,340 kilocycles) would also prove of great assistance in this work if it could be made available. The width of these bands should be 160 kilocycles. Each station should be allowed to use any allocated band.

4. The power required by electric utility radio load-dispatching stations will be, in

times of emergency, the maximum output that can be achieved by any given station. Under normal conditions the lowest workable power output will be used. In the light of present-day knowledge 5 kw. is suggested as a maximum. The interference likely to be caused to other services in these bands will not offer any obstacle, as the operating contacts which exist between electric supply companies are such that they will be entirely able to police their own bands. This, of course, presupposes an exclusive assignment to electric supply companies. The interference likely to be caused to other countries should not be appreciable, as power company communication requirements will in general be limited to distances of approximately 100 miles.

5. Based on answers to letters sent to all member companies of the National Electric Light Association, it is estimated that about one thousand applications for licenses for this service will be made within the next five years.

It will be some weeks probably before the commission's decision is handed handed down.

## Plans for Hydro Development on New York Lakes

Further details have been given out concerning the hydro project for upper New York State noted in the ELECTRICAL WORLD for Nov. 5 (page 960). The temporary dam at Bradford, on which work has been begun by the Dutcher Construction Company of Sodus for the Lamoka Power Corporation, is to be the first link in a power chain designed to take advantage of the relative positions of Lakes Waneta and Lamoka and Lake Keuka. Several years will be required to complete the project. According to present plans, water will be diverted into Lake Keuka from a power reservoir several hundred feet above Keuka Landing. It will be carried down through mains into a power house to be erected at the landing.

A dam 20 ft. high and one mile long will be constructed at the opening of the Lamoka Valley, one mile north of Savona. Behind the dam will be stored water in an artificial lake 16 miles long and one mile wide covering hundreds of acres of farm land. The lake will extend to Bradford, on the summit of the Wayne Hills. A system of feeders will be constructed from the Conhocton River near Savona into the reservoir. The power company already owns the water rights of the former Baker Mills between Bath and a point two miles west of Savona. Plans call for construction of a race from the mills through Bath to Savona to take advantage of floodwaters by diverting them into the reservoir.

The levels of Lakes Waneta and Lamoka will be raised from five to six feet. At the village of Wayne, which will be the outlet for the reservoir, sluiceways and conduits will carry the water down Keuka Hill to the power house. The present village of Sonora will disappear. The temporary dam will confine the waters of the two lakes. Its completion will be followed by work on the power house in order that generation may begin as soon as possible. Power, it is expected, will be sold to communities throughout northern New York State.

The Lamoka Power Corporation is capitalized at $9,000,000 and is headed by Ray Mills and Warren Mills of Sodus.

## Tacoma Considering Start on Second Cushman Unit

Less than two years after completion of the first unit of Tacoma's municipal power plant on Lake Cushman, which brings in 50,000 hp. for the city system, officials are taking steps toward the construction of the second unit. This is intended to develop 45,000 hp., and Ira S. Davisson, Commissioner of Light and Water, declares that, according to present indications, it will be needed to avoid a power shortage in the winter of 1930-31. Mr. Davisson asked the consent of the Council to bring in ordinances providing for starting work on the second unit, but the Council asked for more time to study the situation. The proposed ordinance would appropriate $4,000,000. A 13,000-volt transmission line from Unit No. 1 at Cushman to the site of the projected second unit, with a connection to the site of the second dam to be built, is already under way and will serve the farmers' mutual distribution system on Hood Canal.

It will take between two and three years to complete the second unit, Commissioner Davisson states. J. L. Stannard, chief engineer for the first unit, will continue in that capacity on the second.

## Plans for the Augmentation of Seattle Power

The City Council of Seattle is preparing to authorize an expenditure of an additional $5,000,000 in the Skagit hydro-electric development on one of two plans which are now before that body. One, introduced by Councilman Oliver T. Erickson, which has the backing of the majority of the Council, authorizes a contract with the Ambursen Dam Company for plans for a dam at Hanging Rock and paves the way for what has been known as the Hanging Rock program. The other plan, backed by the minority group in the Council and proposed by Councilman W. T. Campbell, calls for immediate construction of a power house at Diablo Canyon. This latter plan has the backing of both City Engineer C. W. Morse and Superintendent of Lighting J. D. Ross, Mr. Ross declaring that the Diablo development can be completed at a cost of $35 a kilowatt, whereas the Hanging Rock development will cost $100 a kilowatt. The Diablo plan provides for immediate installation of a third generator, 50,000 hp., in the present Gorge power house; construction of a complete power plant at Diablo Canyon, where a dam is now in process of construction, this plant to have two complete generating units of 50,000 hp. each; construction of a power tunnel, approximately 1,800 ft. long, extending from the Diablo Dam to the power house, to be built at Reflector Bar, below the Diablo Canyon; building of a transmission line from the Diablo power house to a connection at the Gorge power house with the existing transmission line to Seattle, and construction of a second main transmission line from the Skagit plant to the city of Seattle, a distance of 105 miles.

An award has been made to the Winston Brothers Company of Minneapolis, for construction of the Diablo Dam. The contract price was $2,546,338.

## Kentucky Utilities Men Show Pride in Work

*Hydro-Electric Achievements in State Praised—Problems of Industry Discussed—Former Governor Speaks in Appreciation of Electric Development*

WORK of untold benefit in conserving the natural resources of Kentucky has been done in the construction of power dams on the Dix River and at the Falls of the Ohio River, W. R. Power, president of the Kentucky Association of Public Utilities, said in opening the eleventh annual meeting of the association at the Brown Hotel, Louisville, on Wednesday, Jan. 18. The foresight of the Kentucky Utilities Company, builders of the Dix River dam and plant, and of the Louisville Gas & Electric Company, owners of the Ohio River Falls project, was praised. Another point touched upon by Mr. Power was the fact that engineering and technical matters which for years occupied most of the time of association meetings have become standardized, until the more interesting problems now are in the commercial department or in the development and growth of the industries.

Tom Wallace, chief of the editorial staff of the Louisville *Times*, speaking on rural electrification, urged the utility men to give more aid to the farmers in solving their problems. Dean F. Paul Anderson of the College of Engineering, University of Kentucky, said "no group of men in America have meant more to the remarkable economic progress of the United States in the last few years than the public utility men." Miss Esther Rockey, Dayton, Ohio, chairman of the women's division of the East Central Division, N.E.L.A., reported on the growing number of light and power companies which have organized home service departments. Addison W. Lee, general superintendent of the Louisville Gas & Electric Company, urged public utility managers in the state to do all in their power to eliminate radio interference which originates in their plants or along their lines. Important betterment of public relations can be brought about through the attitude of the companies in this matter, he said. A. B. Sawyer, president Farm Bureau, St. Matthews, Ky., held that development of power on the farm was largely a question of the ability of the farmer to finance it.

N. H. Dosker, vice-president Louisville National Bank & Trust Company; F. W. Rodenheber, manager Louisville Safety Council; Prof. John B. Troxwell of the University of Louisville, and W. H. Lovejoy, Louisville Water Company, spoke at the closing session on Thursday.

The business sessions drew gatherings of about a hundred, but more than 400 persons attended the annual banquet, visitors including Mayor Harrison of Louisville, state, city, county and federal officials. Ex-Governor Edwin P. Morrow, a member of the Federal Railway Wage Arbitration Board, and Lucius S. Storrs managing director of the American Electric Railway Association, New York, were the speakers.

Mr. Morrow praised the development of natural resources by the electric light and power industry. He expressed a desire that scenic beauties be retained, but urged that electric development in Kentucky be continued, to allow the state to take its rightful place as a great source of power.

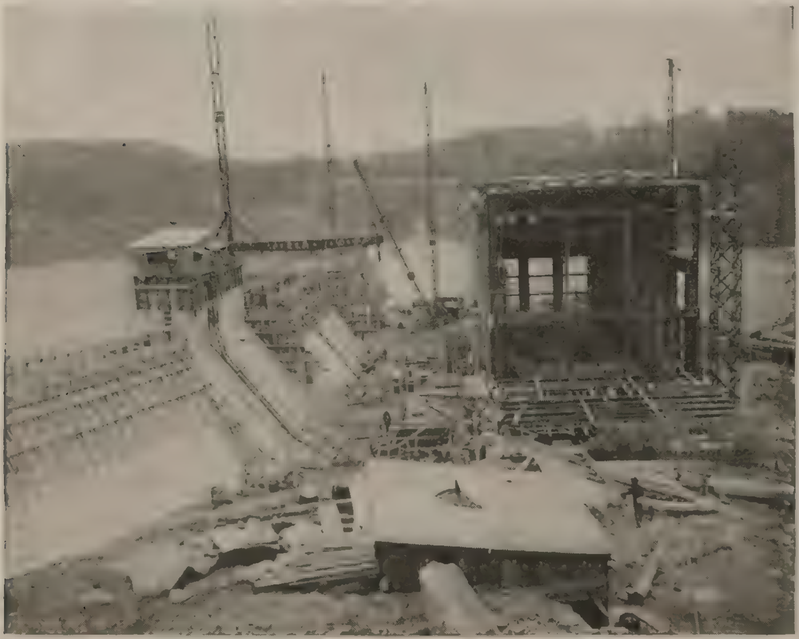
Samuel Riddle, vice-president of the Louisville Railway Company, was elected president of the association. Other officers named are: Vice-presidents, W. H. Harton, general manager of the Cincinnati, Newport & Covington Railway Company, and L. B. Herrington, president of the Kentucky Utilities Company; secretary, E. F. Kelley, Louisville Railway Company, and treasuerer, A. A. Tuttle, Kentucky Utilities Company. Robert Montgomery, general sales manager Louisville Gas & Electric Company, was reappointed chairman of the Kentucky Committee on Public Utility Information.

## Hetch Hetchy Still Fights to Buy Distribution Plants

Final argument in the valuation proceedings instituted four years ago by the city of San Francisco in an effort to acquire for its Hetch Hetchy plants the Pacific Gas & Electric Company's and the Great Western Power Company's distribution systems within the city limits were presented before the State Railroad Commission of California on Jan. 20. Both sides received three months in which to file briefs and 30 days additional for replies. The commission has denied the motion of the two power companies to dismiss the proceedings, and it is expected the power companies will appeal to the courts on the ground of jurisdiction and constitutionality. In consequence a final decision on the valuation of the properties is not expected for many months.

Hetch Hetchy power is now delivered to the Pacific Gas & Electric Company, Newark, on contract. The companies' and the city's figures on the value of the distribution systems are very widely apart.

## Reconstruction of Upper Tallassee Plant in Alabama



THE above illustration shows the status of reconstruction of the Alabama Power Company's Upper Tallassee plant a few weeks ago. At this plant the old 30½-ft. dam is being raised to 56 ft. When complete the power house will contain two 24,000-hp. units. Generation will begin in June, 1928, if the present construction program is adhered to. This plant is on the Tallapoosa River and will have the advantage of the storage capacity afforded by the Martin Dam development completed in 1926. On Dec. 1 about 56 per cent of the concrete had been poured and 95 per cent of the excavation completed.

# Purchases and Mergers

*Baltimore Company May Buy Havre de Grace Competitor—U. G. I. to Acquire Wilmington Properties — Consolidation in the Dakotas—Georgia System for Foshay*

CONTROVERSY over light and power service in Havre de Grace and northern Maryland (see ELECTRICAL WORLD, Jan. 21, page 165) may be solved by the Consolidated Gas, Electric Light & Power Company of Baltimore purchasing the Harford County property of the Northern Maryland Power Company. "Negotiations for the purchase of the Northern Maryland's property are under way," President Wagner of the first-named company is quoted as saying, "but I cannot say when or if the deal will be completed."

The United Gas Improvement Company is to acquire a group of utilities centering in Wilmington, Del., and including the Delaware Electric Power Company and subsidiary electric power and traction corporations controlled by the American Electric Power Corporation. The deal involves the exchange of Iowa properties controlled by the U.G.I. Plans for expansion at Wilmington were outlined on Dec. 17 (page 1263).

Consolidation of the electric and power plants in fifty cities and towns in central and western South Dakota and about fifteen in the southern part of North Dakota with the properties of the Hughes Electric Company of Bismarck, N. D., has been announced by E. A. Hughes, controlling the Hughes Electric Company, and the owners of the Northern Power & Light Company of Mobridge, S. D. The Hughes company's power station at Beulah, N. D., will be tripled in capacity and the power to be furnished over the combined system will be generated there and at Mobridge, Mr. Hughes says. Interconnection of the two distributing systems will be begun at once.

Control of the Baker County Power Company, owning and supplying electric properties in Newton, Camilla and fifteen other Georgia towns, has been purchased by the W. B. Foshay Company of Minneapolis for the Public Utilities Consolidated Corporation of Arizona. The value is said to be in excess of $1,300,000. The main office of the company has been moved from Newton to Camilla.

Sale of a controlling interest in the Kentucky Power Company and the Maysville Public Service Corporation and their subsidiaries to the United Public Service Company of Chicago is announced by Barrett Waters, president of the Kentucky utility companies, who is quoted as placing the value of the companies taken over at more than $4,000,000.

According to local reports, several large power companies in the East and South will file bids for the Kinston (N. C.) electric light plant on or before Feb. 6. There has been, as previously reported, considerable effort to acquire this municipal plant, and bids of $611,000 and $630,000 were refused last year.

# Briefer News

New Interstate Line in the Carolinas Planned by Duke Power.—A high-tension line between Canton, N. C., and Greenville, S. C., is to be built by the Duke Power Company this year, according to a recent announcement. It will connect Greenville with the Pigeon River hydro-electric plant of the Carolina Power & Light Company, 50 miles or so distant.

Public Service Conference Meets in Augusta.—A public relations conference of the operating companies of the New England Public Service Company took place on Jan. 18 and 19 at Augusta, Me. George S. Williams, vice-president Central Maine Power Company, presided at the opening session, and the chairmen at other sessions were W. A. Buttrick, president Twin State Gas & Electric Company, Boston, and A. R. Schiller, vice-president Public Service Company of New Hampshire. Among the principal speakers were Martin J. Insull, Walter S. Wyman, J. Brodie Smith, J. B. Reynolds, Miss Sophia Malicki and W. S. Vivian.

Steamship "California" Put in Service. — Following builders' trials, the *California* — asserted to be "the world's largest" electrically driven commercial vessel—has sailed from Newport News, Va., to New York City and starts on its first voyage Jan. 28. She is due to arrive at San Francisco on Feb. 13, which will reduce the existing fifteen-day passage between New York and California by two days. The boat is completely electrified, including propulsion and auxiliaries, General Electric equipment being used. The main power plant consists of two marine-type steam turbines, each rated at 6,750 shaft-horsepower with a maximum capacity of 8,500 shaft-horsepower. Each turbine is directly connected to an alternating-current generator rated at 5,250 kw. and having a maximum continuous rating of 6,600 kw. There are two main propulsion motors, one directly connected to each propeller shaft, and each being of the synchronous induction type, rated at 5,250 kw.

A "Boulder Dam" Proposed for Nebraska. — Representative Shallenberger of Nebraska has introduced a bill at Washington to appropriate $20,000,000 to develop the combination irrigation and power plant on the Platte River in Gosper County which the State Legislature, at its last session, refused to authorize with the state as a guarantor of the bonds. He plans to tie it up with other river appropriations and schemes. The cost would be amortized over a period of fifty years and recouped out of the profits from the sale of water for irrigation and power. The bill follows the Boulder Dam proposal in its general lines, but also proposes that the profit from the sale of power shall be perpetually used to maintain the plant and repay the cost. Senator Howell of Nebraska has promised to support the project, but the plan has not met with favor in engineering circles because of the distance of the state's principal markets for electrical energy.

Bill for South Carolina State Hydro System Unfavorably Reported.—A bill introduced into the South Carolina Legislature which would sanction the development of water power by the state under a commission of five members, whose duties would include many other matters, including the duty "to pay the costs of government," has been unfavorably reported.

Line Extensions in Nebraska.—The Iowa-Nebraska Light & Power Company has been authorized by the Nebraska Railway Commission to make several extensions in southeastern Nebraska; the Interstate Power will build a line from south of Spencer, connecting the plant on the Niobrara River directly with the towns of Bristow and Lynch; the Central States is to connect Macy with its Walthill plant; the Nebraska Power is building a line from Valley to Le Shara and Yutan and extending its line at Meadows, while the Nebraska Electric is connecting its plants at McCook, Gothenburg and Lexington so that sufficient standby service will be available in emergencies. To add to its generating capacity at Lexington the last-named company is installing a large internal-combustion engine and a direct-connected generator.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

Iowa Section, N.E.L.A.—Roosevelt Hotel, Cedar Rapids, Feb. 2 and 3. H. E. Weeks, Davenport, Iowa.

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16; St. Louis regional meeting, March 7-9. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21; Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.

New Mexico Utilities Association—Albuquerque, N. M., Feb. 20-22. Arthur Prager, Albuquerque Gas & Electric Company, Albuquerque.

Oklahoma Utilities Association—Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

Carrying New Line Over the Susquehanna at Harrisburg.—Another high-tension river crossing is progressing rapidly at Harrisburg, Pa., where the Harrisburg Light & Power Company is building a 66,000-volt line across the Susquehanna River to New Cumberland. This line is to extend from the company's plant in the southern end of Harrisburg west to Mechanicsburg and possibly to Boiling Springs. The largest of the three steel towers is being erected on an island in the river. It will be 320 ft. high and 60 ft. square at the base. The tower on the eastern side of the river will be 120 ft. high and that at the southern end of New Cumberland will be 155 ft. high. They will carry eight cables.

Interstate Power 9.06 per Cent of All Generated by Electric Light Companies.—The Bureau of Business Research of Harvard University has just published a study entitled "Interstate Transmission of Electric Light and Power Companies in 1926" and based on a nation-wide survey. The total quantity of electricity transmitted across state lines, as reported to the bureau, aggregated 6,171,530,837 kw.-hr. in 1926, exclusive of power crossing the Canadian or Mexican boundaries. This is approximately 9.06 per cent of the total generated by all electric light and power companies in the country. Of all interstate power 26.28 per cent involved no change in ownership, according to the bureau's report. In 1926 there were in operation 453 interstate power lines. Of these 152, or 33.6 per cent, were placed in operation in the years 1924, 1925 and 1926.

Puget Sound Power & Light Has Five-Million-Dollar Budget.—The Puget Sound Power & Light Company, Seattle, through its vice-president, W. H. McGrath, announces that $5,000,000 will be spent in 1928 for construction and extensions. Included in this amount is an item of $1,267,000 covering cost of a new unit at the Baker River power plant, together with the necessary addition to the power house. The sum of $787,000 is provided for a transmission line from the Baker River plant to the Beverly Park station; line extensions for new customers will cost $1,652,000, and increasing the capacity of old substations and building new ones represent a proposed investment of $618,400. At least ten thousand families will be served with electricity who have not before had this convenience. Seventy-two hundred rural customers were added in 1927.

Hydro Project for Genesee River at Letchworth Park in New York.—In its first annual report, just issued, the Division of Water Power and Control of New York State reports two applications for approval of water-power projects as received last year. One was from the M. B. Light & Power Company (now owned by the Associated Gas & Electric

Company) for surplus canal waters at Eaton, and negotiations for a license are still in progress. The other application came from the Commonwealth Power Company for a project on the Genesee River near Portage. The company contemplated constructing a high concrete dam across the river, creating a lake 17 miles long, and installing capacity totaling 140,000 hp. at the lowest of the three falls in Letchworth Park. The Letchworth Park Commission now has the merits of the plan under consideration.

INTERSTATE QUESTION INVOLVED IN RAISING BELLOWS FALLS DAM.—When the Bellows Falls (Vt.) Canal Company made application recently to the Vermont Public Service Commission for permission to condemn land as a preliminary to raising its dam in the Connecticut River 11 ft., it was disclosed that under an agreement between the canal company and the New Hampshire Public Service Commission the former would be bound to deliver to New Hampshire as much of the additional electricity generated through raising the dam as the New Hampshire commission might order, or even the total amount. On this account the Vermont commission would not sanction the condemnation proceedings. Three courses are left open to the company: It can seek a modification of the New Hampshire agreement, it can buy the land by bargain with the owners, or it can abandon the scheme.

ROGUE RIVER PLANT OF CALIFORNIA-OREGON STARTS UP ONE YEAR AFTER CONSTRUCTION BEGAN. — The first 16,000-kw. unit of the 48,000-kw. Prospect No. 2 development of the California-Oregon Power Company, under construction on the North Fork of the Rogue River, Oregon, was placed in service on Jan. 11, and trial runs on the second unit, which is of the same rating, were started on Jan. 18. Actual work of construction began on Jan. 24, 1927, and work during the first few months was carried on under the most adverse conditions, heavy snows being followed by a prolonged rainy season. The third unit will be installed when the need for additional power becomes apparent. Prospect No. 2 is tied in with Prospect No. 1 station, which is served by the same canal. The new plant called for the construction of 70 miles of 132-kv. line and 6 miles of 66-kv. line between Prospect and Medford, Ore.

BACKUS EXPOUNDS HIS INTERNATIONAL HYDRO PLANS.—The first authorized statement made public in regard to the proposal now before the International Joint Commission for a construction of a series of storage dams in the Lake of the Woods district, which lies just on or above the boundary line between Minnesota and western Canada, has just been issued by E. W. Backus of Minneapolis. The Backus-Brooks company has proposed the construction of reservoir dams at Basswood, Saganaga and Crooked Lakes and at Lac La Croix. The company also proposes to increase the height of the dam already built at Rainy Lake, which would provide storage for a total of 120,000,000,000 cu.ft. of water above the present Rainy Lake and Namakan chain of lakes. The statement declares that about 100,000 additional hydro-electric horsepower can be developed in the area, of which 50,000 hp. can be used in Minnesota. Mr. Backus and his associates are waiting for the final reports of the engineers of the International Joint Commission before they can determine to what extent, if any, their plans should be modified. They will then be prepared to urge their case before the commission.

# Commission Rulings

JUSTIFICATION OF METER DEPOSITS IS DUTY OF UTILITY.—The burden of justifying a meter deposit was said by the North Dakota Board of Railroad Commissioners to be upon the utility company proposing such a charge where a protest against it was made, and the fact that a meter deposit was in effect in numerous places in the state was not conclusive as to its necessity or reasonableness in all cases. The rules of the commission provided that a utility might require from all consumers or prospective consumers, subject to approval of the commission, a cash deposit, but the commission ruled that it was not therefore mandatory upon a utility to require a meter deposit in every instance. The fact that the majority, if not all, of the consumers of a company owned their meters was said to raise a question in the minds of the commission as to the propriety of the charge. Furthermore, in the case under review, which affected the Hughes Electric Company, the record was conspicuously silent as to the reasonableness of the charge proposed.

CAPITALIZATION OF EXCESS PRICE PAID FOR PROPERTY REFUSED. — The Illinois Power & Light Company asked the Illinois Commerce Commission for permission to buy the Maroa Electric Light Company for $60,000. The commission valued it at only $35,000, but authorized the sale with the proviso that the price paid should not be taken as a basis for rate making. It was required further that the sum in excess of what the commission deemed to be reasonable value should be charged neither to operating expenses nor to capital account, but should be amortized or wiped out at the expense of the stockholders. The commission said: "Under the present method of financing, most public utilities have a wide distribution of securities among consumers, and the imposition of conservative capitalization performs a twofold service to those ultimately affected," implying that excessive stock issues may indirectly affect consumers by impairing the company's credit, while as stockholders they would, of course, be directly affected. The commission aimed, therefore, at protecting the interests both of rate payers and of future stockholders.

# Recent Court Decisions

BURDEN RESTS ON THOSE SEEKING SPECIAL RATES TO SHOW THAT THOSE SET BY COMMISSION ARE UNJUST.—The Supreme Court of Oklahoma has sustained the Corporation Commission of that state in refusing to make special rates for natural gas applicable to a zone comprising the city of Tulsa (Tulsa Tribune Company vs. Oklahoma Natural Gas Company). The court found the presumption to be that the commission's refusal was just and reasonable and held that the appellant had failed in its endeavor to demonstrate the contrary. (261 Pac. 213.)*

DUTIES OF UTILITY SERVING PATRONS AT SUMMER RESORT.—Although a utility company serving a summer resort has the right to enforce reasonable regulations and decline to furnish service unless these are observed, light and water service may not be cut off to enforce a disputed claim or a collateral liability. For this reason the owner of the utility serving Macatawa Park, Mich., was rightly found culpable in discontinuing service to a patron merely because he refused to install a septic tank, and an award of $1,000 damages to the customer, whom the action of the company prevented from renting cottages owned by him, was not excessive. So found the Supreme Court of Michigan in Ten Broek vs. Miller. (216 N.W. 385.)

INDUCTIVE INTERFERENCE BY POWER COMPANY'S LINES WITH MACHINE TRANSMISSION OF MESSAGES BY TELEGRAPH COMPANY NOT A NUISANCE.—The Postal Telegraph-Cable Company brought suit for damages against the Pacific Gas & Electric Company on the ground that "there extends in all directions" about the latter company's 53,000-volt transmission line from Sacramento to Suisun "a field of force for more than 210 ft., and said field of force carries within such field many electric currents of high and varying intensity which are not controlled by or confined to said power lines" and are "inducted onto plaintiff's lines, thereby interfering with the transmission of telegraphic messages thereover," and that "the physical damage to plaintiff's said line and the equipment thereof from such surges and induction within three years last past has amounted to the sum of $2,000." This, the plaintiff contended, constituted a nuisance in the statutory sense, but the Supreme Court of California, sitting *en banc*, has sustained the lower court in finding to the contrary and denying the right of action for damages. The interference alleged was specifically with machine transmission, and the power company made the point that this was an extraordinary use of the plaintiff's property and therefore not subject to the same considerations as inhere in ordinary use. The plaintiff's further charges against the power company of negligent construction and failure to keep lines in repair were dismissed by the court as too general and insufficient to be sustained against demurrer. Five judges concurred in this part of the decision, but two of the five dissented from the first part, holding that a nuisance had been shown to exist. (260 Pac. 11[illegible]

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

**Howard Bardwell**, assistant to the general superintendent of the Empire District Electric Company in the production department, has been appointed head of a newly created division dealing with compensation insurance, employees' safety and personnel problems. In connection with the appointment he has been relieved of his duties in the production department. Mr. Bardwell has for the past three years handled most of the problems arising from employees' compensation and safety and personnel work. The volume of this work has grown to such an extent that it is felt that he can profitably give his entire time to it. Mr. Bardwell has been with the organization nine years. He joined the results department at the Riverton plant early in 1919, but was transferred to the Joplin office in 1922.

H. C. **Blackwell**, president of the Union Gas & Electric Company, Cincinnati, has been elected president of the Cincinnati Chamber of Commerce. Mr. Blackwell served for several years as chairman of the industrial committee of the chamber. He has been in Cincinnati since 1924, when he transferred his interests from Kansas City (Mo.), where he had been vice-president and general manager of the Kansas City Power & Light Company.

**Edward M. Graham**, Bangor, Me., president of the Bangor Hydro-Electric Company, has been elected president of the Eastern Manufacturing Company, which operates mills at Lincoln and South Brewer, Me., in the manufacture of sulphite pulp, writing paper and rayon cellulose, to succeed Stewart Webb of Boston, Mass.

**Theodore Dienst**, for the past several years superintendent of the Kansas Electric Power Company at Parsons, has been appointed manager of the McAlester division of the Southwest Power Company to succeed H. T. Asbury, who has assumed new duties in Arkansas.

E. T. **Hughes**, for eight years manager of the Yankton (S.D.) division of the Northwestern Public Service Company, has been appointed superintendent of the Kansas Electric Power Company at Parsons to succeed Theodore Dienst, who has assumed new duties in Oklahoma.

**Glenn C. Kiley**, formerly service manager of the Oklahoma Gas & Electric Company, Oklahoma City, has been appointed local manager of the company in that city and in that capacity will supervise local matters in Bethany, Moore, Britton, Choctaw, Harrah, Jones and Yukon as well as in Oklahoma City. Mr. Kiley entered the employ of the Byllesby Company in Chicago in the rate and valuation department in 1917, removing to Oklahoma in the summer of 1923. He started with the Oklahoma Gas & Electric Company as a traveling auditor and three years ago was appointed service manager, the position he occupied until his recent assignment to the local managership.

## F. H. Woodward Leaves San Francisco

F. H. Woodward, since 1922 general sales manager of the Great Western Power Company, with headquarters in San Francisco, has been transferred to Oakland as manager of that division of the company. The position of general sales manager in the San Francisco office has been abolished. He is succeeding G. W. Bernhard, who has been made industrial heating engineer with headquarters in San Francisco. Mr. Woodward is returning to a territory by no means unfamiliar to him, he having served as manager of the Oakland division from 1912 to 1922. He has been connected with the company for the past eighteen years, having entered its employ in 1909 in charge of industrial power sales.

F. H. WOODWARD

**Harold T. Melhuish** has joined the staff of the National Electrical Manufacturers Association as director of the radio division. Mr. Melhuish was formerly connected with the Radio Corporation of America for five and a half years, serving successively as special field representative, district sales manager, assistant general sales manager and manager of sales administration.

J. V. **Gongwer** has been named chief assistant engineer for the proposed construction of the second unit of the Cushman power project by the city of Tacoma. Mr. Gongwer will occupy the position of superintendent of hydraulic design and construction.

**James F. Small** has been appointed merchandise sales manager of the Public Service Company of Northern Illinois. Mr. Small was formerly manager of the Chicago Heights Gas Company, now a part of the Public Service company. He first entered the utility business with the Peoples Gas, Light & Coke Company and later affiliated himself with the Western United Gas & Electric Company as district manager. After considerable experience as a consulting and operating engineer, he became manager of the Chicago Heights Gas Company in 1917 and held that position until 1926, when that organization became a part of the Public Service company's system.

**Herman Russell**, vice-president of the Rochester Gas & Electric Corporation, has been elected president of the Rochester Chamber of Commerce. In addition to his executive position with the Rochester Gas & Electric Corporation, Mr. Russell is an officer and director in numerous Rochester banks and other organizations and has always given liberally of his time and energy in the interest of the public welfare.

E. J. **Jones**, for the past fifteen years manager of the Florida Power Company, Ocala, Fla., and its successor, the Florida Power Corporation, has been appointed general manager of the Compañia Electrica de Santo Domingo. This company operates the electrical utilities in the cities of Santo Domingo, Macoris and other cities in the Dominican Republic.

H. P. **Jones** has been appointed superintendent of meters of the Oklahoma Gas & Electric Company and C. E. **Bathe** has been named superintendent of electrical standards and radio. W. K. **Danvers** has been made superintendent in charge of the maintenance and reclamation department recently established.

**Dr. Thomas S. Baker**, president of the Carnegie Institute of Technology, Pittsburgh, is planning to spend six weeks in Europe during February, March and April, to organize plans for the second international conference on bituminous coal at Pittsburgh.

**Carroll A. Dean** has been appointed merchandising manager of the Lawrence (Mass.) Gas & Electric Company. Mr. Dean was formerly in charge of electric appliance sales for the Lowell Electric Light Corporation, Connecticut Light & Power Company and Cambridge Electric Light Company.

R. J. **Malcomson**, formerly street lighting engineer of the Public Service Company of Northern Illinois, in charge of municipal street-lighting sales, has been appointed manager of lighting sales. He is now responsible for both the general and municipal lighting sales of the company. Mr. Malcomson became associated with the company in 1923 in the capacity of sales engineer and in 1924 was appointed street lighting engineer, which position he held until his present assignment.

Leon O. Whitsell has been elected president of the California Railroad Commission to succeed Ezra W. Decoto, retired. President Whitsell has been a member of the railroad commission since 1925 and was reappointed for a full term of six years by former Governor Friend W. Richardson, Jan. 1, 1927. He was appointed from Orange county, where he was a member of the board of supervisors, and a leading figure in the citrus industry of that county. He was a practicing attorney for many years before engaging in citrus growing in southern California.

L. S. Small has resigned as superintendent of distribution for the Pine Bluff district of the Arkansas Power & Light Company, with which company he had been connected for three years. R. J. Rhinehart, who has been affiliated with the company for about a year, has been appointed to succeed Mr. Small. Mr. Rhinehart was formerly superintendent of service for the Southwestern Gas & Electric Company at Texarkana.

George E. Hardy, president of the Commonwealth Power Corporation, sailed for Bermuda Jan. 25 for a short vacation.

C. D. Porter, vice-president and general manager of the Virginia Public Service Company, successor to the Newport News & Hampton Railway, Gas & Electric Company, has resigned to become vice-president and general manager of the Omaha & Council Bluffs Street Railway Company, Omaha, Neb. Mr. Porter has been vice-president and general manager of the Newport News utility since 1921.

C. S. Van Dyke has been appointed rate engineer for the New York Power & Light Corporation in charge of all matters pertaining to rates, both gas and electric, including the compilation and tabulation of rate information, maintenance of records and the study of new rates. Mr. Van Dyke's headquarters will be in Albany.

B. L. Delack, assistant manager of the Schenectady works of the General Electric Company for the past year, has been appointed manager of that plant. Mr. Delack has been associated with the company since 1903 and just prior to his connection at Schenectady he was affiliated with the Erie works.

Samuel Insull, president of the Commonwealth Edison Company, Chicago, has been elected president of the Western United Gas & Electric Company, recently acquired by the Insull interests.

E. A. Wagner has been appointed manager of the Pittsfield (Mass.) plant of the General Electric Company.

Thomas H. Blodgett, president and chairman of the board of directors of the American Chicle Company, has been elected a director of the American Water Works & Electric Company and its subsidiary, the West Penn Electric Company.

J. B. Archer, district manager of the Iowa-Nebraska Light & Power Company at Shenandoah, Ia., has been transferred to the general office at Lincoln. C. C. Helmers of Lincoln will be located at Shenandoah temporarily as manager.

T. H. Hogg, chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, was recently made the recipient of the honorary degree of doctor of engineering by the University of Toronto.

J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, has been elected first vice-president of the Oklahoma State Chamber of Commerce.

E. A. Feldtkeller, who for several months has been supervisor for the General Engineering & Management Corporation in the Florida sector, has been promoted to the general managership of the Jersey Central Power & Light Company, southern division, and has taken up his duties at the division headquarters in the company's offices at Asbury Park, N. J.

Paul Fasoli, formerly superintendent of the Associated Gas & Electric interests at Granville, N. Y., has assumed the duties of general superintendent of the Harlem Valley division, succeeding L. A. Reinhardt, who has been transferred to Ithaca.

J. H. Van Aernam has been appointed manager of merchandise sales for the New York Power & Light Corporation with headquarters in Albany. Mr. Van Aernam will supervise all activities in connection with merchandising operations.

C. E. Lyon has been appointed superintendent of hydro stations for the New York Power & Light Corporation and will have charge of all hydro stations belonging to the corporation.

C. C. Yeakley has been appointed superintendent of the Oklahoma City district, western division, of the Oklahoma Gas & Electric Company.

## Obituary

William E. Gilmore, for many years general manager of the Thomas A. Edison industries and in more recent years president of the Essex Press, a publishing house of New Jersey, died Jan. 17 at St. Mary's Hospital, Orange. A native of New York, Mr. Gilmore became identified with the Edison Electric Light Company at the age of eighteen. While with Mr. Edison, in addition to holding the position of general manager, he became president and general manager of the National Phonograph Company. Prior to his association with Mr. Edison directly, Mr. Gilmore in 1886 removed to Schenectady to become assistant secretary of the Edison Machine Works, which subsequently became part of the Edison General Electric Company, the forerunner of the General Electric Company. He was appointed assistant general manager of the Edison General Electric Company and in 1894 Mr. Edison called him to West Orange.

Charles S. Northcutt, manager of the San Joaquin division of the Pacific Gas & Electric Company, died Dec. 17 of injuries received in an automobile accident. Though a native of Georgia, Mr. Northcutt had been a resident of California since 1905. For four years he engaged in construction work and then became identified with the executive offices of the Sierra & San Francisco Power Company. In 1910 he was appointed agent in Modesto and one year later manager of that district. When, early in 1920, the Sierra & San Francisco Power Company was leased by the Pacific Gas & Electric Company, Mr. Northcutt was appointed manager of the Stanislaus district. Six years ago he was promoted to the position of manager of the San Joaquin division, comprising the Stanislaus, San Joaquin, Tuolumne and Electra districts.

Richard J. Dibowski, secretary and director of the Wadsworth Electrical Appliance Manufacturing Company of Covington, Ky., died suddenly Jan. 8 at his home in that city. Mr. Dibowski was one of the founders of the Wadsworth organization and during the period of its growth contributed substantially to its progress. His interest in civic and business affairs led to his appointment as a director of the Associated Industries of Kentucky. Mr. Dibowski was 53 years of age.

Allen H. Moore, who retired six months ago as chairman of the standardizing committee of the General Electric Company on account of ill health, died Jan. 10 at his home in Albany, N. Y., in his 62d year. At the time Mr. Moore relinquished his duties he had to his credit 39 years of service with the General Electric Company and its associated foreign manufacturing companies.

Augustus T. Holbrook, electrical engineer, died in New York, Jan. 12. Mr. Holbrook was for several years identified with the electrical industry in New England, later having removed to New York. He was a member of the American Institute of Electrical Engineers.

# Financial and Statistical News

## *Rediscount Rate Change Markets Again Active Common Stocks Move Up*

SPECULATION with regard to the possible effect upon the security markets of the rise to 4 per cent of the Chicago rediscount rate soon had its answer in a corresponding tightening of money in the New York market. Stocks reacted from two to five points, but utility stocks were the only main group not materially affected. Prices were maintained with negligible losses.

While the Federal Reserve rediscount rate charge in Chicago need not have any immediate effect on the New York money market, the present situation implies a policy rather than an isolated rate adjustment in one locality. There is the imminent possibility of a rise in the other reserve districts and in any event, the board has a rather forceful, if indirect, check upon speculative activities in the rediscount rate.

After last week's hesitation and temporary selling movement in the markets at large, the trend of power and light stocks is again upward, in utter disregard, apparently, of the Walsh Resolution. American Gas & Electric is up to 124; Brooklyn Edison is up 13 points during the week, to 226; Middle West Utilities gained 5 points to 134. Several other common stocks including Public Service of New Jersey, Southeastern Power & Light, Philadelphia Electric, etc., made smaller gains.

## New German Loan Offered

The twenty-million-dollar loan of the Westphalia United Electric Power Corporation, which last week's issue of ELECTRICAL WORLD announced would be offered in the near future, was brought out Monday in the form of first mortgage 6 per cent sinking fund gold bonds, series A. These securities, due Jan. 1, 1953, were priced at 92¾ and accrued interest, to yield about 6.60 per cent. Proceeds will be applied to the payment of bonds and of floating debt incurred for capital expenditures and for additions and improvements to the properties of the corporation and its subsidiary companies.

## Standard Gas Customer Sales Total $32,000,000

Customer-ownership sales of preferred shares of the subsidiary and affiliated public utilities of the Standard Gas & Electric Company established a new high record in 1927, when sales (par value) totaled $31,975,600, an increase of 27.58 per cent over the previous high record in 1926. There were 42,267 separate transactions. The total represents all sales, less only cançellations. Of this amount, repurchases totaled 13.24 per cent, leaving a total of net sales from treasury of $28,236,900. It is estimated that approximately 22,000 new shareholders were added to the subsidiary and affiliated companies through the operation of the customer-ownership plan in 1927. A total of 9,200 customer shareholders must be deducted because of the merger of the Western States Gas & Electric Company and the Coast Valleys Gas & Electric Company with the Pacific Gas & Electric Company. Therefore, the net gain amounted to 12,800 shareholders.

# November Operations Swing Upward

### Electric Light and Power Revenue, $158,000,000—Is 6.5 per Cent Above Last Year—Energy Generated Increases 7.2 per Cent —Both Show Gain Over October

WITH a revenue of $158,000,000, estimated for the entire industry on the basis of reports received by the ELECTRICAL WORLD, and an energy output of 6,503,442,000 kw.-hr., corresponding to a daily average of 217,000,000 kw.-hr., the electric light and power companies in the United States reached the highest figure ever attained as to the latter item and earned the highest monthly revenue with one exception. The earnings were 6.5 per cent above those of November, 1926, and 4.8 per cent higher than in October, 1927. With two months still to go they missed the midwinter peak attained in January, 1927, by less than 3 per cent.

These returns seem to indicate the setting in of an upward movement, though one not yet strongly defined. For the first half of 1927 the revenue exceeded that for the corresponding portion of 1926 by 10.5 per cent. This fell to 7.2 per cent in July, rose slightly in August to 7.3 and in September to nearly 9 per cent, then in October fell to 6.3 per cent. The November earnings thus represent a slight acceleration compared with October business.

Had the growth in revenue continued at the same rapid rate as during the five years from 1922 to 1926 the average daily revenue would have been $5,370,000. The actual revenue, therefore, fell

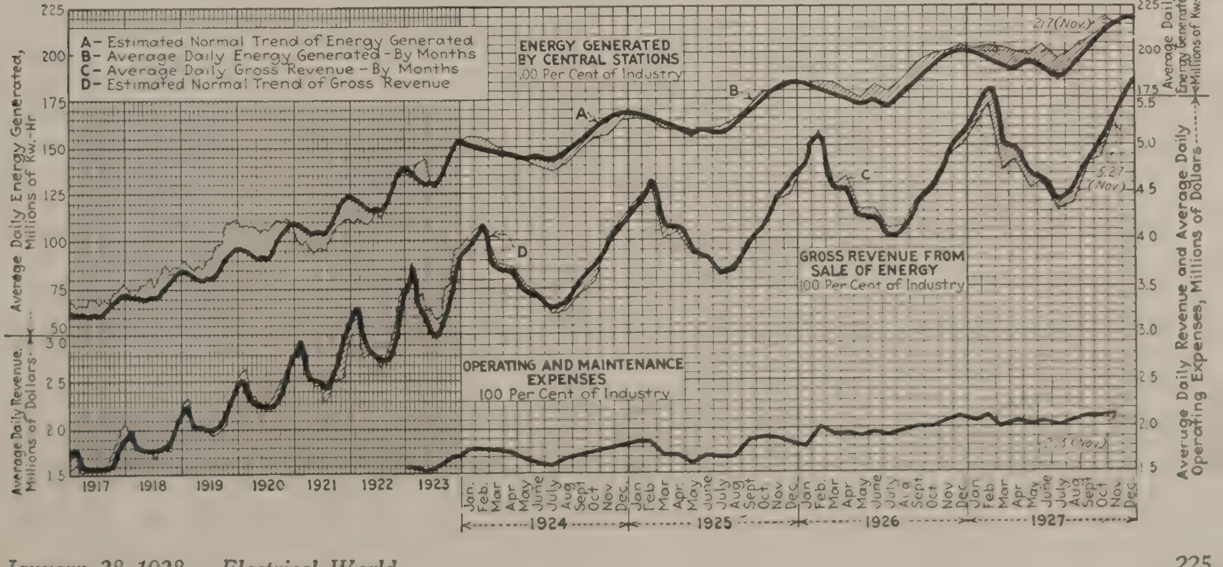

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 Per Cent of the Industry)

| Month | Kw.-Hr. Generated Monthly* | | | Estimated Distribution of Energy Generated | | | | | | | | | | Energy Purchased by Public Utilities for Resale, Kw.-Hr. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total Energy Consumption by Central-Station Customers, Kw.-Hr. | | Energy Consumed for Lighting, Kw.-Hr. | | Energy Consumed for Power, Kw.-Hr. | | Energy Sold to Electric Railways, Kw.-Hr. | | Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr. | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Aug... | 6,335,335 | 5,777,753 | +9.6 | 5,217,335 | 4,663,753 | 1,265,000 | 1,212,000 | 3,425,335 | 2,932,753 | 527,000 | 519,000 | 1,118,000 | 1,114,000 | 1,290,000 | 1,122,000 |
| Sept... | 6,268,814 | 5,825,852 | +7.6 | 5,158,814 | 4,701,852 | 1,274,000 | 1,188,000 | 3,373,814 | 3,009,852 | 511,000 | 504,000 | 1,110,000 | 1,124,000 | 1,299,000 | 1,225,000 |
| Oct... | 6,576,625 | 6,174,959 | +6.5 | 5,412,625 | 4,981,959 | 1,372,000 | 1,262,000 | 3,484,625 | 3,171,959 | 556,000 | 548,000 | 1,164,000 | 1,193,000 | 1,290,000 | 1,240,000 |
| Nov... | 6,503,442 | 6,063,784 | +7.2 | 5,351,442 | 4,989,784 | 1,400,000 | 1,310,000 | 3,392,442 | 3,128,784 | 559,000 | 551,000 | 1,152,000 | 1,074,000 | 1,269,000 | 1,200,000 |

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only

short of the normal, computed on that severe basis, by only 2 per cent.

Operating expenses increased less than revenue; the net earnings, therefore, make a more favorable showing than the gross; compared with the corresponding months of 1926 they were greater by 9.5 per cent in October and 9.6 per cent in November.

The gain in energy output, as in revenue, was greater than in October, rising to 7.2 per cent above the output in November, 1926. More of the increase was borne by water power than by steam. The former grew by 12 per cent, while fuel-generated energy was only 4.5 per cent greater than a year before. Water power produced 2,456,835,000 kw.-hr., or 38 per cent of the whole.

TABLE II—OPERATING RATIO OF CENTRAL-STATION COMPANIES

| Month | Operating Ratio | | | | | |
|---|---|---|---|---|---|---|
| | Steam Plants | | Hydro Plants | | Combined Hydro and Steam Plants | |
| | 1927 | 1926 | 1927 | 1926 | 1927 | 1926 |
| Aug | 52.8 | 53.6 | 34.6 | 36.3 | 44.1 | 45.8 |
| Sept | 48.8 | 49.7 | 33.4 | 37.5 | 42.1 | 43.3 |
| Oct.. | 46.9 | 48.3 | 31.8 | 32.4 | 42.6 | 43.9 |
| Nov.. | 44.7 | 45.8 | | | | |

Although the proportions of coal, oil and natural gas consumed differed slightly, the aggregate in terms of equivalent tons of coal was almost identical in November, 1926, and the same month in 1927. The increase in output was thus achieved without an increase in fuel consumption.

Energy purchased for resale has varied only a few per cent since August and was only 6 per cent greater in November than it was a year earlier.

## Pacific Power and Light Announces Refinancing

The incorporation of a new Pacific Power & Light Company to include not only the old company but seven smaller companies, as announced in the Jan. 21 issue of ELECTRICAL WORLD, will necessitate the retirement of $9,119,000 of the old company's 5 per cent. first and refunding mortgage bonds, due April 1, 1930, which will be accomplished by call on an interest date at the call price of 102. A new issue of first mortgage bonds of the new company, in the amount of $17,000,000, will then be sold. Details have not been determined, but a coupon rate of 5 per cent or less, with a long term, is expected.

The outstanding 57,934 shares of 7 per cent, $100 par, cumulative preferred stock of the present company will be exchanged share for share with an identical stock of the new company, and in addition there will be issued 12,216 shares of $6, no-par, cumulative preferred stock for sale to the public as and when needed by the company. Both of these stocks will carry first preferred privileges as compared with the other junior securities of the company. Behind these issues will be 40,000 shares of $6, no-par, second preferred stock and an undetermined quantity of no-par common stock, which will be taken by the American Power & Light Company as reimbursement for advances made by it to the Pacific company and in payment of properties now owned by it but turned over to the new Pacific company. The absorption of the new properties will add about $15,000,000 of physical assets to the company, bringing the total assets up to about $40,000,000.

TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES
(100 Per Cent of the Industry)

| Month | Total Gross Revenue from Sale of Energy† | | | Estimated Distribution of Gross Revenue | | | | | | | | Total Operating and Maintenance Expenses‡ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lighting Customers | | Power Customers | | Electric Railways | | Other Public Utilities | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| August.. | $155,600 | $126,400 | +7.3 | $79,900 | $77,900 | $41,400 | $35,900 | $4,400 | $4,300 | $9,900 | $8,300 | $63,000 | $60,200 |
| Sept.... | 144,400 | 132,600 | +8.9 | 84,200 | 80,500 | 44,400 | 38,000 | 4,600 | 4,500 | 11,200 | 9,600 | 63,600 | 60,300 |
| Oct..... | 150,800 | 141,800 | +6.3 | 88,700 | 84,100 | 45,900 | 42,000 | 4,600 | 4,600 | 11,600 | 11,100 | 64,450 | 62,950 |
| Nov.... | 158,000 | 148,300 | +6.5 | 94,300 | 89,100 | 47,200 | 43,200 | 5,000 | 4,900 | 11,500 | 11,100 | 64,020 | 62,600 |

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*
(100 Per Cent of the Industry)

| Month | Energy Generated | | | | | | Fuel Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hydro-Plants | | | Fuel Power Plants | | | Coal | | | Oil | | | Gas | | |
| | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Short Tons | 1926 Short Tons | Per Cent Increase | 1927 Barrels | 1926 Barrels | Per Cent Increase | 1927 Thousands of Cubic Feet | 1926 Thousands of Cubic Feet | Per Cent Increase |
| August | 2,371,572 | 2,062,629 | +14.9 | 3,963,763 | 3,715,124 | +6.7 | 3,180,358 | 3,060,647 | +3.9 | 480,022 | 728,864 | —34.1 | 6,259,785 | 5,403,316 | +15.8 |
| September | 2,168,531 | 2,033,312 | +6.7 | 4,100,283 | 3,792,540 | +8.1 | 3,242,546 | 3,114,535 | +4.1 | 478,816 | 883,913 | —45.9 | 6,474,756 | 4,816,755 | +34.4 |
| October | 2,349,720 | 2,122,336 | +10.7 | 4,226,905 | 4,052,623 | +4.3 | 3,332,673 | 3,317,113 | +0.5 | 480,548 | 879,929 | —45.4 | 6,439,602 | 4,872,740 | +32.1 |
| November. | 2,456,836 | 2,193,093 | +12.0 | 4,046,606 | 3,870,691 | +4.5 | 3,225,764 | 3,193,212 | +1.0 | 485,291 | 926,916 | —47.5 | 5,687,217 | 3,975,408 | +43.1 |

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

## Baltimore Consolidated Leads New Capital Issues

During the week ended Jan. 26 the Consolidated Gas, Electric Light & Power Company of Baltimore issued 5 per cent cumulative preferred stock, series A, to the amount of $10,000,000, the price being 100 and accrued dividend. The issue totaled $13,500,000, but $3,500,000 of that sum was reserved by the company for local subscription. The proceeds of the offering will be used to provide funds, in part, for the retirement of $5,000,000 series A 8 per cent, $2,000,000 series B 7 per cent and $4,000,000 series C 6½ per cent cumulative preferred stocks, which issues will be redeemed April 2, 1928, and to reimburse the treasury in part for the cost of additions and extensions and for other capital expenditures.

The Central States Utilities Corporation offered ten-year 6 per cent secured gold bonds to the amount of $3,000,000, the price being 90 and accrued interest to yield about 6.25 per cent. The Central States Utilities Corporation will own all of the outstanding common stock of the Central States Power & Light Corporation.

First mortgage gold bonds of the Washington Gas & Electric Company were offered at 100 and accrued interest.

## National Power & Light And Lehigh Power Merge

S. Z. Mitchell, president of Electric Bond & Share Company stated this week that a plan has been formulated for the exchange of stock of Lehigh Power Securities Corporation for stock of National Power & Light Company. He said that the basis of exchange is one share of $6 preferred stock of the National Power & Light Company for each share of $6 preferred stock of the Lehigh Power Securities Corporation, and one share of the common stock of the National Power & Light Company for each share of the common stock of the Lehigh Power Securities Corporation, and that this privilege of exchange is extended to all stockholders of Lehigh Power Securities Corporation.

Mr. Mitchell stated that while the two companies are remarkably similar as to amount of earnings and share capitalization the character of the business in the communities served by the two groups is quite different. In his opinion, the Lehigh Power Securities Corporation stockholders making the exchange, as well as the stockholders of the National Power & Light Company, will benefit substantially by the business and geographic diversity and the greater financial strength and stability resulting from the union of the two groups.

## Company Reports

| Name of Company | Gross Earnings Twelve Months Ended Nov. 30 1927 | 1926 |
|---|---|---|
| American Wtr. Wks. & Elec. | $48,706,743 | $45,013,322 |
| Associated Gas & Electric | 34,440,164 | 28,802,770 |
| Columbia Gas & Electric | 96,926,462 | 92,210,312 |
| Electric Power & Light | 52,499,277 | 49,425,346 |
| Fort Worth Power & Light | 2,978,740 | 2,871,401 |
| Idaho Power | 3,118,953 | 2,872,883 |
| Illinois Power & Light | 31,286,067 | 30,953,021 |
| Kansas City Power & Light | 12,275,468 | 10,801,037 |
| Nebraska Power | 4,824,915 | 4,365,989 |
| New York Power & Light | 18,789,733 | 17,840,022 |
| Pacific Power & Light | 3,751,229 | 3,745,490 |
| Public Service of New Hampshire | 3,665,361 | 3,586,583 |
| Texas Power & Light | 9,433,144 | 7,575,571 |
| United Light & Power subs. | *41,158,953 | *36,682,193 |
| Utah Power & Light | 10,646,581 | 10,437,622 |
| West Penn Electric | 37,123,471 | 34,101,919 |

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 24 | Low 1927 | High 1927 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, 4% com.—no par | 163 | 140½* | 164* |
| Ala. Pwr., $7 com. pf.—no par | 114½ | 107 | 115 |
| Allis Chalmers Mfg., 6% com. ex.div. | 118¾ | 115½* | 120⅞* |
| Aluminum Co. of Amer., com. | 124¼ | 120* | 125* |
| Aluminum Co. of Amer., 6% pf. | 106½ | 105½* | 106½* |
| Amer. & Foreign Pwr., 7% ptc. pf.—no par | 108 | 105¼* | 108½ |
| Amer. & Foreign Pwr., com.—no par | 26 | 22¼* | 27⅞* |
| Amer. Bosch Magneto, com.—no par | 20⅜ | 20* | 22⅝* |
| Amer. Brown Boveri Elec.† | 15 | 14½* | 17* |
| Amer. Brown Boveri Elec., pf. $7 | 61 | 58* | 63* |
| Amer. Gas & Elec., 6% pf.—no par | 106¾ | 106¼* | 109* |
| Amer. Gas & Elec., com. †—no par | 124¾ | 117½* | 122⅜* |
| Amer. Lt. & Trac., 6% pf. | 115½ | 115½* | 115½* |
| Amer. Lt. & Trac., new com. | 173 | 170* | 174½* |
| Amer. Pwr. & Lt., 6% pf. | 107⅜ | 107½* | 109⅞* |
| Amer. Pwr. & Lt., com. †—no par | 65⅝ | 62¼* | 65⅝* |
| Amer. Pub. Serv., 7% pf. | a 99½ | 94 | 104 |
| Amer. Pub. Serv., com. † | k 70 | 65 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | 92 | 73 | 90 |
| Amer. Pub. Utilities, 7% pr. pf. | a 93 | 92 | 96½ |
| Amer. Pub. Utilities, com. | k 60 | 58 | 70 |
| Amer. States Sec., A | 4 | 2⅞ | 5½ |
| Amer. States Sec., B | 4⅛ | 2⅞ | 5⅛ |
| Amer. Superpwr., 6% ptc. pf.—25 | 29⅝ | 29* | 29⅞* |
| Amer. Superpwr., 6% 1st pf. | l 103 | | |
| Amer. Superpwr., Class A†—no par | 40 | 37* | 40½* |
| Amer. Superpwr., Class B†—no par | 40⅛ | 37⅜* | 40½* |
| Amer. Wtr. Wks. & Elec., 6% pf. | 103 | 101½* | 103⅛* |
| Amer. W.W. & E., com. new—no par | 58 | 56⅜* | 61* |
| Anaconda Copper cap. $3 | 57⅞ | 53¼* | 59⅞* |
| Appalachian Electric Pwr., 7% pf. | 109 | 100 | 109 |
| Arkansas Pwr., & Lt. 7% pf. | 107½ | 101 | 108 |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 98 | 85 | 98 |
| Assoc. G. & E., Class A, 10—no par. | 47½ | 47⅛* | 51½* |
| BABCOCK & WILCOX, 7% com. | 124¾ | 120* | 124¾* |
| Binghamton L., H. & P., $6 pf. | 103 | 93 | 103½ |
| Birmingham Elec., pf.—$7—no par | 109 | 105 | 111½ |
| Blackstone Valley G. & E., 6% pf. | k107 | 103 | 110 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k128 | 98 | 153 |
| Blaw Knox, com. † | m 93 | 70 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f223½ | | |
| Broad River Pwr., 7% pf. | 104 | 97 | 105½ |
| Brooklyn Edison, 8% com. | 225½ | 206½* | 235½* |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26½ | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 34⅛ | .... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | k 98 | 96 | 104½ |
| California Ry. & Pwr., 7% pf. | k135 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | l110 | 109* | 110½* |
| Central & S. W. Util., $7 pf.—no par | a104¼ | 92½ | 99½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a107½ | 98½ | 105½ |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 100 | 107 |
| Central Ill. Pub. Serv., $6 pf. | a 98 | 85½ | 100 |
| Central Ind. Pwr., 7% pf. | a 96½ | 85½ | 95½ |
| Central Maine Power, 6% pf. | 95 | | |
| Central Maine Power, 7% | 106 | 102 | 110 |
| Central Pwr. & Lt., 7% pf. | 105 | 100½ | 105 |
| Central States Elec., 7% pf. | 104¼ | 104¼* | 105¼ |
| Century Elec., 6% com. | b145 | 140* | 142* |
| Chicago Fuse Mfg., com.—$2.50 no par | a 32 | 30 | 35½ |
| Cincinnati Gas & Elec., 5% com. | g100 | ... | ... |
| Cities Service, $6 pf.—no par | l95⅝ | 87⅞ | 94½* |
| Cities Service, pf. B—no par | l 9 | 8* | 8⅜* |
| Cities Service, pf. BB—no par | l 90 | 80½* | 86* |
| Cities Service, com.—20 | l55⅝ | 40¼* | 58½* |
| Cities Service, Bks. Shrs.—10 | l27⅜ | 22¾* | 27* |
| Cities Service Pwr. & Lt., 7% pf. | k105½ | 105¼* | 106¼* |
| Cities Service Pwr. & Lt., 6% pf. | 96⅝ | 95½* | 96⅞* |
| Cleveland Elec. Illg., 6% pf. | 112 | 108 | 114 |
| Cleveland Elec. Illg., 10% com. | 350 | 285 | 370 |
| Columbia Gas & Elec., 6% pf. | 108⅞ | 108* | 110⅛* |
| Columbia G. & E. com. $5—no par | 92⅞ | 89⅜* | 92⅞* |
| Columbus Elec. & Pwr., $2 com.—no par | m 65 | .... | .... |
| Columbus Elec. & Pwr., 7% pf. | 110 | .... | .... |
| Columbus Ry., Pwr. & Lt., 6% 1st pf. | 107 | 98½ | 108½ |
| Columbus Ry., Pwr. & Lt., 6½% pf. B | 105 | 96 | 106 |
| Columbus Ry., P. & Lt. com.—no par | 105 | 75 | 110 |
| Commonwealth Edison, 8% com. | a168 | 138 | 173 |
| Commonwealth Pwr., 6% pf. | 102⅛ | 102⅛* | 104⅜* |
| Commonw'th Pwr., $2, com.—no par | 65½ | 62¼* | 65⅞* |
| Conn. Lt. & Pwr., 8% pf. | 121 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 112 | 119 |
| Cons. Gas of N. Y., pf. | 102¼ | 101⅞* | 102½* |
| Cons. Gas of N. Y., com. $5—no par. | 126⅞ | 119⅞* | 126⅞* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e113 | 110⅛ | 112¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e110½ | 110⅜ | 114¾ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e110¾ | 112½ | 117 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf. | e125¾ | 127 | 130⅛ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 70⅛ | 51 | 71 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | 100 | 106 |
| Consumers Pwr., 6% pf. | 104½ | 100 | 106½ |
| Consumers Pwr., 6.6% pf. | 106¼ | 103 | 107½ |
| Continental Gas & Elec., 8% ptc. pf. | 110½ | 103 | 110 |
| Continental Gas & Elec., 7% pr. pf. | 107½ | 100 | 107½ |
| Conti. G. & E. com. $4.40—no par | k225 | 210 | 265 |
| Crocker Wheeler, com.† | 25 | 23 | 38 |
| Crocker Wheeler, 7% pf. | 85 | 78 | 88 |
| DALLAS PWR. & LT., 7% pf. | 111 | 107 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108½ | 101 | 109½ |
| Detroit Edison, 8% com. | 174 | 166½* | 176½* |
| Dubilier Condenser, com.—no par | 3 | 2¾* | 3¼* |
| Duke Pwr., cap. | 136½ | 136* | 145* |
| Duquesne Lt., 7% pf. | 116 | 115½* | 116* |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 102 | 112½ |
| Eastern New York Util. com. | k 65 | 70 | 75 |
| Eastern States Pwr. $7, com. | 13½ | 11½* | 13½* |
| Eastern States Pwr., pf. | 97 | 90 | 99 |
| East. Tex. Elec., 7% pf. | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d263 | 217 | 267 |
| El Paso Elec., 7% pf. | 110½ | 105 | 112½ |
| Elec. Bond & Share, 6% pf. | l110 | 109½* | 111½* |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 78¼ | 76* | 80¼* |
| Electric Household Util. † | a 15½ | 11 | 15½ |
| Elec. Investors, 6% pf.—no par | 102 | 92 | 101 |
| Elec. Investors, com. †—no par | 43¼ | 40½* | 44* |
| Elec. Pwr. & Lt., ctfs. pf. | 107½ | 106½* | 107⅞* |
| Elec. Pwr. & Lt., ctfs., 40% pd. | k123½ | 120½* | 121½* |
| Elec. Pwr. & Lt., ctfs., com.—no par | 33¾ | 28½* | 34½* |
| Elec. Refrig. cap. † | 12⅞ | 11¼* | 13¼* |
| Elec. Ry. Securities, com.—no par | 6½ | ... | ... |
| Elec. St. Battery com. $5.25—no par | 71½ | 69½* | 75½* |
| Elmira Wtr., Lt. & R.R., 7% pf. | k105 | 99 | 105½ |
| Empire Pwr., ptc.† | m 30½ | 27½* | 30½* |
| Engr. Pub. Serv. $7, pf.—no par | 108 | 107* | 109* |
| Engr. Pub. Serv., com.—no par | 36⅛ | 34⅛* | 36½* |
| Eureka Vacuum Cleaner, com. $4—no par | 75⅜ | 73⅜* | 79* |
| FAIRBANKS MORSE, 7% pf. | k106 | 107 | 112 |
| F.-M., com. $3—no par | 38½ | 32½* | 40¼* |
| Federal Lt. & Trac., com. $1.40 | 47¼ | 42* | 47½* |
| Federal Lt. & Trac., $6 pf.—no par | 102½ | 98* | 103* |
| Florida Pwr. & Lt., 7% pf. | 106½ | 104¼* | 106½* |
| Ft. Worth Pwr. & Lt., 7% pf. | i113½ | 113* | 114½* |
| GALVESTON-HOUSTON ELEC. 6% pf. | 75 | 68 | 85 |
| Galveston-Houston Elec., com. | 31½ | 26 | 32 |
| General Cable, Cl. A $1 no par | 60 | 56¼* | 60* |
| Gen. Elec. $3 com.—no par | 134¼ | 130* | 138¼* |
| Gen. Elec., special 6% | 11⅛ | 11¼* | 11⅜* |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 38⅛ | 35¼* | 38⅜* |
| Gen. G. & E. (Del.) pf. A $8—no par | k122¼ | 113½ | 123½ |
| Gen. G. & E. (Del.) pf. A $7—no par. | k109¼ | 100 | 110 |
| Gen. G. & E. (Del.) pf. B $7 | k105 | 96* | 105¼* |
| Gen. Pub. Serv., $7 cum. pf., no par | k110 | 102 | 112 |
| Gen. Pub. Serv., com., no par | 19½ | 16¼* | 19* |
| Ga. Ry. & Pwr., 8% pf. | k125 | 119 | 125 |
| Ga. Ry. & Pwr., 7% pf. | k113½ | 106 | 115 |
| Gt. Western Pwr., 7% pf. | h105 | — | — |
| IDAHO PWR., 7% pf. | 109 | 103 | 110 |
| Ill. No. Utilities, 6% pf. | k 96 | 88 | 97 |
| Ill. Pwr. & Lt., 7% pf. | 104 | 99 | 104½ |
| Ingersoll Rand com. | k 92 | 91* | 94* |
| Int. Combus. Engr., com. $2—no par | 53⅛ | 49* | 55½* |
| Int. Combustion Engr., 7% pf. | k105½ | 104½* | 105½* |
| Int. Util., Class A—$3.50—no par | 48 | 48* | 51½* |
| Int. Utilities, Class B—no par | 9⅝ | 9* | 10* |
| Interstate Pwr., pf.—$7—no par. | 97½ | 93 | 100 |
| Interstate Pub. Serv., 7% pf. | 102 | 98 | 104 |
| Iowa Ry. & Lt., 7% pf. | k 98½ | 97 | 100 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 105½ | 97½ | 108 |
| Johns-Manville com. †—no par | k114½ | 114½* | 123* |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f* Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 21. *l*Bid price Wednesday, Jan. 25. *m*Latest quotations available. †Dividend rate variable. *1928

## Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 24 | Low 1927 | High 1927 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | 115½ | 115* | 115½* |
| Kansas Gas & Elec., 7% pf. | l108½ | 107* | 109* |
| Kentucky Hydro-Elec., 7% pf. | a103 | 94½ | 104 |
| Kentucky Sec., 6% pf. | 91 | 83 | 90 |
| Kentucky Sec., 5% com. | 140 | 100 | 135 |
| Kentucky Utilities, 6% pf. | k101 | 95 | 101½ |
| LACLEDE GAS LT., 12% com. | 218½ | 200* | 218½* |
| Lehigh Pwr. Sec., com.—no par | 23½ | 19½* | 23 |
| Long Island Ltg., 7% pf. | 110 | 107 | 112 |
| Long Island Ltg., com.†—no par | 170 | 139 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 104 | 98 | 105 |
| Louisville Gas & Elec., cl. A. $1.75 | 28½ | 28½* | 29* |
| MAN. ELEC. SUPPLY, cap. $5—no par | 52 | 50* | 54½* |
| Manhattan Elec., com.†—no par | k 45½ | 40 | 60 |
| Maytag Mfg., com.—50—no par | 34 | 33½* | 34½* |
| Memphis P. & L., pf.—$7—no par | k109 | 107 | 111 |
| Metropolitan Ed., pf.—$6—no par | 104½ | 93 | 106 |
| Metropolitan Ed., pf.—$7—no par | 108 | 104 | 110 |
| Metropolitan Ed., com. $5—no par | k125 | 60 | 72 |
| Middle West Utilities, 7% pf. | a122½ | 110½ | 119 |
| Middle West Util., 7% pr. lien | a128 | 117½ | 127 |
| Middle West Util., com. $6—no par | a134 | 108 | 125 |
| Midland Utilities, pr. ln. 6% pf. | a106 | 91½ | 96½ |
| Midland Utilities, 7% pf. A | a103½ | 96½ | 103½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k 99 | 98 | 101½ |
| Minn. Pwr. & Lt., 7% pf. | l108½ | 107* | 109* |
| Miss. River Pwr., 6% pf. | 107½ | 94 | 108 |
| Miss. River Pwr., 3% com. | m 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k109 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | k104 | 105* | 106* |
| Mohawk Hudson Pwr., com.—no par | 30½ | 29½* | 30½* |
| Montana Pwr., 5% com. | 125½ | 102½* | 125½* |
| Montreal Pwr., 7½% com. | f 94 | .... | .... |
| Mountain States Pwr., 7% pf. | k102½ | 97 | 103 |
| Mountain States Pwr., com.† | 17 | | |
| NASSAU & SUFFOLK LTG., 7% pf. | 110 | 98 | 110 |
| National Carbon, 8% pf. | m139 | 130½ | 139½ |
| National Elec. Pwr., A† | a 28 | 22 | 28½ |
| National Lt., Ht. & Pwr., com. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 110 | 108½* | 110* |
| National Pwr. & Lt., com.†—no par. | 24½ | 21½* | 25* |
| National Pub. Serv., 7% pf. | 100 | 93 | 102 |
| National Pub. Serv., 7% ptc., pf. | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 23 | 22* | 23* |
| National Pub. Serv., B com.—no par | 27½ | 24½* | 27½* |
| Nebraska Pwr., 7% pf. | l110½ | 110* | 111½* |
| Nevada-Calif. Elec., com. | k 33 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | k 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k104 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | k102 | 101* | 102½* |
| New Orleans Pub. Serv.—7% pf. | 108½ | 103 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | k103 | 101 | 104 |
| New York Power & Light 8% pf. | 114 | .... | .... |
| New York Power & Light, 7% pf. | 114 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | k109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | k109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28½ | 28* | 28½* |
| No. Amer., 6% pf.—50 | k 54½ | 53½* | 54½* |
| No. Amer., com.—10 | 61½ | 58½* | 62½* |
| No. Amer. Edison, $6 pf.—no par | k105 | 103½* | 104½* |
| No. Caro. Pub. Serv., pf.—$7—no par | 105 | 93 | 105 |
| Northeastern Pwr., com. | 21½ | 19½* | 21½* |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 20 | 18* | 21½* |
| No. Ont. Lt. & Pwr., 6% pf. | k 98 | 84 | 95 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 108½ | 108½* | 109½* |
| No. States Pwr. (Del.), 8% com. | 130 | 123* | 130* |
| No. Texas Elec., 6% pf. | 47 | 45 | 70 |
| No. Texas Elec., com. | 17 | 5 | 36 |
| OHIO BRASS, com. B $4—no par | 95 | 89* | 95½* |
| Ohio Brass, 6% pf. | k106 | 100 | 111 |
| Ohio Pwr., 6% pf. | 105½ | 96 | 106 |
| Ohio Pub. Serv., $6 pf. | k102 | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | k109 | 103 | 111 |
| Ohio River Edison, 7% pf. | 108 | 103 | 109½ |
| Oklahoma Gas & Elec., 7% pf. | 110½ | .... | |
| PACIFIC Gas & ELEC., 6% pf. | 27½ | 26½* | 27½* |
| Pacific Gas & Elec., 8% new com. | 48 | 47½* | 48½* |
| Pacific Pwr. & Lt., 7% pf. | l108½ | 106* | 108½* |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 79 | 75½ | 80 |
| Penn-Ohio Edison, 6% pf. no par | k 90 | 94½* | 96* |
| Penn-Ohio Edison, 7% pf. | 108 | 107* | 109* |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l109½ | 109½* | 110½* |
| Penn Wtr. & Pwr., 8% com., new | e 70 | 47½ | 75 |
| Phila. Co., 5% pf.—50 | k 48½ | 40 | 51 |
| Phila. Co., 6% pf.—50 | 52½ | 52* | 52½* |
| Phila. Co., com.—50 | 154½ | 149½* | 154½* |
| Phila. Elec., 8% com.—25 | c 58½ | 46 | 58½ |
| Portland Elec. Pwr., 7% pf. | 103 | 97½ | 102½ |
| Portland Elec. Pwr., 6% pf. | 88 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 78 | 55 | 70 |
| Portland Elec. Pwr., com. | 33 | 22 | 30 |
| Potomac Elec. Power, pf. | k111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | 62½ | 62* | 62½* |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | l107 | 99* | 103* |
| Pub. Serv. of N. J., 6% pf. | 104½ | 103½* | 105* |
| Pub. Serv. of N. J., 8% pf. | k134 | 134* | 135* |
| Pub. Serv. of N. J., $2 com.—no par | 43½ | 41½* | 43½* |
| Pub. Serv. of No. Ill., 6% pf. | a111 | 101½ | 113½ |
| Pub. Serv. of No. Ill., 7% pf. | m120½ | 112½ | 120½ |
| P. S. of No. Ill., com. $8—no par | a161½ | 140½ | 161½ |
| Pub. Serv. of No. Ill., $8 com. | a160 | 132 | 161½ |
| Pub. Serv. of Okla., 7% pr. ln. | k103 | 90 | 103 |
| Pub. Serv. Elec. & Gas, 6% pf. | 110 | 109* | 110* |
| Puget Sound Pwr. & Lt., 7% pf. | 112 | 110* | 112* |
| Puget Sound Pwr. & Lt., $6 pf.—no par | m 99 | .... | .... |
| Puget Sound Pwr. & Lt., com. | 46½ | 34½* | 46½* |
| RADIO COPR. OF AMER., $3.50 pf.—50 | 55½ | 54½* | 57½* |
| Radio Corp. of Amer., com.—no par. | 103½ | 88½* | 104½* |
| Rhode Island Public Service, pf. $2—no par | 31 | 30½* | 31* |
| Rochester Gas & Elec. 6% pf. D | 105½ | 101 | 103½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105½ | 101½ | 103½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | k111 | 105 | 112½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel Corp. | 5½ | 4½* | 6½* |
| Sierra Pacific Elec., 2% com. | m 32 | 24½ | 31½ |
| Sioux City Gas & Elec., 7% pf. | 107 | 99 | 105½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | m108 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 89½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 44½ | 42* | 44½* |
| So. Calif. Edison, 8% pf. | k 45 | 36½ | 40 |
| So. Calif. Edison, 7% pf. | k 28 | 27½ | 28½ |
| So. Calif. Edison, 6% pf. | k 26 | 24½ | 27 |
| So. Calif. Edison, 8% com. | 44½ | 43½* | 44½* |
| Southern Cities Utilities, 7% pf. | k 73 | 67 | 90½ |
| Southwestern Lt. & Pwr., A $3 | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 90 | 83 | 91 |
| Southwestern Pwr. & Lt., 7% pf. | 110 | 110* | 110½* |
| Standard Gas & Elec., 8% pf. | 66½ | 65* | 66½* |
| Standard Gas & Elec., 7% pr. pf. | 110 | 103 | 113 |
| Standard G. & E., com. $3.50 | 61½ | 57½* | 61½* |
| Standard Power & Light, com. | m 30 | 30* | 33½* |
| Standard Pwr. & Lt., 7% pf. | 104 | 103½* | 105* |
| Staten Island Edison, pf.—$6—no par | 102 | 99 | 103 |
| Superheater, $6 com.—no par | 170 | 170 | 185 |
| Syracuse Lighting, 7% pf. | k111 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | m 63 | 62½* | 63* |
| Tenn. Elec. Pwr., 6% pf. | 102½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109½ | 103 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 26 | 20 | 30 |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | l113½ | 113½* | 115* |
| Tide Water Pwr., 8% pf. | 109 | 105 | 111 |
| Timken Roller Bear., com.—$4—no par | 131½ | 126½* | 134* |
| Toledo Edison, 7% pf. | l109 | 102* | 107* |
| Toledo Edison, 6% pf. | k103 | 95 | 105 |
| Toledo Edison, 6% com. | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | k 97½ | 96 | 99 |
| UNITED GAS & ELEC., 7% pf. | 101½ | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 74 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c117½ | 89½ | 118½ |
| United Lt. & Pwr., pf.—$4—no par | a 55 | 50 | 57 |
| United Lt. & Pwr., pf.—$6.50—no par | a 98½ | 87 | 97½ |
| United L. & P., com. A .48—no par | a 15 | 13½* | 14½* |
| United L. & P., com. B .48—no par | a 20 | 14 | 20 |
| Utah Pwr. & Lt., 7% pf. | l111½ | 109½* | 111* |
| Utica Gas & Elec., 7% pf. | 106 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 98 | 93 | 100 |
| Utilities Pwr. & Lt., com. A $2 | 29½ | 28½* | 29½* |
| Utilities Pwr. & Lt., com. B $1—no par | 20½ | 18½* | 20½* |
| VERMONT HYDRO-ELEC., 7% pf. | k 97 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k108 | 105 | 110 |
| WAGNER ELEC., 7% pf. | b 98 | 96½* | 98* |
| Wagner Elec., com.—no par | b 39½ | 37½* | 38½* |
| Washington Ry. & Elec., 5% com. | 460 | 180 | 475 |
| Washington Ry. & Elec., 5% pf. | 102½ | | |
| Washington Wtr. Pwr., 8% com. | k215 | 136 | 182 |
| West Penn Elec., 7% pf. | 111½ | 111½* | 114½* |
| West Penn Elec., Cl. A $7. | 109 | 106* | 109* |
| West Penn Pwr., 7% pf. | 116 | 114½* | 116½* |
| West Penn Pwr., 6% pf. | 110 | 109½* | 113* |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf. | k102 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 102 | 96 | 106 |
| Western States Gas & Elec., com. | 38 | .... | |
| Westinghouse Elec. & Mfg., 8% com.—50 | 100½ | 88½* | 100½* |
| Weston Elec. Instrument, Cl. A $2—no par | k 31 | 30 | 34½ |
| Weston Elec. Instrument, com.—no par | 14 | 12½* | 14* |
| Wheeling Elec., 6% pf. | k103 | 95 | 104 |
| Worthington Pump, 7% pf. A | 51 | 46½* | 51* |
| Worthington Pump, 6% B | 44½ | 41* | 44½* |
| Worthington Pump, com. | 31½ | 28* | 31½* |
| YALE & TOWNE com. $5—25. | k 74 | 73½* | 75* |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Jan. 21. lBid price Wednesday, Jan. 25. mLatest quotations available. †Dividend rate variable. *1928

## New Italian Superpower Corporation Organized

Under Delaware laws, the Italian Superpower Corporation has been organized with the purpose of acquiring substantial but not controlling interests in virtually all of the principal electric light and power companies in Italy. As a result of the progressive measures put into effect in recent years, Italy has started a remarkable development of her hydro-electric resources, and with the modern adaption of electricity to practically every line of industry and the assistance of American capital further phenomenal growth along these lines is expected in the future.

The first piece of financing for Italian interests to appear in the American investment markets since the placing of the embargo on foreign loans by the Italian government followed the announcement of the formation of the new company. Thirty-five-year 6 per cent debentures of the Italian Superpower Corporation were offered at 100 and accrued interest to the amount of $20,250,000. Common stock and option warrants were attached. These debentures will be followed by 124,172 shares of preferred stock and 970,000 shares of common stock class "A" (including 202,500 shares to be deposited with the Bankers Trust Company, New York, in connection with the option warrants to be outstanding) and 150,000 shares of common stock class "B."

L. K. Thorne, president of Bonbright & Company, Inc., and chairman of the American Superpower Corporation, is chairman and president of the Italian Superpower Corporation. The management will include officials of many large American utilities. In addition to Mr. Thorne the directorate includes: S. Z. Mitchell, Gerard Swope, C. H. Minor, E. P. Currier, Marshall Field, P. G. Gossler, J. W. Maitland, B. C. Cobb, C. E. Calder, Giuseppe Toeplitz, Silvio Crespi, Ettore Conti, Guido Donegani, Siro Fusi, Achille Gaggia, Rinaldo Panzarasa, Pasquale Simonelli, Michelangelo Facconi and Guido Semenza.

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**Worcester Utility Increases Dividend.**—Directors of the Worcester Electric Light Company have declared a quarterly dividend of $1.50 a share, or 6 per cent, on the $25 par stock. This puts the stock on a regular $6 basis, as compared with a $4 basis previously in effect. Last year, in addition to the regular $4 dividend, the company paid an extra dividend of $1.50 to shareholders.

## Handbook on International Commercial Arbitration

The publication is announced by the American Arbitration Association of a new International Handbook on Commercial Arbitration by the International Chamber of Commerce. This publication has been made possible through the co-operation of the International General Electric Company and the American Arbitration Association in honor of the late Anson W. Burchard, first president of the American Arbitration Association and chairman of the board of the International General Electric Company. The commercial arbitration procedure for each country will be described first in separate pamphlet form, in order to be readily available to business men engaged in foreign trade with such countries. The first instalment of the handbook describing "Commercial Arbitration under Swiss Law" has just been published. When the brochures for all countries are issued they will be combined and published in bound volume form as a complete manual on the commercial arbitration laws of the world.

Louis K. Comstock, chairman of the arbitration committee of the American section of the International Chamber of Commerce and a director of the American Arbitration Association, commenting upon the importance of this publication to business men engaged in international trade, said:

"The publication in condensed form of the requirements of the commercial arbitration laws of the world and of the procedure thereunder, which will greatly facilitate the practice of arbitration in the settlement of such business misunderstandings as may arise in the course of international trade, was a project which Mr. Burchard had very much at heart. Hereafter when the American importer or exporter has a dispute with a business man in a foreign country and he wishes to settle by arbitration, he will know exactly what must be done under the requirements of the arbitration law of the country in which the arbitration is to be held and precisely what his rights and obligations may be. Now, because of the lack of such condensed and readily available information, the uncertainty regarding these requirements frequently discourages a reference to arbitration. The same information is being published in English, French and German."

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# 1927 Production Operations Show 2 per Cent Increase

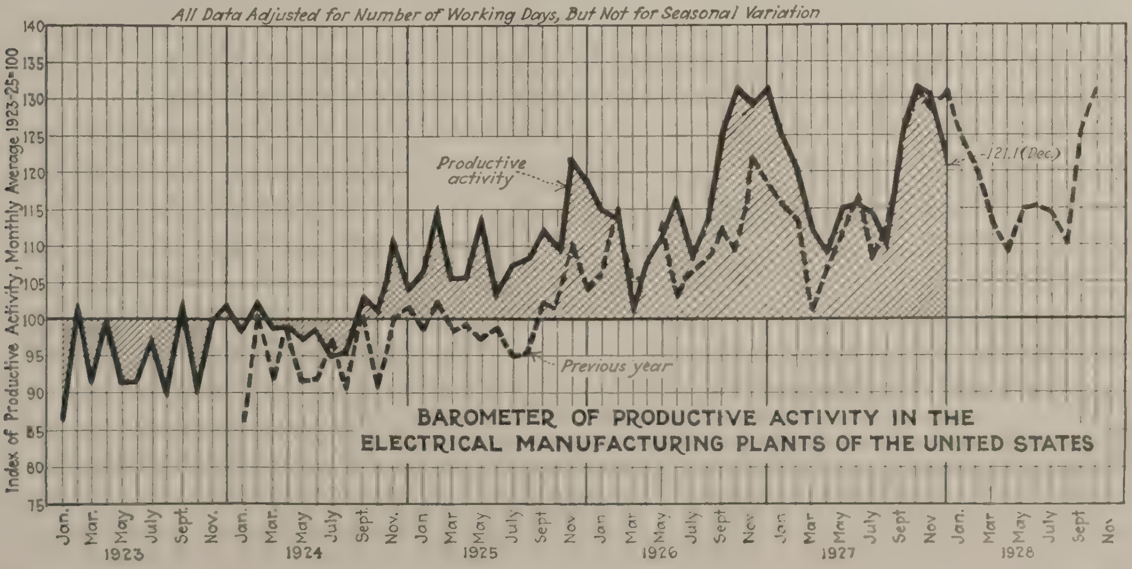
### Electrical Manufacturing Industry, However, Closed Last Year on a Plane 7.8 per Cent Under Year Previous—Gains Confined to First Half of the Year

WHILE the year just closed did not record the greatly increased productive operations in the electrical manufacturing plants of the nation witnessed during 1926, yet it did witness an increase in operations for the year as a whole of 2 per cent over the preceding twelve months. This gain in activities was confined almost exclusively to the first half of the year, operations since July being about on a level with or under the same period in 1926. The year 1927 closed with the rate of operations on a plane 7.8 per cent under December, 1926, the greatest twelve-month comparative drop in activities witnessed since 1923. The slight upturn in operations reported in December, 1926, did not take place last December.

The index of activity in the electrical manufacturing industry based on consumption of electrical energy stands at 121.1 for December as compared with 130.4 for November and 131.7 for December, 1926. Comparative indexes of productive activity, referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days, are as follows:

| | |
|---|---|
| December, 1927 | 121.1 |
| November, 1927 | 130.4 |
| October, 1927 | 131.3 |
| December, 1926 | 131.7 |
| Average for full year 1927 | 119.2 |
| Average for full year 1926 | 117.0 |

The volume of production in American industry taken as a whole during 1927 was also 2 per cent above that reported for 1926. As with the electrical manufacturing industry, the gains made in productive operations by general industry during 1927 were confined very largely to the first half of the year. General industry closed the year on a plane about 8 per cent over December, 1926, due mainly to improved conditions in the steel and automobile industries, although other industrial groups, such as chemicals and allied products, food and kindred products, lumber and its products, and paper and pulp, also reported operations at the close of 1927 on a scale above those witnessed at the close of 1926.



## *Delinquent Electrical Accounts*

(Data Supplied by National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

| Division | November 1926 | November 1927 | Per Cent Increase or Decrease | Eleven Months 1926 | Eleven Months 1927 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | 244 | 219 | —10.2 | 3,847 | 3,345 | —13 |
| New England | 150 | 164 | + 9.33 | 1,353 | 1,716 | +26.8 |
| Pacific Coast | 10 | 26 | +160 | 240 | 195 | —18.7 |
| Central | 687 | 700 | +1.89 | 9,322 | 9,717 | +4.23 |
| Middle and Southern Atlantic States | 150 | 177 | +18 | 2,051 | 1,862 | —9.22 |
| Total | 1,241 | 1,286 | +3.63 | 16,813 | 16,835 | +.13 |

TOTAL AMOUNTS REPORTED

| Division | November 1926 | November 1927 | Per Cent Increase or Decrease | Eleven Months 1926 | Eleven Months 1927 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | $42,131 | $29,476 | —30 | $569,750 | $517,554 | —9.16 |
| New England | 9,909 | 20,516 | +107 | 94,571 | 203,697 | +115.3 |
| Pacific Coast | 432 | 3,012 | +597 | 35,407 | 23,340 | —34 |
| Central | 69,573 | 78,236 | +12.5 | 1,029,831 | 1,070,081 | +3.91 |
| Middle and Southern Atlantic States | 22,940 | 17,118 | —25.4 | 244,520 | 223,182 | —8.73 |
| Total | $144,985 | $148,358 | +2.31 | $1,974,079 | $2,037,854 | +53.9 |

AVERAGE AMOUNTS

| Division | November 1926 | November 1927 | Eleven Months 1926 | Eleven Months 1927 |
|---|---|---|---|---|
| New York | $172 | $135 | $1,628 | $1,698 |
| New England | 66 | 125 | 998 | 1,306 |
| Pacific Coast | 43 | 115 | 1,520 | 1,588 |
| Central | 101 | 112 | 1,218 | 1,212 |
| Middle and Southern Atlantic States | 152 | 96 | 1,265 | 1,338 |

Note:—A sharp increase in accounts is reported by the New England division. This is owing to increased association activity in this section and not to adverse economic conditions.

# Market Conditions

BUYING is more active virtually throughout the country and manufacturers report many inquiries from industrial plants. In New England industrial equipment orders dominate the market, motor sales show a gain, and electric lighting is active. In the Eastern district there is an upward trend in inquiries, industrial motor sales are good, and electric bus equipment business looks promising. Many negotiations covering industrial plant business are under way in the Southeast. Five orders for textile motors and transformers, amounting to $25,000, were placed. Three were received from North Carolina, one from Louisiana and one from Georgia.

In the St. Louis district the tone of business is better. Industrial activity improves in the Middle West. A large utility company is now buying for maintenance requirements at the rate of $75,000 per day. On the Pacific Coast many projects are planned, including an apple refrigerating plant to cost about $250,000, a Los Angeles substation to cost about $225,000, and a plant for the Pacific Can Company to be erected in San Francisco at a cost of $500,000. A number of motors were purchased for the new Seattle cement plant of the Pacific Coast Company.

## *Metal Prices Slightly Higher —Market Quiet But Firm*

Prices of copper, lead, zinc and tin are all slightly higher than a week ago, though the market has not been active. The strength has resulted from increased disinclination by producers to sell, rather than to a good consuming demand. It is felt that buying for most metals is likely to improve within a week or two; in fact, it has been materially better this last week abroad. Excellent sales of copper in the export market during the last two or three days have been a marked influence in removing the pressure to sell on the part of the custom smelters. The copper that was available from such sources until Monday at 14 cents for Eastern deliveries is no longer obtainable, and all sales on Tuesday and Wednesday have been on the 14⅛-cent, Valley, basis. The market on Wednesday was very quiet and it was intimated by one seller that 14⅛ cents was unobtainable, but until actual business is accepted at lower figures, the market must be considered at least as fairly firm at that level. Certainly it is a firm quotation as far as the major producers are concerned, and has been all week. Whether there will be any renewed concessions on the part of the custom smelters depends on the continuance of foreign buying or the resumption of interest by domestic consumers.

NEW YORK METAL MARKET PRICES

| | Jan. 18, 1928 Cents per Pound | Jan. 25, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 14 | 14⅛ |
| Lead, Am. S. & R. price | 6½ | 6½ |
| Antimony | 10¾ | 10¾ |
| Nickel, ingot | 35 | 35 |
| Zinc spots | 5.95 | 6 |
| Tin, Straits | 54⅛ | 55¼ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price Jan. 25, 1928, 15⅞ cents.

## *Business Trends Upward in Eastern District*

While there is an upward trend in inquiries and actual orders in the Eastern district, the situation as a whole can be termed "spotty." The primary demand centers on substation apparatus and industrial equipment. A leading manufacturer states that the call for heavy equipment is at low ebb, but that industrial motors of sizable capacity are showing better sales. A central-station company in the Middle West has placed an order for a 700-hp. motor unit for circulating-pump service, and commitments for several more of similar type are now pending from the same quarter. Another manufacturer reports a number of interesting prospects for the sale of substation apparatus in the metropolitan district and early orders are expected. Electric bus equipment business looks very promising. Steam railroads have been making inquiries for their proposed electrification requirements, and encouraging early spring sales are anticipated. A manufacturer of transformers says that there has been a marked increase in inquiries and orders during the past fortnight. A recent order from a New Jersey broadcasting station was for a 300-kw. transformer unit, with auxiliary equipment, totaling close to $18,000. A maker of porcelain insulators reports a better demand for high-tension equipment. A large order has recently been placed by a California utility for suspension insulators and other good business of this nature is looked for in the immediate future. The past two weeks show gross sales comparing well with the same period of a year ago. Electric marine equipment demand gives early promise in this district.

Immediate construction projects in the district include the following: The Pennsylvania Railroad Company, Philadelphia, Pa., is asking bids until Feb. 2, for transmission towers (Contract No. 7-1928). The Public Service Electric & Gas Company, Newark, N. J., plans an equipment, storage and distributing plant at Jersey City, estimated to cost $150,000. The Quaker City Cold Storage Company, Philadelphia, Pa., will soon ask bids on revised plans for an eleven-story cold storage and refrigerating plant to cost about $1,000,000. The Gold Hosiery Company, New York, plans a power plant at its mill at Milroy, Pa., costing complete $150,000. The Baltimore & Ohio Railroad Company, Baltimore, Md., plans a power plant in connection with engine house, shops, etc., at Youngstown, Ohio, with complete project to approximate $1,000,000. The Consolidated Gas, Electric Light & Power Company, Baltimore, proposes to purchase the Harford County properties of the Northern Maryland Power Company, including system at Havre de Grace, and will extend transmission lines in that territory. The general purchasing officer, Panama Canal, Washington, D. C., will receive bids Feb. 9, for motors, conduits, cable, wire, transformers and other electrical and mechanical equipment (Panama Schedule 1855).

### *Active Market in Southeast— Inquiries Increase*

With inventories practically over, activity is to be noted in the electrical field in the Southeast. Inquiries from industrial plants continue to increase and conditions are better than for many months past. Many negotiations are under way which will undoubtedly result in satisfactory orders within the next few weeks. Central-station companies are buying in slightly better volume, though the orders are individually small, with few exceptions. The largest central station order was from Florida for power transformers amounting to approximately $20,000. Meters and transformers continue in good demand, one company's orders for distribution and small power transformers totaling about $3,300. This same company ordered a search-lighting unit costing $2,100. Two power companies placed orders for creosoted pine poles, one order amounting to $1,100 and the other, $1,000.

One manufacturer reports the receipt of five textile motor and transformer orders aggregating $25,000, three of the orders being from North Carolina, one from Louisiana and one from Georgia. There is a new textile mill project in Georgia, on which bids will be asked in the very near future, which will call for motors and wiring materials amounting to approximately $12,000 and transformers and substation, around $5,000. There are two electrification projects in the same state, one a textile mill and the other an ice plant, on which contracts are expected to be let this week. Three textile mills placed supply orders which averaged $1,000. Municipalities are buying little, though one town ordered weather-proof wire amounting to $800.

The Georgia Power Company has purchased the municipal distribution system in Gordon, which system was formerly supplied by the Central Georgia Power Company, an affiliated company. The rehabilitation and extension of the distribution system will be undertaken. Other construction activities are: The Alabama Cotton Mills Company, Haleyville, Ala., plans a new mill to cost $200,000. Miami, Fla., plans an improved lighting system in the business district. Miami Beach, Fla., is asking bids until Feb. 1, for an ornamental lighting system. The Florida Cold Storage Company, Orlando, Fla., plans a cold storage and refrigerating plant to cost $350,000. The Southeast Georgia Power Company plans improvements in the recently acquired power plant at Alma, Ga. The Columbus Electric & Power Company plans a transmission line from Hamilton to Talbotton, Ga., about 30 miles. The Island Utilities Company, Kansas City, Mo., will purchase the power plant at New Albany, Miss. The Crane Enamelware Company, Chattanooga, Tenn., plans plant additions to cost about $500,000. The American Glantzstoff Corporation, Elizabethtown, Tenn., will build a power plant at its proposed rayon mill, to cost complete about $2,000,000. The Edisto Public Service Company has acquired the municipal power plant at Allendale, S. C. The Savannah River Electric Company, Greenwood, S. C., has received permission for a hydro-electric power development on the Savannah River, near Clark's Hill, with an ultimate output of 120,000 hp. The Appalachian Electric Power Company plans a transmission line from Sullivan to Ralco, with substation installation, estimated to cost $40,000. The Monongahela-West Penn Public Service Company will build transmission lines to Fowlerstown, Franklin and neighboring points in West Virginia.

### *Buying More Active in New England District*

Active buying and an increasing number of inquiries are reported by manufacturers in the New England district. Industrial equipment orders dominate the market, and motor sales gained during the week. A manufacturer reported an order for fractional horse-power motors amounting to over $10,000, and a number of orders for ratings up to 20 hp. are noted. Textile mills are showing an interest in the individual drive plan and several group motor orders are pending. Heavier equipment buying is quiet though the inquiries for turbo-generator units are increasing and the prospects for a number of interesting sales are very encouraging.

Central station supplies are moving slowly, and general equipment and scheduled material is moving fairly well. Industrial electric heating is active and forecasts by a number of prominent manufacturers indicate a strong trend toward the adoption of this equipment. The Connecticut Light & Power Company reports an increase of 2,515 kw. connected heating load for 1927. Electric lighting is active. Electric arc-welding apparatus is in good demand; five units, 200 amp. to 2,000 amp., were recently sold. The general tone is more optimistic throughout this district. A central-station company plans to install a new synchronous condenser in the near future. Permit for a development of 50,000 hp. at Windsor Locks, Conn., has been granted in a recent court ruling. Building contracts show a gain over last year. The Central Falls Manufacturing Company, Central Falls, R. I., plans the rebuilding of its woodworking plant recently destroyed by fire with loss of about $100,000.

### *Industrial Activity Improves in Middle West*

Conditions in the Middle West are very favorable, with industrial activity on the increase. The various utility companies are busy and maintenance purchasing is quite large, running about $75,000 per day for one large company. Apparatus purchased includes a 60-ft. revolving car dumper including steel platform, motor drive control and wiring, complete for $130,000, five vertical traveling screens for intake crib, 12 three-speed selector switches complete with appurtenances, paper and lead covered cables valued at $1,500,000, "Mazda" lamps valued at $140,000 and 300 direct-current watthour meters 5 amp. to 2,000 amp. capacity.

Construction plans are as follows: The Ames Shovel & Tool Company, Anderson, Ind., plans plant additions to cost about $100,000. The Iowa City Light & Power Company, Iowa City, Iowa, will install additional equipment in its power plant in the Coralville district. Moorehead, Minn., will make extensions in its municipal lighting plant, at a cost of $35,000. The Board of Education, Rochester, Minn., plans a central power plant for school service, to cost about $100,000. Willmar, Minn., plans additions in its municipal electric light and water plant. The Elkhorn Valley Power Company plans a transmission line in vicinity of Scribner, Neb., to cost $25,000. Carrington, N. D., plans an ornamental lighting system. Battelle Memorial Institute, Columbus, Ohio, plans a group of laboratories and shops to cost about $500,000. The Ohio Power Company is planning an equipment storage and distributing plant at Crooksville, Ohio, to cost about $45,000. The Economy Rubber Products Company, Dayton, Ohio, plans a new plant to cost $125,000.

### *Many Projects Planned on Pacific Coast*

Miscellaneous projects on the Pacific Coast include new street-lighting systems for Tulare and Madera, a $250,000 apple refrigerating plant for Watsonville, a $5,000 fire-alarm addition to the Sacramento system, a $600,000 State teachers college for Santa Barbara, $3,000 worth of line material and telephone cable for the Delta district, $2,500 worth of reflectors for a Sacramento State Building, $1,500 worth of electrical equipment for a polytechnic school at San Luis Obispo and smaller power line jobs requiring about $2,500 of material each for south San Francisco and Marysville. An outstanding power line job for the Truckee Carson irrigation project near Fallon, Nev., requires nearly $15,000 worth of material. Power company inquiries include 1 carload of pole line hardware. Large power construction, which will not materialize till the Fall, includes such projects as an approximate 40,000-kw. generating station in the Tiger Creek district and a $500,000 steam plant in the Bay Region. A central California company has projected a lighting, cooking and heating load campaign necessitating nearly a $400,000 expenditure the hiring of nearly 100 new salesmen and a $2,000,000 annual revenue rate reduction. Industrial orders include a $6,000 switchboard for an Hawaiian sugar plantation, and 2 motors, 75 hp. each, with accessories totaling $5,500 for a Sierra Lumber Company. Miscellaneous large construction announced includes a $200,000 addition to the United States naval base at Pearl Harbor, Hawaiian Islands, a $750,000 cement plant for Cajon Pass near Devore, a $1,250,000 building for a Los Angeles clothing company, and $2,000,000 to be spent by the government, $1,000,000 immediately on a complete air corps plant at March Field, Riverside. A feature of recent construction is the number of pedestrian tunnels necessitated by traffic accidents. They carry a high proportionate lighting installation.

Contracts closed in the Puget Sound district cover a number of motors for the Seattle cement plant of the Pacific Coast Company. The city of Seattle placed an order for approximately $66,000 worth of additional equipment for the Cedar Falls hydro-electric generating unit. Pump and motor business for irrigation and drainage of the eastern Washington orchard districts is maturing. A Seattle firm reports the sale of eight outfits last week. Sales of motors in Seattle to lumber mills, industrial plants, etc., aggregated more than 100 machines.

Construction projects are as follows: The California Portland Cement Company, Colton, Cal., will make plant extensions to cost about $500,000. Board of Education, Glendale, Cal., will build a power plant at its proposed new group high school. Los Angeles, Cal., plans an ornamental lighting system on Florence and Highland Avenues, and Landa Street. The Municipal Power & Light Bureau, Los Angeles, Cal., plans a substation and distributing plant on Broadway, Venice, to cost $225,000. Pasadena, Cal., plans an ornamental lighting system on Chester Avenue, using concrete standards. The Pacific Can Company, San Francisco, Cal., plans a new plant to cost about $500,000, with equipment.

Santa Ana, Cal., plans an ornamental lighting system on Bush Street. Santa Monica, Cal., plan an ornamental lighting system on Broadway. Blackfoot, Idaho, plans a municipal light and power plant. The Montana Power Company plans extensions in transmission lines at Simms and Fort Shaw, Mont., to cost about $30,000. The Utah Asphalt Corporation, care of John F. Cregon, Third Street and North Grand Avenue, Pueblo, Colo., engineer, plans a new electric-operated mining plant to cost more than $750,000, at properties near Price, Utah. The Smokeless Fuel Company, Salt Lake City, Utah, plans a new plant to cost in excess of $850,000. The Puget Sound Power & Light Company plans two substations in the vicinity of Bellingham, Wash.

### *Tone of Business Better in St. Louis District*

The general tone of business in the St. Louis district has been better. Contract for a 4,500-kw. turbo unit is reported closed. An order was placed for a 1,000-hp. motor for a government dredge boat at a cost of about $10,000, and another for a lot of 40-hp. and 75-hp. motors for a large stone company at a cost of $3,000. The movement of medium-sized motors has been steady. Several good shipments on conduit fittings and other construction materials are reported.

Construction projects in the district are as follows: The Camden Ice & Coal Company, Camden, Ark., will rebuild its ice plant, recently destroyed by fire, with loss reported in excess of $60,000. The Electric Ice Company, McCrory, Ark., plans an ice plant at Sheridan, Ark. The Central States Power & Light Corporation, Davenport, Iowa, has purchased power plant of the Church Point Light, Power & Ice Company, Church Point, La. The Southwest Power Company, McAlester, Okla., plans a substation at Rogers, Ark., and improvements in its system at Lowell, Ark., to cost about $35,000. The Southwestern Sales Corporation, Tulsa, Okla., plans power plant in the reservoir hills section. The Chamber of Commerce, Dallas, Tex., plans a local cotton mill to cost in excess of $650,000. The Standard Ice Company, Houston, Tex., will build an ice plant on the Harrisburg Boulevard, to cost $125,000. Vernon, Tex., is asking bids until Feb. 6, for one 360-hp. Diesel engine, direct-connected to electric alternator, with belt-driven exciter, switchboard, etc.

# Activities of the Trade

## Hygrade Lamp Company Buys Triumph Lamp Works

The Hygrade Lamp Company, Salem, Mass., announces the purchase of the plant and business of the Triumph Lamp Works, Indianapolis, Ind. F. A. Poor, treasurer of the Hygrade company, informs the ELECTRICAL WORLD that the business will be transferred to Salem, closing the Indianapolis factory and increasing the output of the Salem plant to 75,000 lamps per day, a gain of 25 per cent.

## Andrews-Bradshaw Merges with Blaw-Knox Company

The merger of the Andrews-Bradshaw Company of Pittsburgh, with the Blaw-Knox Company has just been consummated. The Andrews-Bradshaw Company is a Pennsylvania corporation whose principal product is known as the "Tracyfier"—a device for cleaning steam, gas, air and vapor. No change in the organization of the Andrews-Bradshaw Company is contemplated, with the exception that the products of that company will be manufactured in the main plant of the Blaw-Knox Company at Blawnox, Pa. The Andrews-Bradshaw Company will operate as the Andrews-Bradshaw division of the Blaw-Knox Company.

This merger gives to the Blaw-Knox Company an additional product for the power plant field, in which the company is already represented through its air preheaters, standard steel buildings, clamshell buckets, and electroforged steel grating. The company also manufactures steel forms for concrete construction, transmission towers and poles, road builders' equipment of all types, equipment for water cooling high temperature furnaces, and other products.

## Westinghouse Gets Orders for Carbon Circuit-Breakers

Two large orders for carbon circuit-breakers have been placed with the Westinghouse Electric & Manufacturing Company. The first, an order for 50 type CL carbon breakers of capacities ranging from 1,200 amp. to 10,000 amp., was sold to the American Rolling Mill Company. This order amounts to approximately $35,000. The second order, consisting of 75 hand-operated, plain automatic type CL carbon breakers, was sold to the Narragansett Electric Light Company. This order includes breakers of capacities from 1,200 amp. to 2,000 amp., and amounts to approximately $9,000.

THE TAPLET MANUFACTURING COMPANY, Philadelphia, announces the appointment of C. H. Van der Bloom, 3684 East 163d Street, Cleveland, as district representative for Taplet conduit fittings in the state of Ohio, Erie, Pa., and that part of New York State west of and including Rochester.

CURTIS LIGHTING, INC., Chicago, manufacturer of "X-Ray" reflectors, announces the appointment of Otis F. Fulhage as resident engineer in Des

Moines, Iowa. The company also announces that George R. Kelly has joined its Chicago sales force.

THE BOTFIELD REFRACTORIES COMPANY, Swanson and Clymer Streets, Philadelphia, manufacturer of "Adamant" firebrick cement, announces the appointment of Ires Prosser as Southeastern representative, with headquarters at Atlanta, Ga., to cover the entire Southeast from North Carolina to San Antonio, Tex.

THE OHIO BRASS COMPANY, Mansfield, Ohio, announces that Frank W. Gorman, formerly with the Mine & Smelter Supply Company, El Paso, Tex., has joined the organization as district sales representative and will make his headquarters in El Paso, covering the states of Arizona, the Panhandle section of Texas, New Mexico and Mexico. Mr. Gorman succeeds L. M. Keating who will assume duties in the general sales department of the company at Mansfield. The company also announces the opening of new offices at 703 Frisco Building, Ninth and Olive Streets, St. Louis. H. W. Kilkenny is district sales manager.

THE C. O. BARTLETT & SNOW COMPANY, Cleveland, announces the appointment of William W. Dodge as its sales representative in western New York with headquarters at Warsaw, New York.

THE OLIVER IRON & STEEL CORPORATION, Pittsburgh, announces that its line material department has appointed Frank P. Withers district manager with headquarters at 332 South Michigan Avenue, Chicago.

THE GENERAL ELECTRIC COMPANY announces the appointment of C. N. Gregory as manager of the New Haven, Conn., office, succeeding Frederic Cutts, and R. B. Ransom has been appointed resident agent in charge of the Hartford office, succeeding Mr. Gregory.

# New Equipment Available

## Gang-Operated Indoor Disconnecting Switches

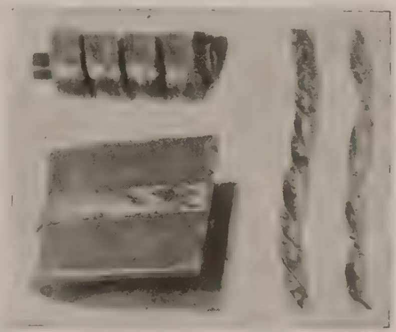
A new line of simplified gang operated indoor disconnecting switches has been developed by the Delta-Star Electric Company, Chicago. All units of the switches are mounted on a single steel base, thus permitting installation on pipe or angle iron frame. The interconnecting mechanism is placed on the back of this base, which permits a simplified mechanism. Appearance of the switch from the front is the same as any ordinary group of single-pole switches and secures the advantage of gang operation without additional space. These switches can be furnished for various ampere capacities, single-throw, double-throw or double-blade, double-throw. This new line of gang switches can also be arranged for either front, back or combination front and back connection. The voltage ratings are 7,500 volt and 15,000 volt.

## Air Preheater

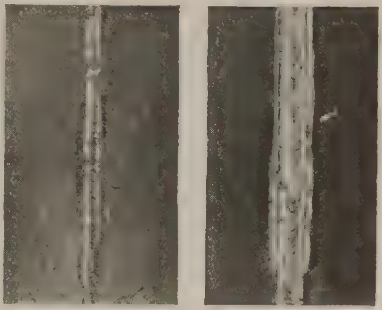
A new design of plate-type air preheater, placed on the market by the Combustion Engineering Corporation, 200 Madison Avenue, New York City, uses a welded assembly construction and is provided with clean-out doors. Access doors are provided in the heater casing to permit blowing the entire surface of the gas passages with steam or air lances. To eliminate any leakage from the air side to the gas side of the preheater, the elements are welded to the casing by means of a sealing strip, which also holds the elements in place and permits expansion of the elements relative to the casing. This construction is also said by the company to reduce greatly the amount of erection work necessary, as there are no bolted joints to be lined up. The air flow through the heater follows the "S"-flow design resulting in an effective transfer of heat from gas to air. In this design, the air inlet and air outlet are located on opposite sides of the heater, and the baffles are so arranged that all lanes of air travel are of approximately uniform length to assure an even distribution of air in all parts of the heater.

## Welding Method Gives Ductile and Low Cost Weld

The "electronic tornado" method of welding which was discovered in the research laboratories of the Lincoln Electric Company, Cleveland, about twelve months ago has been further developed to the point of commercial application. The company states that not only are the welds produced by this new process far more uniform in structure and ductility but the cost of welding is lower than that of other methods. It is stated that the cost of welding ½-in. plates, including operator's time, electric current and carbon electrode will not exceed 3 cents per running foot of weld. The cost of welding plate of other thicknesses will be proportionate. While it is not thought at the present time that the "electronic tornado" method will affect the manual arc welding process equipment which can be welded automatically will use the new principle. Welds can be applied equally well to thick or thin plates.



DUCTILE WELDS MADE BY THE NEW PROCESS. WELDS WERE TWISTED THROUGH 1,080 DEG. WITH NO SIGN OF FAILING



METALLIC ARC WELD AT LEFT COMPARED WITH WELD MADE BY THE ELECTRONIC TORNADO METHOD

Metal deposited by electric arc welding has the characteristics of cast steel. By this new process the metal deposited in the weld has equal or even better physical characteristics than the metal of the plates joined by welding. This is a result of the purifying effect of the electronic tornado. An incidental advantage of electronic tornado welding is the smooth finish which is obtained on the welding bead. This in part is caused by the higher speed of travel of the welding heads and is in part inherent in the new process.

## Portable Winch

A new portable winch, designed especially for public utility work, has been placed on the market by the Yale & Towne Manufacturing Company, Stamford, Conn. Remote control of loads is obtained and upper and lower limit stops are incorporated. A special feature of the equipment is the fact that, by fitting a lower hook and sheave wheel and anchoring the load chain to the crane boom, the lifting capacity is doubled and the hoisting speed is reduced by one-half. A hand chain-wheel is fitted to the hoist sprocket so that the motor can still be operated by hand after the motor brake has been released by one of the manual control handles.

DROP FORGED INSULATOR CAPS.—A new line of drop forged insulator caps has been placed on the market by the American Forge & Machine Company, Canton, Ohio. These caps, which are of the ball and socket type, have been tested up to 36,000 lb. and a routine test of 30,000 lb. is made without the caps showing any distortion. The caps are hot-dip galvanized.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Jan. 3, 1928)

1,654,563. Electrical Welding Machine; A. C. Taylor, Warren, Ohio. App. filed Jan. 16, 1925.

1,654,576. Wave Deviation Meter; L. W. Chubb, Edgewood, Pa. App. filed June 6, 1924. For the determination of the deviation of alternating-current equipment from the theoretical or true sine-wave characteristics.

1,654,599. Fitting Table Heater; E. J. Ovington, Auburndale, Mass. App. filed Feb. 5, 1926. For fitting a spectacle frame.

1,654,613. Electric Switch; I. E. Smith, Stockton, Calif. App. filed March 8, 1926. Motor-starting magnetic switch.

1,654,643. Mail Box Switch; J. P. Gennoy, Oakland, Calif. App. filed Dec. 9, 1922. With signal device.

1,654,646. Electromagnetic Contactor; W. G. Hartwig, Chicago, Ill. App. filed Jan. 22, 1923. For use in connection with heating or cooling apparatus.

1,654,650. Safety Appliance; F. Hymans, Yonkers, N. Y. App. filed April 15, 1926. For elevators.

1,654,657. Cable Terminal; E. M. Matthews, Jamaica, N. Y. App. filed April 16, 1924. Adapted to distribute conductors fanned out from electric cables.

1,654,660. Connecter; J. A. McKay, Toronto, Ontario, Canada. App. filed June 20, 1924. For joining relatively small wires such as are used in lighting fixtures.

1,654.705. Storage Battery; C. E. Schlossnagel, Swissvale, Pa. App. filed Jan. 29, 1927. Vent plug.

1,654,730. Maximum-Demand Meter; F. C. Holtz, Springfield, Ill. App. filed Dec. 10, 1923.

1,654,768. Electrotherapeutic Machine; J. B. Wants, Oak Park, Ill., and A. A. Grothe, Chicago, Ill. App. filed March 13, 1925.

1,654,774. Rotor Shaft and Bearing Support for Electric Motors; A. Arutunoff, Jackson, Mich. App. filed June 14, 1924. For motors or other structures requiring a long shaft with a long rotor.

1,654,776. Short-Circuiting Device; E. C. Ballman, St. Louis, Mo. App. filed Sept. 4, 1925. For single-phase motors.

1,654,778. Preformed Positive Electrode and Process of Making the Same; R. C. Benner, Bayside, N. Y., and J. H. Fink, Brooklyn, N. Y. App. filed July 10, 1923.

1,654,779. Process of Making Preformed Negative Electrodes; R. C. Benner, Bayside, N. Y.; A. J. Briggs, Syracuse, N. Y., and J. H. Fink, Brooklyn, N. Y. App. filed July 10, 1923.

1,654,813. Electric Switch; C. H. Jockmus, Ansonia, Conn. App. filed Oct. 11, 1923. Pull-chain switch for electric lamp socket.

1,654,823. Flashlight Battery; W. R. Millar, Palmerston, Ontario, Canada. App. filed Jan. 21, 1927.

1,654,838. Branch Terminal for Overhead Lines; W. Schroeder and J. Nolte, Bruckhausen, Germany. App. filed June 15, 1925.

1,654,840. Induction Motor; P. F. Shivers, Wabash, Ind. App. filed April 9, 1925. Field-magnet core.

1,654,842. Electric Heating Device; L. A. Smith and R. Rzeminiecki, Washington, D. C. App. filed May 14, 1927.

1,654,860. Electric Heater; J. H. Carmean, Kansas City, Mo. App. filed Feb. 5, 1926. Portable heater.

1,654,910. Process for Treating Articles in Metallic Baths; N. J. Barbier, St. Etienne-Loire, France. App. filed Oct. 28, 1925.

1,654,928. Control and Indicating System for Electric Railways; J. C. Field, Orange, N. J., and F. Zogbaum, New York, N. Y. App. filed Sept. 28, 1923.

1,654,931. Theft-Alarm Device; M. Greene, New York, N. Y. App. filed June 4, 1926.

1,654,937. Regulator of Electric Distribution Systems; H. de B. Knight, Rugby, England. App. filed July 27, 1926. Particularly from direct-current supply means, such as rotary converters, generators, rectifiers or the like, which are operating in parallel with vapor electric discharge devices, such as mercury-arc rectifiers or tungar rectifiers, in which the voltage of the direct-current output can be controlled by control electrodes.

1,654,948. Regulator; L. W. Thompson, Schenectady, N. Y. App. filed Oct. 24, 1925. For regulating the voltage.

1,654,956. Control Apparatus; E. W. Allen, Schenectady, N. Y. App. filed April 30, 1925. Reactance control apparatus.

1,654,971. General Alarm System for Battleships; P. S. Grierson, South Orange, N. J. App. filed Sept. 21, 1921.

1,654,979. Regulation of Electric Distribution Systems; H. de B. Knight, Rugby, England. App. filed Oct. 4, 1926.

1,654,983. Circuit Interrupter; W. O. Lum, New York, N. Y. App. filed Dec. 2, 1924.

1,654,986. Reversing Switch; W. R McCathran, Washington, D. C. App. filed Nov. 24, 1922.

1,654,987, 1,654,988, 1,654,989. Regulator; A. H. Mittag, Schenectady, N. Y. Apps. filed Oct. 28, 1925, and March 10, 1927. For regulating the voltage.

1,655,009. Speed-Governing Mechanism; W. A. Browne, Washington, D. C. App. filed Dec. 29, 1922.

1,655,026. Electrolytic Cell; H. O. Siegmund, West Orange, N. J., and B. E. Brown, Mountain Lakes, N. J. App. filed Sept. 16, 1924.

1,655,034. Adjustable Reaction Resistance; F. J. Zamboni, Hynes, Calif. App. filed Jan. 24, 1925.

1,655,193. Heater Attachment for Electric Fans; M. Murphy, Rushville, Ind. App. filed Aug. 9, 1926.

1,655,220. Three-Position Relay; T. E. Clark, Detroit, Mich. App. filed May 2, 1925. For train control.

1,655,231. Vehicle Driving Apparatus and System; A. V. Livingston, New Haven, Conn. App. filed July 11, 1925.

1,655,237. Protective Relay for Series Releases; W. H. Petersen, Ludvika, Sweden. App. filed Dec. 11, 1925.

1,655,244. Telemetric Summation System; R. M. Rowell, Lynn, Mass. App. filed May 7, 1925.

1,655,252. Frequency Changer; R. A. Warner, Schenectady, N. Y. App. filed Dec. 10, 1926.

1,655,258. High-Tension Cable Joint; W. E. Boyle, New York, N. Y. App. filed March 22, 1923.

1,655,277. Electrical Heating System; G. N. Madsen, Minneapolis, Minn. App. filed Jan. 25, 1926.

1,655,279. Mount-Making Machine; M. E. McGowan, Newark, N. J. App. filed Nov. 25, 1921. Incandescent-lamp mounts.

1,655,286. Electric Motor; H. E. Nietsche, Detroit, Mich. App. filed April 13, 1925. Of the portable type adapted to be utilized with small storage batteries of low voltage.

1,655,307. Protective Arrangement for Alternating-Current Electric Circuits; R. W. Biles, Balcombe, England. App. filed Jan. 21, 1927.

1,655,324. Electric Furnace; P. L. J. Miguet, St.-Julien-de-Maurienne, France. App. filed Sept. 29, 1926.

1,655,334. Electromagnetic Protective Device; W. H. Peterson, Ludvika, Sweden. App. filed Dec. 11, 1925.

1,655,384. Regulating Device; C. A. Bonerz, New York, N. Y. App. filed April 7, 1923. Applicable to thermo-responsive regulators.

1,655,388. Composition and Process of Manufacture; F. J. Groten, Jr., Meriden, Conn. App. filed Nov. 23, 1922. For molded products.

1,655,389. Regulator; A. W. Hull, Schenectady, N. Y. App. filed Jan. 7, 1926.

# New Trade Literature

APPLIANCES.—The Fitzgerald Manufacturing Company, Torrington, Conn., is distributing pamphlets describing the new "Star-Rite" violet-ray machine and the electric mixer.

INSTRUMENTS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-903, describing and illustrating types G-9 and GS-9 demand meters. The company is also distributing bulletin GEA-896, describing its oscilloscopes.

CIRCUIT BREAKERS.—Bulletin No. 580 issued by the Roller-Smith Company, 233 Broadway, New York City, covers its types ESF, ES and EI inclosed circuit breakers.

COMBUSTION EQUIPMENT AND BURNER.—The Riley Stoker Corporation, Worcester, Mass., is distributing a catalog which gives information on combustion equipment for the office building, apartment house, hotel and school. The company has also issued a leaflet describing its new flare-type pulverized-coal burner.

ARC WELDER. — Bulletin GEA-875A issued by the General Electric Company, Schenectady, N. Y., describes its belt, motor or gas-engine driven, stationary or portable, self-excited, constant-energy, single-operator type WD-300A arc welder.

AUTOMATIC MINING SUBSTATIONS. —The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has published circular No. 1785, describing automatic mining substations. It contains a general description of the apparatus, operation, etc., and also a wiring and schematic diagram for an automatic mining synchronous converter.

CONDUIT FITTINGS.—The Appleton Electric Company, 1701 Wellington Avenue, Chicago, is distributing bulletin 9-A, in which is listed a complete line of Appleton no-thread "unilets" and covers. Dimension diagrams for various types of no-thread unilet bodies are included.

SPEED REDUCERS. — The Albaugh-Dover Manufacturing Company, 2100 Marshall Boulevard, Chicago, has issued bulletin "A," covering the A.D. speed reducers. Illustrations and dimensions of the various types are included.

AUTOMATIC TIME SWITCHES.—Bulletin GEA-913 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its types T-8 and T-9 motor-operated automatic switches, for use only on alternating-current circuits with regulated frequency.

CRANES. — The Whiting Corporation, Harvey, Ill., has issued catalog No. 209, superseding No. 200, covering its complete line of cranes. This catalog contains many illustrations of crane installations.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Sydney, Australia (No. 29,226), for electrical appliances.

An agency is desired in Bogota, Colombia (No. 29,118), for flashlights and lanterns.

An agency is desired in São Paulo, Brazil (No. 29,173), for household electrical appliances.

Purchase or agency is desired in Manchester, England (No. 29,172), for household electrical appliances, especially vacuum cleaners.

An agency is desired in Lwow, Poland (No. 29,175), for electric motors.

Purchase or agency is desired in Leipzig, Germany (No. 29,144), for electric refrigeration machinery.

Purchase is desired in Rome, Italy (No. 29,168), of automatic traffic signals.

Purchase is desired in Copenhagen, Denmark (No. 29,174), of electric portable tools.

J. C. Cladder, Jr., 566 Amstelveenscheweg, Amsterdam, Netherlands, desires an agency for electric dishwashers, potato peelers, ice cream freezers and any other electric kitchen machinery for hotel, hospital and steamship use.

Four German firms are interested in purchasing and eventually acting as agents for American vacuum cleaners and floor polishers adapted to alternating current, 50 cycles, according to word received from Consul F. van den Arend, Leipzig. Berndt, Lax & Company, Thomasgasse, Leipzig, is interested in catalogs and quotations for an initial shipment of twenty cleaners and five polishers; Hess and Klanck, Einertstrasse 3, Leipzig, is interested in catalogs and quotations on an initial shipment of fifteen cleaners and five polishers; Iskar Apitzsch, Haus & Kuchengerate, Leipzigerstrasse 2, Delitzsch, is interested in catalogs and quotations for a trial shipment of ten vacuum cleaners, also agency terms. Wolf Seelenfreund, Magdeburg, Germany, is interested in catalogs and quotations on an initial shipment of 25 vacuum cleaners.

# Electrical World

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## *Electrification Power Supply*

UTILITIES are confronted with the problem of supplying railroads with electricity. The railroads are confronted with the problem of electrification and purchased electrical energy. There is a mutual interest and responsibility which calls for co-operative work. Whether electrification involves direct current or alternating current is not of great importance to utilities which furnish the energy except as each system reflects itself in equipment to change energy on the 60-cycle systems in use by the utilities. This energy can be changed to direct current by rotary converters, motor-generator sets or mercury-arc rectifiers. It can be supplied as 25-cycle energy by use of frequency converters of several types. But for a given electrification project it is important that the utility and railroad engineers get together so that a broad perspective and analysis will give a decision as to type of electrification and method of energy supply which will best meet all factors. Naturally, the best transportation for the least money is desired.

Just now there is occurring a try-out period in the supply of railroads. In the direct-current field several types of equipment are in use to convert utility energy to railroad energy. In the alternating-current field several frequency-changer types are in use and several methods are proposed for handling a single-phase load on a three-phase system. In addition, for any system there are several methods for limiting demands, for isolating trouble and for handling emergencies. It is important that the data and experiences obtained from these installations be weighed and studied. A big electrification program is under way and mistakes should be avoided.

* * * *

## *Two Codes or One?*

A UNIFORM electrical code for the industry is a desirable goal and conforms to good principles of standardization. Such a program has been started recently and is based on the consolidation of the National Electrical Code and the Electrical Safety Code. But many factors must be weighed before the object can be attained or even be considered desirable for the immediate future. The National Electrical Code has been formulated on an experience basis and has a standing because it is used. It incorporates fundamental construction and installation standards. The Electrical Safety Code is new; it is little used in practice and is primarily devised to fix safety standards. Its provisions are apt to be changed when they come to be applied in the field, although the present edition of the code is very complete and has been prepared carefully. However, it represents the opinion of a committee and not the results of field trials over a period of years.

Under the conditions facing the electrical industry it is good policy to go slow on a program for consolidating the two codes. It might be better to restrict the Electrical Safety Code to safety conditions only and eliminate the duplications that now exist in the two manuals. Safety legislation is new and should be tried out in the field. When the safety code has attained an experience standing equal to that of the National Electrical Code it would be good policy to consolidate the two. At present the industry should consider the one-code proposal very carefully.

* * * *

## *Bring Forth the Proof; Assure the Public*

THE proposed investigation of the electric light and power industry by Congress is becoming less and less a topic of major interest either in Washington or throughout the industry itself. Hearings before the Senate committee on interstate commerce ended last week with indications that serious questioning had arisen in the minds of many committee members concerning the desirability of any inquiry at all, so weak a presentation did the proponents for an investigation make. However, it is evident that some investigation will be recommended—not so broad in scope as that asked for by Senator Walsh, perhaps, but thorough enough to establish fundamental facts. Indeed, since Senator Johnson of California has moved for a somewhat similar investigation of the telephone industry, it would not be surprising if the entire job were turned over to the Federal Trade Commission. That body is primarily a fact-finding commission and could, by concurrent resolution of both houses of Congress, delve deeply into all the charges, including that of lobbying, made against the public utility companies.

It is significant that Senator Walsh did not question the sufficiency of electric service or the reasonableness of the rates charged therefor. His complaint ranged almost entirely around the financial operations of holding companies. There could be detected also a lurking suspicion on the part of some of the members of the Senate committee that holding-company securities represent a great deal of "water," and, although an effort was made to show this not to be the case, it may require an exhaustive investigation to convince not only Congress but also part of the public. The utility companies made no elaborate defense. In the nature of the case perhaps none was called for. The burden of proof rested on the accusers, and the record, as we have already said, shows how weak a case they presented. None the less, the whole public must be assured that not only are the accusations made against the industry groundless, but that these consolidations and combinations of electric public utility properties are really in the public interest. The proofs abound; they must be spread broadcast throughout the land.

## *The Significance of the Grounding Problem*

PROPER protective grounding is an active theme in the industry right now. The importance of the subject itself is heightened by the fact that the code-making machinery is under close scrutiny. The committee on Article 9 of the National Electrical Code, which has jurisdiction, has devoted much time to evolving new rules. A completely revised text has been prepared in lieu of the provisions of the 1925 code and will go before the N.F.P.A. electrical committee in February. As a supplement to the report of the committee on Article 9 there is being presented a minority report on the grounding of fixed appliances. In addition the National Electrical Manufacturers' Association has studied this subject and has issued certain definite recommended practices. As the situation now stands there are many viewpoints and the whole issue is beclouded.

Every branch of the electrical industry is concerned with grounding. Electrical men should, therefore, realize the fundamental importance of approaching this problem seriously and with caution, since the entire code-making system is involved. The success of the industry in working out this problem will stand as an indication of its ability to regulate itself. The fault lies not with any group, but probably in part with all, and the differences of opinion are not so widely apart that they cannot be reconciled in a practical compromise that will give adequate protection.

* * * *

## *Wired Radio Versus Space Radio —Some Commercial Aspects*

AN INTERESTING problem will be presented to the executives of the power industry before very long by the conflicting commercial possibilities that will lie in the field of radio. The issue will arise over the question of which will be the more profitable for the central-station company both in dollars and in public and trade relations—to provide a service of entertainment by carrier current distributed over its domestic circuits or to push the sale of alternating-current radio sets as energy-consuming appliances to build up residence load?

There seems to be no doubt from an engineering standpoint that so-called "wired radio" will offer opportunity for the establishment of a service of entertainment delivered on power lines through special loud speakers rented by the power company. The programs may be provided by the local company; they may be delivered by wire from some distant studio, or by contract with a broadcaster they might be taken from the air and poured onto the wires. The ability of the company to sell such a service must depend upon the quality of the programs offered and the practical superiority of the service. Strenuous objections by the local radio trade to the entry of a public utility into competition with its own customers in this field will of course be encountered.

On the other hand will lie the load-building possibilities of space radio. Already it is estimated that 550,000 alternating-current radio sets are in use and 2,000,000 using other forms of current supply, all connected to central-station circuits. An alternating-current set produces about $10 a year in revenue to the power company. The alternating-current set today is sweeping the country. Supply is away behind demand, and from now on almost every radio set that goes into a wired home is going to mean load, an increase in residence consumption of about one-third of the present national average. Moreover, the existing leadership of space-radio broadcasting will not be lightly relinquished, and it is reasonable to expect that in face of this the public will naturally be slow to abandon space-radio reception. Certainly the power companies should do anything possible to build up load with alternating-current radio.

The point is this—that the relative appeal of wired radio versus space radio will in the end boil down to a simple equation. Which will be more in the public interest? Which will offer the greater profit to the utility, the net returns from an entertainment service or the revenue from alternating-current sets in general use? In the end the issue will be determined very largely on these two considerations.

* * * *

## *Interconnection Brings Non-Standard Transformers*

INTERCONNECTION of utility systems does not make for transformer standardization during the development stage. Two-winding and three-winding transformers with tap changers on each winding and non-standard voltage ratios have been demanded of manufacturers by utility engineers. The cheapest and easiest way to make two systems operate under interconnection is to have the transformers afford the regulatory control and furnish the flexibility for reconciling differences in system voltages. Such complications as exist for these reasons can be understood and are warranted in a development stage of interconnection.

But thought should be taken to get a maximum possible degree of transformer standardization. Special features may be desirable in an individual transformer installation but may not be necessary. Nor is it reasonable to have oil, air and water cooling and combinations of these cooling methods which complicate mechanical details of transformer design so as to produce a multiplicity of special transformers. Work on transformer voltage standardization might well be supplemented by action toward building systems to interconnect with standard transformers and also by action to get a greater degree of standardization in transformer cooling methods and mechanical dimensions.

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## *Neon Lamps for Home Lighting*

THE neon-tube sign lamp is now to be seen in nearly every city as a recent development in illumination. These colored-light signs have been adopted very rapidly as a new display element in the advertising business, and they have established their place. Speculation as to the future of the neon lamp invariably leads to a consideration of its possibilities for home lighting. The absence of glare from a concentrated light source and of the necessity for shielding resistance filaments, with consequent lessened efficiency in illumination, are clearly advantages. In addition there are possibilities of color and warmth in neon bulbs that offer attractive decorative opportunities. It may be necessary to use small permalloy transformers in the base of the neon bulbs to get the voltage required for the ionization. This type of bulb could be used in existing sockets and with present lighting services.

On the other hand, several disadvantages are apparent which must be overcome before much headway can be made with neon lighting in the home. The low power factor and small energy consumption of neon lamps might well be considered with apprehension by utility companies. But past history shows that new developments never injure business. The neon lamp may force a rapid development of heavy-consumption household-appliance sales to offset the loss of revenue from resistance filament lighting and may add new possibilities for electric lighting in the homes. The future field of the neon lamp not only provides an interesting subject for speculation but is worthy of attention from a practical point of view, and this development will be watched carefully by all electrical men. Researches now under way may be very fruitful.

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## *Turbine-Blade Failures Too Frequent*

THE modern turbo-generator is a splendid achievement and represents the consummation of years of development. But it will not be finished until it shall have a maximum degree of reliability. At present the chief trouble with turbines occurs from blade failures. Rows of blades fail and cause the units to be put out of service.

No basic reason has been found for blade failures, and no general rule covers the location of the failures. It is the intermediate stage blading on the spindle which gives the trouble, so that size of blade or high-pressure effects have little bearing. It may be a vibration effect, but a more reasonable explanation is that it is caused by a combination of vibration, expansion and contraction and change in blade structure. Alloy blades have splendid characteristics on test, but any alloy must undergo life tests before it can be said to have proved itself. Some of the alloy blades may change their structure when placed in turbines or may undergo a fatigue which makes their life limited. Research work on steel alloys is needed to eliminate any chance of these effects causing turbine failures. In some cases also improper plant operation, and not inherent blade defects, may cause blade failures. It would be well to make careful studies of all blade failures, including micrographs of the metal, so that complete data may be had to improve turbine operation.

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## *Where Light Means Life*

NOWHERE is the work of the illuminating engineer more important than in the hospital operating room. Recent improvements in the lighting of these places by the use of prismatic refractors backed by high-powered lamps point the way toward new standards of practice in this vital field of service. Tests reported by H. Logan to the Lighting Engineers' Club of New England at a recent meeting in Worcester show that approximately six minutes is being saved in operations formerly averaging about twenty minutes by the provision of the above type of illumination, with its resulting excellence of distribution uniformity, high intensities at the edges and interiors of wounds and reduction of eye adjustment strain on the part of the surgeon when looking away from the operating table for instruments or supplies or for other reasons. What this means in the reduction of the period of anæsthesia and surgical shock need not be elaborated here, but the progress recorded suggests unrealized possibilities in many fields where analysis of work cycles coupled with a willingness to spend money for desirable increased intensities of illumination properly directed and distributed offers attractive rewards.

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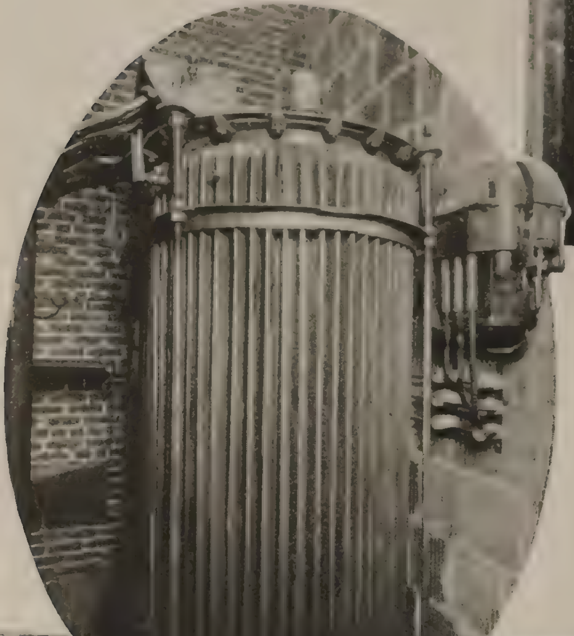
## *Obligations Inherent in the Social Contract*

ROUSSEAU did not have the central-station industry in even the innermost recess of his mind when he entitled the book that was the "Uncle Tom's Cabin" of the French Revolution "The Social Contract." He was thinking of a supposed contract between the individual and the state and of the mutual obligations of the two under that contract. Rousseau has been dead for a century and a half. His ideas, perhaps different in their fruition from his conception of them, had wide influence in their day. But the social contract has enlarged its scope. If it is still a binding agreement between the individual and the state, it is more than that. It is the unstated, and often unrecognized, obligation that the units of industry, whether personal or corporate, owe to the social organization of which they are a part. It does not necessarily follow that this obligation is of the kind to be discharged to the state in the forms of taxes and loyalty; it may be worked out in commercial relations with other members of organized society.

The agency that will bring the benefits of electric service fully into the American home, that will make farm life as comfortable and convenient as city life, is the electricity supply system. The development of electric utilities to the present day has been a history of the unequal sharing of burdens of costs. There will always be some among the total number of customers of any electric utility who, in strict equity, get a little more than they pay for and some who pay for a little more than they get. It is in the very nature of the business that this should be true. On any system it costs less to serve a residence customer within a block of the power house than one ten miles away. Yet both pay the same rate. One is paying part of the cost which, strictly, is chargeable to the other. If the customer near the power house ever took time to think about the matter, no doubt he would cheerfully accept the situation as a part of his social duty to the man who lives farther away. It takes all the residence customers, all the commercial customers, all the industrial customers, all the individual members of these groups, in any given area of city or country to permit the electricity system or systems serving them to reach the highest point of economic efficiency.

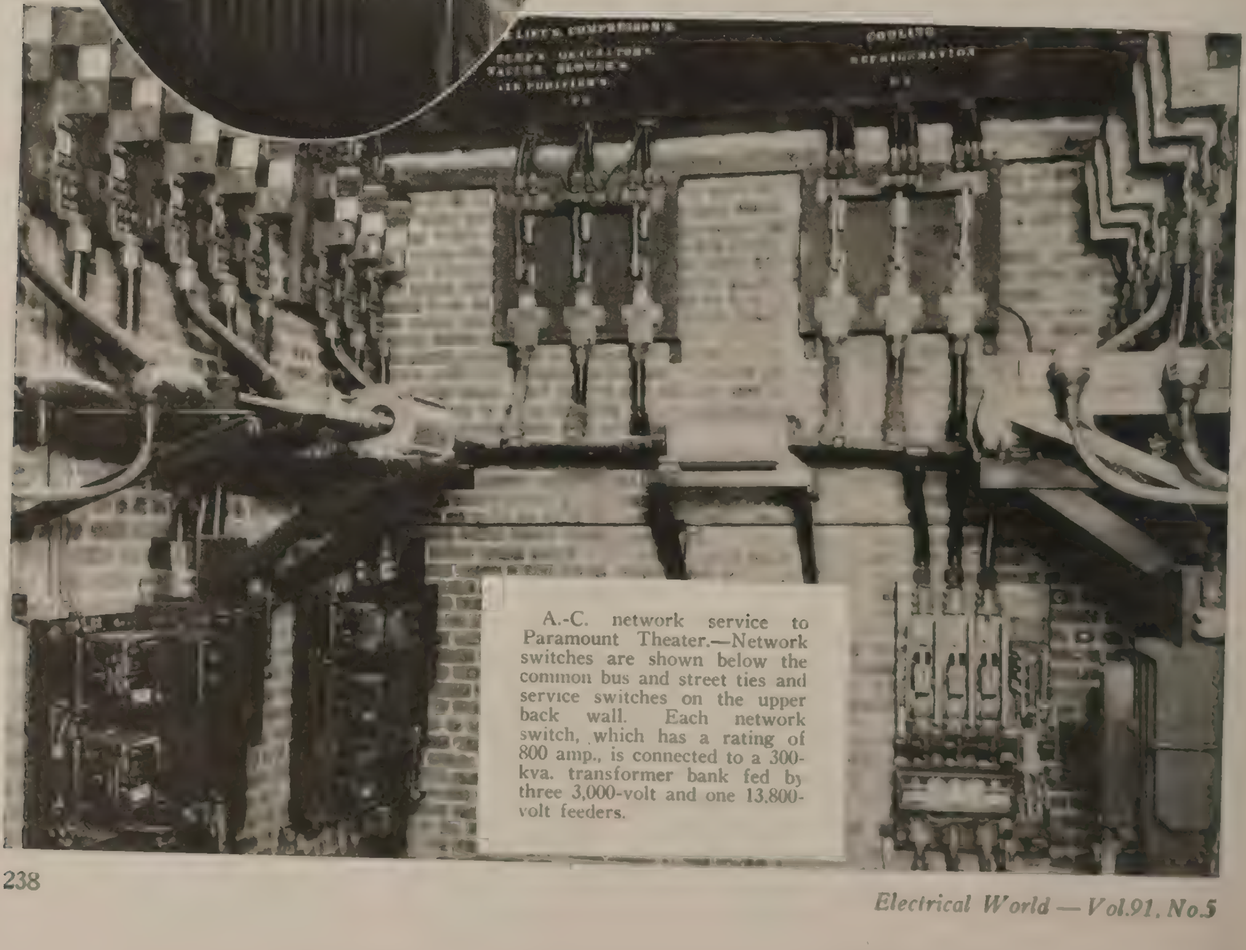
Now, in order to extend electric lines to six million more farms in the United States, to strengthen distribution systems for increased service to domestic users, to do a hundred things that will result in the full and complete electrification of our country, the electric utilities must have the co-operation of every element in the social organism. That co-operation must manifest itself in the use of electricity supplied from the systems. It is the duty of every element of society to promote agencies that are working for the progress of society. If any element or individual fails in that duty, it or he is failing in the obligations of the modern social contract which, except for the enlargement of its scope, might be construed as pretty much the same as when it was explained by Jean Jacques Rousseau.

# A.-C. Network and 120/208-Volt Service in New York City



ECONOMIC justification of alternating-current service has not deterred utilities in seeking means to make it just as reliable as the Edison direct-current network system. With this purpose in view, the network idea is being adopted at many places throughout the United States and the United Electric Light & Power Company is one of the pioneers.

Above and in oval—Bank of three 100-kva., single-phase transformers and one 300-kva., three-phase unit connected delta on high side to 13,800- and 3,000-volt feeders respectively to supply 120/208-volt, three-wire service.



A.-C. network service to Paramount Theater.—Network switches are shown below the common bus and street ties and service switches on the upper back wall. Each network switch, which has a rating of 800 amp., is connected to a 300-kva. transformer bank fed by three 3,000-volt and one 13,800-volt feeders.

# Power in National Defense

Mobilization of power resources planned. Co-operation of utilities needed. Field surveys under way. Basic plans outlined for war service

By MAJOR EDWARD C. KELTON
*Corps of Engineers U. S. Army*

ON NOV. 10, 1927, Col. Hanford MacNider, the Assistant Secretary of War, addressed the Kiwanis Club at Chicago as follows:

"Along 500 miles of broken fields and shattered villages, from the North Sea to the boundary lines of Switzerland, the deep, sullen roar fell away. Five million earth-colored creatures rose uncertainly and tried to stand up again like men. There was a new and strange throb in the breast of every one of them. This was the Armistice. It was over.

"Across the ruined countryside, where a moment before there had been no sign of life, now stood upright once more what was left of the flower of half of the great nations of the earth. The fleeting exultation of victory, of a job well done, the black pangs of defeat, the thought of a bannerless return to the fatherland, all these came and passed. Helmets were pushed back or clattered to the ground in the strange new silence. Eyes that had seen all that hate, death, hell on earth could muster met across what an instant before had meant all those things and more. The long lines of men looked curiously at the sky, at the surrounding devastation, at each other. Resentment, at least as between man and man, was already dying away.

"Across that tired and unhappy and broken land came the faint cheering of men—faint as if afraid that this could not be real. Not a cry of release from peril, or hardship, or pain, but as of the lifting of a curse which had been laid upon the world. It was over.

"If there was in those men's eyes a thing that might be read, it was: 'So that was war. Well, God spare our sons and their sons. We want no more of it.' And so those men stood, swaying a bit on unsteady legs, confused at the new stillness of things, Consciously or unconsciously, a vow wrote itself across the soul of every one of them. There must be no more of war.

"Nine years ago it was, this day. Let those of us who rose from the mud of that western front, who served with the colors of our country wherever it may have been, give an account of ourselves. What have we done about it? And what do we intend to do?"

Many men such as Mr. MacNider was addressing in Chicago on Armistice Day are in the ranks, high and low, of the electrical industry; they are in the central stations, in the offices, out on the lines and in the great establishments manufacturing electrical equipment; from hard and bitter experience they understand war; they do not see anything romantic or beautiful in it; they think of it only as something to be avoided or to be terminated as promptly as is consistent with national honor. On the one hand, from their war experience they know the terrible effectiveness of modern weapons in the hands of trained men; on the other hand, from their every-day life they know the research, science, skill, time and effort that go into the production of those weapons and the enormous amounts of power that are required in their rapid manufacture. They are prone to analyze the power industry as to what it did during the World War and what position it is in at present to meet an emergency.

### POWER SHORTAGE IN LAST WAR

To some it may come as a surprise to learn that ten years ago there were serious power shortages in several parts of the country; that in the Niagara Falls district the shortages ran as high as 90,000 hp.; that the situation there was so desperate that the United States was forced to deliver coal to Canada in exchange for electrical power at a time when every train of coal crossing the International Bridge almost caused a riot among the Americans who were unable to obtain enough to heat their houses; that in certain sections it was deemed necessary for the government to take over the entire electrical output of all central stations; that just before the Armistice the situation had reached the state where the power section of the War Industries Board had introduced in Congress and was pressing for the passage of a bill calling for $200,000,000 to aid the power companies to meet the demands being put upon them by essential war industries. These conditions were not the result of any disinclination on the part of the electrical industry to aid in the war work. They were co-operating 100 per cent, but even with expansion programs rushed to completion, with interconnections hurriedly made and with every stand-by plant put in operation, no matter how inefficient it might have been, the totals available were not sufficient. Fifty and 75 per cent expansions of output over whole sections were achieved, but still the power section estimated the shortage in the seven districts it surveyed to be 236,800 hp. Finally, with certain curtailments of the less important industries, the power situation was met satisfactorily but with such a small margin of safety that only the Armistice avoided even more critical shortages in 1919.

Since the World War the electrical industry has been revolutionized and, what is more important, it has revolutionized every other industry. The table on page 241, recently published by the National Industrial Conference Board, indicates the extent of the electrification.

There seems to be no diminution in the replacement of heavy, back-breaking human effort by machines driven by electrical energy. In the two years from 1923 to 1925, according to the biennial census of manufactures, the horsepower per wage earner jumped from 3.8 to 4.3. It is now probably 4.8 hp. per wage earner. This has released many thousands of workers for other lines of endeavor. It has permitted the employment of women in places where the arduousness of the work limited their usefulness. It has, furthermore, made the individual worker more effective, so that, in spite of a reduction of 496,000 wage earners in manufacturing establishments from 1923 to 1925, the volume of production was not decreased. In fact, certain figures now indicate that the average American manufacturing wage earner can produce 49 per cent more than he could in 1889. The reason is easily discovered—the use of machinery; but, more important still, the electrification of industry.

Within the electrical industry itself the technical and organizational developments have been no less remarkable. One ton of coal now does the work of three. Economic transmission distances have been increased, safety and reliability of service and improved standardization of equipment have resulted in simplicity, increased usefulness and convenience to the consumer. Electricity has been applied to an ever-widening field of useful purposes. Reciprocal agreements between companies, and other efforts, have raised load factors to points not dreamed of in 1917.

### GOAL NOT YET REACHED

The goal is not yet reached. In spite of an increase of 17 per cent in the last three years, industry is still only 73 per cent electrified. Electric furnaces have not yet come to their rightful position; the electrification of the railroads has just begun; the Diesel electric drive for highway, rail and water transport lags behind that of several other countries, in spite of its proved efficiency; the market for electricity for house heating has not been scratched, in spite of the fact that the earnings from byproducts that now go up every stack, if turned to reducing rates for service of this type, could in a few years meet the competition of dirty, inconvenient coal- and even oil-burning service. This will be even more true when the present flush production of petroleum falls, as it must, in a few years. Research and development will continue to place electric energy in every phase of our economic life.

If all this be true, why should the War Department or the government be studying the problem of the mobilization of industries of the country? Why should it be making attempts to obtain the co-operation of the power industry in an effort to have it ready for instant mobilization in case of a war? It is because Congress and its defense agencies, the Army and Navy, as well as many leaders of industry, foresee conditions that are quite different from those that obtained at the outbreak of the World War. These may be outlined briefly.

Primarily, in the case of a major emergency, the demand upon industry will be far greater and much more intense than it was in 1917. In those dark days the War Department was practically without a military plan of mobilization and quite without an industrial mobilization plan. Five or six months passed before the decision was finally reached, calling for the mobilization of 3,000,000 men. Mobilization moved slowly. Orders for munitions were not issued promptly. Now, however, plans are available not only for the mobilization of the number of men required to meet a major emergency but also for the prompt placing of orders for the billions of dollars' worth of supplies required to put and maintain that army in the field. These orders will be placed immediately upon the outbreak of a major emergency. Industry will start to execute the tasks that have been outlined in time of peace. True, efforts will be made to limit the production of non-essential industries and to turn their efforts to war work, but the final result will be an increased industrial activity, which, of course, means increased demand for electrical power.

Second, we little realize the extent of mechanization required in another emergency. Tanks, gas containers, bombs and a few airplanes upset our calculations and strained our unorganized industry in the World War. We visualized and had planes carrying 200-lb. bombs. We had perhaps one plane for every 5,000 of our soldiers in France; who can say that it will not be one to 50 the next time, with each one of them carrying 500-, 1,000- or 4,000-lb. bombs? Rates of artillery fire will be much greater. Power is required to manufacture the planes, the bombs, the gas, the shells, as well as the trucks, the locomotives, the steel, the machine tools, the prime movers, and also to mine the coal and iron ore required in producing and transporting those products to the front. The undoubted increased mechanization of the Army is reflected back and back in increasing waves to the ultimate demand for power.

Again, the very efficiency of the power industry, in raising the load factor, is filling up the valleys in the load curves that were of such importance in meeting the war demand in 1918. Reciprocal operating agreements are cutting down or total reserve generating capacity. With every such agreement it becomes possible for one or both power companies to put off for one or two years the installation of new units or the building of new plants. Reserve stand-by plants may be scrapped. All this is good business. Load factors are rising, overhead costs are being reduced and the country as well as the industry is benefiting from the practice. Still the fact remains that the reserve available to meet an emergency is being cut and cut. Increased efficiency and co-operation promptly made thousands of horsepower available in the World War. Efficiency and co-operation under the stimulus of a national emergency are quickly mobilized, but the making of electrical equipment is not so promptly done. Certainly we should not slacken up on our struggles for efficiency and economy, but we should realize our reserves are being cut and not sink back with a false feeling of security. Under the present favorable financial conditions of the public utilities, the danger is not extreme, but a period of hard times and of intense retrenchment might promptly make the situation critical. Furthermore, the danger appears in its true light when it appears certain that in time of war the central stations, perhaps already breaking under the war demand, will find themselves unable to obtain equipment for expansions because of large direct war orders that may require preference over civilian demands for normal expansion. A little margin of capacity is quite as desirable for national safety as for local protection against interruptions in service. One prevents annoyance and delay; the other may prevent national disaster.

In a major emergency the demands of the Army and Navy for munitions will be extremely large. Theoretically the Navy is more nearly prepared for instant action than the Army. It is well recognized that the Navy cannot go to sea without ships and that it takes two or three years to build a battleship. Hence the Navy's demand upon industry for supplies and equipment will scarcely be as great as that of the Army. Therefore the Army has the paramount interest in seeing that adequate supplies of power are available for the production of its war munitions. Certain items for the Navy are of equal importance, but the total demand for power for munition purposes naturally becomes of prime interest to that agency whose success and whose very existence depend upon it.

### National Defense Act Passed

It may have been some such reasoning that caused Congress in 1920 to pass the national defense act charging the Assistant Secretary of War with the supervision of the procurement of all military supplies and other business of the War Department pertaining thereto and with the assurance of adequate mobilization of material and industrial organizations essential to war-time needs. Be that as it may, the War Department has felt its responsibility, in connection with other industrial mobilization studies, to survey and to ask the power industry to prepare itself to meet the demand that would be placed on it in time of war.

Since 1921 the Corps of Engineers of the Army has been conducting a survey of the power facilities of the country. It has obtained fairly complete information concerning all central stations of 5,000 kw. or over, such as capacity and characteristics of generating stations and transmission lines, interconnections between systems and finally data as to proposed extensions and improvements both under expected normal expansion and under maximum possible expansion in case of emergency. In all cases the co-operation of the members of the central-station industry with the War Department has been most hearty and data even of the most confidential nature have been given freely to the Corps of Engineers, with the understanding, of course, that such information was to be held strictly confidential. With these data much progress has been made in preparing to place our industrial load in such a way as to avoid overloading any particular section. The surveys have also listed the items of major equipment necessary for the expected expansion program. This has enabled the War Department to visualize one of the major manufacturing loads and will insure the essential needs of the central-station industry for equipment being cared for.

However, with the best of planning, shortages of power may occur. It occurred in the World War and may occur again. As a result the entire output of several large plants was taken over by the President of the United States. Such drastic action was necessary not only for the successful prosecution of war but for the protection of the rights of power companies in their relation with their customers. The power was needed for war purposes and by taking the entire output and then distributing the excess over the essential uses the demands of most of the users were met. It is only too easy to forget that such extreme conditions existed just ten years ago. It is only too easy to say that we shall never be in a position like that again. However, the War Department feels that it would be failing to do its duty if it did not attempt to take some steps to avoid such emergencies.

On June 8, 1927, the Secretary of War, Dwight F. Davis, presented a "Plan for the Co-ordination of the Use of Power in Time of War," at the annual convention of the National Electric Light Association at Atlantic City.

The plan had previously received the consideration of many leaders of the central-station industry. It represented their views and was acceptable to them in principle. It was the culmination of more than a year's co-operative effort at evolving some scheme that would insure the effective utilization of the power facilities of the country. Full extracts of Mr. Davis' address were given in the Electrical World of June 11, 1927. However, it might be well to restate the principles upon which the scheme is based. They are:

"1. The government should not take over any plant or power system unless necessary to insure the efficient prosecution of the war.

"2. No additional control should be exercised in regions where power is adequate for present and immediate future needs, both civil and military.

"3. When shortage of power for essential needs exists or is threatened, the government should take over the entire output of the plant or plants in the locality and apportion the power output to users in the best interests of the United States. This action should set aside all existing contracts for the supply of power with which such action conflicts.

EXTENT OF ELECTRIFICATION

| Year and Industry Group | Total Primary Horsepower | Electrical Primary Horsepower: Motors Driven by Purchased Current | Motors Driven by Generated Current | Total Electrical Power | Per Cent of Total Primary Power |
|---|---|---|---|---|---|
| 1914.......... | 22,307,189 | 3,897,248 | 4,938,722 | 8,835,970 | 39.6 |
| 1919.......... | 29,297,963 | 9,260.449 | 6,965,174 | 16,225,623 | 55.3 |
| 1923.......... | 33,056,870 | 13,332,780 | 8,819,217 | 22,151,997 | 67.0 |
| 1925.......... | 35,772,628 | 15,868,828 | 10,254,745 | 26,123,573 | 73.0 |

"4. If the preceding methods fail to obtain sufficient amounts of power, the government should undertake actual operation of such plant or plants.

"5. The existing organizations of any companies taken over should be utilized in their operation, in order to make full use of the experience, training and skill of their personnel."

Following the enumeration of these principles, Mr. Davis then outlined the essence of such a plan. Before considering it, however, it is well to remember that the steps that may be necessary in time of war are a far cry from regulation by the government in time of peace. The two are separate and distinct and are not based upon the same premises. In time of peace the economic, political and social ideas of the nation must govern. In war some of the rights and privileges must give way before the greater responsibility of the nation to repulse the onslaughts of the enemy.

### Executive Feature of Plan

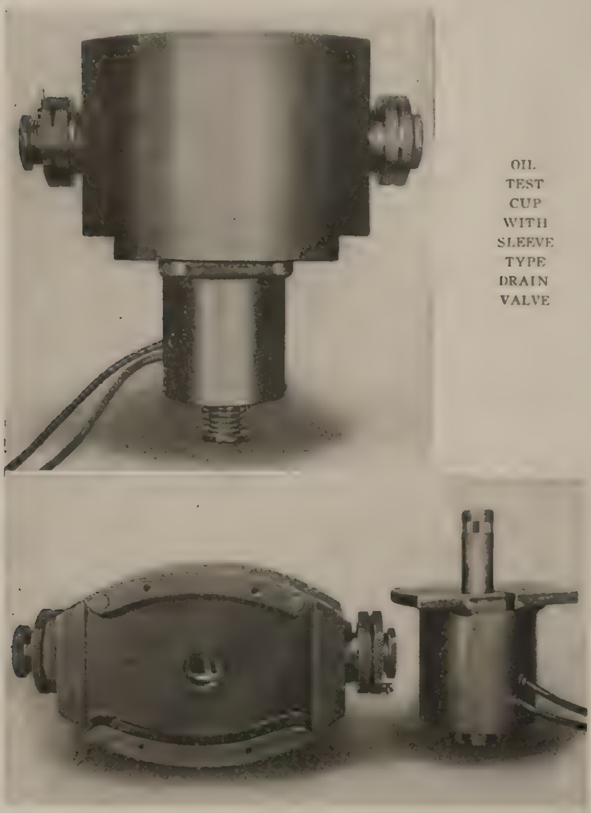
The plan calls for the selection by the President of the United States of an executive assistant, to be known as "the emergency power director," who would be responsible for the effective utilization of the power facilities of the country. The emergency power director would be assisted by an executive committee, the majority of the members of which would be nominated by the National Electric Light Association and approved by the emergency power director. These men would serve in a civilian or military capacity. The committee would serve under the direction of the emergency power director and would be the medium through which the mobilization and co-ordination of the power systems would be carried out and effective co-operation secured.

The plan was left in most general terms; it was designed to give necessary authority to the emergency power director to obtain the best results from the power industry; it had for its basic principle that the executives of the industry were the best able to bring about those results, but that they would need the added authority of the President under the law. The plan provided for this by the appointment of the emergency power director. Thus in case of war, if the situation becomes sufficiently threatening, we shall promptly have an organization, vested with legal authority, in possession of basic data as to requirements and resources of electrical power as is now being gathered by the Corps of Engineers and other agencies, ready to give every aid in co-ordination to the end that the power resources of the nation may be used to their maximum for war purposes.

# Improved Cup for Testing Oil

By J. B. Wallace
*Detroit Edison Company, Detroit, Michigan*

TO FACILITATE emptying the standard oil test cup manufactured by the Westinghouse Electric & Manufacturing Company (style No. 263621), the laboratory of the Detroit Edison Compnay once tried to support it on two horizontal metal bars on which the electrodes could be rolled, but this arrangement was found objectionable. The entire weight of the cup, 6½ lb., rested on the electrodes, with consequent danger of misalignment. When the cup was rolled over for emptying, the impurities in the bottom of the cup were thrown over the gap and tended to remain on the electrodes, unless rinsed repeatedly. A large pan beneath the oil cup was necessary to catch the oil when dumped.



OIL TEST CUP WITH SLEEVE TYPE DRAIN VALVE

To eliminate these difficulties, a valve arrangement was developed. This consists of a hollow sleeve valve in the bottom of the oil cup, which, when closed, is slightly below the bottom of the cavity. When open, the sleeve is raised sufficiently to open ports cut into its side through which the oil is discharged. The sleeve valve is normally held closed by a spring, in addition to gravity.

A solenoid coil is concentric with the sleeve and is mounted on the bottom of the cup. The sleeve is lifted by the coil when the circuit is closed, opening the valve against the spring, permitting the oil to drain out. The cup is rinsed between samples with high-test dry gasoline and dried with a hot-air hand-blower. As set up in the laboratory the cup is mounted permanently on a micarta table top set on wall brackets. A waste pipe receives the oil discharge from the lower end of the valve sleeve. The solenoid terminals are brought out to a separable connector which is opened while test potential is being applied.

With this arrangement the electrodes support no extra weight, the oil and impurities are drained down and away from the electrodes, rendering repeated rinsing unnecessary, and a permanently mounted stationary test cup is made possible. This facilitates setting the test gap exactly. The valve arrangement was conceived and designed in the testing division of the operating department and was applied to the standard cup by the electrical division of the Detroit Edison Company shops.

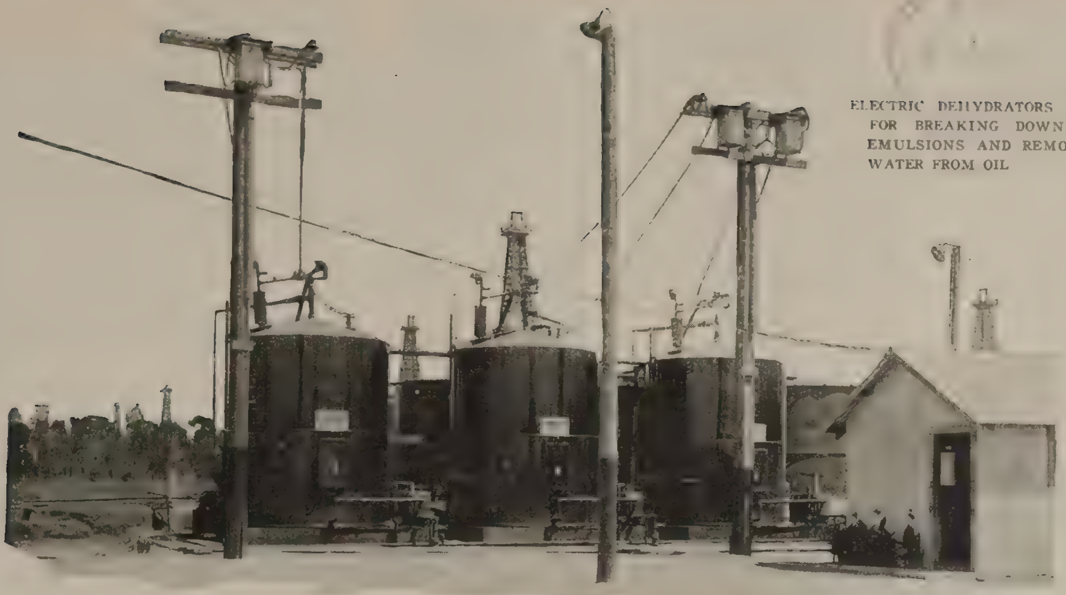
# Costs of Generating Plant Building

IN connection with the development of a New England central station a cost analysis was recently made by Jackson & Moreland, Boston, Mass., bearing upon the 1927 investment outlay required to duplicate various generating plant buildings, and from this analysis the accompanying tabulation has been prepared for use in estimating construction costs.

GENERATING PLANT 1927—BUILDING COSTS
(Excluding all overhead)

| | |
|---|---|
| BOILER PLANT | |
| Building "A," boiler house, 77 ft. x 146 ft. x 72 ft. high. | $321,656 |
| Building "B," boiler house extension, 78 ft. 6 in. x 77 ft. 6 in. x 72 ft., with monitor 42 ft. x 77 ft. 6 in. x 18 ft. high | 150,984 |
| Building "C," boiler house extensions, 78 ft. 6 in. x 87 ft. 6 in. x 73 ft. high, with monitor 42 ft. x 87 ft. 6 in. x 18 ft. high | 182,441 |
| Lighting equipment for above three buildings | 7,051 |
| Heating equipment for above three buildings, including 460 sq.ft. radiators, piping, valves, etc | 753 |
| Plumbing | 9,356 |
| Contractor's compensation | 33,612 |
| TURBINE HALLS | |
| Building "A," turbine hall structure, 61 ft. x 130 ft. x 69 ft. high | 166,539 |
| Building "B," extension 61 ft. x 46 ft. x 69 ft. high, with monitor 26 ft. x 35 ft. 6 in. x 9 ft. | 99,569 |
| Building "C," turbine hall extension, 61 ft. x 92 ft. 6 in. x 69 ft., with monitor 26 ft. x 75 ft. x 9 ft | 85,746 |
| Lighting equipment for above three building units | 3,348 |
| Plumbing equipment for drinking-water system | 279 |
| Contractor's compensation | 17,774 |
| CONTROL ROOM AND OFFICE BAY | |
| Building "A," 4 stories, 27 ft. x 125 ft. x 50 ft. high, with monitor 5 ft. 6 in. x 120 ft. x 4 ft. high | 70,330 |
| Building "B," extension, three stories, 27 ft. x 46 ft. x 38 ft. high, with skylight 5 ft. x 32 ft. x 2 ft. high, and automatic passenger elevator | 20,990 |
| Lighting equipment for above buildings | 2,647 |
| Heating equipment for above buildings | 2,654 |
| Plumbing equipment for above buildings | 5,560 |
| Contractor's compensation | 5,109 |

In general, the buildings and extensions covered embrace structures with foundations of concrete mat on wood piles, steel frame superstructure with brick exterior finish and tar and gravel roof.



ELECTRIC DEHYDRATORS USED FOR BREAKING DOWN OIL EMULSIONS AND REMOVING WATER FROM OIL

# Oil Field Power Costs

Electric pumping data given. Effectiveness of electric dehydrators shown. Electric drilling expense totals but half of that for steam

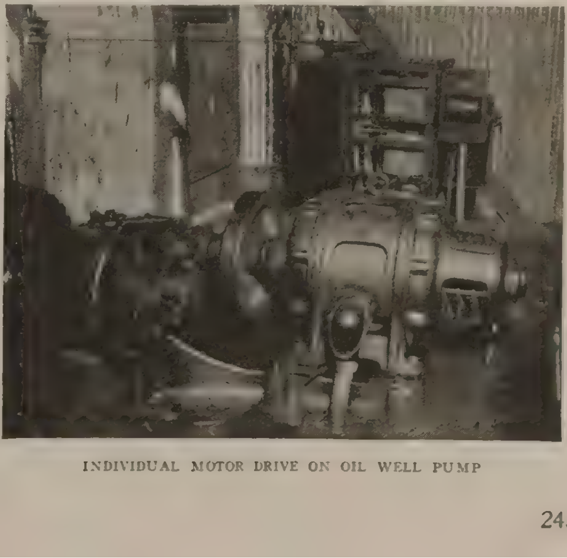
ALTHOUGH electric power was slow to invade the field of oil production, rapid progress has been made during the past few years, until now there are many fields using electric power exclusively. One such field in southern California, visited by a representative of ELECTRICAL WORLD, furnished valuable data on electric pumping and drilling costs. This was the field of the Chanslor-Canfield Midway Oil Company at Torrance, Cal., near the city of Los Angeles.

In this field there are 165 wells electrically pumped by individual motors. Records for the month of June 1927 give the following information relative to pumping:

| | |
|---|---|
| Total barrels pumped | 271,796 |
| Total kilowatt-hours consumed for pumping | 907,486 |
| Average kilowatt-hours per barrel pumped | 3.34 |
| Average cost per barrel for power, cents | 2.7 |
| Average rate per kilowatt-hour, cents | 0.81 |
| Average pumping depth for all wells, ft. | 2,890 |
| Maximum power demand for all purposes, kw. | 1,723 |

Since all pumping in this field is done electrically, no comparative gas or steam pumping costs are available. However, from checks made in another field operated by the same company it has been found that in making a new installation, electric pumping with power at 1 cent per kilowatt-hour is considerably more economical than gas engine pumping using 900 B.t.u. gas that could otherwise be sold at 10 cents per 1,000 cu.ft. One point strongly in favor of electric pumping is that about one-third less labor is required to take care of the pumps. If the 165 wells in the Torrance field were pumped with gas engines, nine men per shift would be needed to attend to the pumps instead of three men now used for the electrically driven pumps.

Two general systems of electric pumping are used in the oil fields; one is the individual motor drive, as in the Torrance field, the other is the so-called jack system, whereby the walking beam of the well pump is actuated by a cable attached to an eccentric motor-driven ring, centrally located with respect to six to eight wells. The latter system has the advantage of lower first cost and lower pumping cost as well, but necessitates the use of portable well bailing and cleaning rigs, which partly



INDIVIDUAL MOTOR DRIVE ON OIL WELL PUMP

SIX 1,000-KVA. TRANSFORMERS FED FROM TWO 15,000-VOLT LINES SERVING SOUTHERN CALIFORNIA OIL FIELD

offsets the advantages of the jack system. However, the determining factor in choosing between the two systems is not in the matter of first cost or pumping cost, but in the condition of the wells in the field. If the field is comparatively new and the production is high, as is the case in the Torrance field, and the wells require frequent cleaning, then individual motor-driven pumps have been found best and most economical on account of the expense of cleaning and bailing and pulling casings with portable rigs. The jack system is generally applicable only to older wells of low production.

In the Torrance field, where individual motors are used, the motors are of the double rated type, having a rating of 15 hp. at 480 r.p.m. for pumping and 25 hp. at 960 r.p.m. for bailing or cleaning or pulling casings. Tests show that the average demand of the motors when pumping is from 6 to 8 hp. One of the accompanying illustrations shows the motor and control apparatus for an individually driven well pump. All motors for this purpose are rated at 440 volts, three phase, and are of the variable-speed type. Service enters the pumping shed through conduit from overhead lines. Protection consists of a main line safety switch and oil circuit breaker with overload trip. Control apparatus consists of a cam-type controller for changing from six to twelve poles on the motor and a drum controller for varying the speed of the motor. The large counterbalanced wheel with crankshaft which operates the pump walking beam is driven through reduction gear and chain. The band wheel on which the crank is mounted is counterbalanced to give as nearly a uniform duty cycle on the motor as possible.

### ELECTRIC DEHYDRATION

A few years ago it was discovered that passing a high-voltage alternating current through oil emulsions would cause the minute particles of water to combine, forming larger and larger particles of water until globules are formed, after which the water is precipitated. This method of dehydration is patented and is now quite widely used by oil companies. One of the accompanying illustrations shows three petroleum rectifying dehydrators in the Torrance field. These dehydrators are purchased from the manufacturer, but are operated on a royalty basis at so much per barrel of oil treated.

For the month of June, 1927, 77,542 bbl. of oil was treated in the Torrance field, requiring 6,482 kw.-hr. of electrical energy, making the average cost per barrel for power 0.07 cent. Two test runs were made after the installation of the dehydrators to determine their effectiveness. The first test was on a sample of oil with high emulsion content. The data on this test follow:

| | Before Treating | After Treating |
|---|---|---|
| Specific gravity (deg. Bé.) | 22.63 | 24.13 |
| Per cent sand | 0 | 0 |
| Per cent free water | 0.2 | 0.2 |
| Per cent emulsion | 15.4 | 0.4 |
| Per cent total foreign matter | 15.6 | 0.6 |

Another test run on an oil sample with low emulsion content gave the following results:

| | Before Treating | After Treating |
|---|---|---|
| Specific gravity (deg. Bé.) | 21.78 | 23.55 |
| Per cent sand | 0 | 0 |
| Per cent free water | 2 | 0 |
| Per cent emulsion | 4.05 | 0.4 |
| Per cent total foreign matter | 6.05 | 0.4 |

This method of treatment has not been found to be so effective where the mud content in the oil is high.

Electric power is now widely used for main line pumping, or shipping stations as they are termed by oil men. At the Torrance field the output of the field is handled

COMPARATIVE STEAM AND ELECTRIC OIL WELL DRILLING COSTS
(Using Hild differential electric drive)

| | Feet Drilled | Drilling, Days | Feet Drilled per Day | Twist Offs | Power Cost | Power Cost per Foot Drilled | Power Cost per Day |
|---|---|---|---|---|---|---|---|
| Steam | 7,150 | 72 | 99.3 | 4 | $1,154.77 | $0.162 | $16 04 |
| Electric | 7,075 | 75 | 94.3 | 2 | 608.36 | 0.086 | 8.11 |

EQUIPMENT COST AND FIXED CHARGES

| | Wooden Derrick | Drilling Machinery | Supporting Equipment | Totals | | Depreciation Rate | Depreciation, Not Including Derrick | | | 6 Per Cent Interest on Investment Including Derrick | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Without Derrick | With Derrick | Per Cent | Year | Month | Day | Year | Month | Day |
| Steam | $3,411.83 | $3,740.62 | $7,564.55 | $11,305.17 | $14,717.00 | 33⅓ | $3,768.39 | $314.03 | $10.47 | $883.02 | $73.59 | $2.45 |
| Electric | 3,545.73 | 15,562.18 | 3,420.52 | 18,982.70 | 22,528.43 | 20 | 3,796.54 | 316.38 | 10.55 | 1,351.71 | 112.64 | 3.75 |

SUMMARY—DAILY CHARGES (FIXED AND OPERATION)

| | Fixed Charges | | Extra Labor | Power Cost | Total |
|---|---|---|---|---|---|
| | Depreciation | Interest | | | |
| Steam | $10.47 | $2.45 | $15.75 | $16.04 | $44.71 |
| Electric | 10.55 | 3.75 | ...... | 8.11 | 22.41 |
| | | | | | $22 30 |

OIL FIELD TRANSFORMER INSTALLATION WITH RADIATING DISTRIBUTION LINES FOR SERVING INDIVIDUAL WELL PUMP MOTORS

by two motor-driven pumps. One of these is a 5x12-in. plunger pump driven by a 125-hp., 440-volt motor. Records for this pump, which is considered the most efficient, for June, 1927, showed:

| | |
|---|---|
| Total barrels of oil pumped | 121,932 |
| Total kilowatt-hours used | 20,140 |
| Total cost for power | $165.55 |
| Pumping cost per barrel, cents | 0.136 |
| Total hours operated | 464.17 |
| Average barrels pumped per hour | 263 |

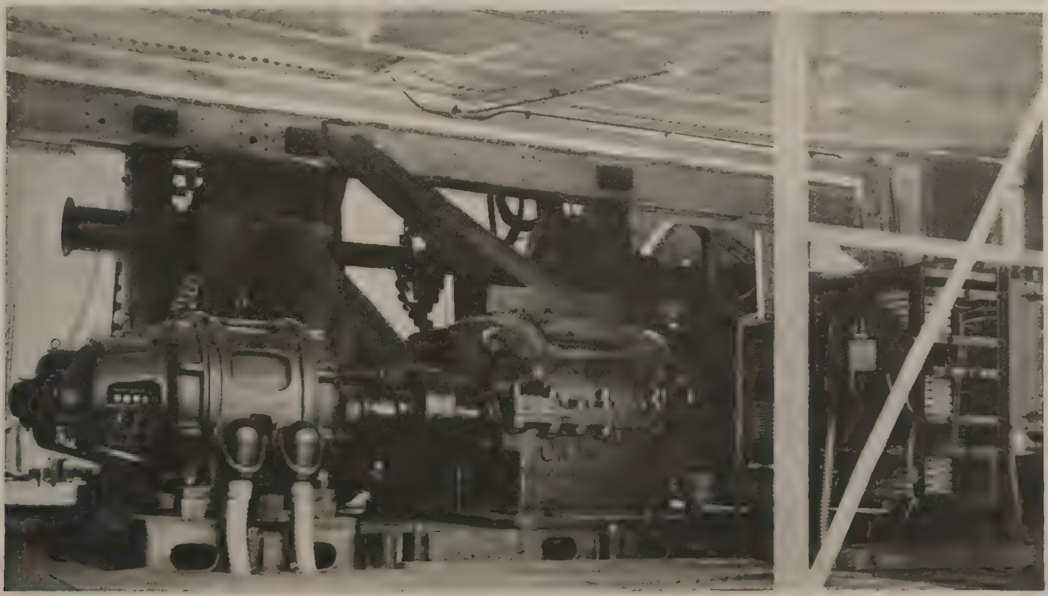
Pumping head varied from 100 lb. to 700 lb. per square inch. A test on this pump showed that it was capable of pumping an average of 288 bbl. of oil per hour against pressures up to 700 lb. per square inch at a cost of 0.1 cent for power, as compared with a cost of 1 cent per barrel of oil pumped for fuel alone when using a gas-fired steam boiler and steam engine-driven pump. All of the several types of pumps have been used for pumping oil, but experience shows that for general oil-field conditions the plunger-type pump is the most satisfactory and efficient. At refineries where comparatively clean oil is handled the screw-type pump is quite popular.

Electric drilling has been found so satisfactory and economical that steam is no longer considered except by those of the old school who are prejudiced. Records kept on two wells drilled with steam power and two drilled with electric power using the Hild differential drive at the Torrance field showed strikingly the economy of electric drive. Comparative data for the two methods of drilling are given in the accompanying tables. From these it will be seen that the total feet drilled by the two methods was practically the same and that under these conditions the net daily drilling cost, all items included, was $44.71 for steam and $22.41 for electric drive, or, in other words, steam-drilling costs were almost exactly double the electric costs.

Temporary power is supplied for the electric drilling rig by three 75-kw., 2,300/440-volt transformers mounted on a sled and inclosed by a wire screen as shown in one of the accompanying illustrations. The three-phase overhead line, which is later to be used for supplying the 440-volt pump motor, is used as a 2,300-volt circuit during drilling operations; thus temporary work for power supply is kept to a minimum.

Other illustrations show the Hild differential drive and the direct motor-driven mud pumps used in electric drilling operations.

Power for the Torrance field is purchased from the Southern California Edison Company at a centrally



HILD DIFFERENTIAL OIL WELL DRIVE

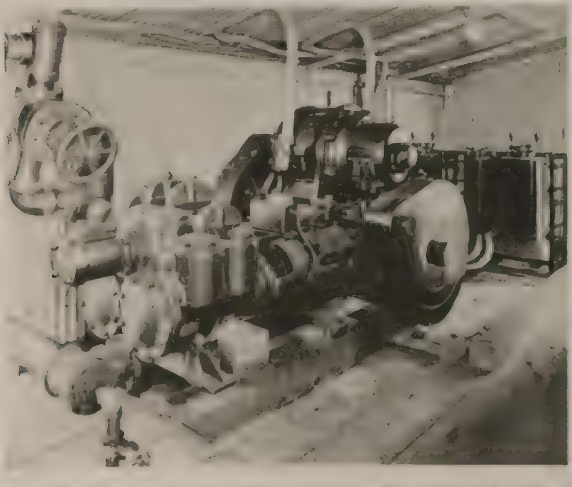
**Two 15-30-hp., 440-volt motors operate the drill through suitable reduction gears and chain drive. A cam-type contactor changes the motors from six to twelve poles. Nine points of speed control are obtained by a drum controller.**

TRANSFORMER BANK MOUNTED ON SLED SUPPLIES TEMPORARY POWER FOR ELECTRIC OIL WELL DRILLING EQUIPMENT

located substation, which is shown in one of the illustrations. The station contains six 1,000-kva. transformers fed from two 15,000-volt lines from different substations to insure uninterrupted power supply in so far as possible. The reason for having so much transformer capacity for a load of less than 2,000 kw. is so that if anything should happen to one 3,000-kva. bank, the other is available for carrying the load while replacement is made.

The transformers are Y-connected on the low side for 4,000-volt, three-wire distribution. The oil company's low-voltage bus is housed in a corrugated-iron building where meters, relays and low-voltage circuit breakers are housed as well. The power company furnishes a totalizing watt-hour meter and demand meter, which are checked by similar instruments owned by the oil company. A feeder switchboard consists of five panels for 4,000-volt feeders for power and three 4,000-volt feeders for lighting. An arrangement effective Aug. 1, 1927, makes it no longer necessary to meter the lighting and power separately and the separate lighting feeders are now unnecessary. Each feeder has a watt-hour meter and an ammeter and is provided with an oil circuit breaker with overload protection.

The 4,000-volt feeders consist of three No. 2/0 weatherproof wires radiating from the main substation to various parts of the oil field. Laterals are run from the main feeders to step-down transformer banks for supplying the pump motors. These transformer banks usually consist of three 50-kva. transformers centrally located with respect to six wells. Three-phase, 440-volt feeders radiate from the transformer banks, which in turn are tapped to serve the individual wells. Main secondary feeders consist of three No. 1/0 weatherproof wires, and for branches to individual wells No. 2 wire is used.



DIRECT GEAR-DRIVEN MUD PUMP FOR OIL WELL DRILLING USING A 15-35-HP. MOTOR. GENERAL PETROLEUM COMPANY

# Generator Inspections

By O. M. Ward

*Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.*

INSPECTIONS on all generators, motor-generators, rotary converters and exciters in the system of the Milwaukee Electric Railway & Light Company are specified and noted on the report here reproduced. Inspections are made on direct-current machines at intervals of two months and on alternating-current machines at six-month intervals. This information regarding machines, inspection periods, and the following quoted notes, are printed on the back of the form, which is a mimeographed sheet measuring 8½x5½ in.:

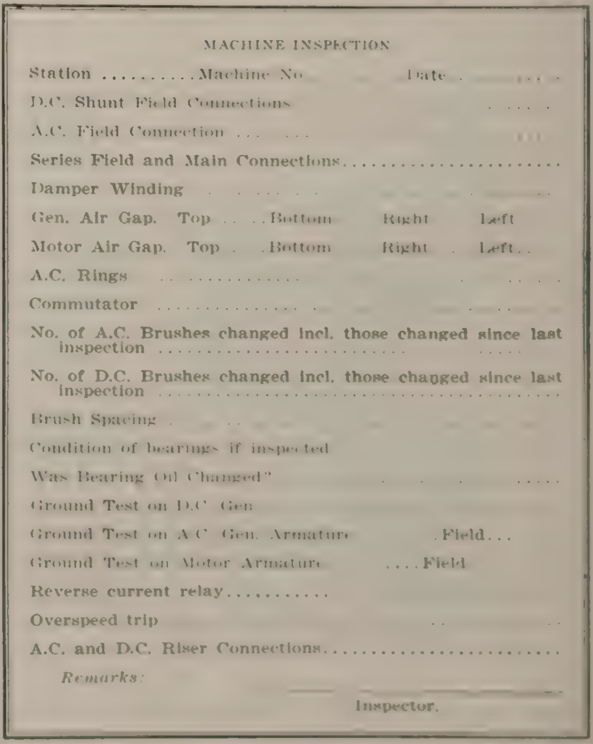
By "air gap, right" is meant the right-hand side of the unit when looking toward the machine from the end that gives clockwise rotation.

Ground tests on direct-current machines will be made with a voltmeter and the number of the meter, the meter reading and the voltage at which the test is made must be given. This test will include the armature, field and cables, unless otherwise stated.

Ground tests on alternating-current machines will be made with a megger.

Reverse-current relay tests will be made by reversing the machine and noting at what current the relay operates.

Overspeed tests are to be made only on all-electric machines. The series field must be cut out before driving a generator as a motor for the purpose of overspeeding.



MACHINE INSPECTION

Station ..........Machine No ............ Date ..............
D.C. Shunt Field Connections ..........
A.C. Field Connection ..........
Series Field and Main Connections........................
Damper Winding ..........
Gen. Air Gap. Top ......Bottom ...... Right ...... Left
Motor Air Gap. Top ......Bottom ...... Right ...... Left..
A.C. Rings ..............
Commutator ................
No. of A.C. Brushes changed incl. those changed since last inspection ..........................
No. of D.C. Brushes changed incl. those changed since last inspection ..........................
Brush Spacing ..........
Condition of bearings if inspected
Was Bearing Oil Changed? ..........
Ground Test on D.C. Gen
Ground Test on A.C. Gen. Armature ...... Field...
Ground Test on Motor Armature ....Field
Reverse current relay...........
Overspeed trip ..........
A.C. and D.C. Riser Connections........................
*Remarks:*

Inspector.

# Quality Industrial Lighting*

Field research in many industrial plants shows factors of illumination intimately related to production. Results establish standards for practical use

By Arthur A. Brainerd
*The Philadelphia Electric Company, Philadelphia, Pa.*

DURING the past few years many experiments have been made both in the laboratory and in the field to determine the exact effect of lighting on manufacturing operations. As a result of these tests, backed by such pertinent statistics as were available, the following advantages have been claimed for scientific artificial illumination:

1. Increased production.
2. Decreased labor turnover.
3. Decreased accidents.
4. Decreased spoilage.
5. Improved morale.

A study of these items will show that to assign accurate numerical values to statements 2, 3 and 5 is a very difficult task, involving the study of records covering a period of several years. Items 1 and 4, however, are comparatively easy to determine within a very short space of time if the operation is repetitive and if it is necessary to rely upon artificial illumination to any great extent.

### Essentials of a Good Lighting System

A study of previous investigations of the effect of light on manufacturing operations revealed the fact that a majority of the cases studied dealt with purely hand operations, where operators were on a day-rate basis. In many cases the change was ascribed entirely to the change in intensity of illumination, although several other variables had been introduced, such as change in color and elimination of direct and reflected glare and sharp shadows.

Secondly, a careful investigation shows that for the Philadelphia area at least 76 per cent of the industrial work is done on semi-automatic or automatic machines and only 5 to 45 per cent of the time is spent on hand operations.

A consideration of these facts seemed to indicate that much remained to be done to place our present knowledge of illumination in such form that it will be readily understood and appreciated by the industrial executive.

In designing an industrial lighting system the following factors should be taken into consideration:

1. Intensity of illumination.
2. Uniformity of illumination.
3. Character and direction of shadows.
4. Character and direction of reflections.
5. Color of light source.
6. Maintenance and extensions.
7. Initial and operating cost.

The intensity of illumination to be used depends upon the visual angle, the reflection factor of the surfaces viewed, contrast in reflecting properties between material viewed and background, the value of product as related to floor area, percentage of window area, intensity and direction of natural light and the speed at which objects are moving.

In many lighting installations the results are unsatisfactory because of excessive variation in light intensity within the working areas and not because of insufficient intensity. Almost any operation can be lighted so that the variation factor within the working area shall not exceed 1.5. In many lighting installations today this factor has a value of 5 or over.

Since in most industrial establishments the surrounding conditions are such that it is impracticable to produce shadowless illumination, care must be taken to see that the shadows fall in such a direction as to do the least damage.

The same care must be taken in dealing with conditions where polished surfaces (such as a lathe chuck or face plate) normally come in the field of vision. Under such conditions the light should come from such a direction as to throw the direct reflection away from the worker's eyes.

In certain operations such as sorting cigars, inspecting cloth, coffee roasting, mixing paints, etc., it is absolutely necessary that light of the correct color value be provided. It goes without saying that as far as possible standard equipment that can be easily duplicated for extensions or replacement should be used. The equipment should be rugged in construction and easily cleaned.

It has generally been assumed that in order to satisfy these conditions direct lighting by means of metal reflectors is the only practical system to be considered in manufacturing operations, this being the best combination of low first cost, high efficiency and ease of maintenance. As a matter of fact, if the expenditure for equipment be considered on a cost basis, it will be seen that the fixed charges on lighting equipment will seldom exceed 10 per cent of the total operating costs, so that if more satisfactory illumination can be secured by the use of more expensive equipment it should be used. The fact that this idea can be sold is well illustrated by one case where a plant manager replaced bare drop lights with fixtures costing $20 apiece and was perfectly satisfied with the result.

Although the RLM dome and the "Glassteel" diffuser will undoubtedly satisfy 70 to 80 per cent of the lighting requirements in factories, all types of illumination can be used to advantage in some of the remaining 20 to 30 per cent.

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**Abstracted from a paper by the author entitled "Quality Measurements in Industrial Lighting Calculations," which received the James H. McGraw N.E.L.A. award for merit.*

With the idea of studying these phenomena under commercial conditions, thirteen plants were selected where adequate records were available and arrangements could be made to carry on investigations that were sufficiently comprehensive. The real object of these tests was to secure data that would enable us to place industrial lighting recommendations on a more exact basis than is the present rule.

The numerical results of these tests are given in the accompanying tabulations, which include all the observed and derived data obtained for the several factors considered in this connection.

The general plan has been to study one machine or a group of machines and one or two operators. Where the regular factory records were sufficiently accurate and complete, these were relied on. In other cases a trained observer secured all necessary records. In investigations of this nature it is unavoidable that variables other than illumination creep in. These variables include such items as outside influence affecting physical ability, lack of uniformity of raw material, variation in distance of eyes from work, consciousness of close supervision, prejudice against any sort of change, influence of union officials, etc.

Another item that has an important bearing on the subject is handwork that mainly involved manual skill. In many cases only careful analysis by the aid of slow motion pictures would enable one to determine the actual percentage of handwork that involves seeing.

Since most of the operations studied were on automatic or semi-automatic machines, it became necessary to develop some formula for the variation in speed of handwork. In any mechanical process, if the machine runs at constant speed, it is obvious that while the machine is running the output is uniform. Theoretically

*Table I—Effect of old and new illuminating*

| | Name and Address | Business | Operation | Per Cent Hand-work | Floor Area, Sq Ft. | Surface | | Refl. *K* Walls | Refl. *K* Work | Refl. *K* Back-ground | Per Cent Con-trast | Visual Angle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Work | Back-ground | | | | | |
| 1. | Reid Hosiery<br>Trenton and Sargent Sts. | Hosiery mfg. | Knitting | 6.7 | 136 | Matte | Spec | 0.598 | 0.292 | 0.107 | 36.6 | 3.83 |
| 2. | Phila. Sweater Mills, Inc.<br>719 Arch St. | Necktie mfg. | Knitting | 28.0 | 130 | Semi-matte | Spec | 0.455 | 0.451 | 0.037 | 8.2 | 0.624 |
| 3. | Realart Silk Hosiery<br>6016 Palmetto St. (day) | Hosiery mfg. | Knitting | 27.2 | 175 | Semi-matte | Spec | 0.440 | 0.240 | 0.080 | 33.0 | 0.552 |
| 4. | Realart Silk Hosiery<br>6016 Palmetto St. (night) | Hosiery mfg. | Knitting | 26.9 | 175 | Semi-matte | Spec | 0.440 | 0.240 | 0.080 | 33.0 | 0.552 |
| 5. | Taylor Brothers<br>Ambler and Adams Sts. | Cotton dress goods | Loom | ...... | 100 | Matte | Matte | 0.600 | | | | 1.5 |
| 6. | M. J. Smith Belting Co.<br>Wayne Ave. and Berkley (night) | Belting mfg. | Loom | 20.1 | 720 | Matte | Matte | 0.320 | 0.735 | 0.304 | 41.3 | 2.20 |
| 7. | M. J. Smith Belting Co.<br>Wayne Ave. and Berkley | Belting mfg. | Loom | 20.1 | 720 | ........... | ........... | ...... | ...... | ...... | | |
| 8. | M. J. Smith Belting Co.<br>Wayne Ave. and Berkley | Belting mfg. | Loom | 20.1 | 720 | ........... | ........... | ...... | ...... | | | |
| 9. | M. J. Smith Belting Co.<br>Wayne Ave. and Berkley (day) | Belting mfg. | Loom | 20.1 | 720 | ........... | ........... | | | | | |
| 10. | M. J. Smith Belting Co.<br>Wayne Ave. and Berkley | Belting mfg. | Loom | 20.1 | 720 | ........... | ........... | ...... | ...... | | | |
| 11. | M. J. Smith Belting Co.<br>Wayne Ave. and Berkley | Belting mfg. | Loom | 20.1 | 720 | ........... | ........... | ...... | ...... | | | |
| 12. | Shenn Mfg. Co.<br>314 Arnot St. | Towel and wash rag mfg. | Loom | 22.6 | 286 | Matte | Matte | 0.400 | 0.500 | 0.140 | 28.0 | 1.21 |
| 13. | John Sidebotham<br>4317 Griscom St. | Tape mfg. | Loom | 30.5 | 640 | Matte | Semi-matte | 0.742 | 0.430 | 0.154 | 36 | 0.942 |
| 14. | John Sidebotham<br>4317 Griscom St. | Tape mfg. | Loom | 30.5 | 640 | ........... | ........... | ...... | ...... | | | |
| 15. | American Pile Fabric Co.<br>Adams Ave. and Wingohocking | Plush mfg. | Inspec. | 100 | 75 | Semi-matte | Semi-matte | 0.474 | 0.191 | 0.191 | | 1.1 |
| 16. | D. B. Flower<br>1317 Spring Garden St. | Brass machine shop | Machine shop | 100 | 80 | Spec. | Spec | | | | Above 40 | |
| 17. | American Metal Works<br>Stenton and Rockland Sts. | Radio and electrical goods | Turret lathes | 37.2 | 50 | Spec. | Spec | .. | | | Above 40 | |
| 18. | American Metal Works<br>Stenton and Rockland Sts. | Radio and electrical goods | Turret lathes | 37.2 | 50 | ........... | ........... | ...... | ...... | ...... | | |
| 19. | American Metal Works<br>Stenton and Rockland Sts. | Radio and electrical goods | Turret lathes | 37.2 | 50 | ........... | ........... | ...... | ...... | ...... | | |
| 20. | Decorative Lamp & Shade Co.<br>307 N. 8th St. (wood shop) | Lamp and shade mfg. | Wood-working shop | 100 | 1,430 | Matte | Spec | 0.259 | 0.383 | 0.139 | 36.3 | 1 |
| 21. | Decorative Lamp & Shade Co.<br>307 N. 8th St. (metal shop) | Lamp and shade mfg. | Metal shop | 100 | 2,850 | Spec. | Spec. | 0.295 | 0.294 | 0.070 | 23.6 | |
| 22. | B. Wilmsen<br>2444 Jasper St. | Xmas tree ornaments | Wire drawing | 44.8 | 2,898 | Spec. | Spec | 0.250 | 0.021 | 0.019 | 56.5 | 2.86 |
| 23. | Martell Mills<br>Chester, Pa. | Cotton spinning | Splicing | 66.6 | 500 | Matte | Semi-matte | 0.567 | 0.663 | 0.014 | 7.1 | 2.20 |
| 24. | American Pile Fabric Co.<br>Adams Ave. and Wingohocking | Plush mfg. | Loom | ...... | ...... | Matte | Matte | **0.427** | **0.587** | **0.001** | **0.17** | **1.23** |

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* H.H. = Hanging height.

this would be true if the operation were carried on in total darkness, and the only improvement that better illumination could produce would be to speed up adjustments when the machine is not running.

Let $M_1$ represent the percentage of time during which the machine is running and $m_1$ the percentage of time spent in hand adjustments with the machine stopped. It is quite evident then that $M_1K$ is equivalent to the amount of handwork completed and $m_1k$ is equal to the time spent in doing this work, where $K$ and $k$ are constants depending upon the nature of the task. If we take speed as the reciprocal of time, it is evident that $\frac{M_1}{m_1} K =$ the speed of handwork where $K$ is a constant.

If by the use of better illumination we succeed in reducing the percentage of time spent in making hand adjustments so that the ratio now becomes $\frac{M_2}{m_2} K$, it is evident that:

$$100 \times \left( \frac{\frac{M_2}{m_2} K - \frac{M_1}{m_1} K}{\frac{M_1}{m_1} K} \right) = \left( \frac{M_2 m_1}{M_1 m_2} - 1 \right) \times 100 =$$

per cent increase in speed of handwork.

For example, suppose that a loom is operating 80 per cent of the time, the remainder being spent in hand adjustments, and by means of good illumination this percentage is increased to 85. Then the increase in speed of handwork would be:

$$\left( \frac{85 \times 20}{80 \times 15} - 1 \right) \times 100 \doteq 41.5 \text{ per cent.}$$

*ystems on factory production and labor turnover*

| Old System | | | | | Daylight | | | | New System | | | | Per Cent Increase in Production | | Wages | | No. of Oper-ators | Addi-tional Light-ing Cost Per Cent Payroll | Weekly Payroll Dollars per Sq.Ft. of Floor Area | Additional Lighting Cost per Week Dollars per Sq.Ft. Floor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Description | Av. F.C. | Var. Fac. | Var. Range | Shadows | Av. F.C. | Var. Fac. | Var. Range | Shadows | Description | Av. F.C. | Var. Fac. | Var. Range | Over-all | Hand-work | Dollars per Week | Basis | | | | |
| re 100 w. | 6.2 | 1.5 | 4.2 | Dense | ..... | Negl | igible | ........ | R.L.M. 200 w. 9 ft. H.H. | 17 | 1.4 | 2.0 | 6.3 | 155 | 22 | Day | 6 | 0.76 | 0.972 | 0.0074 |
| re 50 and 00 w. | 4.5 | 3.0 | 5.0 | Dense | | Negl | igible | | R.L.M. 200 w. 8 ft. H.H. | 17.2 | 1.6 | 2.5 | 10.8 | 43.7 | 25 | Day | 8 | 7.45 | 1.54 | 0.115 |
| allow 100 w. 0 ft. H.H. | ..... | 1.6 | ...... | Medium | 8.8 | 1.6 | 3.3 | Medium | R.L.M. 200 w. 8 ft. H.H. | 17.3 | 1.4 | 1.7 | 3.9 | 15.7 | 75 | Piece | 2 | 0.36 | 0.857 | 0.00309 |
| allow 100 w. 0 ft H H. | 7.2 | 2.2 | ...... | Dense | ..... | ...... | ...... | ........ | R.L.M. 200 w. 8 ft. H.H. | 17.3 | 1.4 | 1.7 | 5.75 | 25.5 | 60 | Piece | 2 | 0.45 | 0.686 | 0.00309 |
| ne 50 w., ft. H H. | 1.8 | 1.4 | 2.5 | Dense | ..... | ...... | ...... | ........ | R.L.M. 75 w., 8 ft. H.H. | 8.8 | 1.1 | 2.2 | 25 | ...... | 16 | Piece | 1 | 1.4 | 0.160 | 0.00224 |
| at tin 50 w., t. H.H. | 1.9 | 1.8 | 4.4 | Dense | ..... | ...... | ...... | ........ | R.L.M., 75 w., 9.5 ft. H.H. | 3.7 | 1.35 | 2.78 | 1.85 | 10 | 40 | Piece | 2 | 1.865 | 0.111 | 0.00095 |
| .......... | ..... | ..... | ...... | ........ | ..... | ...... | ...... | .... | R.L.M 100 w., 9.5 ft. H.H. | 4.74 | 1.47 | 3.5 | 2.18 | 11.6 | ...... | ...... | 2 | 1.15 | 0.111 | 0.00127 |
| .......... | ..... | ..... | ...... | ........ | ..... | ...... | ...... | ........ | R.L.M. 150 w., 9.5 ft. H.H. | 9.66 | 1.34 | 1.71 | 3.22 | 18.5 | ...... | ...... | 2 | 1.73 | 0.111 | 0.0019 |
| .......... | ..... | ..... | ...... | ........ | ..... | ...... | ...... | ........ | R.L.M. 75 w., 9.5 ft. H.H. | 3.7 | 1.35 | 1.97 | 13.95 | 157.5 | ...... | ...... | 2 | 1.55 | 0.150 | 0.00233 |
| ....... | ..... | ..... | ...... | ........ | ..... | ...... | ...... | ........ | R.L.M. 100 w., 9.5 ft. H.H. | 4.74 | 1.47 | 3.5 | 16.75 | 250 | ...... | ...... | 2 | 1.07 | 0.150 | 0.00155 |
| .......... | ..... | ..... | ...... | ........ | ..... | ...... | ...... | ........ | R.L.M. 150 w., 9.5 ft. H.H. | 9.60 | 1.24 | 1.71 | 19.8 | 460 | ...... | ...... | 2 | 0.78 | 0.150 | 0.00117 |
| ne 75 w., ft H H. | 3.3 | 6.1 | 100 | Dense | 1.2 | 4.6 | 39 | Dense | R.L.M. 75 w., 8 ft. H.H. | 10 | 1.1 | 1.2 | 16 | 150 | 20 | Piece | 4 | 13.6 | 0.070 | 0.0952 |
| re 75 w, 0 ft H H | 6.8 | 1.5 | 2.9 | Dense | ..... | ...... | ...... | Dense | Indirect 200 w., 7 ft. H.H. | 7.9 | 1.1 | 1.7 | 7.7 | 30.9 | 25 | Piece | 4 | 3.1 | 0.156 | 0.005 |
| .......... | ..... | ..... | ...... | ........ | ..... | ...... | ...... | ........ | Indirect 300 w., 7 ft. H.H. | 15.5 | 1.1 | 1.7 | 11.1 | 48 | ...... | ...... | ..... | 4.3 | ....... | 0.00671 |
| L M. C2, lear 100 w., ft. H. H. | 43 | 1.2 | 1.7 | None | 3.0 | 1.7 | 5.0 | Negli-gible | R.L.M. C2 Frosted, 150 w. 5 ft. H.H. | 55 | 1.4 | 1.8 | 42 | 42 | 21 | Piece | 5 | 0.97 | 1.40 | 0.0136 |
| re 50 w, ft. H H. | 3.4 | 1.8 | 12 | Dense | ..... | ...... | ...... | Dense | R.L.M. 100 w., 8 ft. H.H. | 8.7 | 1.4 | 3.7 | 3 | 3 | 40 | Day | 1 | 0.80 | 0.500 | 0.004 |
| ep bowl 50 , 6 ft H H | 11.6 | 1.94 | 7.5 | Dense | 2.5 | 1.2 | 1.3 | Dense | R.L.M. 200 w., 8 ft. H.H. | 20 | 1.3 | 2.1 | 12.35 | 42 | 31.50 | Piece | 1 | 1.71 | 0.63 | 0.0108 |
| .......... | ..... | ..... | ...... | ........ | ..... | ...... | ...... | ........ | R.L.M. 150 w., 9 ft. H.H. | 14 | 1.3 | 1.8 | 6.73 | 20 | ...... | ...... | ..... | 1.13 | ....... | 0.0071 |
| .......... | ... | | . | . | . | ... | ... | . | R L M 100 w, 9 ft. H.H. | 7.4 | 1.2 | 1.6 | 2.25 | 6.2 | | | | 0.625 | | 0.004 |
| re 50 w, ft H H | 4.5 | 2.1 | 1.4 | Dense | 4.5 | 1.1 | 5.0 | Dense | R.L.M. 200 w., 9 ft. H.H. | 25 | 1.4 | 3.5 | 20.9 | 20.9 | 25 | Day | 6 | 0.720 | 0.105 | 0.00075 |
| re 50 w, ft H H | 3.3 | 2.1 | 1.4 | Dense | 2.0 | 3.5 | 14.0 | Dense | R.L.M. 200 w., 9 ft. H.H. | 15 | 1.5 | 3.1 | 18.1 | 18.1 | ...... | ...... | 9 | 1.23 | 0.0787 | 0.00096 |
| ne 50 w, 5 ft H H | 2.9 | 1.9 | 4.3 | Dense | 29.6 | 2.0 | 15.0 | Dense | R.L.M. 75 w., 9 ft. H.H. | 9.2 | 1.2 | 1.4 | 16.5 | 46 | ...... | Piece | 12 | 1.13 | 0.0871 | 0.00098 |
| allow 75 1 ft. H H | 4.7 | 2.3 | 7.5 | Dense | 6.6 | 2.1 | 10 | Dense | R.L.M. 200 w., 10 ft. H.H. | 27.5 | 1.3 | 1.7 | 7.8 | 12 | 21 | Piece | 8 | 0.22 | 0.272 | 0.000605 |
| e 50 w, ft. H H | 10 | 1.6 | 2.9 | Medium | 2.0 | 1.5 | 3.0 | Negli-gible | R.L.M. 75 w., 5 ft. H.H. | 13 | 0 | 0 | 15 | ...... | 40 | Piece | ..... | ....... | ....... | ......... |

From this equation it is quite evident that where a large percentage of the operation is automatic, it is necessary to bring about a very large increase in speed of handwork if we are to show any appreciable net increase in production.

### Discussion of Results

*Shadows and Production.*—A careful study of cases 13 and 14 (the Sidebotham mills, see Table I) will show that a mere raising of average intensity of illumination had very little direct effect in improving production. In fact some preliminary figures taken at this plant seemed to indicate, notably in the case of the "Glassteel" diffuser, that increasing intensity served merely to make the shadows harsher. The following records will give some idea of the close relation between production and shadows:

| System | Average Foot-Candles | Variation Factor | Production Increase, Per Cent |
|---|---|---|---|
| Bare drop | 6.78 | 1.48 | 0 |
| Glassteel | 19.8 (harsh shadows) | 3.85 | Negligible |
| RLM | 12.32 | 1.46 | 3.85 |
| Indirect | 7.9 | 1.09 | 7.70 |
| Indirect | 12 | 1.09 | 11.00 |

These results are confirmed by the following figures taken from cases 17, 18 and 19 (the American Metal Works):

| System | Average Foot-Candles | Variation Factor | Production Increase, Per Cent |
|---|---|---|---|
| Deep bowl reflector with bare lamps | 11.6 | 1.94 | 0 |
| RLM (BE lamps) | 7.4 | 1.21 | 2.25 |
| RLM (BE lamps) | 14 | 1.3 | 6.73 |
| RLM (BE lamps) | 20 | 1.3 | 12.35 |

In both cases it will be noted that production was increased by reducing shadows, even when the foot-candle intensity was lowered. After objectionable shadows had been eliminated production increases were consistent.

These results are further confirmed by those at the Martell mills. Here variation factor was reduced only from 2.3 to an average of 1.3 and the variation range from 7.5 to 1.7. A production increase of 7.8 per cent was then noted. After this change had been made no consistent difference in speed of work was noted at several illumination levels varying from 7 to 40. This was also true in case 6 (the M. J. Smith Belting Company), where variation factor was reduced from 1.8 to 1.35, and case 5, where the variation factor was reduced from 1.4 to 1.1.

In cases 3 and 4 (the Realart Silk Hosiery Company) the variation factor was reduced from 1.6 to 1.4 in the daytime and from 2.2 to 1.4 at night. The fact that production could be increased 3.9 per cent in broad daylight where the natural illumination was excellent and the only function of artificial lighting was to dispel the shadow of operator, caused by the vertical windows, demonstrates conclusively the important relation that exists between shadows and production. The higher percentage of increase on the night shift, when the shadows are more dense than in the daytime, also serves to illustrate this point.

A study of the tabulated records shows that in practically every case the change to a modern system of illumination involved a substantial decrease in variation factor, all of which goes to show that proper distribution and diffusion of light are of fully as great importance in production operations as mere light intensity, if not of greater importance.

*Direction and Character of Reflections.*—We frequently hear the statement made that in case of doubt a uniform system of 200-watt RLM's on 10-ft. centers is good illumination. One of the objects of this series of tests was to find sales arguments that would enable us to convince officials of machine tool shops that their lighting problems could best be solved by means of fixed overhead units instead of adjustable drop lights. Experiments in this direction were commenced in the plant of the Progressive Foundry & Machine Company.

Since this shop was engaged in experimental work, it was not possible to get any exact figures on production. Careful tests conducted with an experienced machinist showed that 20 to 25 foot-candles of well-diffused light was necessary to read a micrometer and set a tool to the best advantage.

In order to throw the reflected images of the lighting unit away from the operator, the best position of the unit was fixed at 8 ft. above the floor directly over the operator's right shoulder. A 150-watt bowl enameled lamp in an RLM dome gives excellent results when the lamp is new and the reflector is clean. This method was tried in several jobbing machine shops with lathes, millers and shapers. In the case of small planers, the unit was mounted directly above the bed.

In order to verify the correctness of these deductions two tests were later conducted, one on a drill press at the plant of D. W. Flower and the other on a turret lathe at the plant of the American Metal Works. The factory records for the drill press showed a production increase of 3 per cent, although the foot-candle intensity was increased only from 3.4 to 8.7. Due to lack of uniformity of tasks performed there was no opportunity to check the figures.

The test on the turret lathe was conducted under more favorable conditions and the results were even more significant. When the glare conditions were corrected and shadows reduced and directed in such a manner as to do the least harm, the production was increased 2.25 per cent, although the foot-candle intensity was actually reduced from 11.1 to 7.7. When the proper distribution of light had been secured, raising the foot-candle intensity to 20 increased the production 12.35 per cent above what it was under the old conditions.

Our experience in various industries has convinced us that in a very large percentage of plants each machine or group of machines or operations should be considered as a unit by itself and be lighted by fixed units of relatively high power. This makes it possible to give the proper consideration to reflections, also high-intensity light can be concentrated in the working area. A fixed unit is in most cases preferable to an adjustable unit, since experience shows that rarely does an operator possess the ability to keep an adjustable unit in the correct position. It is much better to find the best all-around position for lighting unit and keep it there than to allow every operator to adjust the lights. We cannot expect a machinist to be an illuminating engineer.

*Character and Reflection Factor of Surfaces in the Field of Vision.*—Closely allied to the foregoing items is the question of contrast in reflection factor between the work and the background. It is of course self-evident that black on gray cannot be seen as easily under a given condition of illumination as black on a white background. A much higher intensity is necessary to secure the same degree of visibility in the former case. It is to be expected therefore that these tests would show

## Table II—Illumination Details of Fourteen Factories Studied

| Name | Present Illumination | | Variation Factor | Shadows | Reflection | Background Contrast | Visual Angle in Minutes | Natural Illumination | Calculated | Actual | Per Cent Error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Excellent | | 0 to 2.2<br>0 | Negligible<br>0 | Diffuse<br>0 | Below 10<br>0 | Over 3<br>0 | Excellent | | | |
| | Fair | | 2.2 to 3<br>5 | Medium<br>2.5 | Specular<br>5 | 10 to 40<br>5 | 1.1 to 3<br>2.5 | Fair<br>5 | | | |
| | Bad | | Over 3<br>10 | Dense<br>5 | Glare<br>10 | Above 40<br>10 | 0 to 1.1<br>5 | Bad<br>10 | | | |
| Philadelphia Sweater | Bad | Excellent | 10 | 5 | 5 | 0 | 8 | 10 | 38 | 43.7 | —13 |
| Realart Hosiery (3) | Fair | Excellent | 0 | 2.5 | 5 | 2.5 | 4 | 2.5 | 16.5 | 15.7 | + 5.1 |
| Realart Hosiery (4) | Fair | Excellent | 0 | 7.5 | 5 | 2.0 | 4 | 5 | 24 | 25.5 | — 5.88 |
| M. J. Smith (6) | Bad | Bad | 0 | 7.5 | 0 | 0 | 0 | 0 | 7.5 | 10 | —25 |
| M. J. Smith (7) | Bad | Fair | 0 | 7.5 | 0 | 5 | 2 | 5 | 19.5 | 11.6 | +68 |
| M. J. Smith (8) | Bad | Excellent | 0 | 7.5 | 0 | 10 | 4 | 10 | 31.5 | 18.5 | +70.3 |
| John Sidebotham (13) | Bad | Fair | 0 | 7.5 | 0 | 5 | 4 | 5 | 21.5 | 30.9 | —30.4 |
| John Sidebotham (14) | Bad | Excellent | 0 | 7.5 | 0 | 10 | 8 | 10 | 35.5 | 43 | —17.4 |
| American Metal (18) | Bad | Bad | 0 | 7.5 | 0 | 0 | 0 | 0 | 7.5 | 6.2 | +21 |
| American Metal (19) | Bad | Fair | 0 | 7.5 | 5 | 5 | 0 | 5 | 22.5 | 20.2 | +11.5 |
| American Metal (20) | Bad | Excellent | 0 | 7.5 | 10 | 10 | 0 | 10 | 37.5 | 42 | —10.7 |
| Decorative Lamp, wood | Bad | Fair | 5 | 5 | 2.5 | 5 | 4 | 5 | 26.5 | 20.09 | +31.9 |
| Decorative Lamp, metal | Bad | Fair | 5 | 5 | 0 | 2.5 | 4 | 5 | 21.5 | 18 | +19.4 |
| B. Wilmsen | Bad | Excellent | 0 | 7.5 | 10 | 10 | 4 | 0 | 31.5 | 46 | —31.5 |
| Average error, per cent | | | | | | | | | | | + 6.66 |

some indication of the practical importance of this particular item. Referring to Table I, we see that all the seven cases where the background contrast was more than 35 per cent (Nos. 1, 6-11, 13-14, 16, 17-19, 20 and 22) showed increases in speed of handwork of 20 per cent or over (contrast as used here is minimum reflection factor divided by the maximum). These figures prove beyond a shadow of doubt that background contrast has an influence on the character of the lighting system required and must be considered in laying out any system of productive illumination.

Dr. Ferree and Dr. Rand in a paper read before the 1926 convention of the Illuminating Engineering Society showed that the illumination intensity necessary to secure maximum speed of vision varies widely with the difference in brightness between the object viewed and the background. The highest contrast values used in their tests correspond to a value of 25 per cent as recorded in this paper. But even at this value and with a visual angle of one minute, it was necessary to employ an intensity of 68 foot-candles before the speed of vision curve began to flatten out.

The practical value of this phase of the problem was especially noticeable in two cases, although no extensive tests were conducted. One was in case 13, where a piece of black oilcloth used as a background for white yarn greatly lightened the task of perceiving broken ends. The other was in the case of a surface grinder in a linotype factory. Here the operator fastened a piece of white paper as a background for his grinding wheel. Improvement in the quantity and quality of his work was noted.

*Visual Angle and Illumination.*—Visual angle has always been recognized as having an important bearing on the character of illumination. The following figures are taken from five different textile mills where the handwork is similar in character:

| Location | Visual Angle, Minimum | —Foot-Candles— Old | New | PerCent Increase in Speed of Handwork |
|---|---|---|---|---|
| Realart | 0.552 | 7.2 | 17.3 | 25.8 |
| Sidebotham | 0.942 | 6.8 | 15.5 | 48 |
| Shenn Mfg | 1.21 | 3.3 | 10 | 150 |
| Smith, M. J | 2.2 | 1.9 | 9.7 | 18.5 |
| Reid | 5.83 | 6.2 | 17 | 370 |

In each of these cases the illumination was very bad. A glance at the figures will show that for angles of 0.5 minute and above there is no reason to believe that illumination will speed up production more with a small visual angle than with a large angle. Of course these results cannot be taken as meaning that visual angle has no bearing on the behavior of a lighting system, but rather that visual angle is by no means the deciding factor.

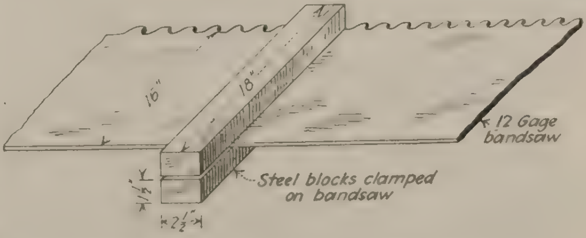
Dr. Ferree and Dr. Rand in the paper referred to have also shown that higher intensities of illumination are absolutely necessary as the visual angle decreases, if we are to maintain the same speed of vision.

In attempting to reconcile these results with practice, however, we find that since the visual angle varies so widely every time the worker moves his head, it is almost impossible to strike a fair average by any method developed up to the present time. This will partly account for some of the discrepancy between the results of this investigation and the findings of Dr. Ferree.

The second part of Mr. Brainerd's paper, giving illustrative examples of practical applications in quality industrial lighting, will appear in an early issue of ELECTRICAL WORLD.

## Reducing Sawmill Fire Hazard

REDUCED fire hazard, absence of scale, cleanliness and greater uniformity of welds are factors that are leading sawmills of the Pacific Northwest to use electric muffle furnaces in the saw-filing shop for annealing silver-soldered joints in band saws. The usual practice is to replace the small blacksmith's forge with a standard 7½-kw., 220-volt, non-automatic muffle furnace for heating the annealing blocks. After a band saw has been mended with silver solder the steel-annealing blocks, which have been heated to a temperature of 1,600 deg.



METHOD OF APPLYING ELECTRICALLY HEATED STEEL BLOCKS TO HEAT TREATING OF BAND SAW JOINTS

C. in the furnace, are clamped onto the saw and allowed to remain for about 30 minutes while cooling and completing the heat-treating process. About 1½ hours of pre-heating of the blocks in the furnace is required to raise them to a uniform temperature of 1,600 deg. C.

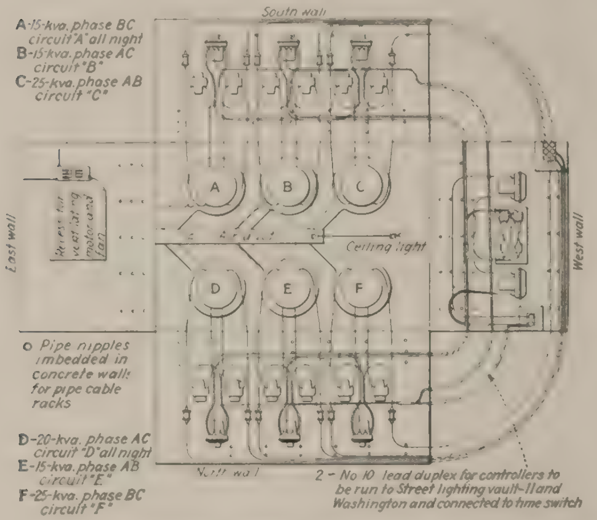
Energy consumption is of secondary importance when the advantages of the electric furnace are taken into consideration.

## Cable Layout Aids Splicers

By T. W. Swartz

*Assistant Engineer Underground Department, Northwestern Electric Company, Portland, Ore.*

FURNISHING cable splicers with a cable layout, such as that shown in the accompanying diagram for a transformer vault, has been found by the Northwestern Electric Company, Portland, Ore., to result in a much neater, safer and more economical job. As will be seen from the diagram the four walls and floor of the vault are laid out in the same plane. This gives the splicers a picture of what the cable layout should look like when the vault is completely wired and enables them to go about their work in an orderly and efficient manner.


South wall
A-15-kva. phase BC circuit "A" all night
B-15-kva. phase AC circuit "B"
C-25-kva. phase AB circuit "C"
A
B
C
D
E
F
East wall
Recess for ventilating motor and fan
Ceiling light
West wall
o Pipe nipples imbedded in concrete walls for pipe cable racks
D-20-kva. phase AC circuit "D" all night
E-15-kva. phase AB circuit "E"
F-25-kva. phase BC circuit "F"
North wall
2 - No 10 lead duplex for controllers to be run to Street lighting vault-11 and Washington and connected to time switch

OFFICE PLANNING OF VAULT CABLE LAYOUT SAVES TIME AND AVOIDS CONFUSION IN THE FIELD

List of Material

| Number | Description |
|---|---|
| 2 | 25-kva. constant current transformers |
| 1 | 20-kva. constant current transformer |
| 3 | 15-kva. constant current transformers |
| 2 | 400-amp. oil switches |
| 12 | 50-amp. oil fuse cutouts |
| 6 | Subway controllers |
| 12 | Disconnecting potheads, 100 amp |
| 2 | 200-volt-amp. potential transformers |
| 2 | 100-amp. current transformers |
| No. 2 | Three-conductor, 2,400-volt lead cable |
| No. 2 | One-conductor, 2,400-volt lead cable |
| No. 8 | One-conductor, 5,000-volt lead cable |
| No. 10 | Duplex lead control cable |
| 1 | 24-in.x48-in.x12-in. instrument transformer box |
| 1 | 12-in.x26-in.x6-in. metal box, vault-service |
| 1 | 60-amp., three-pole S.T. switch-motor control |
| 1 | 30-amp., three-pole S.T. switch |
| 1 | 30-amp., two-pole fuse block for vault-lights |

Formerly it was left to the cable foreman to work out his own vault cable plan in the field. This method has given way to the present plan, whereby careful engineering in the office in advance avoids lost time and confusion in the field. This plan has been followed for several years and is particularly advantageous for large and complicated vault layouts.

## Restoring Service After Flood at Burlington

DURING the flood in the Winooski Valley of Vermont last November the water rose 27 ft. above the crest of the dam at the Gorge plant of the Burlington Light & Power Company, flowing over the roof of the old 1,500-kw. hydro station and submerging the condenser pump of the 2,500-kw. auxiliary steam plant, which was safely located on the west bank of the Winooski River. The 4,800-kw. station at Essex was flooded from the tailrace back-up to a depth of 20 ft. above the operating room floor. Essex was shut down at 4:30 a.m., Friday, Nov. 4, and as the Gorge hydro plant was also flooded it became necessary to concentrate energy first upon putting the auxiliary steam plant in service at the top of the Gorge. This steam plant had not been in operation for a month and the boilers were in winter quarters, as it were. The main boiler-feed pumps were under water in the old Gorge plant. By 1 p.m., Friday, the steam plant was put in service, running non-condensing and supplying a load of about 800 kw. to such important customers as the newspapers, bakeries, two hospitals and the U. S. Army post at Fort Ethan Allen. Feed water was obtained by a 3-in. connection with the Winooski municipal water system. On Saturday the water had run out of the Gorge hydro station sufficiently to permit operating the feed pumps and the load was increased to 1,200 kw. By Monday it was possible to operate condensing in time for supplying the power load. Material aid was given, through a tie line, by the Vergennes plant of the Peoples Hydro-Electric Vermont Corporation during the first week after the flood, and efforts were made to obtain help from the city steam plant at Burlington, but these were unsuccessful. The interconnection with the Fairfax plant of the Public Electric Light Company of St. Albans did not serve as the generators of the latter were wet and trouble occurred from coil burnouts.

Rehabilitation of hydro-electric supply was based upon the plan of putting an engineer and four expert wiremen at each station, with the added help of General Electric wiremen and winders on apparatus. The U.G.I. interests of Philadelphia sent engineers and wiremen to Burlington and the entire construction crew at work on the new 3,000-kw. Gorge hydro-electric development opposite the old Gorge station was turned over to the rehabilitation job. These men moved an 8-in., 50-hp. motor-driven condenser pump from the Gorge to Essex and installed this with two other pumps to help clear the station. The company's river crossing between the Gorge and Essex was washed out and a temporary line was shot across by the Burlington company's line department in co-operation with the New England Telephone & Telegraph Company's field forces and put in operation by Sunday evening.

Before power was obtained efforts were made to siphon out the water from the Essex station, using fire engines and sewer pumping outfits. The large motor-driven pumps rapidly lowered the water level, and on Sunday night it was all pumped out, leaving 2 ft. of mud on the floor under a great mass of lumber and refuse which the flood had carried in through the windows. Seventy men were put in the plant to carry out the refuse, shovel the mud into barrows and wheel it up runways to the windows overlooking the tailrace, whence it was ejected.

At the same time the apparatus was being washed out with water under pressure. Twelve salamanders were assembled by punching holes in transil oil drums, inserting a home-made grate of flat rods in each and mounting on non-combustible bases, coke being used as fuel. Six of these outfits were also built for the Gorge plant. Windows were boarded up, electric ovens built and the drying out process started. By Tuesday morning the floor at Essex was dry and two loads of sawdust were put down. One generator and one waterwheel-driven exciter were boxed in and external heat applied by using trolley car heaters, bathroom spot heaters, etc., and these machines were running on dry-out five days after the shut-down.

About 2 miles of 33-kv. and 13-kv. lines were down between Essex and Montpelier and this reconstruction was accomplished by a line crew and truck sent to Vermont by the Suburban Counties Company, despite great handicaps in highway communication. A truck with an exciter, oil drier, megger, transformers and tools was also sent to Burlington from the U.G.I. headquarters. This exciter made it possible to carry load at Essex fourteen days after the machines were submerged.

At the Gorge plant water poured in the upstream windows behind the switchboard, but due to the floor openings to the tailrace water did not stand very deep (about 2 ft.) on the floor and ran out as soon as the flood subsided. One generator at the Gorge hydro plant was put in service Nov. 13 and all machines were available Nov. 20 at Essex. The first machine went back into service on the same day. At both plants it was necessary completely to rewire all panels and to renew all non-lead-covered cable and control wire. A good feature at Essex in the original plant design was the use of lead-covered cable and potheads on the generator and exciter leads and of lead-covered wire for station lighting. It was possible to salvage most of the equipment, including 87 out of 90 instruments and meters.

Equipment that could not be salvaged on the job included potential transformers and the majority of current transformers, bellows type relays and some shunt field coils on exciters. One field winding on an Essex generator had to be reinsulated from the pole piece, and it is expected that next summer the other machine fields will have to be similarly treated.

ILLUMINATION IN METER DEPARTMENT WAS DESIGNED FOR THE DETAIL WORK INVOLVED

# Modern Lighting in a Service Building

By Willard Allphin

*Lighting Engineer*

*Fall River (Mass.) Electric Light Company*

THE new service building of the Fall River Electric Light Company is equipped with lighting of the most approved type, not because of the advertising value of high intensity illumination, but because executives of the company are convinced that good lighting will pay dividends in safety and comfort for the workers, and in increased production. The illumination in any room is no more elaborate than could be conscientiously recommended to a customer for the same type of room.

DARK CORNERS AVOIDED IN REPAIR SHOP

The main office is lighted by 300-watt totally indirect fixtures of the luminous bowl type. These are mounted on 11x12-ft. centers and give an intensity of 12 foot-candles on the usual plane 30 in. above the floor. The drafting room is lighted to an intensity of 25 foot-candles by 500-watt totally indirect, opaque bowl fixtures, on 11-ft. centers. The distribution superintendent's office contains two 300-watt totally indirect units of the luminous bowl type, giving an intensity of 12 foot-candles. The other private offices differ only in being smaller and containing but one fixture. In the main section of the meter department, 200-watt RLM domes are used on 10x11-ft. centers, providing 10 foot-candles of light.

WORK ON STREET-LIGHTING EQUIPMENT MADE EASIER BY ADEQUATE ILLUMINATION

High intensity lighting for fine repairs is provided by two 500-watt "Glassteel" diffusers which give an intensity of 30 foot-candles. Over the meter racks, 200-watt extensive type prismatic reflectors are used to obtain 8 foot-candles on the vertical surfaces of the meters. Illumination in the street lighting department, the underground department and all similar shops and workrooms is furnished by 200-watt RLM domes.

Bowl white lamps are used throughout in all RLM domes, and all direct reflectors are suspended on conduit with aligners at the outlet boxes. Mounting heights are consistent with the rule that the spacing shall not be more than one and one-half times the mounting height above the working plane. Duplex convenience outlets were installed liberally throughout the building.

Our janitor has been carefully instructed in the methods of cleaning the various types of fixtures and is required to sign a cleaning chart, ruled for months and rooms, each time he cleans the fixtures. The foreman in charge of the building sees that each square is signed every month.

Although the lighting was put in entirely on its own merits, it has been found a valuable sales help in demonstrating office, drafting room and industrial lighting to customers. The cost of the lighting installation was 4 per cent of the total cost of the building.

## Substation Has Publicity Value

By Stanley Stokes

*Power Supervisor Union Electric Light & Power Company*
*St. Louis, Mo.*

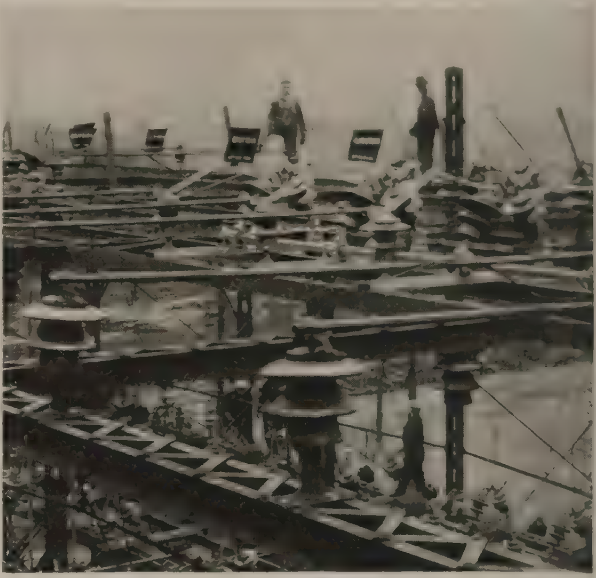
A CONSPICUOUSLY good example of bringing to the public consciousness at least one phase of the utility business is afforded by the Cahokia substation of the Union Electric Light & Power Company at East St. Louis, Ill. This station, which is an impressive structure by day, becomes more spectacularly interesting at night, when it looms up out of the darkness under well-designed and adequate illumination.

Nineteen floodlighting units are used, eleven 500-watt lamps being placed along the top of the structure and on the fence and eight 200-watt sources at a lower level. An energy consumption of 8.1 kw.-hr. per hour offers a strikingly vivid and convincing advertisement of electric service. Since the lighting is a necessary part of the station-operation equipment, its installation cost can be so charged, leaving the energy as the sole cost of the advertisement.

FLOODLIGHTS TRANSFORM SUBSTATION TO A CONSPICUOUS UTILITY ADVERTISEMENT

## Safety for Outdoor Substations

PROTECTION for operating and maintenance men in outdoor substations is one phase of the safety work of the Utica Gas & Electric Company, Utica, N. Y. This activity is under the direction of N. E. Emmons, superintendent of maintenance. Red flags are suspended around roped-off areas in sections where work is being done in outdoor substations and it is the duty of the safety guard in charge to see that these boundaries are not overstepped. Insistence upon safety is the sole function of this man and his word is final. The only way in which his orders can be negated is by removing him from the job under orders of the superintendent of maintenance or general superintendent. The results of this plan have been highly satisfactory in reducing accidents.



SAFETY MAN ESTABLISHES WORKING ZONE

In this 44-kv. yard the flags on a rope fence mark working limits. The safety man who is always on every job of such a nature stands close to the column. Only the particular bay on which the men are working is dead. The boundary flags constitute the "dead line" on both the second and top elevation of the structure.

This company also follows the somewhat unusual procedure of testing rubber gloves and protectors weekly. The expense of this work is, of course, greater than where the tests are not performed so frequently, but defective material is encountered upon every weekly test, indicating the value of such frequent checks.

All equipment is fully labeled in outdoor substations. Warning signs for company men, indication of duty of all equipment, line and phase notations and opened and closed positions of all operating levers are clearly marked. Phase designations are shown on each breaker tank as well as under the buses, thus minimizing errors in cutting in a new job. A red circle with an arrow is placed on the oil switch housing. There is also a red light in connection with this particular location. These are to draw attention to the emergency handle for the oil circuit breakers.

# Protective Grounding

## A discussion of the recommended practices of the National Electrical Manufacturers' Association

### By S. W. Borden*

TO ESTABLISH uniform methods of construction and installation which will do away, in so far as possible, with electrical fire and shock hazards the National Electrical Manufacturers' Association has recently studied and approved certain practices for protective grounding. The recommended practices of the N.E.M.A. are given elsewhere on this page. The desirability of protective grounding is generally conceded, and the circuits installed for this purpose are often referred to as "safety circuits." The greatest single element of resistance in a safety circuit is usually the resistance to the flow of current away from the earth electrode into the surrounding earth. Urban and most suburban districts are equipped with general water-supply systems which, for the most part, constitute an adequate, economical and convenient earth electrode for electrical safety circuits. In rural and farming districts and in some industrial establishments where no such suitable earth electrode is available an artificial ground must be resorted to.

Fig. 1 is a schematic wiring diagram which is more or less characteristic of industrial-plant installations. The effectiveness of any system of protective grounding depends upon its ability to provide protection under both normal and abnormal conditions and to remain intact and in proper working order irrespective of such changes in the wiring system itself as are liable to take place in the normal course of operation. The most severe abnormal conditions are encountered when the higher voltage of a primary system, a series street-lighting system or a trolley feeder finds its way to the secondary wiring, or when a failure occurs in the insulation of a wire in a metal wire inclosure or in the insulation of some appliance or equipment which permits one of the conductors to come into contact with the metal inclosure. The more common changes in the wiring system which may be expected are the reversal of a pair of wires or the open-circuiting of a conductor either by the blowing of a fuse or otherwise.

When the safety circuit consists of the metal inclosure of the conductors there is little possibility of the safety circuit conductor and a working conductor being transposed. When a copper safety circuit is installed its use is obvious, and while electricians and laymen alike are accustomed to arranging two wires more or less indiscriminately, they are also accustomed to arranging three wires systematically since three-wire circuits must be so arranged to be operative. Safety-circuit conductors are clearly identified, as are the safety poles of plugs and receptacles, such poles being marked "Ground." It is suggested that "Safety" is a better marking, because "Ground" may be confused with "grounded wire."

Under normal conditions the neutral or white wire, which is connected directly to the water-piping system, is at earth potential. All of the metal work is likewise at earth potential. Between each of the other wires of the system and the earth there is a potential of 110 volts or more, and a person touching either of these wires, or anything in direct contact with these wires, is liable to receive a shock. There is no known method of effectively eliminating this latter hazard, but it may be reduced to a minimum by means of identified, polarized wiring.

Assume that a high potential from the primary system finds its way to the secondary system and a current flow of 50 amp. takes place. If the ground resistance is 2 ohms, then the grounded-circuit conductor will be raised to a potential above ground of 50 × 2, or 100 volts, and

## *Recommended Practices*

1. Wiring systems should be grounded "where" and "as" required by the National Electrical Code.

2. Non-current-carrying exposed metal parts of fixed equipment, etc., in industrial domestic and other locations should be grounded, with exceptions under certain conditions. Such an allowable exception might be for outlet boxes, fixtures, etc., in rooms of frame dwellings where containing no metallic piping or fixtures connected thereto.

3(a). In industrial locations, except offices, public utility stations and for industrial usages which have certain conditions and are therefore exempted, non-current-carrying exposed metal parts of detachable (portable) equipment should be grounded.

Exempted, except in hazardous, extra-hazardous and conductive locations, are detachable appliances which are not operated above 150 volts and inherently are sufficiently safeguarded against probability of harmful leakage from their exposed metal parts to persons or objects by reason of either (1) their infrequency of handling, (2) their assured degree of insulation between live parts and exposed metal parts, or (3) their inherent characteristics, leading to improbability of exterior metal parts touching persons or objects in such a way as to harm them.

Examples (1) General purpose ventilating fans; (2) "approved" general-purpose pressing irons.

3(b). In office, utility and dwelling locations, and in all other locations except industrial ones, non-current-carrying exposed metal parts of detachable equipment should be grounded where operating at over 150 volts.

3(c). In office, utility and dwelling locations, and in all other locations except industrial ones, non-current-carrying exposed metal parts of detachable equipment, where operating at less than 150 volts, need not be grounded.

4. Conduit with fittings, armored cable sheath with fittings, metal raceway with fittings, and a safety grounding wire suitably identified as such and run with the system conductors, may be used as the grounding medium for equipment ground, or as a portion of such grounding medium, "where" and "as" provided for in the National Electrical Code.

5. No current-carrying conductor of an interior wiring system should be used as a grounding medium, or portion therefor, to ground fixed or detachable equipment.

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*Mr. Borden is a member of the N.E.M.A. grounding committee, a member of the grounding committee of the International Association of Municipal Electricians and a member of the grounding committee of the New York Chapter of the Eastern Association of Electrical Inspectors, and he has devoted a great deal of his time to the study of the grounding problem.

the other conductors will have a potential above ground of 210 volts. The only way in which this rise of potential can be kept within safe limits is by keeping the resistance of the secondary ground circuit sufficiently low. However, where the N.E.M.A. grounding method is followed the equipment frames will remain at earth potential, unless a breakdown occurs in the insulation.

If the insulation on one of the ungrounded circuit wires becomes defective and the circuit wire comes into contact with a grounded metal inclosure, the result would be a short circuit, which would blow the fuses in the ungrounded conductor unless the resistance of the safety circuit provided was so high that the resulting current was limited to an amount insufficient to blow the fuses. With any of the metallic inclosures which are recommended by the N.E.M.A. as suitable safety circuits this condition would not exist, except possibly in the case of an exceptionally long circuit of certain types. If the fuse should not blow, the metal inclosures will assume a potential above earth equal to that of the conductor with which it is in contact, which again emphasizes the fact that the effectiveness of a safety circuit is dependent upon its resistance.

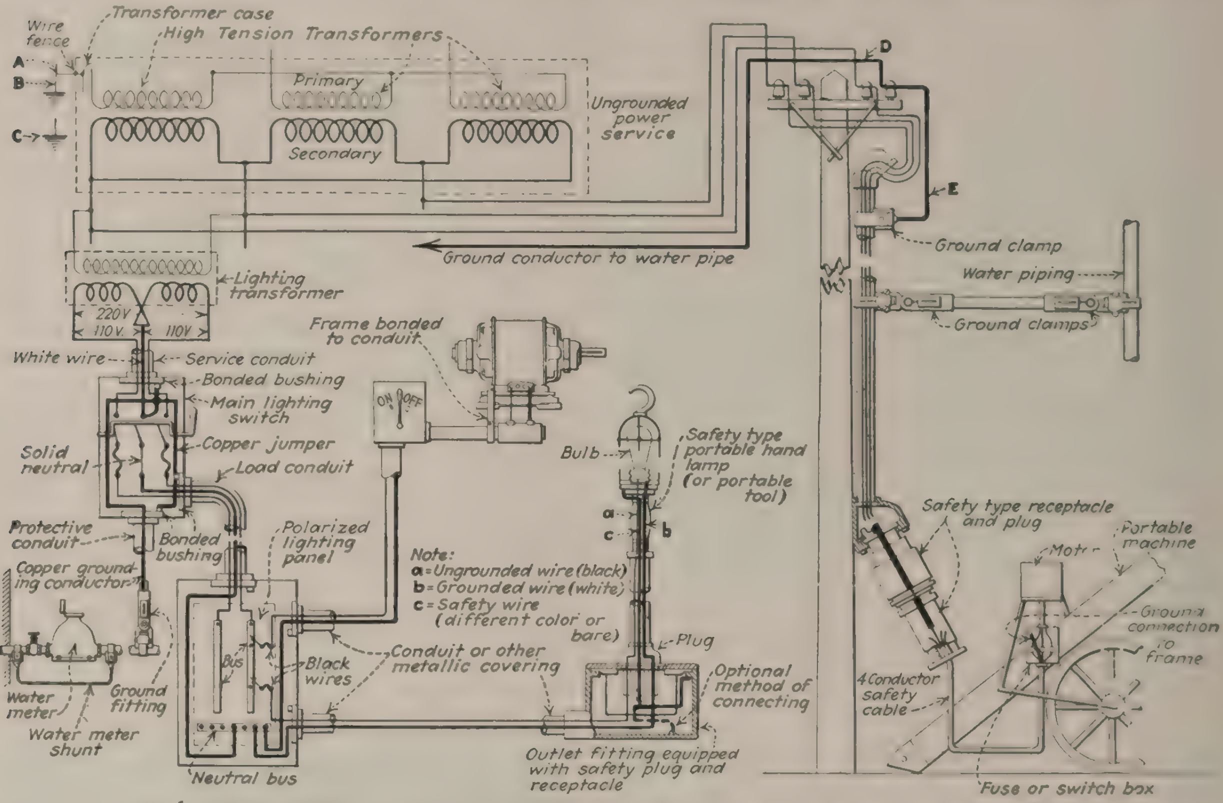

FIG. 1—TYPICAL INDUSTRIAL PLANT INSTALLATION IN ACCORDANCE WITH THE N.E.M.A. RECOMMENDATIONS (For high-tension grounding see N.E.L.A. bulletin No. 256-20)

A. Transformer cases, switchgear, framework and wire fence to be grounded.

B. To street side of water meter or to independent artificial ground of not more than 3 ohms and not smaller than No. 6 B. & S. wire.

C. Lightning arrester must have independent artificial ground, which should be 20 ft. from equipment ground and preferably not more than 10 ohms.

D. If necessary to reach permanent cold-water-piping system, run ground conductor to another building.

E. Can be run inside the conduit and attached to safety terminal of receptacle.

If the grounded-neutral conductor and one of the other conductors of the system are inadvertently reversed, there would be no tendency to blow the fuse, but one of the conductors would be at the same potential as the earth, while the white identified wire would be at a potential of 110 volts to earth and the third conductor would be at a potential of 220 volts to earth. This condition, however, would be quickly discovered, because there would now be 220 volts between the white conductor and one of the others where there should be only 110, and during the short time that the trouble existed the hazard would probably not be very serious because the frames of all the equipment would still be maintained at earth potential.

If for any reason whatever the grounded-circuit conductor becomes open-circuited at some point, the safety features of the system, in the way of equipment grounding, are in no way affected, no hazard is created, and the only effect is to injure or interrupt the service. If an open circuit occurs in a conductor of one of the safety circuits, the usefulness of the safety circuit would be destroyed, but there would be no additional hazard created.

All the above conditions have been predicated on the assumption that a water system is available for grounding. Where artificial grounds are employed, the conditions are as shown in Fig. 2 (a) and (b). The extent to which the secondary voltage would be raised above earth potential, with conditions such as exist in Fig. 2 (a), without an accidental ground, depends on a great many variable conditions, but it may be anything from nothing to practically the full voltage of the primary system. With an accidental ground, as at $G_3$, but without a high-tension cross-connection, both wires of the system will have a potential above earth inversely proportional to the resistance of the respective ground circuits. With the circuit shown the maximum potential is limited to 110 volts, but in the case of industrial establishments, where the 110-volt lighting and appliance circuits are often taken from auto-transformers connected across 440-volt and 550-volt power circuits, and from multi-wire systems, it is possible to obtain the full voltage of those systems between the supposedly grounded conductor and the earth.

These conditions at first sight look rather serious, as they are, but, if grounded as in (a) Fig. 2, these dangerous potentials are confined to the conductors, and it is not very probable that any one will come into contact with the conductors during the usually short period when such conditions exist. So long as there is no breakdown in the insulation of the secondary system the metallic inclosures will remain at earth potential when they are connected to a separate and independent ground electrode as $G_2$. If grounded as in (b) the inclosures will have the same potential as the grounded circuit wire, for which reason the code specifies individual electrodes where artificial grounds are used.

It has been suggested that the metallic inclosures might be grounded by connecting them to the grounded-circuit wire, as in Fig. 2 (c) and (d). With this system full potential is placed upon the equipment frames in case of an open circuit, as in (c), or in case of a reversal as in (d), and it also has all of the disadvantages of system (b). Such a grounding system nullifies those sections of the code which prohibit grounding the circuit wire inside the main switch and the interconnection of neutrals, both of which requirements are important safety measures embodied in the code.

The thing we are most seriously concerned with just now is the grounding of portable equipment in industrial establishments, and considerable pressure is being brought upon these establishments by industrial boards, labor commissions and others to this end. As a matter of fact, none of the old wiring and very little of the modern wiring in industrial establishments is polarized, but, on the other hand, the circuits are generally double-fused and switched, which condition, of course, presents a constant possibility of the grounded circuit wire becoming open-circuited.

A true safety circuit is a circuit which, if entirely removed, would still leave the system in an operative condition. Adequate protection requires systematic inspection of safety circuits of industrial-plant portables. It has been claimed by some that grounding to the circuit wire has an advantage because an open circuit in that wire automatically gives a warning that the device is unsafe to handle, having become inoperative. This reasoning, however, does not appear sound. Failure to operate generally means to the operator a fuse blown or current off, or something wrong with the tool, and no particular warning at all is registered. In any case he is not aware of the inoperative condition unless he is using or trying to use the tool, generally under his normal working conditions, and in that case he is subjected to the full hazard before he can possibly recognize any warning sign.

It would seem, therefore, that there are many serious objections to using the grounded-circuit wire for grounding metallic inclosures even assuming that its use can be restricted to those cases where water-piping systems of known low resistance are utilized for the earth electrode, which seems very doubtful.

The only difference between an artificial ground and a water system used for a ground is entirely one of resistance. It is quite possible to have an artificial ground of relatively low resistance, say less than 3 ohms, though usually expensive, and it is just as possible to have a high-resistance water ground, say higher than 25 ohms. The chances of a high-resistance water system ground are increasing constantly owing to the increase in the practice of using leadite joints in water mains. A recent report of the American Water Works Association indicates that joints of non-conducting material are being used in nearly 30 per cent of all new mains.

In considering costs it should be remembered that the grounded-circuit wire is not usually available at switch outlets, unless run there at extra cost. It is obvious that the cost of a knob-and-tube system, containing the necessary additional safety wire, cannot be a serious burden because there does not appear to be any great difference in cost between knob-and-tube wiring with such necessary protection and most of the other systems which inherently possess such protection. If the grounded conductor is run to all switch outlets, with the idea of using it for grounding, the difference will be still further reduced, if not entirely eliminated or reversed.

It might be well to point out that the objections which apply to the use of the grounded-circuit wire for grounding equipment apply with equal force to the suggestion which has been sometimes made that the neutral or grounded-circuit wire does not need to be insulated. It should be as fully insulated as any other conductor of an interior wiring system.

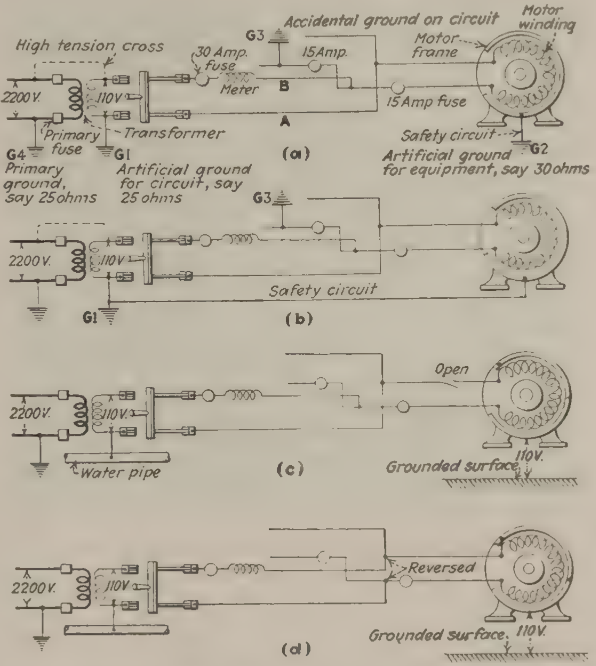

FIG. 2—GROUND CONDITIONS WHICH MAY OCCUR ON A SYSTEM

(a) Independent earth electrode for equipment ground.

(b) Where only a single electrode is used for grounding both the circuit and the equipment the apparatus would always have the same potential above ground as the conductor to which it is connected. A reversal or an open circuit of the grounded circuit wire would not result in any additional hazard.

(c) An open circuit of the grounded-circuit wire would place the frame at full potential to ground.

(d) A reversal will place the frame at full potential to ground. If the wiring has a metallic covering, a reversal will blow the fuse, but with these types of wiring there is nothing to be gained by this method of grounding.

## Movable Lighting Unit Employed in Display Windows

ONE of the special features of the Northwestern Electric Company's merchandising quarters in the new Public Service building in Portland, Ore., is the use of movable window-lighting units. For lighting the nine windows, Frink multi-lamp ten-section, double-banked window lighting troughs were used. A special canopy housing the two banks of lamps is arranged so that it may be raised and lowered to provide effective lighting for different kinds of displays.

The operating mechanism, which was specially designed for the installation, is all overhead, so that there are no obstructions in the window and is self-locking in any position. A detachable crank operated from the floor is used to raise and lower the unit. Its range of movement is such that lamps or color screens may be changed from the floor of the window.

EFFECTIVE ILLUMINATION INSURED FOR APPLIANCE DISPLAYS BY MOVABLE LIGHTING UNITS

Each window has four circuits for the main lighting and a special circuit for spotlights, in addition to which there are outlets for two floodlights. Each window has an individual distribution cabinet with a master switch controlling all circuits. With this arrangement it is possible to make a window lighting set-up with the individual circuit switches and control the whole with the master switch, thus insuring the same lighting effect for any period of time desired.

A portable flasher may be attached to any two adjacent lighting cabinets in case it is desired to have automatic color changes.

## Spectacular Signs Create Advertising Consciousness

IN SEEKING the location of the largest electric sign ELECTRICAL WORLD has been advised by Arthur Williams, vice-president of the New York Edison Company as follows: "I believe Atlantic City is entitled to this credit in the sign of the manufacturers of Chesterfield cigarettes. The size of the sign is stated to be 200 ft. x 60 ft. and is double-faced. It contains 26,000 lamps requiring approximately 500 kw. The estimated cost of the construction was, I understand, $325,000, and the annual cost of maintenance, including service, is said to exceed $100,000.

"The sign according to our reports was erected by R. C. Maxwell, of Trenton, New Jersey, and the changing effects are produced by the flasher of the James H. Betts Company.

"Visitors to Atlantic City are struck with the outstanding brilliancy and attractiveness of these signs along the ocean front. The electrical men of that city are certainly entitled to the gratitude of the entire electrical industry of the country. I imagine that no such lasting effect as to the value of electric signs in advertising is relatively possible anywhere else. In such a place as Atlantic City, men and women congregate from all over the country at a time when their minds are especially susceptible to receiving lasting impressions."

## Utility Ascertains Appeal to Make in Range Advertising

DESIRING to determine the effectiveness of electric range advertising carried on during the past few years and to secure definite information upon which to base its future advertising, the Northwestern Electric Company, of Portland, Ore., made a check of 204 nonrange users. Range salesmen called upon representative customers in their districts and after drawing the housewife into conversation concerning electric ranges, secured the following information by asking eight questions:

*Question 1.* What is your idea of the cost of an electric range?
61 per cent either did not know or thought that the cost was too high.
20 per cent answered "reasonable."
*Question 2.* What do you think of the monthly cost of electric cooking?
64 per cent answered "I don't know," "too high" or "expensive."
17 per cent answered "reasonable."
*Question 3.* Do you think the electric range of today is slow?
55 per cent answered "yes."
22 per cent answered "no."
15 per cent answered "I don't know."
*Question 4.* Do you know that the electric range is wonderfully clean and a big labor-saving device?
96 per cent answered "yes."
1.5 per cent answered "no."
*Question 5.* Do you know that the electric oven is equipped with a temperature control?
85 per cent answered "yes."
15 per cent answered "no."
*Question 6.* Do you know of the fine results obtained in baking with an electric oven?
66 per cent answered "yes."
31 per cent answered "no."
*Question 7.* Do you like to cook with gas?
43 per cent answered "no."
40 per cent answered "yes."
10 per cent answered "fairly well."
*Question 8.* What feature do you like best about gas?
70 per cent answered "It's fast."
15 per cent answered "everything about it."
10 per cent answered "nothing about it."

These replies clearly brought out the fact that six years of electric range advertising concentrated on temperature control and cleanliness had proved quite effective and that three important features—speed, cost of operation and price—which had been kept in the background in the advertising, should now be made the major theme of advertising and sales promotion literature.

# Federal Control Is Issue

## in Walsh Resolution*

Companies will assist. They have nothing to hide, but rather welcome complete investigation to clear the air and reassure public that situation is sound

By M. S. Sloan
*President Brooklyn Edison Company*

WHATEVER develops during the present session of Congress will be of importance not alone to utilities, but to every individual and institutional investor in their securities and to the general public as utility customers and taxpayers.

There are two elements in the situation at Washington. One is the proposal for a Senatorial investigation of gas and electric utilities and their financing. The second is, in essence, an effort to put the federal government into the electric power business. These elements are not as unconnected as they may seem at first glance. In fact, the proposal for an investigation is based in large part on an assumption that a power trust, so called, exists, and that government competition is necessary for the protection of the public.

On Dec. 17 Senator Walsh of Montana introduced his resolution of last year, somewhat amended, calling for appointment of a committee of five Senators to make an inquiry into gas and electric utilities, holding companies and engineering and management companies. The resolution, if finally adopted as presented, would authorize an inquiry into the financing of companies, their relations with holding, investment and management companies—opening the subject of the so-called power trust—the extent to which they may have used money or publicity to influence public opinion regarding municipal ownership of utilities, and whether they have endeavored to influence or control elections.

We are not opposed to an investigation. We are not afraid of an investigation. We are confident that an investigation which is fair and square, seeking a complete and accurate picture of the industry, endeavoring to deal seriously with a very complicated, technical subject, will not harm the utilities, but may, in the long run, be beneficial by setting at rest unfounded and misguided statements which are going the rounds. It ought to dispose finally of the notion that there is a vicious power trust. It ought to convince official critics of utilities that their rates are not extortionate, but are, instead, reasonable and being made lower whenever possible because it is good business for utilities and public alike to have rates as low as they can be and still allow the companies to earn adequate compensation.

It ought to prove that mergers of utilities are a logical and inevitable development of the business, beneficial alike to customers and companies. It ought to prove that holding companies, so called, have been the only agency by which many sections of the country could get better utility service and lower rates. Through these companies, utility units, not strong individually, have been grouped so that adequate financing was possible, economical operation and better service became possible, and frequently lower rates have been put into effect. As greater sales of service have resulted, the local utilities have benefited and the holding companies have been recompensed for their effort and investment.

If an investigation is held, the utilities can be counted on to co-operate. They have nothing to hide; their affairs are not secret. They are operated under the supervision and regulation of public officials; they make sworn reports in great detail to these officials; they keep books according to commission requirements. They have to obtain official authorization for capital increases, rate changes, mergers.

We in the utility business believe we are doing a good job—a job of real value to all elements of the public—and if an investigation is necessary to convince skeptics, we do not intend to fight it even if we cannot see why it should be considered necessary. There's another point I want to emphasize. The utility industry is no more nor less than the individuals who compose it. If there are weak brethren in it, as there may possibly be—if somewhere along the line there have been improper acts or policies by individuals or individual companies—we say let them be shown and known as such. We do not want to see them charged against the industry. The industry, I know, would not defend them or excuse them. It would, on the contrary, do whatever could be done to help prevent anything of the sort in future.

### Opposed to Government in Business

The second element in the situation at Washington is the issue of government in business. Muscle Shoals will be discussed again. Shall the plant be sold? Shall government operate it to make nitrates, or to make power? Shall government lease it to the group of Southern power companies, or to somebody who will produce fertilizer? Because of a new process of making nitrates, government opinion seems to be coming around to the view that it would be uneconomic to devote the plant to that purpose. So far as I can see, that is the one new phase which makes the situation different from what it has been in previous years.

Then we have the Swing-Johnson Boulder Dam bills. This project has been before Congress for a number of years; its advocates hope to get it adopted this session.

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**Address before N.E.L.A. committee on relations with financial institutions, Eastern Geographic Division.*

The project is put forward, first, as a flood control measure to protect the Imperial Valley; second, as an irrigation measure—it is said it would double the area of irrigated land in the valley; third, as a means of supplying domestic water to Los Angeles and, perhaps, other communities in southern California. Its advocates say the entire cost could be met by proceeds of the sale of the power which would be developed.

The electrical industry has gone on record in opposition to these bills as they stand. We are not opposed to flood control by the government in this case, if that is the only agency which can bring about relief—and apparently the seven states in the Colorado River Basin find it impossible to get together and stay together on all the points involved in this matter. We are not opposed to irrigation of desert lands, where it is proved to be a desirable and economic undertaking. We are absolutely opposed to putting the federal government into the electrical business to pay for flood control, or for irrigation, or for a domestic water supply for any community or group of communities. If flood control and irrigation are necessary and desirable, the construction costs should be paid from taxes and the expenditure considered legitimate. If Los Angeles and other communities need more water, why should they not procure it at their own expense as other cities have to?

### Doubtful if Boulder Dam Power Will Pay Interest on Investment

We are not opposed to a complete, scientific development of the Colorado River which shall utilize its waters for all purposes. There should be a revenue for government from the power developed; but it is not necessary to put the government into the power business to obtain that revenue. It could be handled under the provisions of the federal water power act with entire justice to the government and the electrical industry, we believe. In fact, we believe the government would be far surer of a satisfactory revenue under those conditions than if the pending legislation were passed and the government went into business at Boulder Dam.

This project contemplates a feat of engineering such as has never yet been attempted. The estimate of $125,000,000 cost, under the circumstances, is merely a guess. Other engineers have guessed $200,000,000—the cost might easily run a great deal higher than that. The success of the whole enterprise, from the point of view of power, is dependent on the cost. Boulder Dam power must be sold in Los Angeles and that vicinity in competition with any other power supply there. It must be transmitted 250 miles to its market. That market is already fully supplied, and will have to continue to be supplied during the ten years which it is estimated will elapse before Boulder Dam power can be delivered. Electric energy generated by steam is now being produced in Los Angeles at a lower cost than that estimated for Boulder Dam power delivered there and ten years hence power from stream will, without much doubt, be cheaper than it is now, owing to constant improvements in steam generation of electricity. It has been figured—on a basis of $200,000,000 cost—that Boulder Dam power, if and when it is deliverable, cannot be sold for a price that will pay the interest charges on the development, let alone operating charges and amortization of principal.

Power developed and sold by the federal government, therefore, cannot be expected to take care of the costs of this project on any honest system of bookkeeping. But power should not be expected to. The construction costs would be attributable to three purposes: flood prevention, irrigation, power development. The plain, straightforward, business-like thing to do, it seems to me, would be to allocate them in that fashion. Let the power phase of the project be handled in accordance with the federal power act. Let the power house be built, in accordance with the terms of that act, by the highest bidder for the privilege. Power then would not be saddled with the costs of flood prevention and irrigation. Boulder Dam power, under such conditions, might be carried to Los Angeles and sold in the market along with the low-cost steam power generated there. The government would be relieved of a considerable initial expenditure, and it would be assured a revenue. That seems to me reasonable, just and equitable for all interested in this situation. It would not depart from the present policy of the government as to water power development, and it would not put the government into the power business.

### Separate Project for Flood Prevention

There is another point to be considered in respect to Boulder Dam. Eminent engineers, some of them in government service, have carefully considered another site on the Colorado River for a dam for flood prevention. A dam built at Topok, further down the river, for flood prevention only, would cost only $15,000,000, and it is said would offer more real protection to Imperial Valley against floods than Boulder Dam. A word on this subject of floods. A great many people undoubtedly vision something like the Mississippi disaster, with much loss of life. There would be property damage, but there is no likelihood of loss of life.

Cut out the power phase of this project and what is there left? Flood control, which could unquestionably be accomplished by a dam elsewhere, and perhaps better and at less expense. As to the wisdom of irrigation, both practical and economic, there is much question. As to the domestic water supply, there is great division of opinion whether or not Los Angeles has not sufficient and satisfactory sources of supply entirely outside the Colorado River, and whether or not that would be a satisfactory supply under any condition because of the silt and mineral salts the water carries.

The nub of this problem, therefore, is the government development of power at Boulder Dam. I doubt very much whether the agitation for this project could have been sustained over a number of years—whether it could be kept up now—if the idea had not been put out that it "would not cost anything." Yet that phase of the matter is more dubious, more questionable, than any of the other phases. And if it falls, the whole scheme falls.

Boulder Dam is highly important because what is done in this instance will serve as a precedent for others. A similar scheme is being agitated for the Columbia River. It is sought to apply the same idea to developments on the Tennessee. It has been suggested that power could be made to pay a large part, perhaps all, of the costs of flood control on the Mississippi. What we must consider, therefore, is not this one item—government in the power business on the Colorado—but government in business in many parts of the country.

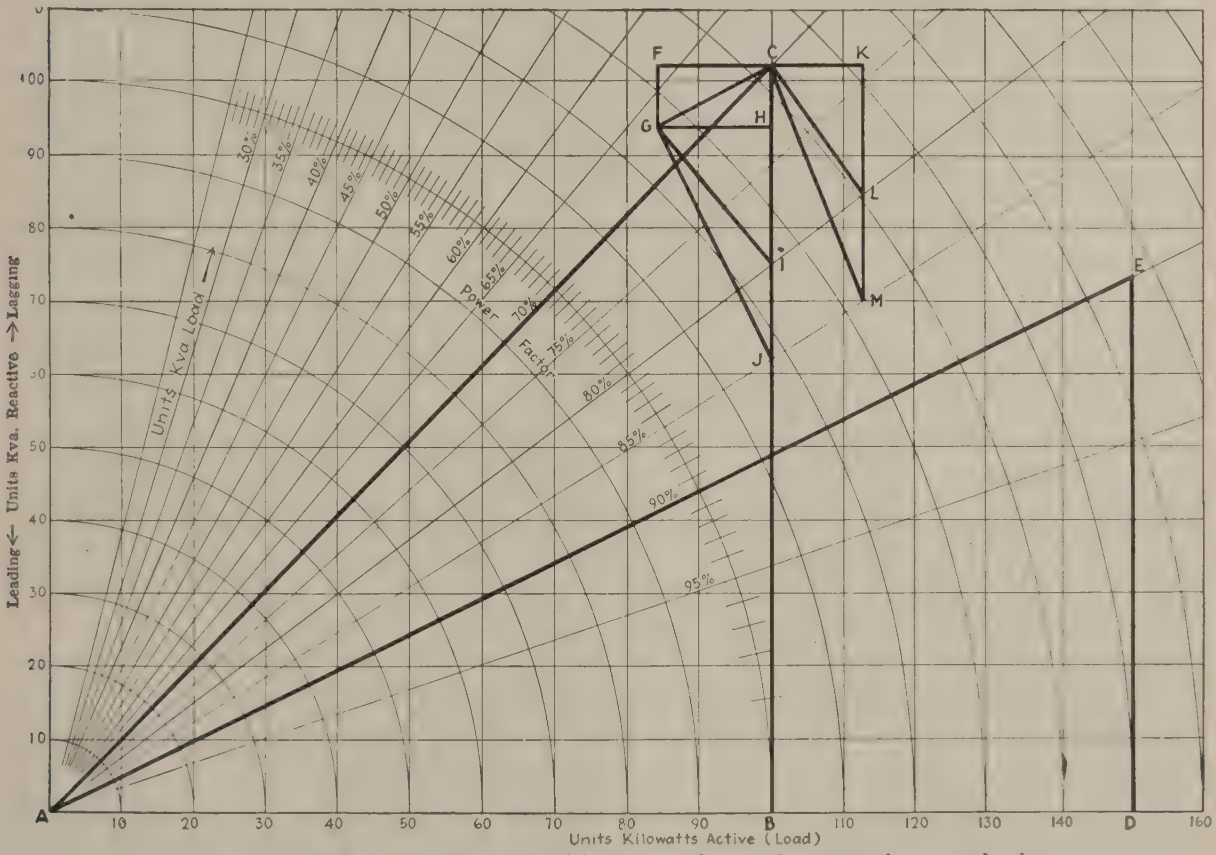
Is it for the best interests of this country to have the government in the power business? President Coolidge said recently that once government entered business it could not stop short of absolute monopoly. Is that what we want in this country, in the electrical business or any other?

## Determining Customer Costs

A STUDY of the cost of serving residential and commercial customers by the Cambridge (Mass.) Electric Light Company recently resulted in a minimum of $11.23 per year as the direct customer cost, including certain operating expenses and overhead. The average number of residential customers in 1926 was 19,329 and commercial customers averaged 3,467. The operating expenses of the company assignable to the former group totaled $154,077 and to the latter $27,619, or $7.97 average per customer. Property values (based on reproduction cost, less depreciation) directly assignable to these customers totaled $854,287 for a maximum number of 20,968 residential customers, and $146,100 for a maximum of 3,589 commercial customers during the year. The average property value prorated per customer was $40.74, and charges on this sum at 8 per cent per annum totaled $3.26, giving a total of $11.23, or $2.23 more than the 75 cents per month service charge proposed by the company in connection with the adjudication of its rates by the Massachusetts Department of Public Utilities. The foregoing analysis included no allowance for operating expenses or property values assignable to either demand, energy or revenue groups of costs.

## Corrective Power Factor Plans Readily Compared

RAPID computation of problems encountered in efforts to secure better power factor conditions at the customer's plant is secured through the use of the accompanying chart by the power representatives of Public Service Electric & Gas Company (New Jersey). This device offers a means of ready reckoning for the comparative merits of achieving corrective kilovolt-amperage by the use of static condensers, by replacement of an induction motor by synchronous equipment and by addition of synchronous motors to existing loads.



*Power factor chart offers rapid comparison of corrective methods*

**Example:** Customer has 1,000-kw. load at 70 per cent power factor. Customer's circuit conditions are as follows, referring to chart: $AB = 1{,}000$-kw. active load. $BC = 1{,}010$-kva. reactive and $AC = 1{,}420$-kva. load (scale 10 to 1). To correct this customer's load to 80 per cent power factor, using three different methods:

*First.*—By means of a static condenser. Condenser should have 265-kva. capacity, represented by $CI$ (nearest commercial size static condenser should be selected). For correction to 85 per cent power factor static condenser would have $CJ$, or 390 kva.

*Second.*—By means of a synchronous condenser to replace an existing induction motor which is in constant use and raise the power factor to 80 per cent. Assume customer has a 225-hp. induction motor operating constantly at full load and 90 per cent power factor. Kilowatt input to motor = 225 × 0.746 × 0.90 = 150. Triangle $ADE$ represents to full scale the conditions on this induction motor and shows reactive kilovolt-amperage of $DE$, or 72 kva. From point $C$ lay off triangle $CFG$ (scale 10 to 1), which represents the 225-hp. motor taken off the customer's circuit ($CF$ representing 150-kw. load taken away and $FG$ representing 72-kva. reactive). The synchronous motor to be added to customer's circuit will have mechanical load of 150 kw., or $GH$, and a leading reactive kilovolt-amperage of $HI$ (note this is projected downward to the 80 per cent line, as it is leading). The kilovolt-amperage of the synchronous motor will, therefore, be $GI$, or 250 kva. In most instances it would be best to figure on correcting power factor to 85 per cent, in which case leading reactive kilovolt-amperage would be $HJ$ and kilovolt-amperage will be $CJ$, or 350 kva.

*Third.*—By means of a synchronous condenser to carry additional mechanical load (motor to be in constant use) and raise the power factor to 80 per cent. Assume customer puts on his circuit a synchronous motor to drive an air compressor which will run constantly, the mechanical load on synchronous motor to be 175 hp., or 130 kw. From point $C$ lay off $CK = 130$ kw. additional load on customer's circuit, then $KL$, or 165 kva., represents the leading reactive necessary in the synchronous motor to bring power factor of customer's circuit up to 80 per cent. The capacity of the synchronous motor is represented by $CL$, which equals 210 kva. In order to provide for future requirements of customer's circuit it would be best to figure on correcting his circuit to 85 per cent power factor, in which case the capacity of the synchronous motor is represented by $CM$, which equals 330 kva.

**Note:** Efficiencies of induction motors and synchronous condensers not taken into account in above calculation.

## Borings Reclaimed at $20 per Ton With Electricity

THE melting of malleable and gray iron in electric furnaces is a comparatively recent development. A new installation of an arc-type electric furnace for this work has been completed in Milwaukee, on which the operating costs were quoted by O. O. Wagley of the Milwaukee Electric Railway & Light Company at the commercial section meeting of the Wisconsin Utilities Association.

In this furnace gray iron borings from the manufacturer's machine shop are utilized. This type of scrap has very small market value and conversion of this material into high-grade castings has great possibilities. The following summary shows the operating costs of this trial installation for melting 49.1 tons of gray iron borings:

| | |
|---|---|
| 1. Power costs—580 kw.-hr. per ton at 1 cent per kw.-hr. . | $5.80 |
| 2. Lining costs—49.1 tons borings melted with $64 lining plus $7.50 patching material, 304 heats averaging 323 lb. each | 1.46 |
| 3. Electrode cost, 9.03 lb. per ton at 25c. per lb. | 2.34 |
| 4. Labor cost, one man at 75c. per hour, producing 1,000 lb. of metal. Cost per ton | 1.50 |
| 5. Boring cost, market price per net ton, f.o.b. Milwaukee | 8.90 |
| 6. Melting loss, 4 per cent of $8.90 | .35 |
| Total melting cost per net ton | $20.35 |

The advantages of these operating costs can readily be appreciated when it is considered that a melting cost of $28 is considered good practice with ordinary cupola operation.

## Carbonizing Furnaces Earn Cost in One Year

IN THE manufacture of automobiles, tractors, and many other types of equipment where there is much carbonizing or case hardening to be done, electric furnaces have been found very well suited for this work, and, from the central station standpoint, this is an important application of electric heating.

One large tractor manufacturer in Milwaukee installed two pusher-type furnaces at a cost of $85,000. While the cost of electric heat about equals the cost of oil fuel formerly used, there are great savings made in labor, in building space, and in quality of product. Instead of twelve employees per shift, five now do the work. The floor space, formerly crowded when carbonizing the parts for 40 tractors per day with oil-fired furnaces, is now adequate for a production of parts for 120 tractors a day. Instead of a large percentage of rejects, the uniformity of results from the electric furnaces is such that there are almost no rejects, and the cost of inspection is reduced. The electric furnaces paid for themselves in one year's operation. The operating economy of the recuperative type of furnace such as that installed is shown in the accompanying tabulation.

OPERATING ECONOMY OF ELECTRIC RECUPERATIVE CARBONIZING FURNACE

| Chamber No. | Gross Weight per Hour Lbs. | Depth of Case, Inches | Kw.-Hr. per Ton |
|---|---|---|---|
| 1 | 945 | $\frac{1}{16}$ | 175 |
| 2 | 946 | $\frac{1}{16}$ | 165 |
| 3 | 760 | $\frac{1}{16}$ | 171 |
| 4 | 728 | $\frac{1}{16}$ | 174 |
| 5 | 720 | $\frac{1}{16}$ | 180 |

These data were taken on five furnaces operating in one plant and cover a regular production period of one week. It is interesting to note that the daily power consumption of the five furnaces averages 8,600 kw.-hr., resulting in a revenue of $86 per day. These furnaces are operated seven days a week, including Saturdays and Sundays, giving a load factor of approximately 90 per cent, with an operating power factor of about 95 per cent. The process results, being greatly improved, add to the factor of cost savings.

# Letters from Our Readers

### *Times Have Changed*

*To the Editor of the* ELECTRICAL WORLD:

"Less than ten years ago we installed electricity upon our farm. My husband was instrumental in getting a line extended in our direction. At that time we had to build the main line ourselves (by 'we' I mean the few neighbors who combined to get this done), wire our own buildings and put up our own transformers. Then, on making a gift of the line to the nearby electric company, it supplied us with juice at a very high rate. But times have changed. Since the small electric companies have become absorbed by large corporations they are able to do far more at extending lines and keeping them in repair than it was possible for local companies to do because of their lack of capital."

The above paragraph is quoted from an article on electricity in the farm home written by a farmer's wife and published in *Successful Farming* for February, 1928. The article is significant because it indicates that the farmer receives, and knows that he receives, a direct economic benefit from large aggregations of capital in the electricity supply industry. CONTRIBUTOR.

Chicago, Ill.

### *The Three Prestons*

*To the Editor of the* ELECTRICAL WORLD:

Stop for a moment counting up how many Smiths, Browns and Johnsons there are in the United States and consider the uniqueness of the fact that there are three officers of the Association of Edison Illuminating Companies who answer to the name of Preston. To begin with there is H. Preston Liversidge, who is the president. Mr. Liversidge is vice-president and general manager of the Philadelphia Electric Company. Next is Preston S. Arkwright, president of the Georgia Power Company, Atlanta, who is vice-president of the association. And then there is the executive secretary, who is Preston S. Millar of New York City.

As Mr. Arkwright said in commenting upon the similarity of names, it would not be quite so noticeable if the name was "Bob," or "John," or "Percy," or "Algernon," but "Preston" is a little out of the ordinary run of names. "At least there should be co-operation and harmony among the three Prestons," Mr. Arkwright commented. BYSTANDER.

Atlanta, Ga.

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Coal Measuring vs. Weighing for Power Houses.*—J. E. Lea.—The author has proceeded upon the assumption that the measurement or weighing of coal is seldom accurately determined. Surface moisture is judged to be the cause of the major discrepancies and it is suggested that an hydraulic principle of measurement which will be continuous instead of intermittent, so that the rate of flow can be determined and so that large quantities may be dealt with in a simple, expeditious and accurate maner, is desirable. The hydraulic principle is based upon the postulate that small coal can be regarded as far as measurement is concerned, as a liquid or at least to such an extent that the principles of hydraulics can be applied to the determination of its volume and weight.—*The Electrician (England)*, Dec. 30, 1927.

*Pulverized Fuel for Power Stations.*—G. H. Lake.—Summarized results of burner-operating tests are given for the Derby generating station in England. Several innovations in steam-superheating and coal-preparing practices have been introduced in the design of this station and, as a result, unusually high economies have been obtained. The author has included detailed costs of coal consumed and of maintenance factors for the various items entering into the pulverized fuel installation. The reduction of these charges to the basis of cost per ton of fuel consumed offers an interesting contribution.—*The Electrician (England)*, Dec. 23, 1927.

## *Transmission, Substations and Distribution*

*Automatic and Remotely Controlled Substations.*—Data regarding automatic substations and those remotely controlled through supervisory direction have been compiled for a number of stations, and information regarding capacity, date of placing in service, the manufacturer of the equipment, the automatic features, the supervision, frequency of inspection, and details of the control circuit, are included for substantially all the stations listed in the present discussion. Recent developments in equipment for this purpose are covered in statements by two large manufacturers and a producer of special equipment. Improvements in and additions to the devices included in such stations are dealt with. — *Serial Report, Electrical Apparatus Committee, National Electric Light Association*, November, 1927.

*132,000-Volt, Single-Conductor, Lead-Covered Cable.*—P. Torchio.—The development of the economic and commercial demand for oil filled 132,000-volt cable is outlined. It is stated that this type of cable permits direct interconnection with high-voltage overhead lines and it is felt that the satisfactory operation of the two lines which have been placed in service this year offer an indication that 220,000-volt cable can be constructed without material changes in design. Particular reference is made to the effect upon the dielectric of occluded gas and to the method of eliminating trouble from this cause in the oil-filled type. The manufacture, inspection and testing of the cable and equipment is also reviewed, and, as the result of tests, it is indicated that the electrical constants of the cable are substantially unchanged by normal temperature cycles. Inspection, indication of oil leaks, and cable and joint repairs as developed in the New York and Chicago installations and the replacement of a length in one section which developed a leak in the sheath, are also covered. — *Report, American Institute of Electrical Engineers*, November, 1927.

## *Generation, Control, Switching and Protection*

*Fire Protection of Generators.*—J. Brandl.—The ease of storing and inert character toward electric arcs makes carbon-dioxide the most desirable quenching gas for electric fires in generators. Steel cylinders, containing the liquified gas, can be located near each protected object, or a centralized cylinder battery can be provided. Neither a pressure gage nor a gage showing the liquid are reliable indicators of the amount of $CO_2$ left in the cylinders. The only dependable method is to install the cylinder battery permanently upon a small platform scale and to balance the load. Special precautions are necessary to avoid freezing and the forming of snow when the gas is released. Dampers or movable louvers are advocated to restrict the escape of the gas, unless the machine is of the closed circulation type.—*Elektrotechnische Zeitschrift*, Dec. 1, 1927.

## *Units, Measurements and Instruments*

*A Two-Range, Vacuum Tube Voltmeter.*—C. M. Jansky, Jr. and C. B. Feldman.—The design, uses and limitations of a new circuit employing the three-element vacuum tube as a voltmeter are discussed. The two overlapping ranges of voltage, together with a single operating battery are the unusual features. The effect of wave-form and the elimination of that effect are treated. It is stated that frequency has but little effect on the operation and this effect can be eliminated by use of a by-passing condenser; the imput impedance is high, of the order of several megohms, and the power factor is low; differences in wave-form are exaggerated but not, for commercial wave-forms, objectionably so; the sensitivity is higher than that of most other communication-frequency measuring instruments; the range is inherently low, covering probably a band of voltages from a tenth or a few tenths of a volt to about ten volts. The stability of calibration over the entire life of the tube is questionable. Experiment showed, however, that, in general, the calibration could be expected to remain constant for periods of operation of more than 40 hours.—*Report, American Institute of Electrical Engineers*, November, 1927.

*Standardization of Terminal Chambers for Single-Phase and Polyphase Watt-Hour Meters.*—The standardization agreed to by utilities and manufacturers is clearly presented. This standardization, it is anticipated, will result in considerable saving, as the installation of the meters will be simplified, and as the number, sizes and types of adapters will be greatly reduced. The adapters were relatively costly, and now that a simple standard arrangement can be utilized, the cost should be decreased. Aside from this saving, the details in connection with the installation of watt-hour meters are simplified, so that any meter available in utility storerooms can be installed on any equipment provided with a standard end wall.—*Serial Report of the Meter Committee, National Electric Light Association*, 1927.

## *Heat Applications and Material Handling*

*The Davies Magnetic Separator for Ores.* — An electro-magnetic apparatus suitable for the separation and concentration of any magnetic material, whether highly or weakly magnetic, has been devised. The design of the equipment utilizes the lines of force emanating from pole pieces, and, by rendering certain bands magnetic, it is possible to remove materials of high magnetic permeability from the mineral under treatment before it enters the magnetic field proper.—*Engineering (England)* Dec. 9, 1927.

*Rectifiers for Dock Cranes.*—W. Waltz.—The article gives a description of dock installations where the power for numerous loading cranes was formerly supplied by a motor-generator substation. The demand of such installations varies almost continuously between low and double normal load in a succession of short peaks, so that the motor-generators formerly used were equipped with heavy flywheels. The average over-all efficiency and the power factor of the driving motor were both low. Conditions were materially improved by the substitution of mercury-arc rectifiers in place of the motor-generator sets. Efficiency and power factor of these rectifiers are almost constant from one-quarter load up. Measurements, continued for a number of days, indicated an average efficiency of 67.8 per cent and 92.6 per cent respectively before and after the remodeling of one of these two installations.—*Brown, Boveri Mitteilungen*, December, 1927.

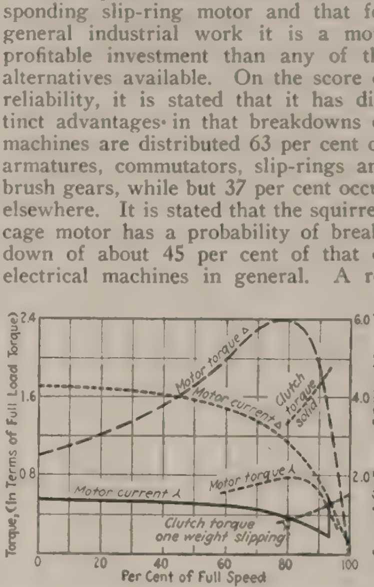
## *Electrophysics, Electrochemistry and Batteries*

*Peculiar Behavior of Transformer Oil.* — A. Schwaiger. — The dielectric strength of oil can be greatly increased by thoroughly removing all traces of its water component. It is stated that if puncture tests are made on three grades of oil with (1) plate electrodes, (2) sphere electrodes and (3) sharp edge electrodes and the results are plotted into a logarithmic coordinate system it will be found that the plates give a straight line, the spheres give an upward bent curve, while the sharp electrodes show a decidedly downward bent line. In other words, for spheres under oil the strength of the oil should be raised as high as possible. For sharp electrodes an increase beyond a certain limit is almost useless. It seems, therefore, that the content of water is useful with sharp electrodes and detrimental with spheres. The author explains this by the fact that the water particles are attracted toward the electrodes and thus tend to make sharp edges more round, while they upset the sphericity of balls, tending to concentrate the field. Since more or less sharp edges are much more frequently found on apparatus than spheres or plates, dielectric strength data of oil based on sphere electrodes are misleading as to what could be expected from drier oil. *Elektrotechnische Zeitschrift*, Nov. 10, 1927.

*Insulating Materials for Electric Machines.* — L. Fleischmann. — Solid insulating materials, such as are in extensive use on electric machines, transformers and apparatus, require a much more careful selection than metallic parts, as their electrical and mechanical properties are not constant, but are affected by a number of circumstances, such as heat, humidity, chemical changes, etc. Furthermore, these changes are not proportional to the variations of the influencing factors, nor can the laws of change be expressed in an exacting mathematical manner. In most cases, experimental work with tabulated or graphically represented results is the only basis for proper selection. A further aggravating factor is introduced by the possibility of the pressure of non-homogeneous material or air-filled voids. A test is described to measure the surface creep over built-up mica insulation to show how distance and thickness affect the flash-over. A characteristic compound puncture curve is given to illustrate how temperature affects the dielectric stress. — *Elektrotechnische Zeitschrift*, Nov. 3, 1927.

## *Motors and Control*

*Squirrel-Cage Induction Motors.* — D. B. Hoseason.—A general discussion of the characteristics and comparative value of squirrel-cage induction motors, with particular references to means of improving their starting performance. It is stated that the squirrel-cage motor has usually both a higher efficiency and a higher power factor than the corresponding slip-ring motor and that for general industrial work it is a more profitable investment than any of the alternatives available. On the score of reliability, it is stated that it has distinct advantages in that breakdowns of machines are distributed 63 per cent on armatures, commutators, slip-rings and brush gears, while but 37 per cent occur elsewhere. It is stated that the squirrel-cage motor has a probability of breakdown of about 45 per cent of that of electrical machines in general. A recently devised centrifugal clutch, consisting of plates pressed together by weights normally held out of operation by springs, offers greatly improved starting performance, and the accompanying curve indicates the characteristics obtained through the equipment of a motor with this device.—*Electrical Review (England)*, Dec. 23, 1927.



MECHANICAL CLUTCH IMPROVES CHARACTERISTICS OF SQUIRREL-CAGE MOTOR

*Capacitors.*—M. C. Lowe.—The fundamental considerations involved in the use of capacitors and the general character of the problems involved in their application to utility and industrial work are mentioned. The use of capacitors as lightning arrestors as well as for power-factor correction is indicated as being a promising development toward which very little has been done. The advantages of capacitors over other devices for the rectification of power-factor are mentioned, as, the elimination of attendants; minimized operating losses; reduced line losses; flexibility of size with capacity requirements; and full agreement with underwriters specifications without special provision. — *Electrical News (Canada)*, Jan. 1, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*The Vacuum Tube Rectifier.*—John H. Kuhlmann and James P. Barton. —An investigation undertaken by means of oscillographic and vacuum tube voltmeter methods has been applied to the B-voltage supply for radio receivers. The object of the determination was to observe possible opportunities for improvement in the design of such rectifiers as well as the most satisfactory type of filter circuits and the appropriate values of inductance and capacitance which will give a direct current output delivered with the least practicable voltage drop and having no fluctuation of sufficient magnitude to interfere with the proper operation of the set. The vacuum-tube peak voltmeter used to detect very small fluctuations is described. The author concludes that the voltage drop in the filter circuit should not be high and that the series inductance should not be larger than required to produce a current without ripples.—*Journal American Institute of Electrical Engineers*, January, 1928.

## *Miscellaneous*

*The Effect of Running In on Journal Bearing Performance.*—F. A. McKee. —A feature recognized by the operators of machines containing journal bearings is that a certain amount of "limbering up" or "running in" is necessary before this type of bearing behaves in a normal manner. The author has described an investigation conducted by the Bureau of Standards, the object of which was to evaluate this effect of running in upon the performance of babbitted, full-journal bearings. A specially designed journal-bearing friction machine provided a method of measuring the frictional loss when operating under different conditions of load, speed of the journal and viscosity of the lubricant. By correlating these factors in a suitable manner, a measure of the effect of progressive amounts of running in on bearing performance was obtained. The results indicate that running in causes a marked reduction in the frictional loss of a bearing under very severe operating conditions. The effect upon the factor of safety is pointed out, and the possibility of increasing the efficiency of high-speed journal bearings is indicated by a hypothetical example of a steam-turbine bearing.—*Mechanical Engineering*, December, 1927.

*The Design of Condenser Bushings.* —A quick method of designing condenser bushings is described. The procedure has been developed for uniform axial and radial potential gradients, assuming infinitely thin layers and also finite thicknesses; the design for uniform axial stress with the use of layers of unequal thickness, has also been worked out. It is stated that the rapidity with which the tabulation may be made and the idea of the nature of the result obtainable is of considerable importance. A number of influences, including length of mounting, diameter of the conductor, and tangential and radial stresses, have been considered and investigated in order to obtain the best arrangement and dimensions. Various formulas and characteristic curves aid in the development of usable information.—*The Electrical Review (England)*, Dec. 9, 1927.

# News of the Industry

## Amended Walsh Resolution Approved

### Language Altered in Effort to Confine Investigation to Interstate and Federal Matters—Move to Substitute Trade Commission as Agency for Inquiry Lost on Tie Vote

By Paul Wooton

*Washington Correspondent of* Electrical World

An investigation of the electric and gas public utilities doing an interstate business was on Feb. 1 recommended by the interstate commerce committee of the Senate as a result of its hearings on the Walsh resolution. The committee recommends that the investigation be conducted by a special committee of the Senate. An effort to have the investigation made by the Federal Trade Commission was lost on a tie vote—nine to nine. Before reporting out the resolution, the committee amended the proposal of Senator Walsh so as to limit the investigation to public utility corporations doing an interstate business and to corporations holding the stocks of two or more public utility corporations operating in different states.

The resolution thus amended was not satisfactory to Senator Wheeler of Montana, Senator Howell of Nebraska and Senator Black of Alabama. They announced their intention of submitting a minority report, which, it is understood, will ask an inquiry into all election campaign contributions of power companies, as proposed in the original resolution. The committee left in the Walsh resolution the provision to investigate expenditures looking to the influencing of public opinion against public ownership. The investigation as to expenditures intended to influence elections was limited so as to refer only to the election of federal officials.

While the amended resolution is unsatisfactory to some of the advocates of the Walsh resolution, its scope has not, it is believed, been restricted to the point where it will meet the approval of those members of the Senate who see in it an unwarranted intrusion into the jurisdiction of the several states. For this reason difficulty may be experienced in bringing about its adoption.

### Ainey on Joint State Regulation

William D. B. Ainey, chairman of the Public Service Commission of Pennsylvania, told the committee at its last session, on Thursday, Jan. 26, that in his opinion Senator Walsh's proposed modification extended the resolution rather than restricted it. Senator Walsh asked if he would like to have it withdrawn. Mr. Ainey said it would be a fine thing if he would withdraw it, and "in so far as the red thread of interference with state regulation and authority is concerned, I would be delighted if you would go a step further and withdraw the whole resolution." In discussing the ability of the states to handle regulatory questions when the power is generated in one state and used in another, Mr. Ainey declared that "in working out the Conowingo project co-operatively between the Maryland commission and the Pennsylvania commission we solved every single interstate regulatory matter that could be involved in that great project."

### Ransom Makes Legal Argument

Final argument on behalf of the Joint Committee of the National Utility Associations was made by William L. Ransom of New York. He said that all the committee had to decide was whether a prima facie case had been made and, if it had, what were the reasonable principles of limitations which should be written into the resolution. He pointed out that Senator Walsh had conceded that power to investigate is limited by the power to legislate. "To talk about investigating an industry," said Mr. Ransom, "is a round phase, but the thing to keep in mind when you investigate an industry, if you call it that, is that what you really investigate is companies, local companies; that what you really bring here is Tom Brown and Ralph Jones and books and papers of the companies operating in the states of the Union. And what you adopt, when you talk about investigating an industry, is that, at the election of your committee, the officers, accounts and vouchers of 3,500 companies in every or any part of this country may be brought by subpœna of any senator for overhauling.

"The resolution as it stands," Mr. Ransom continued, "means the banks in any town. It means the local companies and concerns that do construction service in any county or in any town, the local citizens engaged in local business in any city, village or section of the United States—not only capitalization of utilities, not only capitalization of holding companies, but the capitalization and the increase in capital assets and capital liabilities of all these non-utility corporations."

In his analysis of the matter Mr. Ransom found that only four grounds of possible jurisdiction had been mentioned. They were the transmission of electrical energy and gas across state borders, the interstate sale and transportation of utility securities, the restraint of trade and the exclusion of fraudulent securities from the mails.

Mr. Ransom admitted that Congress had the power to legislate and, as a consequence, to investigate interstate transmission, but maintained that the investigation should not be by a special committee of Congress. He pointed out that the Supreme Court had held that the regulatory power is not limited by the price paid for power at wholesale or the cost at wholesale, but that the courts and the state commissions may inquire what is a reasonable price under all circumstances. In connection with Senator Walsh's charge that a part of the capitalization of the utilities "is pure water or thin air," Mr. Ransom brought forth voluminous evidence to prove that "there is considerably more than a dollar of fixed tangible property on the original-cost basis for every dollar of capitalization of holding company or of security." He contended that ownership of stock in companies in other states is not interstate commerce and does not subject the owner to federal legislation or investigation and that the issuance of bonds or stocks is not interstate commerce. Whether or not the sale and transportation of bonds and stocks constitutes interstate commerce has not been passed upon by the Supreme Court of the United States, Mr. Ransom said, but the Supreme Court has held that the issuance and sale of insurance is not interstate commerce. It also has been held that the use of the mails for business transactions does not constitute interstate commerce; but, even granting the power to investigate and to legislate as to the interstate sale of securities, Mr. Ransom made the point that it would not confer on Congress the power to investigate the production of the securities, which is a function reserved to the states.

## Massachusetts Commission Cuts Cambridge Rates

Petitions which have for some time been before the Massachusetts Department of Public Utilities asking a reduction in the rates of the Cambridge Electric Light Company were acted upon on Monday of this week, when the department made an order reducing the maximum rate of that company for domestic and commercial lighting from 8 cents to 5½ cents a kilowatt-hour, which, the department estimates, will bring to the customers a yearly saving of not more than $318,805 on the basis of 1926 consumption. No order was made affecting power and street-lighting rates. The company's request for a two-part rate based on floor area was not approved, nor was its petition for a service charge, though the department expressed willingness to sanction a service charge of 50 cents a month if the net maximum kilowatt-hour rate were made 4 cents.

## Detroit Edison Budget

*Thirty-Million-Dollar Expansion Program — Sixth 50,000-Kw. Unit at Trenton Channel and Fifth Turbine at Marysville Will Go Into Service*

THE Detroit Edison Company expects to add 50,000 kw. to its peak load this year and to connect twenty-five thousand new customers. To do this it will expend about $30,000,000, of which $8,862,700 will go for power plants, $5,283,100 for substations, $5,042,000 for transmission lines and the rest for new-business promotion, the heating department and miscellaneous equipment, construction and overhead.

The sixth and last 50,000-kw. turbine for the Trenton Channel plant (bringing its rating to 300,000 kw.) is to go into service next fall. Trenton Channel is the only power plant operated by the Detroit Edison Company in which the generating units are substantially identical, and this desirable feature makes a new departure in "spare parts" possible, namely, the purchase of a spare steam rotor, which may be used in any one of the six turbines at Trenton Channel or in one of the two turbines which are destined for Delray Plant No. 3. On the latter plant work will be continued this year, so that the turbines of 50,000 kw. each and four boilers will be ready for service late in 1929. The fifth turbine at the Marysville plant is a 30,000-kw. machine. It is due to go into service May 15. This makes three "thirties" and two "tens" at Marysville, giving a total rated capacity of 110,000 kw. The new 30,000-kw. turbine at Marysville, with the 50,000-kw. turbine at Trenton Channel, will add 80,000 kw. to generating capacity during 1928.

There are now in service three double-circuit, 120,000-volt steel-tower transmission lines connecting the Trenton Channel power plant with the Navarre and West Warren stepdown substations in Detroit. It is planned to add a fourth line during 1928. There is one double-circuit, 120,000-volt line from the Marysville power plant to the Northeast substation in Detroit, and this is to be supplemented by the completion of an additional single-circuit tower line. The interconnection with Consumers Power Company is almost complete and is to go into service early this year. The line is to operate at 132,000 volts. The interconnection will furnish a valuable reserve in case of breakdown and for handling peak loads.

Extensive revamping of oil-switch equipment is another of the items in the 1928 budget. Besides all this, four new substations will be built and additions made to existing stations.

## Norris Muscle Shoals Bill Reported to Senate

*Calls for Government Operation and Use of Revenue for Fertilizer Manufacture—Representatives Madden and Morin's Measures Before House Committee*

SENATOR NORRIS' resolution calling for federal operation of the government's Muscle Shoals power plant and distribution equitably among the states within transmission distance of energy generated there was reported favorably by the Senate committee on agriculture on Wednesday by a vote of eleven to four. The resolution authorizes the government to operate the plant for ten years and the Secretary of War would contract for the sale of energy to states, counties, municipalities, corporations, partnerships or individuals for terms not exceeding ten years beginning Jan. 1, 1929.

The net proceeds from the sale of energy would be set aside for developing, manufacturing and introducing improved fertilizers and fertilizer practices with a view to reducing the cost and increasing the efficiency and use of fertilizers on American soils. The bill would also authorize the Secretary of Agriculture, within the limits of appropriations made by Congress from such special fund or from the Treasury, to construct and operate fertilizer experimental or production plants anywhere in the United States, to contract with commercial producers for the production of fertilizers and to arrange with farm organizations for large-scale practical use of new forms of fertilizers. To enable the Secretary of Agriculture to carry out such program, the resolution carries an appropriation of $2,000,000. This measure will be opposed determinedly both on the floor of the Senate and in the House on the ground that it would be an entrance of the government into the power business.

In the House the military affairs committee has referred the administration's Muscle Shoals bill, introduced by Representative Madden of Illinois, to a sub-committee. Representatives of the American Cyanamid Company and the Air Nitrates Corporation were heard. The Madden bill, providing for the lease of the government's Muscle Shoals properties to the American Cyanamid Company, is still in controversy owing to the fact that President Bell of the company is not willing to make all of the concessions upon which the committee had insisted. The Madden bill has strong support in the House, but its lack of support in the Senate committee is thought to reflect a strong feeling in the Upper House against it.

Chairman Morin of Illinois issued a statement explaining the advantages as he saw them over previous measures of his compromise bill. Representative Morin's bill provides, he said, "for experimental operation on a commercial scale for the purposes of demonstration and experimental use of fertilizer products, looking to private development and operation of such an industry. Further, in view of the widespread insistence in the South that the power developed at Muscle Shoals not used in making fertilizer belongs to the public and should be equitably distributed, the proposed legislation provides for such distribution of the excess power, insuring, however, terms that will bring a reasonable return. Should it not be possible to do this, the proposition would be handled by the Secretary of War as at present and the power sold in the open market."

## Secretary Work Opposed to Pittman on State Rights

Secretary of the Interior Work, in a letter to Senator Johnson made public Jan. 28, takes issue with the contention, made in connection with the proposed construction of the Boulder Canyon Dam and indorsed in October last at the Denver Colorado River conference at the instance of Senator Pittman of Nevada, that individual states are owners of the waters of interstate or other streams flowing through their borders and may impose taxes for the use of such waters.

## Two New Steam Plants for Pacific Coast

*Great Western Power to Build 35,000-Kw. Plant at San Francisco—Los Angeles Gas & Electric Adding Unit of Same Size*

THE Great Western Power Company of California announces the acquisition of 35 acres of land in San Francisco as a site for a new steam plant. The initial capacity of this plant will be 35,000 kw., and it will be designed to burn oil as fuel. The plant will be equipped with 450-lb.-pressure boilers and will deliver energy at 60 cycles, 11,000 volts. It will double the company's present reserve steam supply for the San Francisco Bay region and will provide emergency service for the Great Western's extensive hydro-electric supply in this area. Work is to start at once, with completion expected next year. McClellan & Junkersfeld, New York, have been engaged to design and supervise construction of this station, which will cost approximately $4,000,000.

The Los Angeles Gas & Electric Corporation has begun the installation of a second generating unit of 35,000-kw. rating. The installation of this unit will double the present capacity of the Seal Beach plant, which will ultimately reach 210,000 kw. Three new 2,500-hp. boilers and 45,000 sq.ft. in condensers, together with the necessary pumps and switching apparatus, will be installed with the new generator, which is expected to be ready to operate about Aug. 1, 1928. When it is in operation the total present capacity of the two steam plants of Los Angeles Gas & Electric Corporation will be about 150,000 kw.

## Ottawa Government Views St. Lawrence

*International Aspect of River Development from Canadian Angle—Advisory Council Report—Opposition to Power Exportation Maintained*

AN IMPORTANT phase of the St. Lawrence waterway question dealt with by the Canadian National Advisory Council at a conference held in Ottawa in January concerned exportation of power. While the deliberations were conducted in camera, it is understood that one or two members of the council favored the idea of power export, on the ground that it would be a lucrative source of revenue for the Dominion. The majority of the council, however, were strongly opposed, and it is expected that the report, as finally drafted, will simply commend the stand taken last session of Parliament by the government, when Premier Mackenzie King, during a long discussion on the proposed Carillon department, assured the Parliament that there would be no export of power sanctioned by the Dominion government without the consent of the provinces affected.

Encouragement to private capital to develop the power on the national section of the river, virtually all of which is in the Province of Quebec, and the stipulation that those private concerns assist financially in the deepening of that section of the river, and recommendation that early steps be taken to open negotiations with the United States for a treaty governing joint deepening of the international section of the river between Lake Ontario and Cornwall, are understood to be other salient features of the report, which will be made public during the session of Parliament. that has begun.

A delegation from the Ontario Associated Boards of Trade and Chambers of Commerce recently waited upon the Dominion government and urged the improvement of the St. Lawrence waterways and development of the water powers by public ownership so far as Ontario is concerned. Two resolutions were presented. The first stated that in the opinion of the delegation the transference of any of the interests of the people of Ontario in the water powers of the St. Lawrence to the control of private or corporate interests should not be permitted. The second urged the government to proceed without unnecessary delay to make appropriate arrangements for the early construction of the enlarged St. Lawrence waterway and for the development of hydro-electric power between Lake Ontario and Montreal.

Premier King observed that the matter of "appropriate arrangements" connoted negotiations with the United States. "What," he asked, "is going to be the reaction on the public mind of Canada the minute the government begins to negotiate with the United States? Are the bodies that are now asking for the waterway going to back up the government?" Brig-Gen. C. M. Mitchell, who is a member of the Joint Engineering Board, replied that he thought so. No one could imagine for a moment that Canada could proceed without negotiations with the United States with regard to that part of the project which involved the two countries, he said. It was also felt, he added, that Canada ought not to export any power.

A Canadian newspaper report says that Montreal and Toronto financiers are prepared to install 13 miles of waterway in the St. Lawrence River between Lachine and Cornwall without cost to the government and develop eventually 2,000,000 hp. at this point, beginning with 300,000 hp. for which chemical and metallurgical works are ready to contract. According to the paper, the whole head of 80 ft. will be used and three sites developed, with power houses on the south shore opposite Lachine, which is virtually a suburb of Montreal. The syndicate behind the plan is said to have control of the Beauharnois Light, Heat & Power Company, of which R. O. Sweezy is president, and already to possess power rights on the St. Lawrence.

## State Politics and Utility Companies

### Massachusetts Votes Down Bill to Abolish Commission Jurisdiction —Gubernatorial Candidates in Ohio and Indiana Criticise State Regulation—Movements Elsewhere

A MOTION in the Massachusetts Legislature by Representative Twohig of Boston in favor of transferring to that body the powers of the Department of Public Utilities in connection with the supervision of public service corporations was defeated by 67 to 37. Several members of the Legislature attacked both the utility companies and the commission.

With the spring primaries in Indiana impending, the utility companies in that state are beginning to take an interest in the views of candidates, particularly those who are in the field for Governor and the Legislature. The primary interest of the utilities, naturally, is concerning the retention or abolition of the Indiana Public Service Commission and laws directly affecting taxation. Two well-known politicians are in the field for nomination as Governor both of whom are opposed to the present utility laws. Frank Baker, an Indianapolis attorney, who is a candidate on the Democratic ticket, makes the statement that he favors the abolition of the Public Service Commission. Alvah J. Rucker, recently corporation counsel for Indianapolis, a candidate on the Republican ticket, believes the utility regulation laws should be so changed that the municipalities will have more to say than at present. While corporation counsel he charged that the utility interests of Indiana had donated thousands of dollars to the campaign fund of the present Governor in order to influence his commission appointments.

#### Opposed Viewpoints in Ohio

Attorney-General Edward C. Turner of Ohio, a critic of public utilities, has announced his candidacy for the office of Governor, with the utility question as his chief issue. Mr. Turner has made a number of addresses in recent months in which he denounced Ohio public utilities as dealing unfairly with the public and uniting with other interests for the purpose of influencing the Legislature. He has also criticised the Ohio Public Utility Commission, charging that it is a poor safeguard.

"Rate making," Mr. Turner says, "is primarily an economic, not a political problem, and that is the crux of the whole matter. Our public utility commissioners are composed almost exclusively of men appointed for political, or sometimes personal, reasons. There are not many real economists among them. They may desire to do the right thing, but how can they answer the arguments of the able and resourceful lawyers whom the great corporations seeking franchises or increased rates can hire? What do they know about basic costs of production of public utility products or service or fair valuations of great corporation properties?" Mr. Turner maintains that service to be rendered and rates to be charged by a public utility corporation should be made the subject of a definite contract with provision for price changes in accordance with fluctuations in tax and interest rates and cost of labor and material. At present, he says, there is an overemphasis on reproduction cost as a rate base.

Governor Donahey, on the other hand, says that in Ohio regulation of utilities is a success. "We do not need any aid in this respect from the federal government," he declares, in commenting on the proposed Senatorial investigation of utility companies. "The sale of utility securities, like that of any other securities, is under state control. But, regardless of financial operations in utility securities, consumers' interests are protected, for the companies' earnings are restricted to a fair return on the value of the property used and useful for serving the public. Ohio stands firmly on the principle of state's rights and will resent any movement on the part of Congress to centralize the regulation of public utilities by the federal government."

William Tudor Gardiner, candidate for the Republican nomination for Governor of Maine, advocates leaving the question of power exportation to the people by means of a referendum vote. If there is a surplus of power after the demand for electrical energy in Maine is satisfied, Mr. Gardiner thinks that the power should be sold in any outside market, subject to recall when needed. The Maine Public Service Commission could be called upon to determine what is surplus power.

A joint resolution asking that the International Joint Commission refuse permission for the construction of dams on the Minnesota-Ontario boundary has been introduced in the Wisconsin State Senate by Walter S. Goodland of Racine. The resolution asks that the permission be refused because the proposed dams would destroy the beauty and attractiveness of the boundary lakes.

The question of public ownership and operation of hydro-electric utilities will be before the voters of Oregon again at the next general election if the plans of the Co-operative Berry Growers' Association materialize. Despite the fact that the Oregon electorate declined to sanction a similar proposal by a vote of 147,092 to 35,314, the members of the fruit organization are seeking to arouse interest in an initiative petition which will again place the question before the people. Advocates of the plan propose to frame an amendment which will commit the state to a policy of developing local water-power resources and selling energy to the public at 10 per cent above the actual cost of production.

## Reduced Rate Schedules and New Methods in Indiana

Twenty-five cities and towns in Indiana served by the Interstate Public Service Company are affected by a new optional electric rate schedule on all domestic service, including lighting, cooking, heating, refrigeration, water pumps and oil-burning appliances, which has been filed with the Indiana Public Service Commission. The new schedules provide for lower rates for domestic use in cases where additional equipment for the home, such as cooking and refrigeration, is used in connection with domestic lighting. Cities and towns affected by the new rates include Bedford, French Lick and West Baden.

Reductions in electric rates at Michigan City and six smaller places are provided in new optional rate schedules submitted by the Northern Indiana Public Service Company and approved by the commission. Rates included in the new schedule in most places range from 7 cents net down to 2½ cents per kilowatt-hour, with a meter charge of $1. A 4-cent rate for cooking and refrigeration is included.

Continuance until April or May of the present Huntington rate schedules has been asked by the Northern Indiana Power Company. The Northern Indiana Power Company, a subsidiary of the Central Indiana Power Company, is one of several Insull electric utilities in Indiana experimenting with rate charges based on the number of electrically connected rooms in a house. Some consumers at Huntington are seeking to stop the experiments, and the commission has set Jan. 19 as the date of the hearing.

## Permits Asked for Chattahoochee and Western Rivers

Application to the Federal Power Commission has been made by B. H. Hardaway, J. Smith Lanier and Frederick H. McDonald for a preliminary permit for a power project on the Chattahoochee River, in Chambers County, Ala., and Troup and Heard Counties, Ga., near West Point, Ga. The applicants contemplate construction of one or more dams across the Chattahoochee at the Adamson or Wehadke dam sites, with a head of about 70 ft. and an initial installation of 12,000 hp. to 24,000 hp. of electrical machinery. The developed power will be utilized for public utility purposes. The applicants state that such a development will also aid flood control and afford transportation facilities by water to the town of Franklin, Ga., now 14 miles from railroad connections.

The Mount Baker Development Company has applied for a license for a partly constructed project on Bagley Creek, Wash., within the Mount Baker National Forest, 95 miles from Seattle. A concrete-arch dam 16 ft. high and 64 ft. long, creating a reservoir of 9½ acres in area, provides water for operation of 132 hp. in installed capacity.

The city of Milton, Ore., has applied to the commission for a preliminary permit covering a project on the South Fork of the Walla Walla River, in Umatilla County, Ore. It is planned to construct a power house just above the intake of the present plant and divert water to it from four miles upstream. This diversion will eventually be extended to the tailrace of the power house of the Pacific Power & Light Company. Another power house is to be constructed above the intake of the Pacific Power & Light power house which will furnish water for a proposed reservoir on the South Fork of the Walla Walla River. The power capacity of the first unit will be 1,150 hp.

L. B. Rouse of Pine Grove, Calif., has applied for a license covering a project on the Middle Fork of the Mokelumne River, Calif. This application is in conflict with a larger project of J. W. Preston, Jr.

## Citizens to Study Great Falls of Potomac Plans

Appointment of a committee to study the relative scenic and utilitarian values of the Great Falls and Gorge of the Potomac River, use of which for hydro-electric projects is opposed by the National Capital Park and Planning Commission and various civic organizations of the District of Columbia, is announced by Major Brehon Somervell, United States Army engineer, to whom the applications of Stineman & Quick, Baltimore; the Potomac River Corporation and the South Branch Power Company for permits to develop this section of the Potomac were referred by the Federal Power Commission.

The committee will consist of Capt. H. O. Oram, Corps of Engineers; Charles W. Eliot 3d, city planner, National Capital Park and Planning Commission; C. A. Peters, engineer, office of Public Buildings and Public Parks; Dr. A. Eugene Baker, member Westchester Park Commission, New York, and Addison Flurnoy, Washington, landscape architect.

## Artistic Lighting Association at Cleveland

The first day of the annual meeting and convention of the Artistic Lighting Equipment Association and a meeting of the Illuminating Glassware Guild at the Hotel Winton, Cleveland, Jan. 25 to 28, saw the registration of two hundred manufacturers and dealers. Of particular interest at this meeting was the proposed sales promotion and refixturing campaign, the details of which were outlined by G. P. Rogers on Friday morning. This campaign contemplates the adoption of a slogan and emblem by all members of the Artistic Lighting Equipment Association. This is to be popularized by means of an emblem tag attached to fixtures and is to be advertised locally by dealers and through the trade press by manufacturers and jobbers. A comprehensive plan of direct-by-mail folders, newspaper advertisements and publicity on adequate lighting is to be made a part of the campaign. General business sessions of the lamp and lighting equipment manufacturers were held on Thursday and Friday, with the annual dinner dance on Thursday evening.

## Northwest Inspectors Favor International Association

A determination to continue to strive for the formation of an international association and to continue to co-operate with the electrical committee of the National Fire Protection Association, through its field secretary, as a means of exerting the co-ordinated effort necessary to an adequate revision of the National Electrical Code was the keynote of the third annual convention of the Northwest Association of Electrical Inspectors, which opened on Jan. 26 at Seattle. Eighty members registered.

The efforts to affiliate the sectional inspectors' associations into a nation-wide group were described in a progress report by F. D. Weber, secretary of the Northwest association and its representative in the national conference. In his annual message President H. S. Jenkins, chief electrical inspector for Bellingham, Wash., stressed the necessity of attaining safety through intelligent code making and administration without raising the standards to a point where the cost would act as a deterrent.

Speakers at the sessions included C. R. Welborn, Underwriters' Laboratories, Chicago; W. A. Groce, Olympia, and William Meacham, a Seattle contractor, who insisted that local regulations should be in addition to and not in modification of the national code.

# Electrification, Welding and X-Ray Uses

*These, with an Address by C. F. Hirshfeld on Economic Aspects of Engineering Advance, Are Features of the Michigan Engineering Conference*

At the third annual conference of Michigan technical men, held in Detroit, Jan. 27 and 28, several addresses of special interest to electrical engineers were made. W. N. Vandersluis, electrical engineer for the Illinois Central Railroad, stated that during the first full year of electric operation his road recorded a 20 per cent increase in passenger traffic over the previous year of steam operation. The constant improvement in economy in the generation of electric power by central stations makes electrification of steam railroads increasingly attractive, he asserted; further, the business of the railroad is transportation, and power generation may well be left to the power companies where practicable. One of the advantages of electrification, he pointed out, is the elimination of fuel and water stations and the release of large numbers of coal cars for commercial service. The Chicago, Milwaukee & St. Paul found that 12 per cent of the power output of its substations is returned with regenerative braking. However, Mr. Vandersluis concluded, it looks as though it would be a long time before a uniform electrical system for railroad electrification is evolved in the United States.

According to William Spraragen, secretary American Welding Society, who was another of the speakers, there is great need for recognition of the fact that best results are never obtained by welding a part or a structure designed to be riveted. There is an enormous field for the application of automatic electric welding, which is not only a great labor saver but produces a more uniform product by the accurate control of variables. Electric spot welding has come into wide use in automobile body fabrication.

Prof. George L. Clark of the University of Illinois showed that the X-ray is an engineering tool that has been put to use in inspecting metal castings for hidden flaws, in testing welds for soundness, in the inspection of insulated wire, and in locating wires and pipes hidden behind walls. The hysteresis characteristic of silicon steels may be indicated with the X-ray.

The economic consequences of the revolutionary improvements that research and engineering have made in industry were discussed by C. F. Hirshfeld, chief of research of the Detroit Edison Company. Had it been looked forward to years ago, a large increase in production per unit of time, labor and investment would have seemed to herald disaster to the law of supply and demand. What actually happened was that the consumer, who is also the producer, received increases in real wages, so that he is enabled to buy more, and thus the demand for manufactured goods has kept pace with the increase in production. It is generally said, Mr. Hirshfeld remarked, that American prosperity follows from the large amounts of mechanical and electrical power placed in the hands of our workers. It is an error, however, not to include the effects of improved organization, improved treatment of wage earners, increased efficiency of executive forces and increased output per unit of invested and of working capital.

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# Serving Luncheon on Top of a Power-Plant Stack

Something new in the way of pleasing customers was recently thought of by the Jordan (Minn.) Electric Light & Heating Company. One hundred and twenty citizens of that place made an ascent to the top of the smokestack of the company's plant, which is 108 ft. high, 4 ft. in diameter and built of brick and concrete. Of these climbers seventeen were women. About fifty persons were served with luncheon on top of the stack, six at a time, according to S. L. Sly, manager of the plant. The luncheon, which was cooked electrically, can be seen in the picture as it approaches the reach of the guests.

The Jordan plant furnishes electric light and power service to the city and district steam heat to 64 buildings, so that the stack is the only one in the place, which in consequence boasts a sky almost clear.

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# Build 946 Miles of Line in North Dakota in 1927

North Dakota's seven major electric light and power companies had 2,846 miles of transmission lines either constructed or approved on Dec. 1, 1927, according to a report just made public by the North Dakota Board of Railroad Commissioners. The seven companies are the Otter Tail Power, the Northern States Power, the Montana-Dakota Power, the Hughes Electric, the Northern Power & Light, the Northern Utilities Corporation and the Interstate Power Company. During 1927 four of these companies constructed 946 miles of transmission lines. The policy of merging small community units, thus adding a total of 53 towns to their service, was continued by the four companies.

The report shows that the total mileage of the Otter Tail Power Company's transmission lines in North Dakota, either constructed or approved, is 1,562 miles; of the Northern States Power Company, 110 miles of the Montana-Dakota Power Company, 477 miles; of the Hughes Electric Company, 307 miles; of the Northern Power & Light Company, 276 miles; of the Northern Utilities Corporation, 82 miles, and of the Interstate Power 25 miles. During 1927 the Montana-Dakota Power added 53 miles of 13,200-volt lines, the Northern Power & Light 157 miles at 22,000 volts, the Hughes Electric 46.5 miles at 12,300 volts, the Otter Tail Power 410 miles at 38,100 volts, 115 miles at 6,600 volts, and 165 miles at 13,200 volts. Thirty towns were added to the Otter Tail Power Company system, eleven to the Montana-Dakota Power system, seven to the Hughes Electric system, and five to the Northern Power & Light system.

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# Conowingo Dam Closed

*Formation of Nine-Thousand-Acre Lake Begins as Ancient Village Disappears from Maryland Map—Power to Be Transmitted in Spring*

Many spectators gathered near the deserted site of the 150-year-old village of Conowingo, Md., on Wednesday, Jan. 18, to watch the water gradually accumulate in the 9,000-acre reservoir which became a fact when the last eight gates of the great dam were closed early that morning. The new lake will extend 13 miles up the river into Pennsylvania. Its depth will vary from 100 ft. at the dam down to 40 ft.

Work on the Philadelphia Electric Company's great hydro-electric plant began in March, 1926. From that time until a few weeks ago from 2,000 to 3,500 men were employed on the task. With favorable conditions and organizations, the fifty-two-million-dollar project has been finished several months ahead of time. The construction required the excavation of 400,000 cu.yd. of rock. More than 750,000 cu.yd. of concrete were required on the work.

The first three of the seven generators are to be installed at once, and it may be possible to transmit power to Philadelphia in three months' time. In the fall, when the seven generators are completed, Conowingo will be second only to Niagara Falls among the hydro-electric plants of the country. It will then have a capacity of 378,000 hp., outranking the existing installation at Muscle Shoals and far surpassing such plants as those at Holtwood and Keokuk. The eventual capacity of Conowingo, with eleven generators, will be 594,000 hp.

# Purchases and Mergers

*Iowa Public Service Company, Along with Sioux City Gas & Electric, Goes to American Electric Power—Bankers Buy Central West Public Service—Many Other Transactions*

PURCHASE by the Iowa Public Service Company of the Sioux City Gas & Electric Company from the United Gas Improvement Company of Philadelphia is reported. This sale, which is connected with the U.G.I.-American Electric Power transaction recorded last week (page 220), includes the new Big Sioux power plant in North Riverside, which cost $3,500,000 and upon which a million-dollar addition is under way, and several hundred miles of high-tension transmission lines in northwest Iowa, serving nearly a hundred towns and cities in the Sioux City district, as well as the Sioux City Service Company. The deal is reported to have involved nearly $10,000,000. The United Gas Improvement Company had been interested in the Sioux City utilities since 1889. C. I. Crippen and H. A. Clarke, vice-presidents of the American Electric Power Corporation, and Don Stearns, president of the Iowa Public Service Company, announce that the actual transfer of properties will probably be accomplished in 30 days. W. J. Bertke, president of the Sioux City Gas & Electric Company, said that the American Electric Power Corporation will acquire the interests of the United Gas Improvement Company in the Iowa Public Service Company in exchange for the holdings of the American Electric Power Corporation in the Delaware Electric Power Company. This arrangement, he explained, had been promoted by the desire of the United Gas Improvement Company to concentrate its holdings in the East and by the desire of the American Electric Power Corporation to acquire a strong utility company in the Middle West. General offices of the Iowa Public Service will be continued in Fort Dodge, Iowa, and Don Stearns will continue as president.

Announcement is made of the purchase by A. B. Leach & Company and I. M. Porter & Company of New York and Chicago of the stock holdings of Walter M. Albertson, president, and George M. Kaltwelt, vice-president, in the Central West Public Service Company and subsidiaries for a consideration of $3,000,000. The Central West Company serves 147 communities in Nebraska, Iowa, North and South Dakota and Minnesota, with headquarters at Omaha.

Negotiations have just been concluded by which the New England Public Service Company, as already forecast, acquires the Utilities Company of Meredith, N. H. The purchase, which follows that of the Franklin (N. H.) Light & Power Company, may, it is rumored, be followed by acquisition of additional rights in and around Plymouth, N. H., including the plant of the Parker-Young Company. The Utilities Company has a dam on the Pemigewasset River near Bristol, N. H., and supplies power and light to a population of approximately 70,000.

Arthur S. Dewing of Boston has obtained control of the Goodrich Falls (N. H.) Electric Light & Power Company. He now controls also, it is understood, the Meredith Electric Company, the Baker River Light & Power Company, the Hill Light & Power Company, the East Andover Light & Power Company and the Alton Electric Light & Power Company, all in New Hampshire. Water rights are included.

Permission to purchase the electric distribution systems at Hannaford and Cooperstown has been given by the North Dakota Railroad Board to the Northern Light & Power Company. Both properties now are owned by the Electric Construction Company. The Otter Tail Power Company has received permission to buy the electric properties at Sanish and Van Hook from the General Service Company and the Van Hook Light & Power Company respectively and also to purchase the electric property at Ryder from the Ryder Electric Company.

Approval by the North Dakota Railroad Board has been given the transaction whereby the Northern Utilities Corporation sold to the Dakota Public Service Company, controlled by the same interests, the electric properties at Buffalo, Gackle, Medina, Streeter, Starkweather and Tower City. The commission has also authorized the purchase of electric properties at Bowman and Reeder by the Dakota Public Service Company. Both of these properties were owned by the Bowman Electric Company. The former company has bought the Hettinger Electric Light & Power Company and the Alpena (S. D.) plant.

Announcement has been made that Baker, Young & Company have acquired the control of the Page Power and Massanutten Power companies, Luray, Va. The Page Power Company recently completed a hydro-electric dam on the Shenandoah River. The Massanutten Power Company, a subsidiary of the Page Power, was the result of a purchase of municipal plants.

Merger of the Saranac River Power Corporation and the Saranac Utilities, Inc., just chartered, is in prospect, according to T. Harvey Ferris of Utica, N. Y. If the merger is permitted, the company will own 8,000 hp., of which 7,000 hp. is developed.

By a vote of 244 to 168 the village of Sargent, Neb., has rejected a proposal to sell the municipally owned plant to the Nebraska Electric Power Company.

The Northwestern Utilities Corporation of Minneapolis has completed the purchase of the Mapleton (Minn.) Electric Company.

Jolley, Iowa, will sell its municipal electric system to the Iowa Public Service Company if the voters approve an agreement entered into by the Town Council.

Sale of the municipally owned electric system at Bagley, Iowa, to the Iowa Railway & Light Corporation has been authorized at a special election.

The Adrian, Burnside, Colusa & Ferris Light & Power Company of Ferris, Ill., has applied to the Illinois Commerce Commission for permission to sell its property to the Central Illinois Public Service Company.

The Illinois Public Utility Company has been authorized to purchase the Heyworth Electric Light & Power Company, serving Heyworth, Randolph and Wapella, for $55,000 and to construct and operate a 13,000-volt transmission line between these places.

Elsberry, Mo., has sold its municipal electric plant to the Missouri Edison Company for $55,000.

The Federal Public Utilities Company of Chicago has sold the Waynesboro (Miss.) ice and light plant to the Central States Power & Light Company, with headquarters in Davenport, Iowa. The plant was purchased by the Chicago concern several months ago for about $72,000. Included in the same deal were the light and power plants in four other Mississippi towns—Lucedale, Leaksville, New Augusta and Brandon—and in Citronelle, Ala.

Purchase of the Santa Cruz County Utilities of Boulder Creek, Cal., and the Capitola Company of Capitola, Cal., by the Public Utilities California Corporation, a Foshay organization, has been approved by the California Railroad Commission. The newly acquired properties supply electric power and water to a territory about 14 miles from Santa Cruz.

What seem to be well-authenticated reports from Phoenix, Ariz., indicate that the Arizona Power Company, an independent utility, may soon become a subsidiary of one of several large holding companies interested in Arizona utility properties.

Sale of the Gallup (N. M.) Electric Company to the International Utilities Company of New York is announced. A previous deal with the Texas-Louisiana Power Company fell through.

The merger of the Kentucky Power Company with the United Public Service Company of Chicago, noted last week, has led to speculation in Cincinnati as to the possibility of future competition between Kentucky and Ohio utilities. The Kentucky company supplies power to Augusta and 37 other places in Kentucky and has wires covering fourteen counties and reaching as far west as California, Ky., about 25 miles from Cincinnati.

Confusion caused by newspaper announcements is cleared up by an official statement from George N. Tidd, president of the American Gas & Electric Company, that, while retaining the electric light and power business in Roanoke and Lynchburg, Va., and the Lynchburg gas plant, which have for some time been operated by the Appalachian Electric Power Company, the American Gas & Electric has sold the Roanoke Railway & Electric Company, the Roanoke Traction & Light Company and the Lynchburg Traction & Light Company, operating railway and bus lines. The new owner is the Central Public Service Company, Chicago, which also recently purchased the Rockford Electric Company and various railway and bus lines from the American Gas & Electric Company.

Official announcement is made at Montreal of a long-looked-for absorption of the St. Maurice Power by the Shawinigan Water & Power Company, the parent company. The subsidiary will be merged into the Shawinigan on a basis of two shares of Shawinigan for one share of St. Maurice, with the alternative of $175 per share in cash offered to St. Maurice stockholders.

Making its first entry into the northern Canadian field, the Mid-West Utilities, Ltd., a subsidiary of the International Utilities Corporation, has purchased the municipal electric plant at Grande Prairie, Alberta, for $13,500.

The International Power & Paper Company of Newfoundland, Ltd., a subsidiary of the International Paper Company, has acquired the property and assets of the Newfoundland Power & Paper Company, Ltd. The properties include a hydro-electric plant generating 98,000 continuous horsepower. The controlling interest in the Newfoundland Power & Paper Company was owned by English interests.

# Jersey City Is Site of New Switching Station

*Public Service Production Company Builds Third in Series of Such Plants, Hudson Following Trenton and Athenia—Built in Seven Months*

THE third of a series of high-voltage distributing centers for electrical energy was connected to the lines of the Public Service Electric & Gas Company at Jersey City, N. J., on Jan. 28. This station, known as the Hudson switching station, is supplied with power at 132 kv. from a two-circuit tower line connecting near by to the 132-kv. link between the Marion generating station and the Kearny and Essex stations.

The Hudson switching station, designed and constructed by the Public Service Production Company, is somewhat similar in design to the Trenton and Athenia stations, respectively placed in operation about four months and twelve months previously. Four 15,000-kva., single-phase self-cooled transformers, one a spare, are installed for stepping down the voltage to 26.4 kv. for distribution of power to the Hudson and Bergen divisions of the operating company. All of the primary disconnecting switches necessary for the operation of the bank of transformers in the initial installation are motor-operated, as are the secondary transfer-bus switches, the switches of both voltages being the first in the Public Service system to place dependence upon high pressure rather than large area of contacts. Outdoor 26.4-kv. reactors are employed in the bus layout and represent the first installation on the company's lines of oil-immersed reactors. Owing to the switching station's proximity to the three large generating stations of the system, no provision has been made for the future installation of synchronous condensers on the tertiary windings of the main transformers.

Additional sources of power to the switching station are furnished by connections at 26.4 kv. from two 11,500-kva., three-phase transformers adjacent to the Marion station. At the switching-station end of these lines 26.4-kv. tap-changing voltage regulators are installed to facilitate handling of the three-cornered condition, viz., the step-up to 132 kv. from 13.2 kv. at the Marion generating station, the step-down from 132 kv. to 26.4 kv. at the Hudson switching station, and the step-up from 13.2 kv. to 26.4 kv. at Marion.

The actual construction of the switching station presented several unusual problems. The entire foundations are supported on piling, it having been necessary in some instances to drive a number of piles in close proximity in order to obtain sufficient support in the marshy soil. The presence of surface water made necessary the continuous operation of pumps and the temporary erection of earth dikes at certain edges of the property. Nevertheless, the date of the station's completion followed the date of ground breaking by only about seven months. A feature is the installation of a kenotron set for the testing of cable up to a direct-current voltage of 150 kv.

# Briefer News

Upstate New York Utility Changes Name.—The Depew & Lancaster (N. Y.) Light, Power & Conduit Company has filed a certificate changing its corporate name to the Western New York Gas & Electric Corporation.

Additional 4,000-Hp. Generator for Government Plant at Guernsey, Wyo.—A second 4,000-hp. generating unit was installed recently at the government's irrigation and power plant at Guernsey, Wyo., thus doubling its capacity. Enough water for two more such units is reported to be available at this site.

Georgia Power Company's Enlarged Headquarters. — Reconstruction of the office building of the Georgia Power Company in Atlanta by the addition of three floors and by improvements in the Walton Street annex, at a cost of $500,000, has recently been completed and gives the company 33,000 sq.ft. of floor space and modern quarters for its business offices and its display rooms.

New Interstate Line Authorized for New Hampshire Company.—The Southern New Hampshire Hydro-Electric Company has received permission from the New Hampshire Public Service Commission to build a transmission line from Canaan, Vt., through Stewartstown, Colebrook, Columbia, Northumberland and Stratford to Lancaster, N. H. Work will be begun as soon as conditions are favorable.

Hydro Plant to Be Built to Serve Oregon Mines.—Coming construction by Eastern capital of a hydro-electric system on Blue River, 45 miles east of the city of Eugene, Ore., has been announced by J. S. Miller, owner of mining properties in the district, who says that the energy generated will be used for the operation of a railway from Eugene to the mining property and also in the operation of mining machinery.

Progress of Northern States Power Company.—Present indications are that the Northern States Power Company's 30,000-hp. hydro-electric station at Chippewa Falls, Wis., which is to operate synchronously with the 42,000-hp. Wissota hydro-electric station, 3 miles further up the Chippewa River, will be completed by September in accordance with the plans. The Northern States company has just replaced the steam ends of two 1,500-kw. turbine units in its steam plant at Fargo, N. D., with new equipment, thereby increasing their rating to 2,250 kw. each. Additional generating capacity at Grand Forks and Minot, N. D., has also been authorized, and plans have been approved for the construction of the 84-mile transmission line from Green Bay to Stevens Point, Wis., which is to interconnect the systems of the Wisconsin Public Service Corporation and the Wisconsin Valley Electric Company. This line will be of H-frame, wooden-pole construction and will operate at 110,000 volts. It will involve substation equipment at each end and will cost about $1,500,000.

Northwest Commercial Men to Meet in Portland on Feb. 20-21.—A meeting of the executive committee of the Commercial Section, Northwest Electric Light and Power Association, set the time for the midwinter meeting of the section as Feb. 20 and 21. Portland, Ore., will be the place. Reports of committees showed activity in the promotion of commercial cooking, merchandising, industrial heating, rural service, street and highway lighting and home and industrial illumination. Ten talks before business men's lighting clubs have been made already, out of thirty scheduled.

International Water Commission to Meet at El Paso and Juarez This Month.—The first joint meeting of the Mexican and American sections of the International Water Commission has been called to convene at El Paso, Tex., and Juarez, Mexico, on Feb. 27, the chairman of the American section of the commission, Dr. Elwood Mead, announces. The American commissioners appointed by the President are, as previously announced, Dr. Mead, Gen. Lansing H. Beach and W. E. Anderson. Miss M. A. Schnurr is secretary of the American section.

Oklahoma-Kansas Interconnection. — The Empire District Electric Company is making rapid progress on construction of a frequency changer and turbine room at its Riverton (Kan.) steam plant. This is a part of a construction program which is expected by late spring of this year to involve an expenditure of approximately $1,100,000 and to bring transmission-line connections between the Riverton plant and the Neosho River plant of the Kansas Gas & Electric Company, southwest of Pittsburg, Kan. It will give all the Oklahoma towns on the lines of the company direct connection with these two Kansas power-generating plants.

South Georgia Rate Reductions.—The Georgia Public Service Commission has followed the investigation previously reported by ordering substantial rate reductions in all cities and towns in the state served by the Georgia Power & Light Company, which supplies Valdosta, Waycross, Bainbridge and other cities in south

Georgia. In the three cities named the new rates for residential and commercial lighting range from 11 cents for the first 40 kw.-hr. per month down to 5 cents for consumption over 1,000 kw.-hr. In Blackshear, Boston, Jessup, Waynesboro and other towns the new rates range from 12 cents to 6 cents. Rates for industrial service were also reduced in nearly every community served.

Arizona Power Company Makes Five-Year Contract with United Verde Copper Company.—Negotiations have just been concluded whereby the Arizona Power Company contracts to supply the United Verde Copper Company with its power requirements for five years from Oct. 1 last, according to B. M. Wotkyns, director of the Arizona company. The contract assures Arizona Power of a large and steady load from this one source. Another advantage accruing to the power company is that it is enabled to buy waste-heat power from the copper company on good terms for use during peak conditions. The copper company operates a large concentrating mill and copper smelter in connection with its mine.

Electric Department Budget of New Jersey Public Service Calls for $22,000,000.—Budgets for 1928 of the operating companies of the Public Service Corporation of New Jersey representing a total of approximately $37,000,000 have been approved. Of this sum more than $22,000,000 will be used by the electric department of the Public Service Electric & Gas Company, $7,000,000 being appropriated for interconnection and transmission projects, half of which is for the tri-company agreement to which the Pennsylvania Power & Light and the Philadelphia Electric are the other parties. The 40-acre Roseland switching station will cost between $5,000,000 and $6,000,000, and $700,000 is to be spent on a spare bank of transformers, consisting of three 15,000-kva. units, and other equipment at Kearny.

Two Nebraska Companies Will Push Rural Service Even at Loss.—The Nebraska Power Company has provided in its 1928 budget more than a million dollars for reconstruction and extensions. A considerable portion of this will be expended in rural electrification, the company having just obtained authority from the State Railway Commission to construct a dozen transmission lines in the well-settled counties surrounding Omaha, where its plant is situated. In this section the company has bought a number of municipal plants, and it will make these the center of farm operations. A complete circuit will enable the routing of energy in either one of two directions. The company is offering to supply all equipment needed to reach each farmer, the service charge to be a sum equal to the interest on the investment plus the upkeep cost, after which electricity will be supplied at rates close to those prevailing in the cities. The Iowa-Nebraska Light & Power Company is planning developments along the same lines. Both companies are said to be prepared to lose some money in making the experiment, if necessary.

N. E. M. A. Policies Division Meeting. — Business practices and business getting will be major subjects of discussion at the March 14-16 meeting of the Policies Division, National Electrical Manufacturers' Association, according to announcement by Vice-president Clarence L. Collens. The meeting will be held at the Edgewater Beach Hotel, Chicago. A meeting of the board of governors, at which President Gerard Swope will preside, is scheduled for Wednesday evening, March 14.

New International Company to Serve Both Sides of the Rio Grande.—Another utility company has been organized on the Lower Rio Grande border for the purpose of doing an international business. It is the Hidalgo Utilities Company and has a capital stock of $100,000. It will construct an electric power plant at Hidalgo and has obtained a concession from the Mexican government to build a wooden-pole transmission line to Reynosa, Mexico, and other towns in the State of Tamaulipas. The company will also serve Hidalgo and other towns on the American side of the river. A. Y. Baker of Edinburg, Tex., has been elected president.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16; St. Louis regional meeting, March 7-9; Baltimore regional meeting, April 17-19. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21; Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.

New Mexico Utilities Association—Albuquerque, N. M., Feb. 20-22. Arthur Prager, Albuquerque Gas & Electric Company, Albuquerque.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Madison, Wis., March 17-18. W. Wilke, 4211 Eiring Place, Milwaukee.

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N.E.L.A. — Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Uvalde, Tex., Becomes Strategic Point in Electric Service.—Uvalde, Tex., will soon be the hub of a transmission network connecting it with the Winter Garden district on the south, with San Antonio on the east and, from Del Rio, with the extensive system of high-tension lines in west Texas. Lines from the San Antonio Public Service Company and the West Texas Utilities Company will join the Central Power & Light Company's system at Uvalde, where the Central Power & Light Company is building a large substation. That company expects that a 132-kv. trunk line will be necessary eventually, into which the 66,000-volt system now under construction can be tied. Uvalde will be power headquarters for the Winter Garden district, the company says.

Cleveland Electric Illuminating's Big 1928 Budget.—Announcement that the Cleveland Electric Illuminating Company would spend $9,800,000 in 1928 on additional facilities for providing the Greater Cleveland district with electric service was made at the recent annual meeting of stockholders. This is nearly $2,600,000 in excess of the sum similarly expended in 1927. Construction will include the installation of a 35,000-kw. turbo-generator with boilers and auxiliary equipment at Avon station, as already announced; a 132-kv. steel-tower transmission line to connect Avon station with Clinton substation, the million-dollar structure at West Ninety-fifth Street completed a year ago, and additions to that substation and to twenty others, besides additional underground lines and distribution lines.

Large Attendance at San Francisco Engineering Meetings.—An unusually large attendance and keen interest in committee work featured the midwinter meeting of the Engineering Section of the Pacific Coast Electrical Association held in San Francisco, Jan. 11-12. At a luncheon meeting attended by 180 P. M. Downing, vice-president of the association, said that the ideal toward which the Engineering Section should work is to obtain the greatest possible number of kilowatt-hours per dollar of invested capital. Individual committee meetings were unusually well attended and all committees reported a most active year. An innovation was joint meetings of each committee with the accident prevention committee. In this way the latter committee was able to arouse the interest of all committee members in accident prevention work, and through the presentation of papers on safety practice and methods and training of personnel many valuable ideas were brought out.

Another Unit for McCamey, Tex.—Another unit for the power plant of the Pecos Valley Power & Light Company, 10 miles west of McCamey, Tex., is under construction. It will have a capacity of 8,000 hp. and will bring the total rating of the plant to 24,000 hp. Power from this plant goes to the oil fields of west Texas as well as to towns which are within a radius of more than 100 miles.

Ohio Power Company's Biggest Unit to Go in at Philo This Year.—The Ohio Power Company has now 350 men at work on the construction of its 165,000-kw. unit at Philo. Thirty-four concrete caissons have been sunk to rock, 52 ft. below ground level. These caissons vary from 8 ft. to 22 ft. in diameter. All the steel columns for the superstructure will be supported by these caissons. Field work to date indicates that the new turbine will be ready to take the line load before the end of the year—perhaps by Nov. 1.

Back River Power Company Lets Construction Contracts in Quebec Province.—Several contracts have been awarded on the power development of the Back River Power Company near Montreal, a project which will involve a total expenditure of $8,000,000. The operating company is to be the Montreal Island Power Company, Ltd., incorporated in 1927. This company has a contract with Montreal Light, Heat & Power Consolidated under which the latter will purchase all the power for a period of 30 years, with opportunity of renewal for 30 years more. The site is capable of developing 65,000 hp. under a 26-ft. head, and it is expected that the initial 40,000 hp. will be available for delivery by the end of 1929. The power plant will consist of a number of units of 7,500 hp. each. Eventual installation may reach 92,000 hp.

Los Angeles Rivals Both to Cut Rates Again.—The Bureau of Power and Light of Los Angeles has been authorized by a resolution passed by the Board of Water and Power Commissioners to reduce its present rates for electricity approximately 10 per cent. The reductions are to be put into effect beginning July 1 of this year, when the lighting rate will be reduced from 5 cents to 4.5 cents per kilowatt-hour and the maximum power rate from 4.5 cents to 4 cents. Last July the bureau cut its lighting rate from 5.6 cents to 5 cents and its maximum power rate from 5 cents to 4.5 cents. Coincident with the announcement of the reduced rates on the part of the municipal department, Addison B. Day, executive vice-president and general manager of the Los Angeles Gas & Electric Corporation, announced that his organization would make a similar move.

# Recent Court Decisions

Commission Cannot Prohibit Utility from Keeping Second Set of Fixed-Capital Accounts in Its Own Way.—While the New Jersey Board of Public Utility Commissioners could order the Passaic Consolidated Water Company to keep its fixed-capital accounts in a way approved by the commission, it could not forbid the company to keep in addition another set in which its own desires could be followed, said the Supreme Court of New Jersey in deciding for the plaintiff in a suit brought by the water company against the commission. (139 At. 324.)*

Commissions Must Be Governed by Principles of Common Law.—"It is elementary," declared the Appellate Court of Indiana in reversing a verdict for damages (Puckett vs. Terre Haute, Indianapolis & Eastern Traction Company), in which the headlighting equipment of an interurban car as prescribed by the Public Service Commission was concerned, "that boards and commissions in exercising power conferred upon them by statute must be governed by the rules and principles of common law. These rules and principles require that such power shall always be exercised in a reasonable manner. If not so exercised, any rule, order or ordinance contrary thereto will be by the courts declared void." (158 N.E. 639.)

Entry of Occupied Field Permitted in North Dakota. — M. A. Erickson of Rugby, N. D., has won in the Supreme Court of that state the suit brought against him to halt the construction of a power plant at Kenmare (Electrical World, Dec. 3, page 1168) and has announced that he will proceed with the building early next spring. The State Railroad Commission held that Erickson should be enjoined from constructing the plant since he had not obtained a certificate of convenience and necessity as required by the 1927 law, which became effective on July 1. Erickson maintained that since he obtained a franchise from the city of Kenmare on June 6 the law did not apply. Erickson will now institute court action to halt the Montana-Dakota Power Company, now furnishing electrical service at Kenmare, from further operations in that city.

Jacksonville's Right to Wire Domestic Electric Equipment Again Sustained.—The Circuit Court at Jacksonville, Fla., has handed down a decision to the effect that the city has the proprietary right to engage in the business of making wiring connections and installations for electric stoves and other equipment. Suit was brought several months ago (Electrical World, Oct. 8, page 756) by Edward Hamler, a taxpayer, to restrain the city from doing such work, the plaintiff contending that the city was stepping outside its province in doing the wiring work and that the work was being done at less than cost on the theory that the city would profit through the increased use of electricity. It was also contended that electrical dealers were being injured and that the interests of the public were jeopardized because any losses sustained by the city would have to be paid from public funds. Application for a temporary injunction was denied last November, and the sustaining of the demurrer settles the case as far as the Circuit Court is concerned.

Private Company Barred from Supplying Alternating-Current Energy in City with Municipal Direct-Current Supply. — Decision for the town of Ackley, Iowa, in a suit to uphold a temporary injunction procured by the town to halt the Central States Electric Company's installation of wires through Ackley to reach a creamery desirous of alternating-current service has been given in the Iowa Supreme Court. The manager of the creamery claimed that the direct-current service of the municipal plant was unsuitable to his needs and contracted with the Central States company, from which the town, which is to change over to alternating service, will now seek damages.

# Commission Rulings

Profit by Construction Company in Sale of Its Product to Allied Utility Company Condemned. — The California Railroad Commission has laid down the principle that it will not permit a corporation owning all of the stock of a public utility under its jurisdiction to exact a profit at the expense of the public utility and to capitalize such profit in securities issued by authority of the Railroad Commission. The commission took this action in a supplemental order on the application of the Pickwick Stages System for authority to use the proceeds from the sale of stock and certificates issued by it to buy rolling stock owned by the Pickwick Corporation, a company which owns all of the outstanding stock of Pickwick Stages System, the operating utility. It was brought out that the Pickwick Corporation proposed to charge a profit on the equipment constructed for its own use in the amount of $8,910. In passing upon the application the commission said: "We do not look with favor on the practice of permitting a construction company to profit at the expense of a public utility when the construction company controls the public utility or is owned or controlled by the same interests which own or control the utility."

Unused Property in Valuation.—The rate base of the Lakewood Water Company has been modified on rehearing by the New Jersey Board of Public Utility Commissioners, which sustained a contention that in making deductions for property not used and useful the amount deducted had been only the basic figures representing values of the items in question and that additions for intangibles such as "going concern" value had not also been deducted. On the other hand, the commission refused to sustain a contention that part of a building used jointly by several companies as a shop for the maintenance and repair of gas, electric and water meters should be omitted from the rate base because the water company involved did not own the building. Likewise, the commission refused to exclude from the rate base an amount representing the value of excess land not used by the company and not easily salable, but necessarily acquired with other land which was necessary for the right-of-way.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *Drexler Acting Manager of Virginia Utility*

Norman E. Drexler, since 1916 chief engineer of the Newport News & Hampton Railway, Gas & Electric Company, now the Virginia Public Service Company, has been named acting manager of that utility to supervise the work formerly directed by C. D. Porter, who has transferred his interests to Omaha.

Mr. Drexler became assistant engineer of the Newport News company in 1912 and after serving in that capacity for two years he was made master mechanic and subsequently assistant superintendent of transportation. It was in 1916 that he was appointed chief engineer. As announced in the Jan. 28 issue of ELECTRICAL WORLD, Mr. Porter, vice-president and general manager of the Virginia Public Service Company, resigned to become vice-president and general manager of the Omaha & Council Bluffs Street Railway Company.

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E. N. HENRY, assistant superintendent of the northern division of the Alabama Power Company, Huntsville, has been transferred to Demopolis in the capacity of district superintendent.

FRANK TIBBALS has been elected secretary and treasurer of the Westfield Power Company, Westfield, Mass. Mr. Tibbals is also a member of the board of directors.

H. T. ASBURY, manager of the McAlester division of the Southwest Power Company, has been transferred to Fayetteville, Ark., where he will have charge of the Fayetteville division.

J. E. EVERSON, formerly electrical engineer of the Sioux City (Iowa) Gas & Electric Company, has been promoted to the position of general superintendent with general supervision of electric and gas production and distribution.

B. E. WALTZ, vice-president of the United Public Service Company of Chicago, will leave that city this month to take active charge of the Kentucky Power Company's plants recently acquired by the United Public Service Company.

W. L. CARR has been appointed supervisor of electric metering for the New York Power & Light Corporation, Albany. Mr. Carr's new duties will include the selection of types of electric meters, installation methods and testing.

OLIVER A. CHURCH has been appointed district manager of the Batavia (N. Y.) district of the Niagara, Lockport & Ontario Power Company and GLENN W. IDE has been named district manager at Medina. Mr. Church was formerly construction superintendent at Batavia. His promotion follows the company's change in name from the Western New York Utilities Company to the Niagara, Lockport & Ontario Power Company. He is replacing H. K. Stein, formerly district manager at Batavia, who recently resigned.

WILLIAM FOSTER has been appointed general superintendent of aerial and underground construction of the Philadelphia Electric Company.

OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, was elected a member of the board of managers of the State Charities Aid Association at a meeting held at the Bankers' Club, New York, Jan. 31.

WILLIAM C. HORNBERGER of Phoenix, Ariz., has been elected vice-president and general manager of the Arizona Edison Company, a subsidiary of the Peoples Light & Power Corporation. Mr. Hornberger was for several years assistant general manager of the Central Arizona Light & Power Company, controlled by the Electric Bond & Share Company.

DR. THOMAS H. MCLAUGHLIN, director of electrical supply of the Irish Free State, arrived in New York Jan. 25 aboard the Cunard liner *Aquitania*. Dr. McLaughlin is in the United States to study plant construction and operation methods of the American electrical industry. The construction of the hydro-electric developments on the Shannon River has been under the supervision of Dr. McLaughlin.

ROY COSBEY has been elected secretary and a director of the Wadsworth Electric Manufacturing Company to fill the vacancy created by the death of Richard J. Dibowski. For the past four years Mr. Cosbey has been the comptroller of this company and was previously connected with the Joslin-Schmidt Company, the Cincinnati Milling Machine Company, the Modern Foundry Company, and Ernst & Ernst, all of Cincinnati, Ohio.

WILLIAM C. L. EGLIN, vice-president and chief engineer of the Philadelphia Electric Company, is seriously ill. Mr. Eglin was on a cruise in the Caribbean Sea when he was stricken. He was transferred at Havana to a northbound steamer and on reaching Philadelphia was removed at once to the Jefferson Hospital in that city. Eminent specialists as well as the physicians of the Philadelphia Electric Company were called in consultation. Mr. Eglin is suffering from "sleeping sickness" and while the physicians hold out some hope for his recovery, they do not deny the seriousness of the case.

GEORGE C. HEISTERMAN, formerly assistant industrial development engineer of the Public Service Company of Northern Illinois, has been appointed industrial development engineer for that company. A graduate of the University of Iowa, Mr. Heisterman became associated with the company in 1924 as an assistant power salesman. In 1925 he became a power salesman and one year later assistant industrial development engineer.

WILLIAM J. CASEY, president of the Continental Trust Company, Baltimore, has been elected a member of the board of directors of the Consolidated Gas, Electric Light & Power Company of Baltimore. Mr. Casey is succeeding the late S. Davies Warfield on both the directorate and executive committee of the Consolidated company as he also did in the presidency of the Continental Trust Company. He recently was elected a director of the Washington, Baltimore & Annapolis Electric Railroad.

BARON JEAN DANIEL DE MONTENACH of Geneva arrived in New York Feb. 1 aboard the White Star liner Olympic. The baron will spend a month in the United States, acquainting himself with American methods of power development. He will study particularly the properties of the Virginia Electric & Power Company, formerly the Virginia Railway & Power Company, which the Engineers' Public Service Company purchased from Frank Jay Gould, whose daughter Helen he married. Baron de Montenach is a director in many French enterprises.

## Obituary

ROBERT W. MUNK, production manager of the Crouse-Hinds Company, electrical manufacturer of Syracuse, N. Y., died Jan. 17 in that city after a short illness. Mr. Munk was 53 years of age.

LEON J. KENNEY, manager of the merchandising department of the Bristol (R. I.) Electric Company, died on Jan. 13. The Bristol company is affiliated with the Narragansett Electric Company, Providence.

RUDOLF V. ROSE, engineer and superintendent for the Empire Builders' Supply Company, Niagara Falls, N. Y., died Jan. 26 after a week's illness. A graduate of the Stevens Institute of Hoboken, Mr. Rose had formerly been connected with the Niagara Falls Power Company for more than twenty years. Starting in the capacity of draftsman, he later became chief draftsman and then assistant engineer. From 1907 to 1918 he served as construction engineer for the Niagara Falls Power Company, the Canadian Niagara Power Company and the Niagara Junction Railway Company. In 1920 he became president of the Consolidated Fuel & Supply Corporation, Niagara Falls, and four years later affiliated himself with the Empire Builders' Supply Company. Mr. Rose was 52 years of age.

# Financial and Statistical News

## *Stocks Move Upward Money Rate at 4½ Per Cent Bond Market Firm*

FOLLOWING the irregularity occasioned last week by the rise to 4 per cent in the Chicago rediscount rate, the market became firm and before the week closed the trend moved toward higher levels, with the utilities leading the upswing. Activity continued during the sessions this week and the utilities absorbed the bulk of interest. In fact, the utility group provided a background of strength for the market in general. Montana Power was the leader, advancing thirty-eight points in the course of a week. Brooklyn Edison advanced ten points during the week, while National Power & Light, Columbia Gas & Electric and Standard Gas & Electric made substantial gains. Other public utilities which continued in demand were Public Service Corporation of New Jersey, Pacific Gas & Electric, Southern California Edison and the Philadelphia Company.

The bond market was firm on the whole, wide fluctuations in prices being lacking. A feature of the week was the reduction from 5 to 4½ per cent in the call money rate.

## Twelve-Million-Dollar Italian Loan Floated

First mortgage 6½ per cent sinking fund gold bonds, series A, of Terni-Società per l'Industria e l'Elettricità were offered the investing public Jan. 30 at 90½ and interest, to yield about 7.35 per cent, a piece of financing involving a total of $12,000,000. Terni-Società per l'Industria e l'Elettricità, or "Terni" as it is known throughout Europe, was organized in 1884. The properties now in operation include four hydro-electric power stations located in the Apennine Mountains about 60 miles northeast of Rome, having a combined generating capacity of 86,200 kw. The company is building a new hydro-electric plant with an initial generating capacity of 105,000 kw., and in addition a subsidiary company, Società Elettrica dell 'Alto Nera, has under construction a plant with an initial generating capacity of 9,000 kw. These bonds will be a direct obligation of Terni-Società per l'Industria e l'Elettricità.

## National Power & Light Increases Dividend Rate

Directors of the National Power & Light Company at the same meeting at which they voted to give in exchange one share of common stock of National Power & Light Company for each share of Lehigh Power Securities Corporation common stock also voted to increase the regular quarterly dividend rate on National Power & Light Company common stock for the payment due June 1, 1928, from 20 cents a share to 25 cents a share. The regular quarterly dividend of 20 cents payable March 1 was declared Jan. 19 and will be payable to stock of record Feb. 14. No dividend has ever been paid on Lehigh Power Securities Corporation common stock. Subject to the plan becoming operative, holders of Lehigh Power Securities Corporation stock who make the exchange for National Power & Light Company common stock on or before Feb. 14 will receive a dividend on March 1 of 20 cents a share and thereafter the regular quarterly dividend of 25 cents a share.

## American Power & Light to Increase Capital

The American Power & Light Company, which in the near future is planning to acquire the Washington Water Power Company, as announced in the Jan. 21 issue of ELECTRICAL WORLD, has announced plans to increase its authorized preferred stock from 500,000 to 2,000,000 and the authorized common from 2,300,000 to 4,000,000 shares. The stockholders of the company have been notified of a meeting to be held Feb. 4, at which time the proposals will be submitted for approval. Common stock will be issued for expansion purposes.

## Detroit Edison Revenue Increased 5.6 Per Cent in 1927

### Statement Reflects Industrial Slackening, but Company Is Now in Position Where It Is Little Affected by Ups and Downs of Motor Industries

WITH the publication of Detroit Edison's financial statement for 1927, the first to be received this year by ELECTRICAL WORLD, the annual report period of the year again commences. The publication of these reports of 1927 activities is a matter of very considerable interest in the industry. Previous estimates can now be verified and a clear picture of what 1927 meant in the power and light industry can be secured.

Detroit Edison's report reflects the result of conditions existing in several industrial sections of the country and may be regarded as fairly representative of the large operating units serving industrial areas. Gross revenue increased only 5.6 per cent and net 3.6 per cent, which is considerably below the average rate of annual increase. This was due to relatively quiet conditions in certain large Detroit industries during all but the last few weeks of the year. Industrial slackening has been reflected in other branches of industry, and according to the statement the effect upon the power and light business was exactly that which has been observed in similar periods in the past. The usual compensatory causes, however, were operative in that the use of current by the average consumer is increasing. Furthermore, large industrial consumers increase their power purchases by nearly 3 per cent. It is intimated that the company has now reached a point where it will not be greatly affected by the ups and downs of a single industry, such as the automobile industry.

Examination of the earning statement of the company shows net income of $10,492,716 after depreciation, interest and federal taxes, which is equivalent to $11.32 a share on the common. This is exactly the same amount that was earned on common during the previous year. The operating ratio fell slightly, to 55.3 per cent. The average fuel required in 1927 by all the street power plants was only 1⅓ lb. of coal for each kilowatt-hour of energy generated.

| | For the Year 1927 | | For the Year 1926 | |
|---|---|---|---|---|
| Gross earnings from all operations: | | | | |
| Electricity | $44,759,413.36 | | $41,989,942.98 | |
| Steam | 2,223,656.44 | | 2,459,046.62 | |
| Gas | 305,992.89 | | 287,227.16 | |
| Miscellaneous | 90,716.01 | | 118,518.68 | |
| | | $47,379,778.70 | | $44,854,735.44 |
| Expense of all operations, including maintenance | $21,619,975.03 | | $21,310,959.02 | |
| Retirement reserve (depreciation) | 5,950,000.00 | | 5,500,000.00 | |
| Federal income and other taxes | 4,586,000.00 | | 4,049,600.00 | |
| | | $32,155,975.03 | | $30,860,559.02 |
| Balance, being net earnings from all operations | | $15,223,803.67 | | $13,994;176.42 |
| Interest on funded debt | $4,888,716.56 | | $4,200,021.14 | |
| Interest on unfunded debt | 307,967.37 | | 101,470.06 | |
| | $5,196,683.93 | | $4,301,491.20 | |
| Less amount charged to property account for interest on money borrowed for construction purposes | 465,596.29 | | 439,330.33 | |
| | | $4,731,087.64 | | $3,862,160.87 |
| Net income | | $10,492,716.03 | | $10,132,015.55 |

It is also noted that sale of electric energy to private consumers was by far the largest item. Sales to other public utilities were relatively small. The output of current was 2,142,549,100 kw.-hr., against 2,025,063,700 kw.-hr. in 1926. Kilowatt-hours actually sold were 1,811,100,684, against 1,709,656,328 the year before. The reduction in the service rate which was made in 1926 brought the 1927 average price for this class of service down to 4.7 per cent per kilowatt-hour. This price includes current, lamp renewals and servicing. The average of the supply to domestic consumers was 544 kw.-hr. In 1920 the figure was 415 and in 1923 it was 460.

The income account of the company and subsidiary utility companies for 1927 and for the previous year is as shown on the preceding page.

**NEW ENGLAND POWER BONDS TOTAL $12,223,000.**—In an article entitled "New England Power to Issue New Stocks" appearing on page 124 of the Jan. 14 issue of ELECTRICAL WORLD, the face value of the bonds of the New England Power Company outstanding was quoted at $2,223,000. This figure should have been $12,223,000.

# An Investor's View of Utility Investigation

## Hearing of Interstate Commerce Committee Brings Out Investors' Scrutinizing of Utility Securities—Testimony of Vice-President of Metropolitan Life Insurance Company

A NUMBER of points of importance to public utility companies and security holders were brought out at the hearing before the Senate committee on interstate commerce recently when Mr. Ecker, vice-president of the Metropolitan Life Insurance Company and chairman of the National Association of Owners of Railroads and Public Utility Securities, Inc., was heard. This association, it will be recalled, was reorganized recently as what might be called the mouthpiece of the large body of security holders in all classes of utilities and railroads, which comprises institutions which hold investments somewhat in the relation of trustees.

As was pointed out by Mr. Ecker, a great proportion of the population of the country is directly or indirectly affected either through direct holdings or through insurance companies. Over 62,000,000 individuals are affected, to a greater or lesser degree. Illustrating the wide interest in the subject, Mr. Ecker called attention to the fact that his own company alone has fourteen and a half billions of dollars of insurance in force, insuring individual lives in the number of about 27,000,000. This company's holdings of public utility securities are approximately $200,000,000. It was furthermore pointed out that savings banks have resources of $9,000,000,000 and have between eleven and twelve million individual depositors and these institutions hold between three hundred and three hundred and fifty million dollars of public utility securities.

Asked whether or not, in the course of his experience, Mr. Ecker had run across anything at all that would indicate that there is need for federal investigation of public utility companies, his answer was, "No!" He modified this, however, by explaining that the bonds which the company held were those only of operating companies in

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 31 | Low 1927 | High 1927 |
|---|---|---|---|
| **ABITIBI PWR. & PAPER, 4%** com.—no par | 163 | 140[illegible]* | 164* |
| Ala. Pwr., $7 com. pf.—no par | 114[illegible] | 107 | 115 |
| Allis Chalmers Mfg.,6% com. | 116 | 115[illegible]* | 120[illegible]* |
| Aluminum Co. of Amer., com. | 128[illegible] | 120* | 129[illegible]* |
| Aluminum Co. of Amer., 6% pf. | 106[illegible] | 105[illegible]* | 106[illegible]* |
| Amer. & Foreign Pwr., 7% pf.—no par | 107[illegible] | 105[illegible]* | 108[illegible]* |
| Amer. & Foreign Pwr., com.—no par | 25[illegible] | 22[illegible]* | 27[illegible]* |
| Amer. Bosch Magneto, com.—no par | 19[illegible] | 19* | 22[illegible]* |
| Amer. Brown Boveri Elec.† | 18 | 14[illegible]* | 18* |
| Amer. Brown Boveri Elec., pf. $7 | 62[illegible] | 58* | 63* |
| Amer. Gas & Elec., 6% pf.—no par | 107[illegible] | 106[illegible]* | 109* |
| Amer. Gas & Elec., com. †—no par | 124[illegible] | 117[illegible]* | 125[illegible]* |
| Amer. Lt. & Trac., 6% pf. | 115[illegible] | 115[illegible]* | 115[illegible]* |
| Amer. Lt. & Trac., new com. | 172 | 170* | 174* |
| Amer. Pwr. & Lt., 6% pf. | 107[illegible] | 107[illegible]* | 109[illegible]* |
| Amer. Pwr. & Lt., com. †—no par | 6[illegible] | 62[illegible]* | 69[illegible]* |
| Amer. Pub. Serv., 7% pf. | a 99 | 99* | 100* |
| Amer. Pub. Serv., com. † | k 70 | 65 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | 93 | 73 | 90 |
| Amer. Pub. Utilities, 7% pr. pf. | 96[illegible] | .... | .... |
| Amer. Pub. Utilities, com. | k 60 | 58 | 70 |
| Amer. States Sec., A | 4 | 2[illegible] | 5[illegible] |
| Amer. States Sec., B | 4[illegible] | 2[illegible] | 5[illegible] |
| Amer. Superpwr., 6% ptc pf.—25 | k 29[illegible] | 29 | 29[illegible] |
| Amer. Superpwr., 6% 1st pf. | l 102[illegible] | ... | .... |
| Amer. Superpwr., Class A†—no par | 40[illegible] | 37* | 41* |
| Amer. Superpwr., Class B†—no par | 40[illegible] | 37[illegible]* | 41[illegible]* |
| Amer. Wtr. Wks. & Elec., 6% pf. | k104 | 101[illegible]* | 104* |
| Amer. W.W. & E., com. new—no par | 59[illegible] | 56[illegible]* | 61* |
| Anaconda Copper cap. $3 | 56[illegible] | 53[illegible]* | 59[illegible]* |
| Appalachian Electric Pwr., 7% pf. | 109 | 100 | 109 |
| Arkansas Pwr., & Lt. 7% pf. | 107[illegible] | 101 | 108 |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 98 | 85 | 98 |
| Assoc. G. & E., Class A, 10—no par. | 47[illegible] | 47[illegible]* | 51[illegible]* |
| **BABCOCK & WILCOX, 7% com.** | 122[illegible] | 120* | 124[illegible]* |
| Binghamton L., H. & P., $6 pf. | 103[illegible] | 93 | 103[illegible] |
| Birmingham Elec., pf.—$7—no par. | 109[illegible] | 105 | 111[illegible] |
| Blackstone Valley G. & E., 6% pf. | k107 | 103 | 110 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k128 | 98 | 153 |
| Blaw-Knox, com.† | i 94 | 91* | 95* |
| Brazilian Trac., Lt. & Pwr., $7 com. | f199 | | |
| Broad River Pwr., 7% pf. | 104 | 97 | 105[illegible] |
| Brooklyn Edison, 8% com. | 235[illegible] | 206[illegible]* | 235[illegible]* |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26 | .. | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 35 | .... | .... |
| **CALIFORNIA ELEC. GENERATING, 6% pf.** | k 98 | 96 | 104[illegible] |
| California Ry. & Pwr., 7% pf. | k135 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | l110[illegible] | 109* | 110[illegible]* |
| Central & S. W. Util., $7 pf.—no par | a103[illegible] | 99[illegible]* | 105[illegible]* |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a107[illegible] | 105[illegible]* | 107* |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 100 | 107 |
| Central Ill. Pub. Serv., $6 pf. | a 98 | 97[illegible]* | 98[illegible]* |
| Central Ind. Pwr., 7% pf. | a 96[illegible] | 95* | 96[illegible]* |
| Central Maine Power, 6% pf. | 96[illegible] | .. | .. |
| Central Maine Power, 7% | 106 | 102 | 110 |
| Central Pwr. & Lt., 7% pf. | 105 | 100[illegible] | 105 |
| Central States Elec., 7% pf. | 107[illegible] | 104[illegible]* | 107[illegible]* |
| Century Elec., 6% com | b145 | 140* | 145* |
| Chicago Fuse Mfg., com.—$2.50 no par | a 33 | 31 | 33[illegible]* |
| Cincinnati Gas & Elec., 5% com | g 99[illegible] | 98[illegible]* | 100* |
| Cities Service, $6 pf.—no par | l 95[illegible] | 87* | 94[illegible]* |
| Cities Service, pf. B—no par | l 9 | 8* | 8[illegible]* |
| Cities Service, pf. BB—no par | l 90 | 80[illegible]* | 86* |
| Cities Service, com.—20 | l55[illegible] | 40[illegible]* | 58[illegible]* |
| Cities Service, Bks. Shrs.—10 | l 27[illegible] | 22[illegible]* | 27* |
| Cities Service Pwr. & Lt., 7% pf. | k105[illegible] | 105[illegible]* | 106[illegible]* |
| Cities Service Pwr. & Lt., 6% pf. | 96[illegible] | 95[illegible]* | 96[illegible]* |
| Cleveland Elec. Illg., 6% pf. | 113 | 108 | 114 |
| Cleveland Elec. Illg., 10% com | 350 | 285 | 370 |
| Columbia Gas & Elec., 6% pf. | 108 | 108* | 110[illegible]* |
| Columbia G. & E. com. $5—no par | 97[illegible] | 89[illegible]* | 97[illegible]* |
| Columbus Elec. & Pwr., $2 com.—no par | m 65 | .... | .... |
| Columbus Elec. & Pwr., 7% pf. | 112 | .... | .... |
| Columbus Ry., Pwr.&Lt., 6%, 1st pf. | 105 | 98[illegible] | 108[illegible] |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 105 | 96 | 106 |
| Columbus Ry., P.& Lt. com.—no par | k105 | 75 | 110 |
| Commonwealth Edison, 8% com | a169 | 165* | 169* |
| Commonwealth Pwr., 6% pf. | 102[illegible] | 102[illegible]* | 104[illegible]* |
| Commonw'th Pwr., $2, com.—no par | 67[illegible] | 62[illegible]* | 68* |
| Conn. Lt. & Pwr., 8% pf. | 121 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 112 | 119 |
| Cons. Gas of N. Y., pf. | 102[illegible] | 101[illegible]* | 102[illegible]* |
| Cons. Gas of N. Y., com. $5—no par. | 127[illegible] | 119[illegible]* | 128[illegible]* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e113 | 110[illegible]* | 113* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6[illegible]% pf. | e110[illegible] | 110[illegible]* | 113* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e110[illegible] | 110[illegible]* | 115* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf. | e125[illegible] | 125[illegible]* | 128[illegible]* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 70[illegible] | 67[illegible]* | 70[illegible]* |
| Consolidated Pwr. & Lt., 7% pf. | 105 | 100 | 106 |
| Consumers Pwr., 6% pf. | 104[illegible] | 100 | 106[illegible] |
| Consumers Pwr., 6.6% pf. | 106[illegible] | 103 | 107[illegible] |
| Continental Gas & Elec., 8% ptc. pf. | 110[illegible] | 103 | 110 |
| Continental Gas & Elec., 7% pr. pf. | 107[illegible] | 100 | 107[illegible] |
| Contl. G. & E. com. $4.40—no par | k225 | 210 | 265 |
| Crocker Wheeler, com.† | 26 | 23 | 38 |
| Crocker Wheeler, 7% pf. | 85 | 78 | 88 |
| **DALLAS PWR. & LT., 7% pf.** | 110 | 107 | 111[illegible] |
| Dayton Pwr. & Lt., 6% pf. | 108[illegible] | 101 | 109 |
| Detroit Edison, 8% com. | 174[illegible] | 166* | 176[illegible]* |
| Dubilier Condenser, com.—no par | 2[illegible] | 2[illegible]* | 3[illegible]* |
| Duke Pwr., cap. | 139 | 135* | 145* |
| Duquesne Lt., 7% pf. | 116 | 115[illegible]* | 116* |
| **EASTERN NEW YORK UTIL., $7 pf.** | k110[illegible] | 102 | 112[illegible] |
| Eastern New York Util. com. | k 65 | 70 | 75 |
| Eastern States Pwr. $7, com. | k 12 | 11[illegible]* | 13[illegible]* |
| Eastern States Pwr., pf. | k 97 | 90 | 99 |
| East. Tex. Elec., 7% pf. | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d262[illegible] | 259* | 268* |
| El Paso Elec. 7% pf. | 112 | 105 | 112[illegible] |
| Elec. Bond & Share, 6% pf. | l110 | 109[illegible]* | 111[illegible]* |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 88 | 76* | 80[illegible]* |
| Electric Household Util.† | a 15[illegible] | 13[illegible]* | 15[illegible]* |
| Elec. Investors, 6% pf.—no par | 102 | 92 | 101 |
| Elec. Investors, com.†—no par | 43[illegible] | 40[illegible]* | 45[illegible]* |
| Elec. Pwr. & Lt., ctfs. pf. | 107[illegible] | 106[illegible]* | 107[illegible]* |
| Elec. Pwr. & Lt., ctfs., 40% pd | k123 | 120[illegible]* | 123* |
| Elec. Pwr. & Lt., ctfs., com.—no par | 33[illegible] | 28[illegible]* | 34[illegible]* |
| Elec. Refrig. cap.† | 12[illegible] | 11[illegible]* | 13[illegible]* |
| Elec. Ry. Securities, com.—no par | 6[illegible] | .... | .. |
| Elec. St. Battery com. $5.25—no par | 71[illegible] | 69[illegible]* | 75[illegible]* |
| Elmira Wtr., Lt. & R.R., 7% pf. | k105 | 99 | 105[illegible] |
| Empire Pwr., ptc.† | 35[illegible] | 27[illegible]* | 35[illegible]* |
| Engr. Pub. Serv. $7, pf.—no par | 108 | 107* | 109* |
| Engr. Pub. Serv., com.—no par | 35[illegible] | 34[illegible]* | 36[illegible]* |
| Eureka Vacuum Cleaner, com. $4—no par | 75[illegible] | 73[illegible]* | 79* |
| **FAIRBANKS MORSE, 7% pf.** | k106 | 104* | 104* |
| F.-M., com.—$3—no par | k 36 | 32[illegible]* | 40[illegible]* |
| Federal Lt. & Trac., com. $1.40 | 55 | 42* | 55* |
| Federal Lt. & Trac., $6 pf.—no par | 104 | 98* | 105* |
| Florida Pwr. & Lt., 7% pf. | 106[illegible] | 104[illegible]* | 107* |
| Ft. Worth Pwr. & Lt., 7% pf. | l113[illegible] | 113* | 114[illegible]* |
| **GALVESTON-HOUSTON ELEC. 6% pf.** | 76 | 68 | 85 |
| Galveston-Houston Elec., com. | 32 | 26 | 32 |
| General Cable, Cl. A $1 no par | 58[illegible] | 56[illegible]* | 60* |
| Gen. Elec. $3 com.—no par | 130[illegible] | 129[illegible]* | 138[illegible]* |
| Gen. Elec., special—6% | 11[illegible] | 11[illegible]* | 11[illegible]* |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 38[illegible] | 35[illegible]* | 39[illegible]* |
| Gen. G. & E. (Del.) pf. A $8—no par | k123 | 123* | 126[illegible]* |
| Gen. G. & E. (Del.) pf. A $7—no par. | k110 | 108[illegible]* | 110* |
| Gen. G. & E. (Del.) pf. B $7 | k106[illegible] | 105[illegible]* | 106[illegible]* |
| Gen. Pub. Serv., $7 cum. pf., no par | k110 | 102 | 112 |
| Gen. Pub. Serv., com., no par | 19[illegible] | 16[illegible]* | 20[illegible]* |
| Ga. Lt., Pwr. & Rys., com. | k 59 | 50 | 70 |
| Ga. Ry. & Pwr., 8% pf. | k125 | 119 | 125 |
| Ga. Ry. & Pwr., 7% pf. | k113[illegible] | 106 | 115 |
| Gt. Western Pwr., 7% pf. | h105 | | |
| **IDAHO PWR., 7% pf.** | 108[illegible] | 103 | 110 |
| Ill. No. Utilities, 6% pf. | a 98[illegible] | 98[illegible] | 99 |
| Ill. Pwr. & Lt., 7% pf. | 104 | 99 | 104[illegible] |
| Ingersoll Rand com. | k 92 | 91* | 94* |
| Int. Combus. Engr., com. $2—no par | [illegible] | [illegible]* | [illegible]* |
| Int. Combustion Engr. 7% pf. | 105[illegible] | 104* | [illegible]* |
| Int. Util. Class A $3.50—no par | k 48 | 48* | [illegible]* |
| Int. Utilities, Class B—no par | 9[illegible] | 9* | 10[illegible]* |
| Interstate Pwr., pf.—$7—no par | 98[illegible] | 93 | 100 |
| Interstate Pub. Serv., 7% pf. | 102 | 98 | 104 |
| Iowa Ry. & Lt., 7% pf. | k 98[illegible] | 97 | 100 |
| **JERSEY CENTRAL PWR. & LT. CO., 7% pf.** | 105[illegible] | 97[illegible] | 108 |
| Johns-Manville, com.†—no par | 122[illegible] | 114[illegible]* | 124[illegible]* |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; f Montreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Jan. 28. lBid price Wednesday, Feb. 1. mLatest quotations available. †Dividend rate variable *1928

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Jan. 31 | Low 1927 | High 1927 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | k115½ | 115* | 115½* |
| Kansas Gas & Elec., 7% pf | l109 | 107* | 109* |
| Kentucky Hydro-Elec., 7% pf. | a102½ | 102* | 103* |
| Kentucky Sec., 6% pf. | 91 | 83 | 90 |
| Kentucky Sec., 5% com. | 140 | 100 | 135 |
| Kentucky Utilities, 6% pf. | k101 | 95 | 101½ |
| LACLEDE GAS LT., 12% com. | k240 | 200* | 245* |
| Lehigh Pwr Sec., com. no par | 25¾ | 19½* | 27⅛* |
| Long Island Ltg., 7% pf | 111 | 107 | 112½ |
| Long Island Ltg., com.†—no par | k170 | 139 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 106 | 98 | 105 |
| Louisville Gas & Elec., cl. A. $1.75 | 28¾ | 28¼* | 29½* |
| MAN. ELEC. SUPPLY, cap $5—no par | 50½ | 50* | 54⅞* |
| Manila Elec., com †—no par | k 45¾ | 40 | 60 |
| Maytag Mfg., com. .50—no par | 32¾ | 32½* | 34¼* |
| Memphis P. & L., pf.—$7—no par | k109¾ | 107 | 111 |
| Metropolitan Ed., pf.—$6—no par | 106 | 93 | 106 |
| Metropolitan Ed., pf.—$7—no par | 109 | 104 | 110 |
| Metropolitan Ed., com. $5—no par | k125 | 60 | 72 |
| Middle West Utilities, 7% pf. | a122 | 116⅛* | 123¾* |
| Middle West Util., 7% pr. lien | a127½ | 125¾* | 128½* |
| Middle West Util., com. $6—no par | a132¾ | 123¼* | 134½* |
| Midland Utilities, pr. ln. 6% pf | a106 | 105* | 106* |
| Midland Utilities, 7% pf. A | a104¼ | 103* | 104¼* |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k 99 | 98 | 101½ |
| Minn Pwr & Lt., 7% pf. | l108½ | 107* | 109* |
| Miss River Pwr., 6% pf | 108 | 94 | 108 |
| Miss River Pwr., 3% com | m 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k109 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7 no par | l104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 31 | 29½* | 31½* |
| Montana Pwr., 5% com | 161¼ | 102¼* | 161¼* |
| Montreal Pwr., 7½% com | f 91½ | .... | .... |
| Mountain States Pwr., 7% pf | k102½ | 97 | 103 |
| Mountain States Pwr., com.† | 17 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110 | 98 | 110 |
| National Carbon, 8% pf. | a138¼ | 138* | 139* |
| National Elec. Pwr., A† | a 29 | 27½* | 29* |
| National Lt., Ht. & Pwr., com. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | k109 | 108½* | 110* |
| National Pwr. & Lt., com.†—no par. | 25¼ | 21⅞* | 27⅛* |
| National Pub. Serv., 7% pf. | 100 | 93 | 102 |
| National Pub. Serv., 7% ptc., pf | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 23 | 22* | 23¼* |
| National Pub. Serv., B com.—no par | 27¾ | 24¼* | 27⅞* |
| Nebraska Pwr., 7% pf | l110½ | 110* | 111½* |
| Nevada-Calif. Elec., com. | k 33 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | k 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k104 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | k102 | 95 | 100 |
| New Orleans Pub. Serv.—7% pf. | 108½ | 103 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | k103 | 101 | 104 |
| New York Power & Light 8% pf. | 114 | .... | .... |
| New York Power & Light, 7% pf. | 114 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | k109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | k109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28¾ | 28* | 28¾* |
| No. Amer., 6% pf.—50 | 54⅛ | 53½* | 54⅛* |
| No. Amer., com.—10 | 61 | 58⅝* | 62⅛* |
| No. Amer. Edison, $6 pf.—no par | k105¾ | 103¾* | 105¾* |
| No. Caro. Pub. Serv., pf.—$7—no par | 105½ | 93 | 105 |
| Northeastern Pwr., com. | 20¾ | 19¼* | 22⅛* |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 24 | 18* | 24⅛* |
| No. Ont. Lt. & Pwr., 6% pf | 98¼ | 98* | 98¼* |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf | 109½ | 108¾* | 109½* |
| No. States Pwr. (Del.), 8% com. | 134⅛ | 123* | 135¼* |
| No. Texas Elec., 6% pf | 53 | 45 | 70 |
| No. Texas Elec., com. | 17½ | 5 | 36 |
| OHIO BRASS, com. B $4—no par. | 98 | 89* | 98⅞* |
| Ohio Brass, 6% pf. | k106 | 100 | 111 |
| Ohio Pwr., 6% pf | 105½ | 96 | 106 |
| Ohio Pub. Serv., $6 pf | k102½ | 95 | 102 |
| Ohio Pub. Serv., 7% pf | 109½ | 103 | 111 |
| Ohio River Edison, 7% pf. | 108½ | 103 | 109½ |
| Oklahoma Gas & Elec., 7% pf. | 111 | .... | .... |
| PACIFIC Gas & ELEC., 6% pf. | 27⅛ | 26⅞* | 27⅞* |
| Pacific Gas & Elec., 8% new com. | 49⅛ | 47¼* | 49¼* |
| Pacific Pwr. & Lt., 7% pf | l109 | 106* | 108½* |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 79 | 77⅝* | 79* |
| Penn-Ohio Edison, 6% pf. no par | k 90 | 78 | 91 |
| Penn-Ohio Edison, 7% pf. | k107½ | 97½ | 104 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109¼ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l110¼ | 109½* | 110½* |
| Penn Wtr. & Pwr., 8% com., new | e 71½ | 68* | 72⅛* |
| Phila. Co., 5% pf.—50 | k 46½ | 46½* | 48¼* |
| Phila. Co., 6% pf.—50 | 52¾ | 52* | 52⅛* |
| Phila. Co., com.—50 | 163 | 149½* | 163* |
| Phila. Elec., 8% com.—25 | c 57¼ | 55½* | 58¼* |
| Portland Elec. Pwr., 7% pf. | 103 | 97½ | 102½ |
| Portland Elec. Pwr., 6% pf. | 91½ | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 81¾ | 55 | 70 |
| Portland Elec. Pwr., com. | 43½ | 42¼* | 43½* |
| Potomac Elec. Power, pf. | k111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | 61 | 61* | 62½* |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | l107 | 99* | 103* |
| Pub. Serv. of N. J., 6% pf. | 105 | 103⅞* | 105* |
| Pub. Serv. of N. J., 7% pf. | 120 | 118* | 120⅛* |
| Pub. Serv. of N. J., $2 com.—no par | 44¼ | 41½* | 45* |
| Pub. Serv. of No. Ill., 6% pf. | a111 | 111* | 113½* |
| Pub. Serv. of No. Ill., 7% pf. | a120 | 120* | 120⅛* |
| P. S. of No. Ill., com. $8—no par | a162 | 159¼* | 162* |
| Pub. Serv. of No. Ill., $8 com. | a161 | 132 | 161½ |
| Pub. Serv. of Okla., 7% pr. ln. | k103 | 90 | 103 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109¾ | 109* | 110* |
| Puget Sound Pwr. & Lt., 7% pf. | 111 | 109* | 113* |
| Puget Sound Pwr. & Lt., $6 pf.—no par | m 99 | ... | ... |
| Puget Sound Pwr. & Lt., com. | 44⅞ | 34⅞* | 46⅞* |
| RADIO COPR. OF AMER., $3.50 pf.—50 | 55¼ | 54½* | 57⅞* |
| Radio Corp. of Amer., com.—no par. | 101⅞ | 88¼* | 104¼* |
| Rhode Island Public Service, pf. $2—no par | k 31 | 30⅝* | 31* |
| Rochester Gas & Elec. 6% pf. D | k105¾ | 101 | 103½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105¾ | 101½ | 103½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | k111 | 105 | 112½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel Corp. | k 5⅛ | 4½* | 6⅛* |
| Sierra Pacific Elec., 2% com. | 32½ | 29* | 33* |
| Sioux City Gas & Elec., 7% pf. | 108 | 99 | 105½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l108½ | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 89½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 44 | 42* | 44⅛* |
| So. Calif. Edison, 8% pf. | k 45 | 36½ | 40 |
| So. Calif. Edison, 7% pf. | k 28 | 27½ | 28½ |
| So. Calif. Edison, 6% pf. | 27⅛ | 25⅞* | 27¼* |
| So. Calif. Edison, 8% com. | 47½ | 43½* | 47½* |
| Southern Cities Utilities, 7% pf. | k 74½ | 67 | 90½ |
| Southwestern Lt. & Pwr., A $3 | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf | 90 | 83 | 91½ |
| Southwestern Pwr. & Lt., 7% pf | 111¾ | 110* | 111½* |
| Standard Gas & Elec., 8% pf | 67 | 65* | 67* |
| Standard Gas & Elec., 7% pr. pf | 111 | 103 | 113 |
| Standard G. & E., com. $3.50 | 64½ | 57¼* | 65* |
| Standard Power & Light, com. | m 30 | 30* | 33⅛* |
| Standard Pwr. & Lt., 7% pf | k104 | 103¼* | 105* |
| Staten Island Edison, pf.—$6—no par | 102 | 99 | 103 |
| Superheater, $6 com.—no par | 175 | 164* | 178* |
| Syracuse Lighting, 7% pf. | k111 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 62½ | 62* | 64* |
| Tenn. Elec. Pwr., 6% pf. | 102½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109¾ | 103 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf | k 26 | 20 | 30 |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf | l113½ | 113½* | 115* |
| Tide Water Pwr., 8% pf | 111 | 105 | 111 |
| Timken Roller Bear., com.—$4 no par | 128¾ | 126½* | 134* |
| Toledo Edison, 7% pf. | l109 | 102* | 107* |
| Toledo Edison, 6% pf. | k103 | 95 | 105 |
| Toledo Edison, 6% com. | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | k 97½ | 96 | 99 |
| UNITED GAS & ELEC., 7% pf. | 101½ | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 74 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c116 | 111¼* | 117¼* |
| United Lt. & Pwr., pf.—$4—no par | a 53 | 53* | 55* |
| United Lt. & Pwr., pf.—$6 50—no par | a100 | 95* | 100* |
| United L. & P., com. A .48—no par | a 16 | 14* | 16* |
| United L. & P., com. B .48—no par | a 20 | 19* | 20* |
| Utah Pwr. & Lt., 7% pf. | l111¼ | 109⅛* | 111* |
| Utica Gas & Elec., 7% pf. | 106 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 98½ | 93 | 100 |
| Utilities Pwr. & Lt., com. A $2 | 30¼ | 28⅛* | 30⅛* |
| Utilities Pwr. & Lt., com. B $1—no par | k20⅛ | 18½* | 20½* |
| VERMONT HYDRO-ELEC., 7% pf | k 97 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k108 | 105 | 110 |
| WAGNER ELEC., 7% pf. | b 99½ | 96½* | 99½* |
| Wagner Elec., com.—no par | b 38 | 37½* | 40* |
| Washington Ry. & Elec., 5% com. | k460 | 180 | 475 |
| Washington Ry. & Elec., 7% pf. | 102 | ... | . |
| Washington Wtr. Pwr., 8% com. | k215 | 136 | 182 |
| West Penn Elec., 7% pf. | 110¼ | 110⅛* | 114¼* |
| West Penn Elec., Cl. A $7 | 109¼ | 106½* | 109½* |
| West Penn Pwr., 7% pf. | 116 | 114⅜* | 116⅛* |
| West Penn Pwr., 6% pf. | 110 | 109⅛* | 113* |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf. | k102 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 102 | 96 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .. |
| Westinghouse Elec. & Mfg., 8% com.—50 | 96¾ | 88⅛* | 100⅛* |
| Weston Elec. Instrument, Cl. A $2—no par | 33 | 30¾* | 33* |
| Weston Elec. Instrument, com.—no par | k 14½ | 12½* | 14½* |
| Wheeling Elec., 6% pf | k103 | 95 | 104 |
| Worthington Pump, 7% pf. A | 54¼ | 46¼* | 54¼* |
| Worthington Pump, 6% B | 49 | 41* | 49* |
| Worthington Pump, com. | 33¾ | 28* | 34¼* |
| YALE & TOWNE com. $5—25. | 72½ | 72½* | 75* |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 28. *l*Bid price Wednesday, Feb. 1. *m*Latest quotations available. †Dividend rate variable. *1928

which there was a direct mortgage on property. Relative to the nature of the inquiry, Mr. Ecker said: "As I observe it, this business must be very substantially, very materially and extensively expanded in the next few years, and thinking solely from the standpoint of the financial side of it I feel, and am confident that you would feel, that it is important that confidence in these securities and in these sound organizations should not be disturbed. I took comfort in the Senator's presentation of the subject yesterday, when he said he realized that danger and that it was farthest from his thought that such a result would ensue unless there should develop circumstances that would indicate there were abuses that should be corrected, but that it was his desire, or at any rate he felt the importance of doing nothing that would unduly disturb the credit situation. In conclusion, I only have to add that it is the hope of the interests that I am speaking for that if it be determined that an investigation be had it should be conducted in the form of a fact-finding matter and along the lines of a judicial inquiry. I emphasize that to you, as a part of our thought on the subject, with a great deal of confidence that this committee will have those considerations in mind."

### Factors Considered in Buying Securities

Mr. Ecker was asked whether, in buying bonds, his company makes a distinction between bonds issued by a corporation operating in a state where there is strong regulation resulting from vigorous policy and those where there is no regulation of that character. The answer was that there is a sort of framework or standard required to determine the acceptable offerings among these issues. This, it was admitted, would be one factor. Then there is the population served, the reasonable permanence of that property, the age of the property, its capacity, what its reports show are its costs of production compared with production costs in other localities or a similarly situated locality. Mr. Ecker stated that his company was particularly interested always in the methods of accounting of these operating companies, seeing to it that they set up proper reserves for depreciation and obsolescence. Mr. Ecker stated that his company would prefer to buy bonds where they are subject to state regulatory bodies because "Our observation is that even where these facilities are what might be termed monopolies, if they are regulated monopolies the service to the public is secured at a lower price than where there is competition without regulation. My personal opinion is that these securities would be safer for the public to invest in.”

Questioning by members of the committee elicited the information that the company rejects certain securities not always because of the question of security but sometimes because of the rate of interest. Sometimes the committee naturally feels that the offering does not yield as good a return as it should.

## Company Reports

| Name of Company | Gross Earnings Twelve Months Ended Dec. 31 1927 | 1926 |
|---|---|---|
| Bangor Hydro-Electric | $1,867,760 | $1,732,114 |
| Baton Rouge Electric | 1,017,110 | 960,479 |
| Binghamton Lt., Ht. & Pwr. | 2,276,827 | 1,958,545 |
| Blackstone Valley Gas & Elec. | 5,910,629 | 5,528,770 |
| Cape Breton Electric | 656,656 | 612,630 |
| Carolina Power & Light | *8,900,700 | *8,086,081 |
| Central Illinois Light | 4,391,161 | 4,197,747 |
| Cleveland Elec. Illuminating | 23,609,479 | 22,048,268 |
| Columbus Elec. & Pwr. & Subs. | 4,200,699 | 3,777,339 |
| Commonwealth Power | 53,172,977 | 49,197,543 |
| Consumers Power | 26,612,449 | 24,135,477 |
| Detroit Edison | 47,379,779 | 44,854,735 |
| Eastern Texas Electric | 7,214,132 | 5,657,495 |
| Edison Elec. Illg. of Brockton | 1,942,473 | 1,756,686 |
| Electric Light & Power of Abington & Rockland | 627,857 | 580,914 |
| El Paso Electric | 2,998,271 | 2,836,915 |
| Federal Light & Traction | *6,962,554 | *6,547,496 |
| Galveston-Houston Electric | 5,052,638 | 4,589,081 |
| General Gas & Electric | 25,347,713 | 24,771,054 |
| Illinois Power | 2,637,188 | 2,581,131 |
| Lehigh Power Securities (subs.) | 39,007,415 | 37,495,707 |
| Lowell Electric Light | 1,788,419 | 1,728,755 |
| Metropolitan Edison | 10,600,634 | 9,859,831 |
| New York Power & Light | 18,799,093 | 17,810,759 |
| Northern Ohio Power | 12,575,214 | 12,040,841 |
| Northern Texas Elec. & Subs. | 2,707,487 | 2,524,333 |
| Ohio Edison | 1,921,427 | 1,815,937 |
| Portland Electric Power | 12,154,452 | 11,763,567 |
| Puget Sound Pwr. & Lt. & subs. | 14,925,482 | 13,533,748 |
| Savannah Electric & Power | 2,227,380 | 2,233,704 |
| Sierra Pacific Electric & subs. | 1,240,946 | 1,260,542 |
| Southern Indiana Gas & Elec. | 3,038,391 | 2,883,251 |
| Tampa Electric & subs | 4,714,686 | 4,871,773 |
| Tennessee Electric Power | 12,515,760 | 11,909,560 |
| Virginia Elec. & Pwr. & subs. | 15,471,570 | 14,378,199 |

* Twelve months ended Nov. 30, 1927.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of 79,000 additional shares of preferred stock of the American & Foreign Power Company, Inc. ($7 cumulative dividend), without par value, making the total amount of such preferred stock applied for 479,000 shares. The New York Exchange has also authorized the listing of additional cumulative 6 per cent preferred stock, series A, of the Columbia Gas & Electric Corporation to the amount of $2,666,600 and 13,372 additional shares of class A stock without par value of the Utilities Power & Light Corporation. There has been authorized the listing of 5,088 additional shares of common stock, class A, without par value, of the General Gas & Electric Corporation and 12,244 additional shares of its common stock, class B, without par value, on official notice of issuance and payment in full, making the total amount applied for 345,747 shares of common stock, class A, and 216,310 shares of the common stock, class B.

## Stock Sales to Customers Exceed $18,000,000

Sales of stock by electric light and power companies directly to customers and employees in November aggregated 243,400 shares valued at $18,303,000 and involving 24,410 transactions. These estimates are based on returns from companies serving 87 per cent of the whole number of customers of all companies selling securities locally, with estimates for companies not reporting.

After the year's minimum and maximum were successively reached in September and October the returns indicate that November was an average month as to value of securities, number of transactions and their average magnitude, the latter about $750. Sales in November, 1926, were $19,060,000, but the average transaction involved only $500. Of the $18,303,000 slightly less than $2,000,000 was in the form of low-priced shares, the balance was at or near $100 per share. Seven companies each reported over $1,000,000 and three of these approached or exceeded $2,000,000; $16,100 was reported in red, which is assumed to mean that securities were returned to the companies.

## Public Service of New Jersey to Raise $43,689,000

The Public Service Corporation of New Jersey will offer to its common and 8 per cent preferred stock holders this month twenty-year 4½ per cent convertible debentures to the amount of $43,689,000. The holders of each fifty shares of stock will have the right to subscribe for $500 principal amount of the new debentures at 98 and interest. The debentures will be convertible before Feb. 1, 1930, into common stock at the rate of twenty-two shares for each one-thousand-dollar debenture. Proceeds from the sale will be used to redeem $19,384,0000 of 6 per cent secured gold bonds and $15,000,000 of 5½ per cent secured bonds and for other corporate purposes.

## January Issues Total $98,850,000

During the month of January the electric light and power companies of the country issued new securities to the amount of $98,850,000, a figure which compares with $223,859,000 for January, 1927, and $303,332,500 for December, 1927. These two months, however, were the high spots in new electric light and power financing in 1927. The Continental Gas & Electric Corporation contributed $36,000,000 to the month's total, the issue being in the form of thirty-year gold debentures priced at 95½. The only other offering exceeding $10,000,000 was made by the Lexington Water Power Company, a piece of financing involving a sum of $12,000,000.

Financing in January was almost exclusively of a long-term nature. The average yield advanced from the 5.06 per cent mark in December to 5.40 in January, the highest rate since last June.

### *Security Issues of Electric Service Companies in January*

| Name of Company | Amount of Issue (Par Value) | Period Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| American Water Works & Electric Co. | $3,000,000 | 47 | Gold debentures, series B | To reimburse company in part for expenditures in connection with the acquisition of additional properties, for additional working capital and for general corporate purposes | 5 | 95 | 5.28 |
| Lexington Water Power Co. | 12,000,000 | 40 | First mortgage gold bonds | Construction | 5 | 98 | 5.10 |
| | 5,000,000 | 25 | Convertible sinking fund gold debentures | | 5½ | 98½ | 5.60 |
| National Electric Power Co. | 5,000,000 | | Cumulative preferred stock | To retire notes and for other corporate purposes | 6 | 94½ | 6.35 |
| | 10,000,000 | .. | Secured gold debentures | | 5 | 94½ | 5.30 |
| Arizona Edison Co. | 1,700,000 | 20 | First mortgage gold bonds | Acquisition of certain properties and for other corporate purposes | 5 | 96 | 5.33 |
| Gulf States Utilities Co. | 3,000,000 | .. | Preferred stock | To provide additional capacity or to reduce notes payable | 6 | 100 | 6 |
| Central Public Service Corp. | 1,500,000 | .. | Cumulative preferred stock | To invest in additional stock | 7 | 100 | 7 |
| Continental Gas & Electric Corp. | 36,000,000 | 30 | Gold debentures | To retire securities | 5 | 95½ | 5.30 |
| United Public Service Co. | 2,400,000 | 14 | Collateral trust gold bonds, series A | To acquire additional subsidiary securities | 6 | 98 | 6.20 |
| Consolidated Gas, Electric Light & Power Co. of Baltimore | 10,000,000 | . | Cumulative preferred stock, series A | To retire outstanding issues and to reimburse for the cost of additions and for other capital expenditures | 5 | 100 | 5 |
| Washington Gas & Electric Co. | 1,250,000 | 25 | First mortgage gold bonds | | 5½ | 100 | 5.50 |
| Central States Utilities Corp. | 3,000,000 | 10 | Secured gold bonds | To acquire stocks of subsidiaries, to provide funds for the retirement of their bonds and stocks and for other corporate purposes | 6 | 98 | 6.25 |
| General Public Service Corp. | 5,000,000 | 25 | Convertible gold debentures | To provide funds for investment | 5 | 97½ | 5.19 |
| Total | $98,850,000 (par value) | | Rights | $657,750 | | | |
| Total amount actually realized | 95,626,500 | | Total financing for January | 96,284,250 | | | |

# Business News and Market Conditions

INDUSTRIAL equipment orders and inquiries continue to dominate the New England market. Small motor sales have gained and inquiries for turbo-generators of the lower ratings are being received by manufacturers. Increased buying is noted in the Eastern district, and one manufacturer stated that business appears to be even better than was expected. Orders are small, but gross sales are high. Wire and cable sales are slow, but present inquiries from the New York zone presage betterment. In the Southeast inquiries and orders show an increase. The engineering contract was let for a two-million-dollar plant in Texas. A textile mill contract let covered $70,000 worth of electrical materials and another planned involves $30,000 worth of electrical equipment.

In the St. Louis district business shows an improvement. Motors and control sold to a steel company amounted to $30,000 and elevator orders totaled $40,000. Industrial conditions improve in the Middle West and utility companies are planning many extensions. On the Pacific Coast several large projects include a 360,000-hp. hydro-electric plant on the Feather River, a 35,000-kw. steam turbine plant in the India Basin of San Francisco, a soap plant costing $700,000, two large apartment houses totaling $1,600,000 and transmission line installations in western Washington.

## *Large Order Placed in Metal Market*

Buying of non-ferrous metals has been small, but prices are little changed from those obtaining last week Wednesday in the domestic market. Copper has been particularly dull, but there is only a negligible decline in the quoted price. On Wednesday afternoon wire drawing interests entered the copper market rather unexpectedly and purchased about 5,000,000 lb. of copper at 14⅛ cents, delivered in Connecticut. These sales were distributed among several sellers and in the aggregate formed a considerable proportion of the business of a comparatively dull week. A moderate business was done in both lead and zinc, prices for the former tending to weaken as a consequence of material declines in London, while zinc became slightly firmer. Both buyers and sellers appear to be marking time. Primary producers of copper continue to stand pat at the 14⅛ cent price. Moreover, they have made sales at that figure each day during the week. On the other hand, one or two custom smelters have shaded the even eighth by from 2½ to 5 points. Incidentally, two interests that come under this classification have been firm at 14⅛ cents.

NEW YORK METAL MARKET PRICES

| | Jan 25, 1928 Cents per Pound | Feb. 1, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14⅛ | 14⅛ |
| Lead, Am. S. & R. price | 6¼ | 6¼ |
| Antimony.......... | 10¾ | 11¼ |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots........... | 6 | 6 |
| Tin, Straits.......... | 55¼ | 54½ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price Feb. 1, 1928, 15⅞ cents.

## *Increased Buying Noted in Eastern District*

There is a noticeable increase in buying in the Eastern district, with industrial business leading by a good margin. Indications point to heavy commitments in the early weeks ahead. Orders are comparatively small, but the continuous character of present business is rounding out excellent gross sales. Inquiries are increasing in volume. Sales of fractional-horsepower motors have increased in the past few days and marked improvement is expected to continue. Crane motors are advancing in call and a nitrogen company in the northern New York territory has placed orders for about $20,000 worth with a leading manufacturer. The sales tendencies in control apparatus are giving encouragement in the New York market. A prominent company in this line reports a government contract for battleships and for the Bureau of Ordinance totaling about $90,000. A sizable order also has been secured from a baking concern in the West. Industrial locomotives are in demand and a gas company in Brooklyn has purchased two such units from a leading maker, and there is other business of this kind in sight. Electric elevator sales are rising to decidedly higher levels and commitments in excess of $50,000 have been secured by a representative manufacturer covering a large warehouse and bank in the metropolitan district.

While central-station turbine business is curtailed, industrial interests are making purchases of smaller-sized units. A company at Rochester has placed a contract, aggregating $50,000, for apparatus of this kind. A leading manufacturer of wire and cable says that business is slow at the present time. Some promising wire inquiries, however, have been received from utility companies in the New York zone, and a few weeks hence is expected to show betterment in the situation. Instrument business is passing through a quiet period, although radio-frequency meters are selling well. An order has been received recently from the government for apparatus of the latter sort, totaling $20,000.

Construction activities include the following: McClellan & Junkersfeld, Inc., New York, will prepare plans for a plant for the Great Western Power Company near San Francisco, with initial capacity of 35,000 kw. The Niagara, Lockport & Ontario Power Company will build a steel-tower transmission line at Salamanca, N. Y. The Paul Smith's Power & Electric Corporation will build new transmission lines in Franklin and Clinton Counties. The Public Service Electric & Gas Company, Newark, N. J., has purchased 176 acres at West Orange, N. J., for transmission line right-of-way and a switching station. The Philadelphia Electric Company plans an addition to its substation at Westmoreland Street and Hunting Park Avenue. The Pennsylvania Power & Light Company will take over properties in Northumberland and Wayne Counties and plans transmission line extensions. The Pennsylvania Power Company, Sharon, has applied for permission to build a transmission line over the Mahoning River, near Mahoningtown, Ohio. The United States Engineer, Pittsburgh, plans a power house at Lock No. 6, Allegheny River, and will soon take bids. The General Purchasing Officer, Panama Canal, Washington, D. C., is asking bids until Feb. 10, for motor-driven air compressors (Panama Schedule 1856).

## *Inquiries and Orders Increase in the Southeast*

Both inquiries and orders are on the increase in the Southeast and prospects for the next few months are very bright. The engineering contract for a two-million-dollar power plant in Texas has been let. The largest central-station order was from Alabama for varnished cambric cable amounting to approximately $50,000. The demand for distribution and small power transformers is active, with the orders coming from the territory generally. One company in Georgia ordered transformers to the extent of $8,300, while another company in the same state ordered transformers totaling $6,000. A Tennessee firm placed an order for distribution transformers amounting to $3,000 and a Florida company purchased distribution transformers totaling $1,500. Inquiries on transformer equipment are in much greater number than was the case this time last year. An interesting power company order was for $5,000 worth of watt-hour meters, while some other central-station orders were for cable and wire amounting to $3,100, arresters totaling $2,300 and small switches amounting to $2,000. One company ordered $1,200 worth of sign equipment.

Contracts were let last week on a textile mill addition involving $70,000 in electrical equipment and materials and an ice plant electrification calling for $10,000 worth of electrical materials. There is a new textile mill project for South Carolina, involving $30,000 worth of electrical equipment and materials, that is now in the hands of engineers and construction contracts will be let within the next four weeks.

Construction projects are as follows: The Florida Power & Light Company will extend the street-lighting system at Sarasota, Fla., at a cost of $18,000. The Woodmere Lumber Company, Venice, Fla., plans rebuilding a mill recently destroyed by fire with loss of about $100,000. The Crisp County Power Commissioners, Cordele, Ga., plan a hydro-electric plant on the Flint River, to cost $1,200,000, with transmission lines. Lexington, N. C., plans extensions in its transmission system to cost about $20,000. The Duke Power Company plans a transmission line from Canton, N. C., to Greenville, S. C. The Virginia Public Service Company, Charlottesville, Va., plans transmission lines in Bedford and Amherst Counties. The Virginia-Carolina Soapstone Company, Roanoke, Va., plans a plant near West Jefferson, N. C., to cost about $300,000. Bonds to the amount of $1,250,000 are to be issued by Crisp County, the proceeds to be used for a hydro-electric power development on the Flint River at Warwick, Ga.

## *Industrial Conditions Improve in Middle West*

Actual business placed in the Middle West justifies the optimism expressed at the beginning of the year. The first two weeks sales were not as good as the last two. It is apparent that a feeling of confidence in the future is manifested in most every business. Industrial conditions in the Calumet steel region were improved. The ninth blast furnace of the Gary works of the Illinois Steel Company was fired, giving employment to an additional 1,000 men. One of the large railroads placed an order for passenger cars, valued at $4,000,000, with a manufacturer in the Middle West.

The various utility companies are planning many extensions, additions and increases to service, buildings and distributing equipment. Among the interesting items ordered were: Three 500-kva. power transformers, ash pit overflow pump complete with appurtenances and ignition arches for six B. & W. boilers. Maintenance purchasing was quite large adding materially to the volume of business. Jobbers' sales have gradually increased, although the volume of business is not unusually large.

Construction projects are as follows: The Continental Ice Company, Chicago, Ill., will build an ice plant at Silvis, Ill., to cost $200,000. The Davenport Cement Company, Davenport, Iowa, plans a new mill at Buffalo, Iowa, to cost $1,350,000. The Cownie Tanning Company, Des Moines, Iowa, plans rebuilding of plant recently destroyed by fire with loss of $150,000. The Timken Roller Bearing Company, Canton, Ohio, plans a substation in connection with new plant units. The Cleveland Electric Illuminating Company, Cleveland, will build a substation on West Ninety-fifth Street, to cost about $100,000. Springfield, Ohio, plans an ornamental lighting system on Main Street. The Ice & Fuel Company, Youngstown, Ohio, plans an ice plant to cost $125,000. The Rhinelander Paper Company, Rhinelander, Wis., plans a new power plant. The Wisconsin Veneer Company, Rhinelander, Wis., plans rebuilding its mill recently destroyed by fire, to cost $100,000. The Wisconsin Electric Power Company will soon enlarge its Lakeside power plant, St. Francis, Wis., with installation of a 60,000-kw. turbo-generator unit.

## *Motor Sales Dominate in New England Market*

Industrial equipment orders and inquiries were outstanding features in the electrical market in New England. Small motor sales gained and one manufacturer recorded a volume amounting to more than $40,000. Another company reports a demand for sizes ranging up to 50 hp. with textile and shoe factories considering replacements. Inquiries for turbo-generators of the lower ratings are being received by manufacturers. Power apparatus and control equipment sales are steady, with the demand on a par with last year. Industrial electric furnaces continue to attract attention. Electrically driven ice plants are being considered in the district. Projects in eastern Massachusetts are under way and one in Hartford, Conn., calls for an expenditure of about $100,000. Electric refrigerator sales are gaining and one central-station company recently placed 60 among its employees.

Central-station supplies are receiving little attention and distributors report spotty conditions. Orders for cross-arms, weatherproof wire and line hardware are mounting, with railroads most active among buyers. The industrial situation in central Massachusetts is improving.

Construction projects are as follows: The Wilton Manufacturing Company, Maine, will add 60 looms to its weaving plant. The U.G.I. Company, Philadelphia, is making surveys in western Massachusetts for hydro-electric possibilities on the Konkapot River.

## *Business in St. Louis Shows Improvement*

Conditions in St. Louis show improvement. One of the steel companies bought $30,000 worth of motors and control apparatus for two main roll drives. A contract for elevator motors for addition to a hotel amounted to $20,000, and electrical equipment for six new elevators in a department store cost $20,000. An order for auxiliary motors and equipment for a large power station in the western part of Missouri amounted to $52,000, and another order covered $30,000 worth of lamp globes. A good demand for conduit, wire and other construction materials is reported.

Construction projects in the district are as follows: The Joplin Realty Company, Joplin, Mo., heads a project to install an ornamental lighting system on Main Street. Kennett, Mo., plans a municipal lighting plant to cost about $25,000. St. Louis plans an appropriation of $2,500,000 for an ornamental lighting system in the downtown district. The H. D. Lee Flour Mills, Inc., Salina, Kan., plans rebuilding plant recently destroyed by fire with loss of $100,000. Picher, Okla., plans an improved lighting system in the downtown section. The Public Service Company of Oklahoma plans extensions in its ice plant at Grove, Okla., and will build a transmission line to that place from Alto, Okla., to operate at 11,000 volts. The Arkansas Cold Storage Company, Little Rock, plans a cold storage and refrigerating plant to cost about $100,000. The Arkansas Power & Light Company, Little Rock, will install an ornamental lighting system on Markham Street. Colorado, Tex., and Snyder, Tex., both plan a municipal power plant and ice plant. The Houston Lighting & Power Company, Houston, Tex., plans a new substation on Richmond Road. The Hildago Utilities Company, Hildago, Tex., plans a power and ice plant. The Travis Cottonseed Products Company, Austin, Tex., plans a plant at Corpus Christi, Tex., to cost about $200,000. The Louisiana Power & Light Company will build a transmission line from Magnolia to Haynesville, La.

## *Large Projects Reported on Pacific Coast*

Large construction projects on the Pacific Coast include a soap plant for Long Beach at a cost of $700,000, two apartment houses for San Francisco, valued at $600,000 and $1,000,000 respectively, a can factory for San Francisco, and street lighting systems for Albany, Watsonville, and Suisun. San Jose has ordered thirty-four duplex standards totaling $10,000. Two huge power projects recently broached were one by the Pacific Gas & Electric Company for a 360,000-hp. unit on the south and middle forks of the Feather River, and another by the Great Western Power Company for a 35,000-kw. steam turbine plant in the India Basin of San Francisco. Small local power line orders are reported from Sacramento and Truckee, south San Francisco is in the market for a 40-box fire alarm system, and Glendale for four 200-amp feeder regulators. Power company orders include one carload of pole line hardware and two carloads of poles, also an inquiry for 1928 requirements of creosote, valued at about $30,000. Export orders include $6,500 worth of wire and wiring material for Mexico. Imports from the Far East were better during January than for the previous decade. Industrial orders include assorted oil well motors and transformers for the Kern oil fields, 2,500 ft. of submarine dredging cable and 3 250-hp. motors for a cement plant, and 72 lightning arresters for the Mt. Whitney area. Prices of conduit and loom boxes and of rubber-covered wire have decreased about 5 per cent and special inducements are being offered on 1,000 lots of certain schedule staples, marking perhaps a tentative return to the larger units of ordering.

Transmission line projects and the letting of large contracts were features of business in the Puget Sound district. The Puget Sound Power & Light Company purchased $100,000 worth of transmission wire, $42,000 worth of insulators and pole line hardware and $21,000 worth of poles for 188 miles of heavy transmission line from Sedro-woolley to Seattle to be known as the Baker River line No. 2. The same company will shortly begin construction of a 16-mile transmission line from Wenatchee to Moses Coulee, opening up 7,500 acres of agricultural lands. The city of Tacoma has awarded contract for the special underground duct system at the Nisqually substation and has bought 18,000 lb. of copper transmission wire. Owing to changes in route necessitating new plans and specifications for the transmission line between Morton and La Grande, the date of opening of bids has been indefinitely postponed. Motor sales reported were light last week, and aggregated about 60 units from 100 hp. down.

Construction projects are as follows: The Pacific Fruit Express Company, San Francisco, plans erection of an ice and cold storage plant at Tucson, Ariz. at a cost of $400,000. The Auburn Fruit Exchange, Auburn, plans an ice and precooling plant to cost about $100,000. The Coast Counties Gas & Electric Company plans a new equipment storage and distributing plant at Hollister, to cost $35,000. The Water and Power Commission, Los Angeles, is asking bids until Feb. 28, for generators, exciter, transformers, hydraulic equipment and accessory electric apparatus. The Sacramento Pulp & Paper Company, Sacramento, plans a new mill to cost $400,000. The Illinois-Pacific Glass Company, San Francisco, plans a new plant at Vernon, Calif., to cost $750,000. The National Lumber & Creosoting Company, Texarkana, Ark., plans a plant at Utah Junction, near Denver, Col., to cost about $350,000. The Idaho Power Company plans a hydro-electric power plant on Snake River, near American Falls, Idaho, to cost $1,500,000, with transmission line. Sand Point, Idaho, plans a municipal hydro-electric plant on Priest River, to cost $166,000. The Glacier County Light & Power Company, Cut Bank, Mont., plans a power plant on Two Medicine River with transmission lines, to cost $400,000. Great Falls, Mont., will buy high-duty pumping equipment for waterworks service, to cost $35,000. The Southern Pacific Railroad Company will build a new addition to its locomotive and car shops at Eugene, Ore., to cost about $250,000. Morton, Wash., is asking bids until Feb. 20, for construction of a transmission line from power plant near Alder, with distributing systems at Morton and Mineral, Wash. Culver City, Fresno, Pittsburg, Richmond, Ukiah, and Willows, all of California, plan ornamental lighting systems.

# Activities of the Trade

## General Electric Sells Welding Equipment to Ford

In the past few months the Ford Motor Company has installed approximately 30 General Electric automatic arc welding equipments. Although this is considered a fair-sized automatic welding installation, it is understood that it is but a beginning of the automatic arc welding operations planned by the Ford company. The increasing use of welding in automobile manufacture is demonstrated by the fact that a large number of parts on the new Ford car are constructed by arc welding. Among these welded parts are the rear axle housing, the steering gear casing, the radius rod, the spare tire carrier, the drag link for the front axle and the axle rods. It is said that experiments are now under way preparatory to welding several other parts in addition to these.

## Sterling Electric Motors Moves into New Plant

Recently organized in California, as announced in the Nov. 19, 1927, issue of the ELECTRICAL WORLD, Sterling Electric Motors, Inc., has moved into its new modern factory, located on Telegraph Road at Atlantic Boulevard, is installing most of its heavy machinery and expects to be in production early in February. The company will market the Sterling "Cros-Line" motor and will produce motors from ½ hp. to 30 hp.

## Lighting Schools Will Study Electrical Advertising

Under the direction of C. J. Eaton, chairman of the advertising committee of the National Electric Light Association, the first electrical advertising school will be opened March 5-8 at the Edison Lighting Institute of the Edison Lamp Works of the General Electric Company at Harrison, N. J. Experts in the electrical advertising world, central station men, electrical sign manufacturers and engineers of other interested companies will give courses designed to inform the industry as a whole of the developments among its component parts. Industry problems will be discussed, individual developments explained, future possibilities pointed out, and improvements toward benefiting the whole suggested.

A second school offering similar courses will be held at the Nela School of Lighting of the National Lamp Works of the General Electric Company at Cleveland, Ohio, March 19-22. The Westinghouse Lamp Company is co-operating with the General Electric Company under the committee on electrical advertising of the N.E.L.A. in both of these schools. Registration for the Harrison school should be made through A. D. Bell, Edison Lighting Institute, Harrison, N. J., or through J. J. McLaughlin, Westinghouse Lamp Company, Bloomfield, N. J., no later than February 27. Names of those planning to attend the course at Cleveland should be sent to L. C. Kent, Nela School of Lighting, Nela Park, Cleveland, or to J. J. McLaughlin, Westinghouse Lamp Company, Bloomfield, N. J., not later than March 12.

## Fire-Fighting Equipment Demonstrated

An exhibition and demonstration of the Phomene accumulator system of fire-fighting equipment was given in Newark, N. J., by the Globe Automatic Sprinkler Company, and the Pyrene Manufacturing Company on the afternoon of Jan. 19. The most spectacular part of the demonstration was the 30-ft. tank of oil which was ignited and allowed to burn for about ten minutes. Then the fire-fighting equipment was brought into action, and in two or three minutes a blanket of foam was formed over the oil and completely extinguished the fire. Although the other fires were not as spectacular as the oil tank, the efficiency with which they were handled indicated the effectiveness of the system.

The Phomene accumulator system consists of a tank containing a white powder which is connected to the water system, through an automatic valve, and to the object to be protected. When the water is turned into the powder a foam forms and flows through a foam-distribution system, over the object on fire. The fire is extinguished by the foam blanket excluding the air from the combustible material. Various methods may be employed for making the system automatic, such as sprinkler heads and thermostatic devices.

## Northern White Cedar Association Holds Meeting

A large and successful meeting was held by the Northern White Cedar Association this week at Minneapolis. It was the sense of the meeting that producers' facilities are in better shape than ever, and the high spot of the discussion centered around the promotion of the best service to customers. An attendance larger than at any previous meeting was recorded at the banquet on Tuesday evening. The new officers elected are: Guy Ramsey, president; Wilbur Lafean, vice-president; H. S. Gilke, treasurer, and N. E. Boucher, secretary. The board of directors includes L. A. Page, J. E. Gerich, Donald Bell and John Twomey.

The Peerless Electric Company, Warren, Ohio, announces that John M. Tuthill has been appointed general sales manager of the company. Mr. Tuthill, recently of Philadelphia, was formerly with the Niagara Falls Power Company. Phil F. Toman will be sales manager of the motor division of the company and will devote all his attention to that phase of the business.

The Insulation Manufacturing Company, Inc., is moving from 70 Washington Street, Brooklyn, to New York Avenue and Herkimer Street, Brooklyn, where 50 per cent more manufacturing space is available. Together with the General Insulate Company, which was acquired by the Insulation Manufacturing Company early last year, the products manufactured are "bakelite," molded parts for many electrical applications and insulators, including its trade marked goods "Electrose" and "Insulate."

The Master Electric Company, Linden and Master Avenues, Dayton, Ohio, held its annual sales convention at its plant last month.

The Electro-Kold Corporation, Spokane, Wash., early in December elected L. M. Simpson president and general manager. Mr. Simpson succeeds as president Dr. X. L. Anthony, who has become chairman of the board of directors, and C. L. Lewis, formerly general manager, who has resigned to take care of personal affairs.

The Conduo-Base Company, 2345 Carnegie Avenue, Cleveland, announces the development of its "Junior Conduo-Base" for the wiring of buildings. The United Metal Products Company, Canton, Ohio, and the Dahlstrom Metallic Door Company, Jamestown, N. Y., are licensed manufacturers.

Porter & Ross, Inc., 30 Church Street, New York, manufacturers' agents, announce the opening of branch offices at the Monadnock Building, Chicago, 839 Oliver Building, Pittsburgh, and 1002 Louderman Building, St. Louis.

The C. H. Wheeler Manufacturing Company, Philadelphia, manufacturer of condensers, pumps and cooling towers, announces that the Reeves & Skinner Machinery Company of St. Louis and Kansas City has been appointed agent for those territories.

The Trumbull Electric Manufacturing Company, Plainville, Conn., announces the opening of its Boston sales office in the Statler Building, room 1002. J. S. Ingebretsen is in charge of the office. The company also announces the appointment of Frank M. Buckley as sales representative in the Pittsburgh district. He will work this year with A. H. Bergendahl, the present salesman.

The R. H. Beaumont Company, 319 Arch Street, Philadelphia, Pa., manufacturer of skip hoists, cable drag scrapers, etc., announces that L. O. Hassler, formerly chief engineer, has been transferred to its Western headquarters at the Strauss Building, Chicago, and he will devote himself to sales in the Chicago territory under the direction of H. E. Birch. The company also announces that William P. Alexander, who resigned from the organization in May of last year, has returned to the sales department and will devote himself to sales duties in the Philadelphia, Baltimore and Washington district.

The Daniel Woodhead Company, Chicago, has placed on the market the "Protex" rubber-handled portable extension lamp and the "Vaprotex" vaporproof portable extension lamp.

The Rome Wire Company, Rome, N. Y., a division of the General Cable Corporation, announces the appointment of Jenkins & Gunther, Unit 2, Santa Fe Building, Dallas, Tex., as sales agents. The territory covered will include the states of Texas, Arkansas, Oklahoma and western Louisiana.

The National-Harris Wire Company, Newark, N. J., has leased for ten years, with option to purchase the Heller Brothers' file works at Mount Prospect and Verona Avenues. Paul Heller will become actively associated with the company.

# New Equipment Available

## Thermostat and Relay

An electric immersion thermostat suitable for maintaining liquid temperatures within a range of plus or minus 5 deg. F. has been added to the line of temperature control equipment of the Wilcolator Company, 17 Nevada Street, Newark, N. J. It is supplied in three ranges of temperatures: 50 to 150 deg. F.: 100 to 300 deg. F., and 250 to 550 deg. F. The unit has a bulb immersion of 2⅜ in. and is threaded for ½-in. standard pipe. Three wire control is used through a relay, the terminals are arranged for open wiring, armored cable or conduit connection, and the maximum voltage is 250. Calibration is secured by removing the cover and moving the adjustment lever to the desired temperature to be maintained. Its application is particularly well suited to electric water heaters, urns, sterilizers and similar apparatus requiring close temperature control.

A relay also has been designed particularly for three-wire control through thermostats or other pilot means and is built for alternating current only with a rating of 110 volts, 25 or 60 cycles, 30 amp. or 220 volts, 60 cycles, 15 amp. It is designed for non-inductive circuits only and in operation it is said to be particularly quiet.

Indoor Bus Support.—A new line of low-voltage indoor bus supports which embody complete interchangeable features has been placed on the market by the Line Material Company, South Milwaukee, Wis. The line embodies a variety of types for mounting buses either vertically or horizontally and on any type of structure as well as for mounting round buses. The bus supports are available for 750-volt and 2,300-volt service.

Portable Tinning Pot.—A portable tinning pot has been added to the line of electric heating equipment of the General Electric Company. It is used for small tinning and soldering operations. It is built on the same principle as the larger melting pots made by the company. The heating unit, which is of the cartridge type, dissipates 150 watts. This pot is particularly designed for solder and tin, having a maximum operating temperature of 500 deg. F. About 15 minutes only are required to reduce the full contents of the pot to working temperature. While the pot is normally designed for operation on 110-volt circuits, it can be supplied for operation on 100-, 120-, or 240-volt circuits if desired. It has an approximate shipping weight of 6 lb.

## Multiple Duct Slant Conduit

A multiple duct slant conduit especially adapted for building curves of various radii has been developed by the National Fire Proofing Company, Pittsburgh, manufacturer of "Natco" underground clay conduit, with the assistance and co-operation of the Bell Telephone Laboratories, New York. These slant conduits have been made and used for some years in the single duct shapes but this idea has now been applied to various multiple duct shapes including 2, 3, 4, 6 and 9-way. These multiple duct slants used alone or in combination with the straight short pieces of the same multiple may be used in building curves from 10 ft. to 25 ft. radius as well as in various angles such as 15, 22½, 30, 45, 60 and 90 deg.

Recording Thermometer.—A 72-hour recording thermometer 6 in. in diameter by 3¾ in. high has been placed on the market by the Bristol Company, Waterbury, Conn. The instrument is useful in obtaining data on commercial and residential installations before and after electrical units are placed in service. It is drum-shaped, without tubes or cables, and has a range of from 30 to 70 deg. F. It may be placed flat or hung on a hook. As a central-station sales department adjunct it is designed to eliminate many causes of argument over temperature conditions in prospective customers' apparatus and to aid in the adjustment of new installations to local service conditions.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Jan. 3, 1928)

1,655,035. Regulating System; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 17, 1925.

1,655,036. Control of Electric Power; E. F. W. Alexanderson and A. H. Mittag, Schenectady, N. Y. App. filed April 25, 1925.

1,655,037. Locomotive Control; E. F. W. Alexanderson, Schenectady, N. Y. App. filed May 25, 1925.

1,655,038. Power-Factor-Control System; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 5, 1925.

1,655,040. Control of Electric Power; E. F. W. Alexanderson and A. H. Mittag, Schenectady, N. Y. App. filed Dec. 15, 1925.

1,655,041. Regulating Apparatus; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 15, 1926.

1,655,042. Speed-Control System; E. F. W. Alexanderson, Schenectady, N. Y. App. filed July 14, 1926.

1,655,050. Sealing-in Machine for Tubes and Bulbs; C. Eisler, Newark, N. J. App. filed April 25, 1925.

1,655,051. Machine for Making Stems for Incandescent Lamps; C. Eisler, Newark, N. J. App. filed July 1, 1926.

1,655,087. Shade Mounting; A. Bostroem, Roselle, N. J. App. filed July 24, 1924. For portable desk lamp.

1,655,102. Lighting Fixture; V. G. Kay, Cleveland, Ohio. App. filed Jan. 20, 1926.

1,655,106. Electrical Conductor; C. A. Parsons, J. Rosen, A. W. Grey and B. Blair, Newcastle-on-Tyne, England. App. filed Nov. 9, 1925. Of a flat, elongated form suitable for the slot windings of dynamo-electric machines.

1,655,119. Protected Thermometric Electric Circuit Closer; E. B. Wilson, East Orange, N. J. App. filed Feb. 18, 1927.

1,655,142. Elevator Signaling System; R. H. Gaylord, Los Angeles, Calif. App. filed March 26, 1925.

(Issued Jan. 10, 1928)

1,655,404. Outlet Box Cover; A. J. Bassett, Brooklyn, N. Y. App. filed Feb. 7, 1921.

1,655,405. Electrical Connecter; H. W. Batcheller, Bethel, Vt. App. filed Aug. 1, 1924. Comprising a socket provided with internal conducting members adapted to connect the lamp, which is placed at one end of the socket with a conducting cable at the opposite end.

1,655,408. Governor-Operated Switch; J. E. Boyce, Yonkers, N. Y. App. filed Sept. 29, 1923.

1,655,413. Electric Water Heater; E. L. Emerson, Braintree, Mass. App. filed Dec. 15, 1921.

1,655,430. Electric Circuit - Closing Means; H. L. Merrick, Passaic, N. J. App. filed May 10, 1924. For use in connection with balances and automatic weighing mechanism.

1,655,451. Electric Current Regulator; C. S. Agate and A. E. Hill, Chelmsford, England. App. filed Aug. 8, 1922.

1,655,453. Electromagnet; H. W. Brown, Schenectady, N. Y. App. filed May 15, 1923.

1,655,464. Electric Switch; H. J. H. Huber, Schenectady, N. Y. App. filed April 10, 1922. Oil switch.

1,655,465. Grounding and Testing Arrangement; H. J. H. Huber, Schenectady, N. Y. App. filed March 10, 1926

1,655,466. Method and Apparatus for Treating Filaments; G. E. Inman, East Cleveland, Ohio. App. filed June 9, 1926.

1,655,469. Power System; C. MacMillan, Schenectady, N. Y. App. filed April 27, 1923. In which a plurality of prime movers such as Diesel engines or steam turbines are utilized to drive the generators which supply power to the propeller motor.

1,655,470. Electric Ship Propulsion; C. MacMillan, Schenectady, N. Y. App. filed March 21, 1924.

1,655,475. Electric System; D. C. Prince, Schenectady, N. Y. App. filed Aug. 12, 1925. Wherein current transmitted between direct and alternating-current circuits is rectified or derectified by an electric valve apparatus.

1,655,479. Electric Heater; H. E. Strunk, Ontario, Cal. App. filed Jan. 16, 1924. Means for protecting from overheating, particularly for electric flatirons.

1,655,480. Electric Heater; R. L. Uhl, Ontario, Cal. App. filed Jan. 3, 1923. Means for protecting electric heaters from overheating.

1,655,488. Electric Incandescent Lamp; H. Wolff, F. Koref and F. Skaupy, Berlin, Germany. App. filed Nov. 3, 1925.

1,655,492. Kilovolt - Ampere - Demand Meter; H. J. Blakeslee, West Hartford, Conn. App. filed Feb. 9, 1924.

1,655,493. Secondary Electric Clock; T. S. Casner, Plainfield, N. J. App. filed Sept. 6, 1924.

1,655,502. Incandescent Electric Lamp; G. Holst, Eindhoven, Netherlands. App. filed March 11, 1927. In which the absorption of light is reduced by means of a substance usually called a "getter."

1,655,528. Electric Ignition System for Gas Burners; E. T. Banzhaf, San Francisco, Cal. App. filed Dec. 6, 1922.

1,655,540. Moth Exterminator; A. C. Friedel, Syracuse, N. Y. App. filed Jan. 29, 1927.

1,655,554. Device for Electric Therapeutic Treatment; J. A. Lev, Peoria, Ill. App. filed May 8, 1926.

1,655,590. Automatic Traffic Signal; H. J. Borgerding and J. F. Borgerding, Oakland, Cal. App. filed March 20, 1924. For directing traffic at the intersections of highways or streets.

1,655,598. Battery Terminal Connecter; S. Diller, Des Moines, Iowa. App. filed Oct. 18, 1926.

1,655,604. Electricity Meter; J. Harris, Lafayette, Ind. App. filed Jan. 22, 1926. Means for causing such a meter to operate accurately over a wide load range.

1,655,663. Regulator System; H. W. Rogers and E. H. Horstkotte, Schenectady, N. Y. App. filed Feb. 13, 1926. For segregated drives such as paper-machine drives.

1,655,665. Electric Waffle Iron; J. L. Shroyer, Oak Park, Ill. App. filed Aug. 2, 1926.

1,655,694. Electric Switch; F. Gropp, Berlin, and M. Butterlin, Neubabelsberg, Germany. App. filed Jan. 6, 1927. Fluid-break type.

1,655,706. Cable Splice; E. C. Kirk, St. Albans, W. Va. App. filed April 25, 1923.

1,655,708. Stand for Electric Flatirons; C. L. Moyer, Chicago, Ill. App. filed Nov. 30, 1925.

1,655,717. Brush for Small Motors and Dynamos; R. H. Wappler, Yonkers, N. Y. App. filed May 27, 1924.

1,655,720. Heating Unit and Method of Making Same; H. A. Ziola, Toledo, Ohio. App. filed March 28, 1925.

1,655,746. Electric Boudoir Lamp; C. Wachtel, New Hyde Park, N. Y. App. filed Jan. 16, 1925.

1,655,760. Timing Device; H. F. Delmanhorst, Louisville, Ky. App. filed Sept. 29, 1925. Employed in automatically operating varicolored lights as at street crossings.

1,655,761. Electric Incandescent Lamp; P. Duffy, San Francisco, Calif. App. filed April 2, 1927. Adapted for electrotherapeutical, general lighting and automobile headlight uses.

1,655,781. Apparatus for Electroplating; G. Caraccio, Genoa, Italy. App. filed Aug. 3, 1926.

1,655,783. Electrode for the Combined Therapeutic Application of High-Frequency Current and of Ultra-Violet Radiation; R. Gallois, Lyons, France. App. filed Sept. 14, 1926.

1,655,824. Motor Construction Having Cooling-Oil Circulation; B. F. Schmidt, Los Angeles, Calif. App. filed Sept. 30, 1925.

1,655,834. Electric Rain Switch; F. Dzierzenga, Brooklyn, N. Y. App. filed Sept. 20, 1926. Switches provided with means to collect raindrops, the weight of the collected rain water causing the switch to close the electric circuit.

1,655,837. Subway Transformer; S. Horelick, Pittsburgh, Pa. App. filed Dec. 17, 1925.

1,655,838. Electrical Heater Element; E. C. Lackland, New Haven, Conn. App. filed May 7, 1924.

1,655,842. Fuse; E. F. Pelletier, St. Joseph, and W. Bandlow, Benton Harbor, Mich. App. filed Sept. 10, 1925. With means for visibly indicating fusing of the fusible element.

1,655,857. Method of and Element for Heating Hovers; H. O. Cunard, Modesto, Calif. App. filed May 13, 1925.

1,655,892. Insulator; B. E. Colburn, Green Bay, Wis. App. filed June 30, 1926. For radio antennas.

1,655,928. Circuit Controller; H. N. Wade, Milwaukee, Wis. App. filed July 19, 1919. Applicable to the control of polyphase circuits for effecting automatic interruption under conditions of phase failure or phase reversal or upon predetermined reduction of the line voltage.

1,655,929. Electrical Connecting and Supporting Device; E. C. White, New York, N. Y. App. filed April 28, 1923. For fixtures.

1,655,930, 1,655,931. Oil-Refining Still and Method of Making the Same by Electric Arc Welding; W. F. Woolard, Wauwatosa, Wis. Apps. filed Feb. 27, and March 13, 1926.

1,655,952. System and Method of Commutation for Frequency Changers; R. E. Hellmund, Swissvale, Pa. App. filed April 18, 1922.

1,655,965. Impulse Starter for Magnetos; S. D. Livingston, Freeport, N. Y. App. filed April 1, 1926.

1,655,966. Arc Incandescent Lamp; C. F. Lorenz, East Orange, N. J. App. filed March 14, 1923.

1,655,967. Thermal Relay; H. D. Matthews, Mansfield, Ohio. App. filed Nov. 21, 1925.

1,655,972. Lightning Arrester; S. M. Pineles, Pittsburgh, Pa. App. filed Feb. 23, 1922.

1,655,983. Induction Furnace; P. H. Brace, Wilkinsburg, Pa. App. filed April 2, 1927.

1,656,013. Electrical Measuring Instrument; R. T. Pierce, East Pittsburgh, Pa. App. filed Jan. 30, 1923. With means for limiting the movement of the index or pointer members.

1,656,052. Terminal Connecter for Toy Railways; A. R. Fergusson, Buffalo, N. Y. App. filed Sept. 27, 1922.

1,656,066. Dry Cell; W. F. Hendry, Ossining, N. Y. App. filed Jan. 23, 1924.

1,656,091. Depolarizing Mix for Dry Cells; V. Yngve, South Orange, N. J. App. filed March 24, 1924.

1,656,116. Electrical Measuring Instrument; W. E. Hull, Sharpesville, Pa. App. filed April 14, 1926. For measuring the ohmic resistance of any given conducting element.

1,656,121. Refillable Electric Fuse; F. C. La Mar, Pittsburgh, Pa. App. filed Dec. 1, 1924.

1,656,142. Electric Hair Waver; S. Cocroft, New York, N. Y. App. filed Aug. 28, 1926.

1,656,151, 1,656,152. Electric Switch; G. B. Thomas, Bridgeport, Conn. Apps. filed Oct. 28, 1920, and Feb. 4, 1922. Mechanically operated switch associated with an automatic actuating mechanism of any suitable sort, connected, for instance, with the mechanism of a washing machine.

(Issued Jan. 17, 1928)

16,851 (reissue). Switch; H. D. James, Edgewood, Pa. App. filed Feb. 20, 1920. Electromagnetic switch of the "lockout" type.

1,656,174. Braking Mechanism; A. C. Dahl, Hinsdale, Ill. App. filed June 30, 1926. For motor driven apparatus.

1,656,188. Electric Switch; F. Favarger, Neuchatel, Switzerland. App. filed Feb 19, 1926. Quick make and break.

1,656,203. Electric Storage Apparatus; P. Kapitza, Chesterton, England. App. filed Aug. 26, 1924. "Flash" discharge accumulator.

1,656,247. Arc Regulator; H. H. Strong, Toledo, Ohio. App. filed Jan. 18, 1926. For effecting and regulating the feed of the electrodes of the arc of a motion-picture projector.

1,656,274. Electric-Welding Apparatus; H. S. Holmes, New York, N. Y. App. filed Feb. 9, 1925.

1,656,313. Control System; H. L. Blood, North Plainfield, N. J., and R. C. Deale, Plainfield, N. J. App. filed Nov. 19, 1923. For operating machine tools.

1,656,321. Protection of Lamp Controllers; E. Dick, Geneva, Switzerland. App. filed May 5, 1924. For train-lighting systems.

1,656,329. High-Tension Cable Adapted for Small Currents; E. G. Sievert and H. Svensson, Sundyberg, near Stockholm, Sweden. App. filed Nov. 11, 1925. As used in Röntgen-ray apparatus.

1,656,383. Safety Switch; W. E. McCoy, New York, N. Y. App. filed May 4, 1920. With switching means for entirely disconnecting the fuses from the circuits when the switch is opened.

1,656,395. Terminal; A. B. Saurman, Pittsburgh, Pa. App. filed Dec. 17, 1924. Used in the installation of electrical service lines.

1,656,399. Electrical Switch: A. G. Steinmayer, Milwaukee, Wis. App. filed July 31, 1924. Quick-break cut-out switch.

1,656,407. Switch Mechanism; P. F. Williams and J. Rah, Chicago, Ill. App. filed June 25, 1926. Junction box with disconnecting pothead.

1,656,421. Heat-Balance System: C. W. Clarke, New York, N. Y. App. filed July 16, 1923. In steam-driven, power generating plants.

1,656,458. Electromagnet Construction; L. J. Wahl, Sterling, Ill. App. filed Sept. 25, 1925. Adapted for use in restricted space.

1,656,510. Electric Furnace for Melting or Producing Glass, Water-Glass, Cement, or Other Substances; C. F. Cornelius, Stockholm, Sweden. App. field Feb. 26, 1926.

1,656,518. Electric Water Heater; W. J. Hammers, Grand Rapids, Mich. App. filed Aug. 23, 1926. Induction type.

1,656,689. Train-Signal System; W. E. Benn and G. E. Davies, Troy, N. Y. App. filed May 10, 1920.

1,656,690. Heat Pencil; G. W. Blackburn, Elgin, Ill. App. filed Sept. 7, 1926. For making marks on paper, fabric or the like by charring or burning the fabric.

1,656,703. Electric Switch; B. E. Getchell, Plainville, Conn. App. filed Sept. 4, 1926. With means for preventing the formation of an injurious arc in the opening movement of the switch and for snuffing out such minor arcing as may form.

1,656,709. Electric Oven; S. L. Kelly, Toledo, Ohio. App. filed Jan. 27, 1927.

1,656,725. Cluster Outlet for Electric Lamps; F. Chadwick, Hamilton, Ontario, Canada. App. filed Dec. 10, 1926.

1,656,729. Lamp-Bulb Holder; C. E. Godley, Detroit, Mich. App. filed Jan. 25, 1926.

1,656,750. Road Switch for Electric Garage Doors; R. V. Morse, Ithaca, N. Y. App. filed April 25, 1925.

1,656,753. Storage Battery; P. E. Norris, Wilkinsburg, Pa. App. filed Nov. 17, 1924.

1,656,768. Testing Device for Electric Wiring Systems; S. B. Berkowich, Baltimore, Md. App. filed Jan. 8, 1927.

1,656,777. Combination Heat and Light Therapy Lamp; H. Dennis, New York, N. Y. App. filed Nov. 6, 1924.

1,656,792. Rosette; C. A. Jameson, Franklin, Neb. App. filed Sept. 30, 1925.

1,656,793. Electric Bulb; F. K. Kayte, Farr, Col. App. filed Oct. 27, 1924.

1,656,797. Splicer for Power Lines; J. D. Scott, Curfew, Ky. App. filed May 26, 1926.

1,656,800. Electric Cut-Out and Fuse; W. J. Turenne, Danvers, Mass. App. filed Oct. 6, 1922.

1,656,837. Circuit Breaker; H. F. Smith, Dayton, Ohio. App. filed April 21, 1924. Which will break the circuit without producing objectionable arcing at the contacts.

1,656,851. Circuit Breaker; C. E. Anderson, Stratford, Conn., and W. H. Keefe, Jr., Bridgeport, Conn. App. filed June 24, 1925. Thermostatically controlled.

1,656,856. Electric Appliance Having Pin Contacts and Method of Manufacturing the Same; W. J. Gagnon, Bridgeport, Conn. App. filed Dec. 20, 1926.

# New Trade Literature

OVERHEAD CONSTRUCTION MATERIALS.—The Copperweld Steel Company, Glassport, Pa., is distributing a leaflet containing data on Copperweld non-rusting construction materials for overhead lines (wood-pole construction).

RECORDING THERMOMETER. — The Bristol Company, Waterbury, Conn., is distributing bulletin No. 363 describing its new small-sized Bristol recording thermometer.

ELECTRICAL SUPPLIES. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing its large complete catalog of electrical supplies for 1928-1930, containing 1,171 pages. It is a complete and up-to-date reference book of the electrical supplies made by the company and describes and illustrates the material.

CONNECTORS.—A bulletin issued by the Burndy Engineering Company, Inc., 10 East Forty-third Street, New York City, describes and illustrates the Burndy outdoor connectors equipped with "Everdur" parts.

ARC WELDING AND OUTDOOR STATION EQUIPMENT.—The General Electric Company, Schenectady, N. Y., is distributing bulletin No. GEA-823 covering its atomic hydrogen arc welding equipment for hand welding on 60-cycle circuits and bulletin No. GEA-460 B describing its types TA-1, TA-2, TA-5 and TA-6 horn-gap and disconnecting switches for outdoor station equipment.

TIME RECORDER.—Bulletin No. 1127 issued by the Esterline-Angus Company, Indianapolis, Ind., covers its new time recorder, an instrument for recording the time and duration of events.

EXCAVATOR AND CRANES. — The Harnischfeger Corporation, Milwaukee, has issued bulletin GH-2, covering its model 200 "P&H groundhog" for use as a shovel, dragline, clamshell crane, skimmer-scoop or trench-hoe. The company is also distributing bulletin 650-X describing the "P&H" model 206B excavator cranes.

TELEPHONE SYSTEMS.—Catalog No. 1110 issued by the Federal Telephone Manufacturing Corporation, Buffalo, N. Y., covers its complete line of interior private telephone systems and switchboards for apartment houses, schools, offices, industrial plants, residences, hospitals, etc.

LIGHTING FIXTURES. — The Artistic Lighting Equipment Association, 420 Lexington Avenue, New York City, has issued a booklet describing its sales promotion and refixturing campaign.

TRUCK AND TRAILER CRANES.—Bulletin No. 639-X issued by the Harnischfeger Corporation, Milwaukee, describes and illustrates its model 203-A "P&H" truck and trailer cranes.

PROTECTIVE PRODUCTS.—The Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., has isued catalog No. 56, covering the "Noark" meter service and safety switches, fuses, service and fuse boxes, underground boxes and fittings, and molded products and line material. The company is also distributing a miniature, pocket size reproduction of this catalog, which contains the switch and fuse sections only.

BLOWER. — A bulletin issued by the National Flue Cleaner Company, Inc., Groveville, N. J., describes the National soot blower.

CRANES. — The Whiting Corporation, Harvey, Ill., has issued catalog No. 209, superseding No. 200, covering its complete line of cranes. This catalog contains many illustrations of crane installations.

BALL AND ROLLER BEARINGS.—The Timken Roller Bearing Company, Canton, Ohio, has issued a booklet entitled "The Truth About Anti-Friction Bearings," discussing their design, their function, their necessity and their performance.

RESISTORS.—Bulletin No. 111 issued by the Monitor Controller Company, Baltimore, Md., describes and illustrates the Monitor edgewound, hexwound and smoothwound resistors.

MOTORS AND CONTROL. — Bulletin GEA-761A, GEA-891, GEA-892, GEA-893 and GEA-910 issued by the General Electric Company, Schenectady, N. Y., describes and illustrate respectively, the improved brush holders for GE-57 railway motors, motors and control for ventilating fans in coal and metal mines, G-E motor drives for centrifugal pumps in coal and metal mines, geared induction-motor type electric drive for coal and ore hoists and the proper method of removing and replacing pinions for type HM industrial haulage motors.

LIGHTING EQUIPMENT.—The Lightolier Company, 569 Broadway, New York City, has issued a new catalog entitled "How to Make a Profitable Retail Fixture Sale."

FANS.—"New Sales Helps for Your 1928 Fan Business" is the title of catalog No. 1363 issued by the Robbins & Myers Company, Springfield, Ohio. It contains booklets and folders for distribution, photographic display signs, etc.

LIGHTNING ARRESTERS.—Booklet No. 245 issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, covers its Keystone crystal valve lightning arresters. Illustrations are given showing typical installations of the arresters.

ELECTRIC DRIVE FOR MOTOR BUSES.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-855 entitled "The Application of Electric Drive to Motor Buses," in which it gives illustrations of buses equipped with the G-E electric drive.

CONDUIT.—The National Fire Proofing Company, Pittsburgh, is distributing a pamphlet covering the "Natco" underground clay conduit of various shapes and sizes.

HIGH-POTENTIAL FUSES. — Bulletin 200A issued by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, describes and illustrates the S & C high-potential fuse for 2,200-volt to 132,000-volt service in capacities from ½ amp. to 400 amp. In addition to ordering information covering ratings, dimensions, weights, etc., a number of important subjects are discussed as the S & C fuse and its relation to electric power systems, the S & C fuse and the requirements for interrupting high-voltage circuits, the S & C fuse and the fundamentals of fuse design, how the S & C fuse operates, application recommendations, etc.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Breslau, Germany (No. 29,255), of storage batteries.

Purchase is desired in Lille, France (No. 29,272), of wooden battery separators and battery parts.

Purchase and agency are desired in Glasgow, Scotland (No. 29,327), for electrical appliances such as switches, lamp fittings, and wiring supplies.

Purchase and agency are desired in Vienna, Austria (No. 29,283), for household electrical appliances.

Purchase is desired in Toronto, Canada (No. 29,280), of household electrical appliance parts for assembling.

Purchase or agency is desired in Toronto, Canada (No. 29,279), for quartz ultraviolet ray lamps or quartz burners for such lamps.

An agency is desired in Konstanz, Germany (No. 29,340), for electrical machinery.

Purchase and agency are desired in Durban, South Africa (No. 29,326), for electrical machinery and wiring supplies.

Purchase is desired in Madrid, Spain (No. 29,278), of electric refrigerators and electric vacuum cleans and floor waxers.

Purchase is desired in Magdeburg, Germany (No. 29,274), of electric vacuum cleaners.

Purchase is desired in Delitzsch, Germany (No. 29,275), of electric vacuum cleaners.

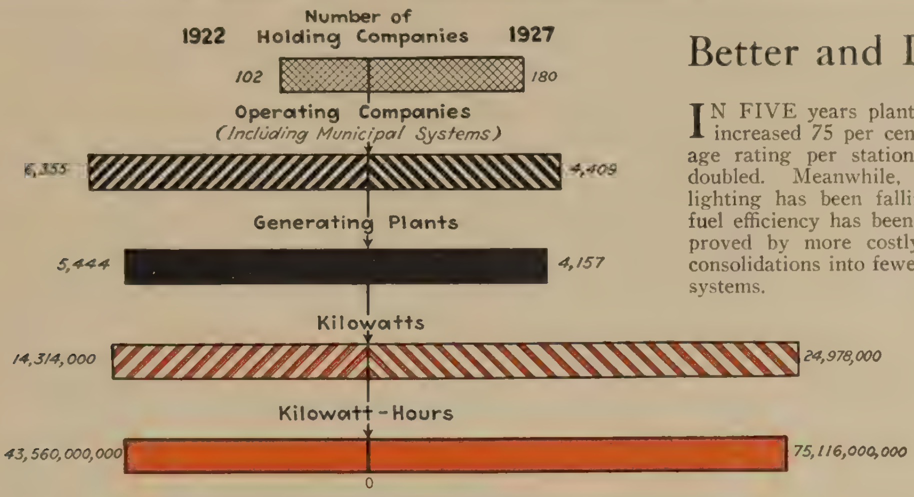
Purchase is desired in Leipzig, Germany (No. 29,276), and another (No. 29,277), of electric vacuum cleaners and floor polishers.

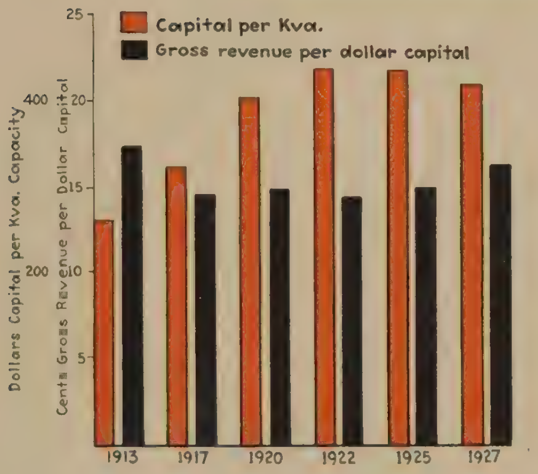
# Business Facts for Electrical Men

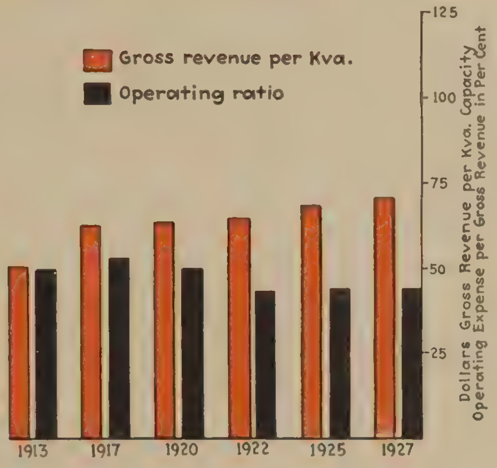
Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

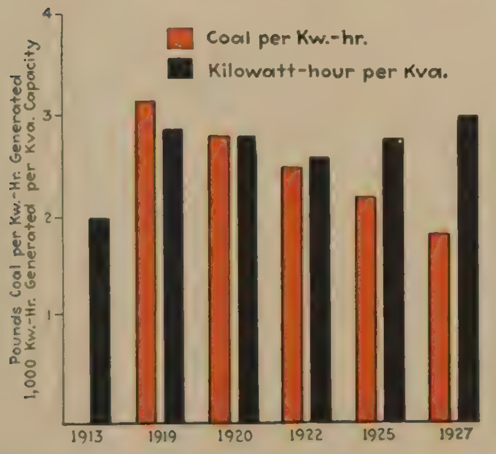
## Better and Larger

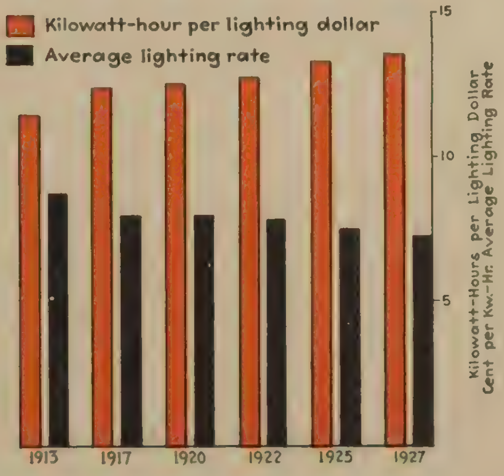
In FIVE years plant and output increased 75 per cent; the average rating per station more than doubled. Meanwhile, the cost of lighting has been falling steadily; fuel efficiency has been greatly improved by more costly plant and consolidations into fewer and larger systems.











# Western States Increase Productive Operations by 2 Per Cent During 1927

THE year 1928 opened with the manufacturing plants of the Western States operating on a plane about 8.2 per cent over that at the opening of 1927. This rate of annual increase in production in this section is about the rate of annual growth which has been witnessed during the past three years, which in turn is an indication that in general the manufacturing plants of the West have not been subject to the same influences which have affected general industry in the nation as a whole.

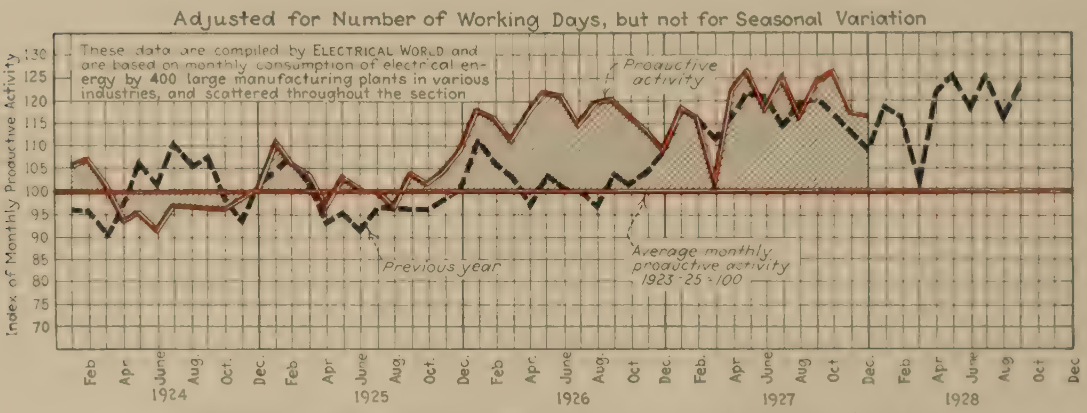
Operations of manufacturing plants in this section during 1927 as a whole were 2 per cent over those reported during 1926, which was materially under the annual industrial gain recorded in this section during 1926. The year just closed, however, witnessed general industrial operations above those of the same months in 1926, with the exception of February, March, June and August. There is every reason to believe that 1928 industrial production in the Western States will be over that of 1927.

*Indexes of Productive Activity in the Western States*

All Figures Adjusted for Number of Working Days

| | Dec., 1927 | Nov., 1927 | Dec., 1926 | Average for Full Year, 1927 | Average for Full Year, 1926 |
|---|---|---|---|---|---|
| All industries | 116.9 | 117.0 | 108.0 | 118.8 | 116.5 |
| Chemical and allied products | 84.7 | 89.4 | 105.6 | 103.4 | 119.7 |
| Food and kindred products | 148.5 | 140.0 | 95.2 | 123.2 | 103.4 |
| Lumber and its products | 110.7 | 120.0 | 105.3 | 112.4 | 117.7 |
| Metals industrial group | 108.8 | 97.8 | 116.7 | 127.3 | 123.7 |
| Paper and pulp | 132.4 | 142.6 | 131.2 | 133.3 | 134.2 |
| Rubber and its products | 89.0 | 107.7 | ..... | ..... | ..... |
| Shipbuilding | 95.8 | 102.1 | 141.0 | 114.6 | 120.8 |
| Stone, clay and glass | 142.0 | 159.0 | ..... | ..... | ..... |

## ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*

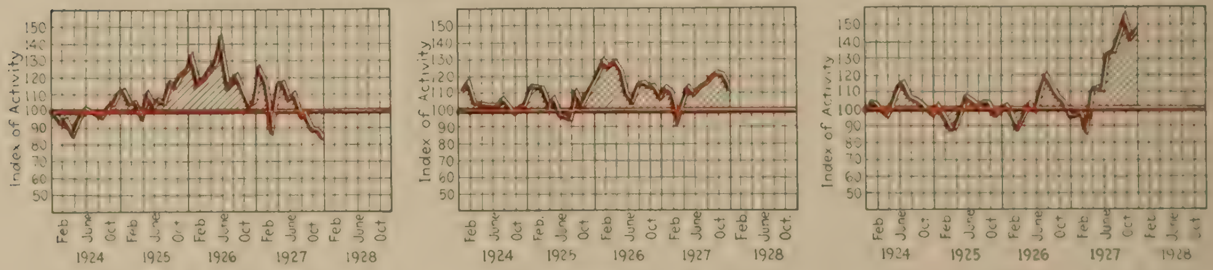


These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section

*States in the* WESTERN GROUP

Montana,
Idaho,
Wyoming,
Colorado,
New Mexico,
Utah,
Nevada,
Washington,
Oregon,
California

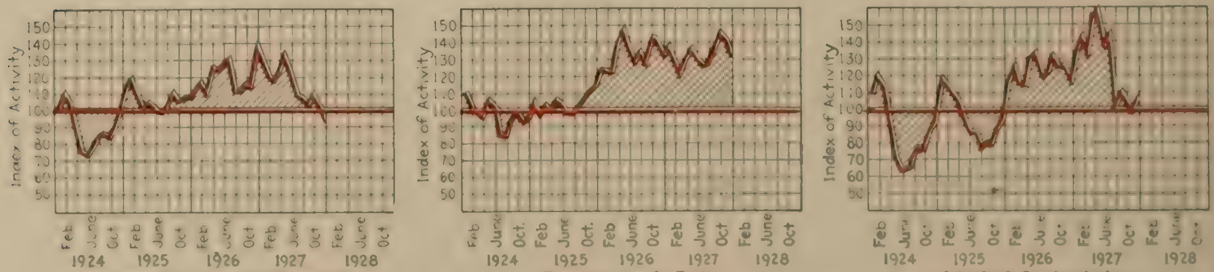
GENERAL PRODUCTIVE ACTIVITY IN THE WESTERN STATES



**Chemical and Allied Products**

**Lumber and Its Products**

**Food and Kindred Products**



**Automotive and Shipbuilding**

**Paper and Pulp**

**Metal Industries**

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES

# Electrical World

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W. H. ONKEN, JR.
*Editor*

VOLUME 91 *New York, Saturday, February 11, 1928* NUMBER 6

## *Effect of Regulation in Pennsylvania*

THE situation at Washington as it affects electric public utilities moves slowly onward toward investigation. Senator Walsh, although at present well occupied in directing the inquiry into the Teapot Dome oil scandal, will before long in all probability employ his skill and legal talents on the public utility industry. That he will be able to uncover anything approaching in flagrance the oil scandal is improbable. Compared with the oil inquiry, the proposed inquiry into the public utilities and holding companies is bound to be disappointing to those who seek sensation. Why this should be so may be inferred from the general reputation and performance of the industries concerned.

There is a suspicion that state regulation is ineffective. Certainly, it is not what it ought to be in some states; but that is no reason why the federal government should, if it could, intervene. The utilities are well regulated in many states, Pennsylvania among them, and one has but to review what has been done in these states in the interest of the consuming public to be assured of the competency of regulation properly applied. The charge that state regulation is ineffective was scotched in the course of the Senate committee hearings by commissioners from Wisconsin and Pennsylvania. Nevertheless, it is well to have on record the facts against which the charges could not prevail. Judge Ainey, chairman of the Pennsylvania Public Service Commission, gave them. They vindicate the judgment of the Commonwealth of Pennsylvania in establishing regulation, prove its value, and, though self-praise is absent, they inferentially testify to the ability, the public spirit, the broad outlook and the grasp of the philosophy of utility regulation that characterize the man whom that state is so fortunate as to have at the head of its commission.

* * * *

## *Notable Telephonic Feat at Institute Convention*

EPOCH-MAKING feats in the art of communication have followed one another so closely that they are losing their power to thrill the layman. Only technical men can appreciate the advance in the art which makes possible the joint meeting of the American Institute of Electrical Engineers and the British Institution of Electrical Engineers to be held next week. An audience in America and another in England will hear a program rendered partly here and partly across the ocean. This event follows four years after a joint meeting of the Institute in New York and Chicago which was extraordinarily successful. Where a thousand miles of land was bridged four years ago, three thousand miles of land and ocean will be leaped this year. It is a tremendous step forward; yet communication engineers have not ceased their efforts, and four more years may bring similar joint meetings wherein sight will unite with sound to annihilate space and time.

The electrical industry will do well to applaud its engineers. Quietly and modestly they are constantly building and expanding their art and their industry. At the meeting next week they will present noteworthy papers and will discuss current problems with knowledge and power. In all this they make no attempt to attract the attention of the general public or even of the industrial world, yet many very important developments may be announced which would be of interest to the world at large. The industry could well afford to give the engineers a press agent.

* * * *

## *Commercial Foresight in the Irish Free State*

POWER companies and electrical manufacturers in the United States in the past few weeks have had as their distinguished guest Dr. Thomas A. McLaughlin, managing director of the Irish Free State Electricity Supply Board. Dr. McLaughlin has charge of the Shannon River hydro-electric development in Ireland, which will begin operation next year with 90,000 electrical horsepower, later to be increased to 180,000 hp. His visit, however, is not being made primarily to study the benefits of interconnection, of consolidation of properties, or even of our most ambitious engineering projects. The economic advantages of American practice in utility operation, he believes, are well recognized and will be followed generally in Ireland.

Dr. McLaughlin's problem is a commercial one. He has been here to study methods of load building, and most particularly those for the residence customer. He is carrying back to Ireland with him many ideas for selling plans, advertising and publicity which he expects to put in use. But, of equal importance, he has seen and profited by some of our commercial short-sightedness, and of this not the least part has been the failure to provide sufficient capacity in the customer's service. Dr. McLaughlin declares that every house to be supplied with electricity by his project must be so wired as to carry a load of at least three kilowatts and preferably six. This is indeed a wise policy when it is considered that fewer than 20 per cent of the houses in even the largest cities of the Emerald Isle are yet wired. Five or ten years from now the electrical industry in Ireland will not be struggling with the problem of inadequate wiring as the power companies in America are now doing. Furthermore, Dr. McLaughlin is attacking the problem of load development even before there is any hydro-electric power available from the Shannon River. Another wise move. Had the American electric utilities been blessed some ten or twenty years ago with such foresight as is displayed by the Electricity Supply Board of the Irish Free State, there would now be more selling and less worrying about commercial development in the industry.

* * * *

## A Suggestion to Self-Appointed Fuel Administrators

IN CERTAIN districts a citizen is not permitted to use electricity for fuel. A mile away another citizen served by the same electric utility and getting his energy from the same primary circuit is urged to cook and heat water electrically. This rationing of energy and control of its application are not based upon anything that has to do with generation, distribution or rates, but is governed solely by the length of a gas main. If the gas main reaches the citizen's frontage, electricity is not available to him for cooking.

The fact and what lies behind it are both too obvious to escape the attention of those whose business it is to be unpleasantly inquisitive. For the people—who regulate and largely own the utilities—are supposed to be all treated alike, and, after all, what is best for the public is best for the utility in the long run. Some combination companies have already put this principle into practice. Many have not.

* * * *

## Innovations in High-Pressure Boilers

HIGH-PRESSURE stations are coming into vogue rapidly, and more than thirty are now in operation in various parts of the world. In this country eight or ten installations of 1,200-lb. boilers are recorded, and it is reasonable to assume more will come into existence. A plant operating on a low load factor finds a combination of high-pressure turbine and moderate-pressure turbine to be very economical.

The use of these high pressures has influenced boiler and turbine design and many innovations have been made recently. The Edgar and Lakeside station boilers are of about the same construction as lower-pressure boilers with the exception of the forged-steel drums. But the Sulzer, Bradford, Löffler, Atmos and Benson boilers are innovations and depart from customary boiler designs. Stations embodying these new designs are in operation in Europe, and it is reported that all operate successfully. But the largest of these installations produces only about 50,000 lb. of steam per hour, and much development must occur before it can be said the new designs will meet American requirements. In this connection it should be said that normal-design high-pressure boilers of the type used in the Edgar and Lakeside stations have proved themselves satisfactory in operation, and a new installation of a 10,000-kw. high-pressure and a 30,000-kw. normal-pressure combination unit in the Edgar station has been ordered.

Probably the most interesting development in boilers is the attempt to generate steam from water at the critical pressure of 3,200 lb. and a temperature of 706 deg. F. This type of boiler is called the Benson boiler and is being developed and applied in Germany. The high-pressure steam is superheated and throttled to give steam at 1,500 lb. and 850 deg. F. temperature to a turbine. Existing installations of this type of boiler in England and in Germany have performed very well but are of small rating.

Developments in boiler design should be encouraged, but the operating savings inherent in high-pressure installations must be measured chiefly in a reduction in fixed charges. Less material, higher unit ratings, smaller station volume and other installation advantages must be brought about before fixed charges can be lowered. In due time the cost factors involved in the newer type of boilers will be known so that these proposed units may be measured as to their economic possibilities for wide-scale application to power generation. Technical developments must take precedence now, but the ultimate gage is a reduction in fixed charges.

* * * *

## The Cambridge Rate Cut

ANOTHER drastic rate reduction has been ordered in Massachusetts. In the Cambridge Electric Light Company's case the maximum rate of 8 cents per kilowatt-hour has been slashed to 5½ cents by the Department of Public Utilities, with the alternative of permitting the company to establish a schedule consisting of a service charge of 50 cents per month and a net maximum rate of 4 cents per kilowatt-hour for domestic and commercial lighting. At this writing the company has not announced its course, but, apart from the effect of the decision upon the affairs of this particular property, the finding is important to light and power companies in general.

It is the province of the courts rather than of the ELECTRICAL WORLD to determine whether any commission finding is confiscatory or otherwise, if that issue be raised, as in the pending Worcester Electric Light Company case in the federal arena. The Cambridge company maintained that its rate base should be $8,035,469, determined upon the reproduction-cost-less-depreciation method, and that its residential and commercial lighting allocated bases should be $2,224,175 and $1,451,349 respectively. On the basis of its 1926 earnings, the company set forth that a total of $664,848 was available for return, surplus and contingencies, or 8.274 per cent on the total base. The corresponding returns available on the residential lighting and commercial lighting base pro ratas were 6.539 and 17.189 per cent.

As in its Worcester decision, the commission in its computations of what it considers a fair return named a sum intermediate between the reproduction cost of the property less depreciation and the book cost. A majority of the board finds that, "so far as it may be material," the fair value of the property for rate-making purposes, "based upon the principles enunciated by the Supreme Court of the United States in McArdle et al. vs. Indianapolis Water Company (272 U. S. 400)," does not exceed $5,500,000 and puts the fair value of that portion of the property devoted to domestic and commercial business (excluding power, street lighting and sales to other companies) at not over $2,500,000. The commission also comments upon the attractiveness of a 6 per cent return in Massachusetts for securities of this sort.

Even with the qualified phrase, the granting by a majority of the board of the petitioner's request that the commission should find the reproduction value less depreciation is significant to those who have been coming to see that the so-called Massachusetts regulative doctrine is less rigid than the industry has been led to believe in recent years. It now looks as though the issue between the commission and those who resist its rulings were crystallizing along economic lines. In its final determination, by whatever tribunal, the question of what is a reasonable return is an economic one, bound up with many factors, among which are quality of management, character of market for service, stability of territory, cost of money at the time of adjudication, hazards of climate, public relations, standards of operation, maintenance and others.

The importance of designing rate structures to serve class business equitably is great. Thus, in the Cambridge case, it is unfortunate that residential and commercial service should have been lumped together in the company's rate structure and so ruled upon by the commission. The former yields about one-third the latter in terms of percentage on base, and we cannot regard this practice as sound; in fact, it would be nothing less than deplorable if regulative commissions should generally make such group rulings, whether forced to do so by the legal status of rate structures before them or led to treat such unassimilable classes of customers *en masse*. Finally, it would be very much less disturbing to the industry if commissions deciding to order drastic rate reductions would spread them over reasonable periods of time. It seems too bad that the Massachusetts commission saw fit not to grant the Cambridge company's appeal to be allowed at this time to try out an optional rate of the inducement type in which an area charge was to be combined with a 3-cent energy rate, but we need not conclude that the cause of promotional rates is hopeless in the Bay State at this stage of regulative history.

* * * *

## *The Time Has Come to Spotlight the Outlet*

BEYOND all else in the residence field, the electrical industry needs more outlets, more convenient receptacles available for connecting appliances. There are no lack of domestic consumers of electricity, for 17,590,000 homes are wired and using the service. But because of the inadequacy of the wiring—the lack of outlets—there is little electrical equipment in these homes. People don't use things that are not convenient. It is the same with electricity. Electrical men must spotlight the outlet in their selling from now on.

The industry has been inclined to leave the sale of wiring up to the contractor. When the home is wired the contractor is supposed to show the owner where the outlets should be. But he doesn't do it. Nobody has been thinking in terms of adequate facilities in the past—not even power-company men. And a great many in the industry have been feeling that more outlets cannot be sold because of the cost. Now comes an idea that seems to point the path.

In casting about to find a way to sell additional convenience outlets, somebody hit upon the plan of selling them in combination with an appliance. The theory was that people often refuse to buy a heat pad or a toaster or some other device because they have no convenient outlet to which to connect it. They refuse to buy an outlet because they have in mind no particular appliance that they wish to use with it. Merchandise the two together, however, and the customer at once sees in her mind this desirable lamp or percolator in use connected right where she would like to have it—so much for the appliance and the outlet, so much for the appliance alone. The salesman stresses the combination and it sells, because all question of how to connect it is solved. Convenience is assured. And while the wireman is installing the outlet there comes the opportunity to sell several more. This plan is now being successfully followed in several cities.

The development of residence load waits on adequate facilities in the connected homes for the use of complete equipment. It is time electrical men stopped talking about the reasons why adequate wiring has not been sold and turned their minds to merchandising outlets. They must spotlight the outlet. And if they sell outlets with appliances, they not only build load—they automatically open up a vast market for wiring materials, appliances, fixtures, lamps and all the meters, transformers and other equipment that will be needed to provide the capacity for carrying the load.

* * * *

## *Uniformity in Street Lighting*

STANDARDIZATION in street and highway lighting is proposed in Great Britain. A national agency is suggested which will specify types and kinds of lighting for the country as a whole in order to eliminate the present chaotic conditions. The plea is that safety considerations make it imperative to call a halt on installations which reflect individual opinions and which do not conform to other installations.

Some constructive work should be done in this country along similar lines, but no one would venture to propose a national dictator on public lighting. Yet each city has suffered from the ebb and flow of street-lighting styles, and a lack of plan and co-ordination is obvious in all public lighting. Many large cities have made a fundamental plan for street lighting and some states have attempted to deal with highway lighting, but these projects have not been co-ordinated. It would be well worth the effort if a joint committee were to survey national conditions in lighting to find the facts and then outline a comprehensive plan for getting more uniformity and co-operation in street and highway lighting.

* * * *

## *Market Capacity Fixes Values*

MASS production is made possible by mass consumption. Many industries strive for volume in production by high-pressure selling in markets of limited consuming capacity. The result is harmful to their balance sheets. No situation of this kind exists in the electrical industry. The soft-coal industry, the steel industry and in some degree the automotive industry face an exploited market with uncontrolled and surplus production facilities. They are forced to use high-pressure selling methods and get their volume by reducing profit margins. But there is no market saturation facing the electrical industry. Whatever lack of balance exists is created by inertia in selling and by lack of co-operation between industry groups.

The homes, the factories and the railroads offer a present market for electricity and for electrical products equal to that now served. These markets should enable each group in the industry to get volume sales at a fair margin of profit if the industry is geared to sell. At present there is too much "buck passing." The manufacturers criticise the utilities and vice versa; too much effort is spent on competitive selling rather than market development; margins of profit are low because business expansion is not so fast as production expansion, and there is too little team play in selling efforts. The industry would do well to get behind the industry sales program recently started.

# Gaging of Mountain Snowfall Enables Forecast of Hydro-Electric Supply

Estimates by trained observers of winter-stored water power in the Cascades enable the forecasting of available resources in a warmer season. The Big Creek Power House No. 1 of the Southern California Edison Company also utilizes the melting snows.

# Average-City Street Lighting

Business aspects for central stations to consider.
Plans should be comprehensive. How to
sell street lighting. Results to be expected

By Thomas W. Rolph
*Managing Engineer Street Lighting Department, Holophane Company*

THE value of the street-lighting load to the central station is well recognized in the industry. Under equitable contracts, the business is profitable to the utility and the load is practically a constant one, usually contracted for in advance, to cover long periods of time. The revenue is assured in periods of depression as well as in good times and there is seldom any trouble due to poor credit. Meter reading and billing, which form so large an item in the usual cost of rendering service, are almost negligible in the case of street lighting. Perhaps the greatest advantage, however, is in the effect on the load curve. Of the 24 hours represented in a daily load curve, street lighting will run through an average of eleven, and these eleven hours cross the lowest valley in the curve.

It is, therefore, generally recognized that the central station should take aggressive steps to develop the street-lighting business. It is further recognized that such development is not only to the advantage of the utility but is also a service to the public, because street lighting throughout this country today is far below the standards which present traffic conditions require for the safety and convenience of the public. The average annual city expenditure for street lighting (in cities of more than 10,000 population) is 92 cents per capita,* whereas "it is generally conceded that in the average American city an annual expenditure of not less than $2 per capita is justified by its returns in decreased accidents, decreased crime, increased convenience of urban life and increase in property values."†

### Three Reasons for Slow Progress

Yet, in spite of these facts, it must be admitted that street lighting moves forward at a disappointingly slow pace. With the need so clearly evident, it cannot be doubted that something is wrong with the selling activity. The lighting industry is not selling street lighting today as aggressively as the need calls for. Yet there are many salesmen and commercial engineers working on street lighting throughout the United States. Why is the result so small compared with the possibilities? A careful consideration of this question leads to the belief that the lack of more rapid progress is due to three things, as follows:

First—Lack of a definite and complete street lighting plan for each community.

Second—Lack of aggressive leadership in each community

Third—Lack of co-operation on the part of the factors in the industry who are interested in street lighting.

It would seem that the central station should take a position of aggressive leadership in each city which it serves and see that a plan is drawn up by some competent engineer for a complete and fully adequate street lighting system. The various salesmen and commercial engineers working on street lighting would then find it to their interest to co-operate with the utility and to work definitely along the right lines toward this planned result, because it would be much larger and more comprehensive than any result which could be reached through their individual, separate activities. Wherever the central station will take an aggressive attitude and plan on a large scale there is little doubt that the ultimate street lighting result will be splendid and all parties concerned, including the city itself, will profit largely thereby. The size of the city and the character of its administration will have a bearing on the exact procedure. Cities of moderate size where the central station is now supplying the street lighting offer one of the best fields for sales activities, which should increase the street lighting load by a handsome percentage within a very few years.

### Need Competently Engineered Ultimate Plan

The first step for the central station is to demonstrate "the desirability of each community adopting a competently engineered 'ultimate plan' definitely establishing all physical elements of a street lighting system which will provide adequate street lighting service, including satisfactory appearance, at the minimum cost consistent with such service."‡ It matters not how visionary this may seem. The entire plan on a scale fully up to modern requirements is the first thing to be worked out and set as a goal. Then every street lighting project which arises in the community should become a definite part of this comprehensive plan and fit into it perfectly. The science of street lighting has developed to such a point that it is now possible to design a fully adequate street lighting system for an entire community on such sound engineering principles that the essential features of the system will stand for many years to come. Even if it will take three years or five years or longer to install the complete system for the city, its general engineering features can be planned definitely and adequately right now.

In some cases the city engineer can well prepare the plan, working with the central-station engineers; in

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**Weighted average figure from values given in "A Survey of Street Lighting Practice in the United States," by Dr. J. Franklin Meyer of the U. S. Bureau of Standards, Transactions I.E.S., January, 1925.*

*†Quotation from July, 1927, serial report of the street and highway lighting committee of the National Electric Light Association.*

*‡Quotation from July, 1927, serial report of the street and highway lighting committee of the National Electric Light Association.*

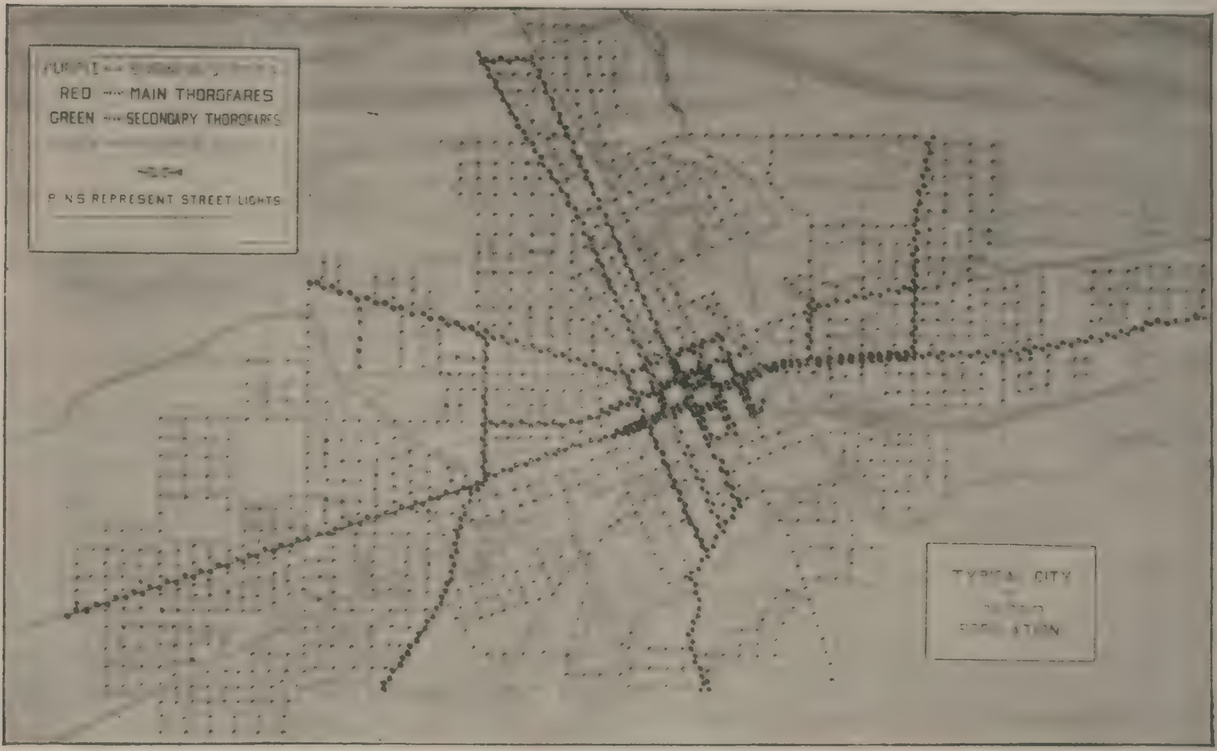
other cases it will be desirable for the central station to take the initiative and make the complete layout subject to the approval of the city engineer.

The first step is to take a map of the city, preferably on a scale of 500 ft. to the inch or larger, and mount it on a board so that colored pins can be used to indicate locations of street lights. Before starting on the street-lighting layout, the various classes of streets should be indicated in colored crayon on the map. First outline the central business district and mark in one color all the streets in this district. Next, lay out the main thoroughfares, marking them in some other color. In many cases these have been definitely fixed by local authorities or by the state highway department as part of certain through state routes. Some city officials or the local automobile club will often have the authoritative information on these main thoroughfares. If the city is of more than 15,000 population there will usually be secondary thoroughfares also which should be marked in a third color. The primary thoroughfares carry traffic from main interurban automobile routes into the city and out again; secondary thoroughfares carry traffic from the central part of the city into the residence districts, but do not form a part of main through routes. Secondary thoroughfares also include lateral connecting links between different parts of the city. In this connection it is useful to remember that the ideal city plan, as far as traffic is concerned, is very much on the order of a spider web. From the central business district radial thoroughfares go out in all directions, some (main thoroughfares) to the state routes and some (secondary thoroughfares) only to residence sections and the surrounding country. At certain distances out from the center of the city there should be lateral connecting links (secondary thoroughfares) between the radial thoroughfares. Few cities today approximate these ideal conditions,* because most of them were laid out before the days of rapid traffic and scientific city planning, yet the spider web layout should always be kept in mind as the ideal when fixing the arteries of traffic for a city.

In the typical city of medium size there will be these four classes of streets:

Primary business streets.
Primary thoroughfares.
Secondary thoroughfares.
Residence streets.

There are also alleys, parks, etc., but these need not be considered at present. In the larger cities there will be secondary business districts also. Often these will be a part of the thoroughfare system and can be taken care of by the thoroughfare lighting. Sometimes they require ornamental treatment somewhat similar to the primary business streets.



GENERAL PLAN FOR A CITY STREET-LIGHTING SYSTEM

Having classified the streets of the city the next step is to lay out a definite street-lighting system for the entire city. Here it is essential that the illuminating engineer of the central station should do a thoroughly creditable piece of work. If the central station has no illuminating engineer competent to handle this outside engineering talent should be secured. The best is none too good, because the engineering of a complete street-lighting system is a fairly complicated proposition and the plan, when completed, will form the basis for large sales activities and line extensions.

The lighting layout should be fully adequate so that the city will have a system to be proud of. At the same time the cost must be checked carefully and the character of the installation in each part of the city

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**Washington, D. C., and Indianapolis, Ind., are notable exceptions.*

adapted to what is a reasonable expenditure. In most cities it is impracticable to consider extending an ornamental system throughout the entire city within the next one or two decades. There are occasional exceptions to this, but usually, when such a large ornamental program is attempted, the progress of the installation will be so slow, under its cost handicap, that a large part of the city will remain inadequately lighted for many years to come, to the detriment of the city's interests and the central-station revenues. Ornamental lighting should always be provided for the business district and should be carried as much farther throughout the city as is practical. It should always be borne in mind that the interests of the city and the interests of the central station are concerned primarily with supplying a fully adequate amount of light properly distributed on every street throughout the entire city.

Anything which interferes with obtaining fully adequate lighting on every street, or which delays progress toward such lighting, works directly against the interests of the central station, for the reason that it has an unfavorable effect on the street-lighting revenue and works directly against the interests of the city, because it prolongs the time during which the public must put up with unnecessary traffic accidents, crime and inconvenience.

When the street-lighting system has been laid out from the illuminating engineering standpoint it should be checked carefully with the electrical engineer or superintendent of distribution. Close co-operation should prevail between the illuminating engineer and the distribution department. The final result should be satisfactory to both departments.

When the final plan is completely worked out the central station is ready to begin its real sales activity. The plan should be discussed with city officials and prominent citizens and as many of them as possible should be sold on the idea of working toward such a plan for the lighting of the city.

All of this activity is particularly appropriate when the street-lighting contract is due to expire within the next year. At such a time there is an opportunity to have the complete street-lighting plan adopted as the basis for a new contract. If the program seems too large to the city the new contract could provide for the installation of the complete system on a program which might run from two to five years.

Even when no new street-lighting contract is contemplated it is desirable for the central station to have the complete plan worked out as the basis for its street-lighting sales activities. Regardless of the contract period, a city which recognizes the situation clearly should find it possible to adopt some program of improvement, in order to attain the character of street lighting which modern traffic conditions require. When the city administration is indifferent it often happens that groups of merchants or residents are only too glad to help push through new street-lighting projects and often to finance them. These should always fit in and form a part of the complete "ultimate plan" for the city.

### STEP-BY-STEP PROGRAM

It is important for the central station to direct its sales activities toward those parts of the city which promise the largest immediate returns consistent with carrying out the complete program. A typical case is therefore considered here, in order to show what street-lighting load can be expected from the various parts of the city when the complete ultimate street-lighting system is in service.

The map illustrated herewith shows the complete plan for a typical city of 35,000. Classification of the streets of this city discloses the following distribution:

| | Miles | Per Cent |
|---|---|---|
| Main business streets | 2 | 2.2 |
| Main thoroughfares | 7 | 7.6 |
| Secondary thoroughfares | 8 | 8.7 |
| Residence streets | 75 | 81.5 |
| Total | 92 | 100.0 |

The following shows the average illumination values which should be provided throughout such a city in order to meet modern standards:

| | |
|---|---|
| Main business streets | 0.7 foot-candles |
| Main thoroughfares | 0.5 foot-candles |
| Secondary thoroughfares | 0.3 foot-candles |
| Residence streets | 0.08 foot-candles |

No city of moderate size can be called completely lighted today unless the streets throughout the entire city are supplied with average illumination values at least as high as the above.

The layout of a street-lighting system to give this illumination is shown in the accompanying illustration. It is believed that this system is fairly representative of the best illuminating engineering practice of the day. The mounting height is not less than 20 ft. on any street. The spacing is approximately eight times the height on the business streets and thoroughfares and approximately twelve times the height on the residence streets. The general characteristics are:

*Business Streets*—Twin-light standards, ornamental upright units, height to light center 22 ft., spacing 165 ft. opposite system, 6,000-lumen lamps, type B asymmetric light distribution, underground service.

*Main Thoroughfares*—Simple ornamental standard with 6-ft. bracket arm, pendent unit, height to light center 20 ft., spacing 150-ft. staggered system, 15,000-lumen lamps, type B asymmetric light distribution, underground service.

*Secondary Thoroughfares*—Same as primary thoroughfares except using 10,000-lumen lamps.

*Residence Streets*—Pendent units suspended over center of street, height to light center 25 ft., average spacing 300 ft., 4,000-lumen lamps, four-way and two-way light distributions, overhead service.

The lighting system will require the following amounts of energy, not including line and transformer losses:

| | Kilowatts | Per Cent |
|---|---|---|
| Business streets | 81 | 12 |
| Main thoroughfares | 190 | 29 |
| Secondary thoroughfares | 148 | 23 |
| Residence streets | 236 | 36 |
| Total | 655 | 100 |

This indicates that when a typical city of medium size is properly lighted the central station can expect 12 per cent of the street-lighting revenue from the business district, 29 per cent from the main thoroughfares, 23 per cent from the secondary thoroughfares and 36 per cent from the residence streets.

At the present time few, if any, cities can claim to have lighting of this character. In many cities of moderate size the business district is up to the standard here given. In a few cities the thoroughfares are well lighted, but practically no cities have the above standards of illumination supplied throughout the entire city. There is, therefore, a great deal of sales work to be done on street lighting in order to bring practice up to present-day requirements.

Of the street-lighting sales work which is at present being carried out the greater part is conducted by manufacturers of street-lighting equipment. Most of this effort is placed on the sale of ornamental street-lighting equipment for business districts. A certain amount is directed toward thoroughfare lighting and a still smaller amount toward residence street lighting.

This indicates that the central station is not benefiting to the maximum degree by the present sales efforts in street lighting. Most of these efforts go into a field where the central station can expect only 12 per cent of its ultimate street-lighting load. Some of the sales effort is directed toward a field where the central station can expect an additional 52 per cent of its street-lighting load and very little effort in the field where the central station can expect the other 36 per cent of its ultimate street-lighting load.

Considerations of good business will dictate that the central station direct its sales efforts toward the fields which promise the greatest and most immediate financial returns. This does not mean that the sales effort now going on toward business district street lighting should be discouraged in any way. Such effort is useful and helps to build up central-station revenue. However, since this portion of the street-lighting field is so well covered by sales effort today and since it promises such a small percentage of the ultimate income from street lighting it would seem desirable for the central station to center its main sales activity first on the proper lighting of thoroughfares and second on the proper lighting of residence districts. In that way the street-lighting load of the central station can be built up most rapidly and the interests of the public in obtaining adequate street-lighting service will be well served.

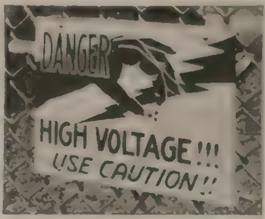
## Conveyor Oven Bakes 2,000 Loaves of Bread Per Hour

ONE of the largest electric bread baking ovens to be served by the Utah Power & Light Company is the oven recently installed in the American Lady bakery, Salt Lake City. The oven is approximately 55 ft. long and 8 ft. wide and has a connected load of 220 kw. Automatic temperature control maintains the proper baking temperatures. The instruments mounted above the center of the oven indicate operating conditions at all times, enabling desired conditions to be maintained day after day, one year as well as another.

# Safety Practices

By N. E. Emmons
*Superintendent of Maintenance Utica Gas & Electric Company, Utica, N.Y.*

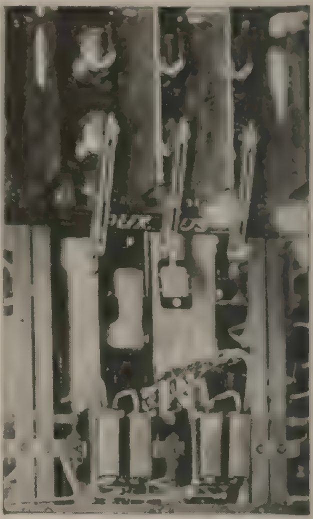
SAFETY IS the major consideration of the maintenance department of the Utica Gas & Electric Company. To eliminate possible operating errors a policy of detailed protective designation has been adopted for all work involving any potential hazards. In the generating and substations, for example, barriers between line and phase conductors are so painted that there can be no possible visual error in opening disconnecting switches which may not have been de-energized. Bright red coloring is used between individual line services. Oil circuit breaker-operating control positions are carefully labeled and each line is properly marked. In outdoor substations the signs are of such proportions that even in a poor light exact information as to line designation, operating arm position, etc., is clearly evident.



*Danger sign for public warning*

This sign is designed to warn those who cannot read, those whose eyesight is less keen than the average, and heedless trespassers.

There are two types of signs for high-tension structures. This one is of the public type. The brilliant red hand, jagged flash and white death's head carry a bold, arrestive warning.



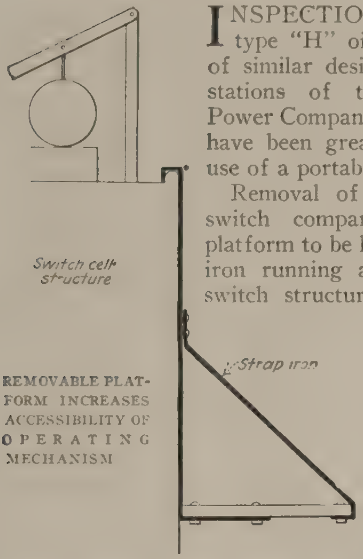
*Safety card holder for open disconnecting switches*

A Bakelite plate of brilliant crimson is attached to the free end of the movable blade of the switch. Under working conditions, all three disconnects would have this safety card holder clamped on to them. A red stripe is painted on the potential transformer fuse block about 2 in. from the bottom. This is put on the block that is on the solidly fused ground leg of the potential transformer, so that, in removing and replacing these fuses, a solid block will not be put on the live leg in place of the fused one. A black triangular strip of wood is installed on the switching structure directly underneath the disconnects and stenciled with the particular designation of that circuit so as to eliminate a switching error. This designation is also shown directly above the oil switch handle, but does not appear in the illustration.

Control cabinets are in many locations a source of possible confusion, as the proper indication cards are either lost or, through procrastination, are never made up. This company insists that switch designations be painted on the control panel doors opposite to and in line with the switches to which the information applies when the doors are in an open position. All circuit breakers are tagged when removed from service and each disconnecting switch blade is provided with a Bakelite marker of ample proportions, which prevents the closing of the disconnect, unless the marker is removed. It is required that all disconnecting switches be grounded by means of a clipped cable, ground clip and attaching pole before any work may be undertaken on such devices.

Protecting the public from the potential dangers involved in utility properties is undertaken by means of large-lettered signs of high visibility, which are fastened to the fences and gates surrounding outdoor substation structures, are placed on the doors of substations and are attached to the base of transmission towers where there is any possibility of public trespass.

## Oil Switch Maintenance Aided by Portable Platform



REMOVABLE PLATFORM INCREASES ACCESSIBILITY OF OPERATING MECHANISM

INSPECTION and maintenance of type "H" oil switches and others of similar design, in the plants and stations of the Northern States Power Company, Minneapolis, Minn., have been greatly facilitated by the use of a portable platform.

Removal of the doors from the switch compartments permits the platform to be hung from the channel iron running along the top of the switch structure. The maintenance man may then work on the operating mechanism comfortably and without bending over. The length of the platform is such that its ends rest against the concrete partitions separating the two outside phases of the switch under inspection from those adjacent. The platform is about eighteen inches wide. The support-brackets at each end are made of ¼-in. strap iron 1½ in. wide.

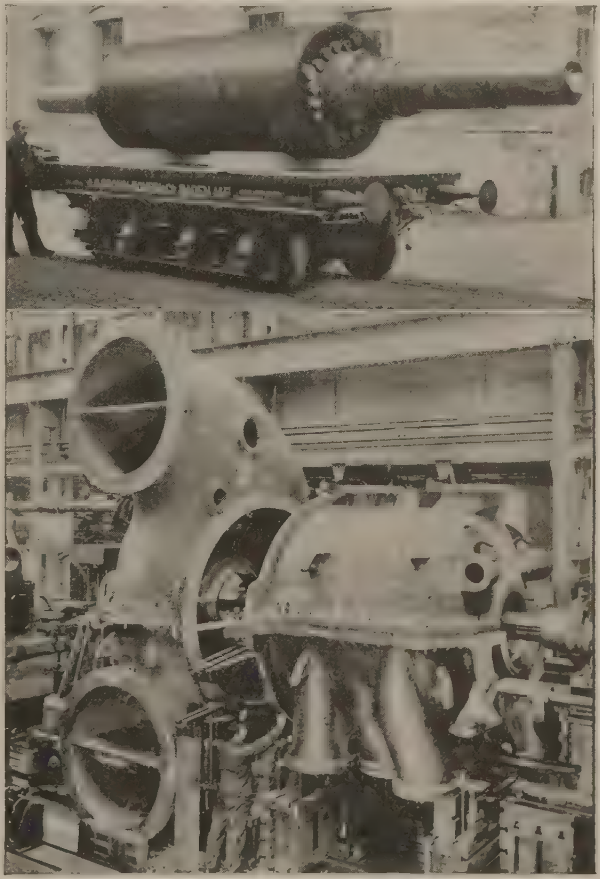
## The Sledgehammer Test for Source of Radio Interference

THE combination of the sledgehammer with the delicate sensitivity of a radio-receiving set is sometimes very efficacious in locating faults which figure as sources of radio interference. Two such instances are reported by C. P. Edwards, director of radio service of the Department of Marine and Fisheries, Ottawa, Canada. The technique of the test consists in striking the bases of poles with the hammer while the radio trouble man listens in with his portable set and notes whether the effect of the blows is indicated by any change in the character of the interference. This test is not made until the fault is localized in a definite and rather small area. Both of the cases here encountered occurred in the city of Ottawa.

In the first case the radio investigator had traced the interference down to a definite area and he then noticed that when one particular pole was struck the interference increased tremendously. A lineman was sent for and a demonstration of the interference was arranged for his benefit. But this time the pole was struck a little too hard and instead of the interference resulting, the primary cutout of the transformer on the pole fell to the ground, narrowly missing the lineman's head. It was found that the contact jaws of this cutout were badly burned due to continuous arcing. It was reported that during the time this transformer was dead, while the cutout was being replaced, all radio interference was absent in the district, proving beyond doubt that this was the source of the reported trouble.

In the second instance it was noticed that the response in the radio receiver was about the same when any pole within a length of four spans was struck with a sledgehammer. This was evidently due to the fact that the vibration from the blow of the hammer traveled along the wires from pole to pole. Repeated tests, in which the strength of the hammer blow was decreased each time, finally narrowed the fault down to one pole. The lineman then climbed the pole and very gently shook the different wires, finally locating the loose connection in one of the transformer cutouts, the clamping screw of which had become loosened. This fault was found as the result of an investigation lasting about one hour and a half and it included the test of about 30 transformer poles. The users of the radio sledgehammer test believe it to be the most economical method known for locating faults of this nature.

## New York's 160,000-Kw. Turbo-Generator in Manufacture



PARTS of the 160,000-kw. turbo-generator which is being made for the Hell Gate station in New York City are shown at the manufacturer's plant in Switzerland. The top view portrays the 85,000-kva. generator rotor and that below shows sections of the high-pressure cylinder being bored. The illustrations were furnished by the United Electric Light & Power Company.

# Reducing Distribution Losses

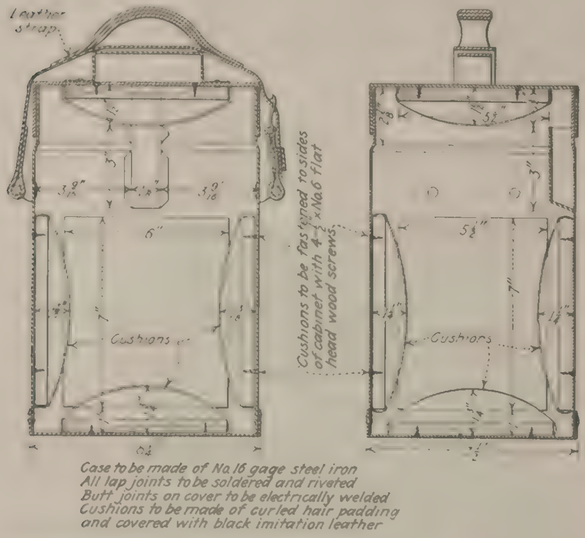
SEVENTH ARTICLE

## *Load and Voltage Tests*

By J. B. Moorhouse
*Electric Distribution Engineer Central Illinois Public Service Company, Springfield, Ill.*

THE REDUCTION of transmission and distribution losses requires a considerable amount of testing with electrical instruments. Few instruments can be conveniently carried about for general testing, so that a wide variety of such devices is not usually available and a careful selection of instruments must be made.

Graphic instruments should be readily portable, light in weight, accurate and sturdy. Charts must be continuous if the instruments are to be used for general purposes. Twenty-four-hour circular charts have many uses, but are not satisfactory for general load and voltage checking. Instruments with continuous charts driven by eight-day clocks are found most convenient. Permanence of calibration is not to be expected of portable graphic instruments and a high-grade, indicating, voltmeter-ammeter scale, 0-150-300 volts and 0.5 amp., must be carried as part of the graphic equipment for calibrating purposes. A double-range instrument usually costs as much as two single-range instruments, but is less cumbersome to carry about than two instruments.


Leather strap
3"
$3\frac{9}{16}$"
$1\frac{1}{8}$"
$3\frac{9}{16}$
6"
7"
Cushions
$6\frac{1}{4}$
Cushions to be fastened to sides of cabinet with 4-$\frac{1}{2}$"×No.6 flat head wood screws
$5\frac{1}{2}$"
$5\frac{1}{2}$"
3"
7"
$1\frac{1}{4}$"
$1\frac{1}{4}$"
Cushions
Case to be made of No.16 gage steel iron
All lap joints to be soldered and riveted
Butt joints on cover to be electrically welded
Cushions to be made of curled hair padding
and covered with black imitation leather

CARRYING CASE FOR STANDARD GRAPHIC AMMETER. THE VOLTMETER CASE IS SIMILAR BUT OF DIFFERENT DIMENSIONS

A graphic voltmeter with ranges of 90-130 and 180-260 volts is usually best for general voltage survey testing. This instrument is only slightly heavier than a single-range instrument. A graphic ammeter, range 0.5 amp., when used with a multi-range current transformer, is desirable. The current transformer must be compensated as nearly as possible for the exact burden of the graphic ammeter. The compensation, if secured by removing turns from the secondary winding, will be correct for all ranges. For checking loads on distribution transformers a special current transformer with ranges of 25-50-100-200 amp. is found most convenient for average conditions, the 200-amp. range being sufficiently high for checking a 37½-kva. transformer.

For convenience in mounting instruments on poles a weatherproof steel box with two padded compartments for instruments has been found very satisfactory. The steel box also serves as an excellent carrying case when transporting the instruments from pole to pole and from town to town. Connection is made between the instruments in the box and the line with a multi-conductor cable fitted with proper lugs and clamps. The box is supported by means of a steel chain wrapped around the pole.

If proper instruments are selected and all equipment is prepared for universal service before it is sent out of the shop time losses in the field may be avoided.

# New Hydro-Electric Development Survives Flood

THE hydro-electric development under construction for the Burlington (Vt.) Light & Power Company by the U. G. I. Contracting Company, Philadelphia, at Winooski Gorge came through the great flood of Nov. 4 last without material damage, despite the conditions shown in the accompanying illustration from a photograph taken about at the peak of the deluge. This 3,000-kw. development is being made at the left of the rock wall around which the flood is surging and the reinforcing steel for the penstock roof was in place at the time of the flood and remained in position until after it had subsided.

The flood reached an elevation 27 ft. above the dam crest. The railroad bridge below the Gorge was destroyed. The side walls of the penstock had only just been poured and this green concrete was called upon to take very severe erosion, with the result that it was somewhat pitted. The penstock forms remained in place throughout, but the centering was swept away. After the flood this centering was replaced, but was again cleaned out by a second and smaller flood. The superstructure of this plant has been designed with the object of permitting passage of floods over it without injury and of enabling operations to continue even up to a flow of 50,000 sec.-ft.

CONSTRUCTION WORK ABOVE RAILROAD BRIDGE WITHSTOOD FLOW THREE TIMES THE MAXIMUM FOR WHICH DESIGNED

Studies have been conducted involving a comprehensive ultimate development at this point requiring the eventual demolition of the old belt and countershaft Gorge plant, the installation of floodgates in the channel and the raising of the head 10 or 15 ft. with the addition of two 3,000-kw. units adjacent to that now being placed.

# The Boulder Canyon Project

Events which brought it before Congress. Engineering objections to the proposal and reasons why further engineering study of the flood control problem of the lower Colorado are needed

BOULDER CANYON is in the limelight in Congress and the following digest of the project should be read by electrical men:

The proposed Boulder Canyon project includes:

(a) A dam in the Colorado at Black Canyon, not far from Las Vegas, Nev., creating a reservoir with a storage capacity of 26,000,000 acre-ft., estimated to cost $41,500,000.

(b) A power house with 1,000,000 hp. of installed capacity, estimated to cost $31,500,000.

(c) The All-American Canal, estimated to cost $31,000,000.

The estimated period of construction is five years. Interest at 4 per cent during this period would amount to $21,000,000 and would make a total project cost, as estimated by the Department of the Interior, of $125,000,000.

The proposed dam would be 677 ft. from foundation to crest, 550 ft. above water level and 127 ft. below. The length of the dam at the crest is 900 ft. It would contain 3,750,000 cu.yd. of concrete. The firm power developed by the project would be 550,000 hp., as it is estimated that the project can be operated on an annual capacity factor of 55 per cent. The reservoir would be about 100 miles long and cover about 125,000 acres.

### PURPOSES OF PROJECT

The All-American Canal would be located just north of the Mexican boundary, starting from the Laguna Dam in the Colorado at Yuma, Ariz., and leading to the Imperial Valley in California. It would replace, so far as American farms are concerned, an existing irrigation canal, which begins in American territory below Yuma but traverses 60 miles of Mexican territory. The existing canal irrigates about 400,000 acres in the United States and 200,000 in Mexico. This acreage is definitely limited by the present low water flow of the river. In the United States any material increase in acreage of irrigated lands from the present canal would require the introduction of pumping plants to raise the water to higher level canals. The proposed All-American Canal would irrigate by gravity an additional area of at least 400,000 acres. It would, however, traverse an area covered by high and shifting sand dunes and would thus be expensive to dig and maintain.

The purposes of the combined dam and canal project are:

(a) The generation of electric power for sale.

(b) Increased irrigation in the Imperial Valley and freedom from Mexican control of the canal.

(c) Flood protection for the lower Imperial Valley.

(d) The furtherance of a solution of the water supply problem of Los Angeles and other cities of southern California by making available in the Colorado stored and desilted water, and by supplying power for pumping requirements along the aqueduct under contemplation.

The moving impulse that led Congress to direct the Reclamation Service to make a study, which resulted in the proposal of the Boulder Canyon project, came from the Imperial Valley in California. The various groups in the valley aimed at four major objects: Flood control, increase of low water flow gravity, supply of water for irrigating additional lands, and a canal free from Mexican territory. The last two objects are to be accomplished by the All-American Canal. It has no physical relation to the first two. It will neither increase the low water flow nor reduce the flood menace. It is not, therefore, of primary importance to the owners of the developed lands in the Imperial Valley, but in the minds of many it has become a large desideratum and so has been tied to the flood control project.

The Reclamation Service itself, when called upon by Congress to study the problems of the Imperial Valley, was strongly predisposed toward an All-American Canal because it had built the Laguna Dam in the Colorado as a part of the Yuma reclamation project, which project was hopelessly weighted down with debt, and it was recognized that if Laguna Dam could be utilized by the Imperial Valley people, part of the cost of the dam could be charged against them and the Yuma project helped out of bankruptcy. The All-American Canal, though having nothing to do with the flood control problem, thus became solidly established as a part of the undertaking, and its high cost profoundly affected the solution of the problem as finally proposed by the Reclamation Service.

A $31,000,000 canal tied on to a $15,000,000 flood control dam would look out of all proportion. The tail would seem to be wagging the dog and Congress would demand that the two items be separated and each judged independently. This consideration, together with the then existing favorable relation of hydro to steam-power costs and the rapid growth of power consumption in southern California, naturally led the Reclamation Service to dismiss any idea of a simple flood control dam and to look instead for a high power dam capable of producing revenues sufficient to pay for all, or at least a large part, of the cost of the entire undertaking. This idea was subsequently seized upon by the then comparatively new Municipal Electric Bureau of Los Angeles. Further impetus was added by the proposal of that city to augment its domestic water supply by the diversion of 1,500 cu.ft. per second from the Colorado.

The present support for the Swing-Johnson Boulder Dam bill comes from "municipal ownership of power" enthusiasts, from water supply advocates for southern California, from those with selfish interest in a government construction program of $200,000,000 and from the flood-menaced people of the Imperial Valley.

### FALLACIES THAT HAVE GROWN UP

As a result of misinformation and misunderstanding, certain fallacies have grown up in the minds of the public at large, whose knowledge of the subject must depend largely on newspaper publicity:

(a) It is believed that, at a not far distant date, Los Angeles will suffer for lack of drinking water unless Boulder Dam is built. As a matter of fact, the proposed Colorado River water supply for Los Angeles can go ahead entirely independent of the Boulder Dam. There is slight connection between the two. The proposed water intake of the aqueduct is to be located 220 miles below Boulder Dam and this water supply will require but a small amount of storage, amounting to less than one one-hundredth of the capacity of the Boulder Dam reservoir.

Claims are advanced that the Boulder Canyon reservoir is indispensable for the desilting of the heavy burden of mud always carried by the Colorado, so as to insure a clear stream at the aqueduct diversion, but the river, issuing from Boulder Dam more than 200 miles away, would once more pick up a new load of silt from the sediments of the valley bottom and so would arrive at the aqueduct laden with silt. For several score years ahead desilting works would have to be provided. The existence of Boulder Dam would have no vital effect on the silt problem of the aqueduct.

The water supply project will require 375,000 hp. for pumping, but Boulder Dam is by no means the only, or, for that matter, the best, source of power for this pumping. Unless this demand for power arises approximately when Boulder Dam power comes on the market, that power will be compelled by the weight of accumulating interest charges to take the first profitable outlet that offers itself. Later, when the pumping demand develops, it will naturally look elsewhere for a power supply if cheaper sources are to be found. If not, it will have to supplant other power markets by paying a price that will divert Boulder Dam power to it. There are sites on the Colorado where dams built solely for power purposes can produce cheaper power than Boulder Dam.

### ADEQUATE SUPPLY AVAILABLE FOR LOS ANGELES

As for the time when the need for this additional water will become pressing, the present water supply, together with the potential supply from the Mono Basin, will take care of a population of 4,500,000, or about four times the present. The proposed project would supply about 10,000,000 people, or eight times the present number. The pumping cost when this 1,500 cu.ft. per second is raised over a range of mountain with a combined lift of 1,500 feet along the 250 miles of aqueduct, even at a power cost as low as 3 mills per kilowatt-hour, including generation and transmission of 225 miles, will be on the order of $25,000,000 per annum, which is sufficient warrant for concluding that this pumping project is not near at hand. It will be many years before water will be pumped from the Colorado 250 miles to Los Angeles. This pumping load is too far ahead to be counted on as a market for Boulder Canyon power.

(b) It is understood that the All-American Canal is an integral part of the flood control project. As a matter of fact, there is no physical relation between the two; the relation is entirely political. At first the owners of developed lands in the Imperial Valley strongly opposed tying the All-American Canal to their flood problem. The agreement to pay back the cost of this canal to the government was the equivalent of mortgaging their land for about $40 per acre just to insure a water supply independent from Mexico. It was manifestly not worth it. Their attitude, however, changed when they observed the general success with which reclamation project settlers have defaulted on similar payments to the federal government.

(c) It is presumed that the sale of power and stored water will repay in about 25 years the cost of the entire project. As will be discussed later, because the elements of cost have been underestimated and the rate of return has been overestimated, revenue from the project will not earn interest on the investment, to say nothing of amortization of the federal bonds it is proposed to issue.

(d) It is assumed that there is no alternative to the Boulder Dam project. Other government engineers have pointed out another solution and have disagreed with the Reclamation Service as to the merits of their recommended dam site and proposed solution of the problem. The engineers of the Reclamation Service stand pretty much alone on this question.

### OBJECTIONS TO THE BOULDER DAM PROJECT—POLITICAL AND ECONOMICAL

The broad economic and political objections to the Boulder Dam project are:

(a) It proposes to put the federal government into the power business on a large scale as a means of producing revenue at the expense of, and in competition with, individual enterprise.

(b) It proposes to subsidize the power and water consumers of southern California at the expense of the federal treasury.

(c) It will provide a much larger low-water flow in the Colorado River. In the absence of international treaties to the contrary, and regardless of any agreements which might be made between the various states through which the river flows, it will permit a large irrigation development in Mexico. This presumptive right to water so used by Mexico will inevitably tend to restrict the development of the arid lands in the basins within the United States.

### OBJECTIONS TO THE BOULDER DAM PROJECT—ENGINEERING

The broad engineering objections to the project are:

(a) It does not fit in with the best scheme of development of the entire river for flood control, power and irrigation. Such a scheme requires large storage at or above the Utah-Arizona state line, so as to regulate the flow of the Colorado for power development in the canyon section below; a series of power dams of the most economical heights and at the most suitable locations, and a small reregulating reservoir at the foot of the canyon section for irrigation needs. Such a system would develop 5,500,000 hp., or 5½ times the amount at Boulder Dam. If this power is to be developed, Boulder Dam storage must be duplicated, thus necessitating a great waste of money and a needless loss of water by evaporation.

(b) The construction program will necessarily be so long that the flood hazard to the Imperial Valley will continue for many years.

If the arguments as to the imminent danger of the Imperial Valley are at all sound, it is needless to emphasize their force in advocating that program of relief which can be put through in the shortest possible period of time.

The detailed engineering objections to the project are:

(a) Storage on top of a very high dam is manifestly very expensive. If Boulder Dam were to be built as proposed, with the top 8,000,000 acre-ft. of storage devoted to flood control, it would soon be seen that the increased output in kilowatt-hours to be had by utilizing for power this lost head, at the rate of return estimated by the Department of Interior, would finance the building of an 8,000,000-acre-ft. flood storage reservoir located down on the ground at Topock near Needles, Cal., 100 miles below Boulder Canyon. In other words, if this whole undertaking is to be self-supporting, why not follow sounder engineering and build two dams, one strictly for flood control and the other solely for power production, unhampered by requirements that would seriously impair its ability to provide revenue. Two dams would be good engineering. It would be poor politics, because, once these two functions—flood storage and revenue—were separated, Congress would strike out the investment proposal and limit itself to a contribution to the flood control problem.

(b) The character of the river, of the dam site and of the proposed dam are such as to make the proposed construction hazardous and expensive. In the opinion of disinterested engineers the estimated cost of the dam will probably be exceeded several times and the time of construction will be lengthened twice or even three times.

During protracted construction, interest and sinking funds steadily accrue on bonds, and the resulting capital charges, arising from this greatly increased cost and the lengthened period of construction and development, grow to uncontemplated proportions.

(c) Because of the drop during the past five years in the cost of steam-generated power due to increased efficiencies, contrary to the estimates of the Reclamation Service, Boulder Dam will not carry on its back the cost of the All-American Canal nor will it carry the cost of the flood control storage. Even stripped of these two loads, it would still be an unsound investment as a power project because of the character of the dam site, the size of the dam, the large block of power to be absorbed, with a market many miles away, and the telling effect of the competition of low-cost and reliable local steam power. There are dam sites for smaller dams on the Colorado, involving less risk and giving a lower cost per horsepower developed. As water-power investments they would be superior to the Boulder Dam project, but even they are not now attractive because of the present-day trend of steam costs and the long distance to markets.

(d) The justification for building the All-American Canal is not readily apparent. The shifting sand dunes, through which it must inevitably pass, may well prove a more serious problem than that of maintaining a canal in Mexican territory, particularly when account is taken of the fact that neither the Boulder Dam nor the All-American Canal will relieve the Imperial Valley from the necessity of dealings with Mexico because of the need for maintaining levees there to keep the Colorado out of the Salton Sea and because of the need for agreements as to the division of water. Since the All-American Canal is entirely apart from the flood control problem, the two should not be tied together, but each should be treated separately on its own merits. This would avoid a needless confusion of issues.

Discussing a little further the second objection raised, because of the unprecedented height of the dam proposed, the Reclamation Service sought out a very narrow canyon for its location so as to save the enormous yardage of concrete which a longer dam of such height would entail. At the chosen site, the width of the canyon at water surface is about 350 ft. At the crest of the dam, some 550 ft. higher, the width is about 900 ft. The dam site saves concrete, but the depth to bedrock is very great—three times as great as at other dam sites where the walls of the canyon are farther apart. Foundation troubles multiply rapidly with increasing depth.

The flood flow past the dam rises at times to 200,000 cu.ft. per second. Flash floods during almost any season of the year may rise to 100,000 cu.ft. per second. As it would be manifestly impossible to cofferdam half the river and dig down 127 ft. to bedrock, the plan proposed calls for diversion tunnels, supplemented by cofferdams across the entire river. It is proposed to build temporary rockfill cofferdams, behind which are to be built permanent cofferdams of concrete. The temporary cofferdams are to contain about 1,000,000 cu.yd. of material. The upper permanent cofferdam is to be a very thin arch dam about 225 ft. high—in a class with the very high dams of the world. It is proposed to build these two sets of dams and do this excavating during one low water season, an apparent impossibility in view of the quantities of material to be handled, the uncertainties to be faced and the limited space to work in. In the first place, there is good reason to doubt that the river can be dammed by dumping rock into the stream except at a very low flow stage—perhaps late in the season. Rock dumped into this very narrow gorge would quickly build up an appreciable head, giving the river transporting power to carry away rock as fast as new material is added. An attempt to carry out this ambitious program would probably result in a flood catching and overtopping the partially completed cofferdams. Such drowning out would in any case be costly and might be disastrous to the river valley below if the failure occurred after the temporary cofferdam had been completed but before the permanent ones were in. Such failure would mean starting all over again, with as much chance or more so of getting caught just as badly by the next flood.

A wiser plan would surely be to spend very much more money than has been proposed, in digging several additional diversion tunnels, which, with the use of only a low rock-fill cofferdam, could divert any flood reasonably to be expected. The drowning out of a low dam would be costly, but not disastrous.

### THE ESTIMATES IN ERROR

Because of the uncertainties to be met in handling the difficult foundation problems of Boulder Dam, any cost estimates are bound to be unreliable, but the estimates of the Reclamation Service seem to be low in this and in other particulars. The item of mass concrete has been estimated to cost $7 per cubic yard, whereas under the circumstances a unit price 40 per cent greater would appear more reasonable, though such an increase in this item alone would add many millions to the estimated cost of the dam.

The foregoing considerations have caused experienced engineers, in studying this proposed undertaking, to estimate that the dam will require ten years to build and will cost 2½ times the government's estimate. These considerations also explain why the engineers of the Reclamation Service are almost alone in selecting the Boulder Dam site.

The rate of return on a hydro-electric power investment depends principally on the capital cost, the interest rate, the sale price of power, the number of years required to market the power output and on the capacity factor, which is the ratio between the average load carried by the power plant to the total load that the plant is capable of carrying.

The self-same development project, as an investment, can be made to look very attractive or most unattractive by pyramiding all the favorable factors or by pyramiding the unfavorable. In the general case the favorable and unfavorable factors are mixed up and the result comes out somewhere between the rosy prospectus and the dire prediction. It is believed that the Reclamation Service engineers have been optimistic in their estimates. In making the assumptions and estimates set forth herein an effort has been made to arrive at probable values as shown by experience.

### REVENUE FROM SALE OF ELECTRICITY IS QUESTIONABLE

The Swing-Johnson bill before the last Congress provided for the repayment to the United States in 50 years of the funds advanced to cover the cost of the complete project. The revenues for such repayment were to come from the sale of electricity generated at Boulder Dam, from the sale of stored water for irrigation and for domestic use and for the disposal, under the reclamation act, of such public lands as are made reclaimable by the irrigation works proposed. How much revenue might be expected from the last source is a question. At any rate, the proponents of the bill have claimed that the revenue from Boulder Dam itself will more than suffice to reimburse the federal treasury for the loan of its credit to cover the cost of the complete project, the All-American Canal included.

The Secretary of the Interior, in a letter to Congress dated Jan. 12, 1926, estimates a total capital cost of $125,000,000, a construction period of five years, annual revenue of $12,300,000, annual charges of $6,200,000 and the repayment of all costs in 25 years. The sale price of power at the dam is estimated at 3 mills per kilowatt-hour. The $12,300,000 revenue includes an estimated return of $1,500,000 from the sale of stored water, the remaining $10,800,000 being the estimated return from the sale of power. A capacity factor of 55 per cent is used. On this basis Boulder Dam is an attractive investment, but that, of course, depends on the reasonableness of the estimates.

The estimated cost of the dam and flowage rights is $41,500,000. With allocated interest this amounts to $55,000,000. The estimated cost of the equipment for the power plant, with allocated interest, is $35,000,000. The sum of these two estimates is $90,000,000. As stated before, in the opinion of experienced engineers who have given the matter study, the estimates for the dam should be multiplied by 2½ to get a more reasonable estimate of $137,500,000. The estimate for the power equipment should be increased to $42,500,000 to bring it into line with present costs, making the total probable cost of the dam and power house $180,000,000, or just double the government's estimate. To this cost must be added the accumulated deficit during the years required for the power market within reach of Boulder Dam to absorb its complete output.

The estimated cost of the All-American Canal, with allocated interest, is $35,000,000. No attempt has been made to check the accuracy of this estimate nor of the estimated return from the sale of stored water. Using the $35,000,000 estimate, the probable cost of the complete project is $215,000,000, instead of $125,000,000 as estimated by the Department of the Interior.

A reasonable estimate of the time required completely to absorb the output of Boulder Dam is eight or nine years. The present installed capacity in all southern California, including the territory centering around Fresno, is 1,350,000 hp. A comparison of the predictions of various authorities in California indicates that ten years hence this capacity will be 2,700,000 hp. and that the rate of growth at that time will be about 120,000 hp. per annum. Hydro plants are now supplying 70 per cent of the power being generated. These cannot be shut down; the capital expenditures have already been made and operating costs are small. The present steam power installation in southern California, compared to the estimated load of ten years hence, is small, 627,000 hp. Part of this is already being used as standby reserve. Ten years hence most of it will be, and the need for standby power will not be eliminated by the introduction of power from a source 250 miles away. During the period of construction of Boulder Dam the normal growth of load will have to be supplied as fast as it develops. This growth is now largely being provided for by the construction of new steam plants located near the market, and this is the power that Boulder Dam will have to compete against. A 250-mile transmission line does not afford equally reliable service.

The capacity factor is an important element of the cost of power production. A high factor means high utilization of equipment and a comparatively low cost of production. This factor is fixed by the requirements of the market to be served and is largely independent of the source of power. The present over-all capacity factor for southern California is 39.5 per cent. This compares favorably with that of other parts of the country, and it may be expected to remain in the vicinity of 40 per cent. Because of expensive transmission costs it would be good economy to operate Boulder Dam power plant on a high capacity factor, thus throwing the burden of very low capacity factors on the plants near to market. A capacity factor of 55 per cent for Boulder Dam seems reasonable. For comparing production costs, a large steam plant located at Long Beach, Cal., will be assumed to operate at this same high factor.

### COMPETITION FROM STEAM

Such a plant installed today can deliver power at Los Angeles for about 5.7 mills per kilowatt-hour. This price, reduced by the energy losses and cost of 250 miles of transmission from Boulder Dam to Los Angeles, becomes 3 mills per kilowatt-hour, which is the price at Boulder Dam for power sold in competition with the large steam plant of today. But steam efficiencies are improving, and it is reasonable and safe to predict that ten years hence, or when Boulder Dam project could be expected to be completed, steam costs will be so lowered by increased fuel economies that the price quoted above for power at Boulder Dam will be 2 mills per kilowatt-hour.

The argument may be raised that fuel prices will probably rise to offset the advantage of increased efficiencies. A material rise in the price of oil would promptly be offset by switching to coal. On the other hand, a combined mercury vapor and steam generating unit now being successfully experimented with at Hartford seriously threatens to cut generating costs so that power at Boulder Dam would have to sell for 1 mill per kilowatt-hour to compete with such a plant in Los Angeles. This last figure is given merely to point out that the possibilities for the next ten or more years favor steam development rather than hydro. Later on, the cost of money and other factors may tend to even up the differences.

It might also be argued that offsetting the prospective shrinkage in steam power cost is a probable reduction in interest rates on capital. On this point it should be noted that steam power costs will have ten years within which to shrink after the capital for the construction of the project has been provided. We are dealing with money rates now—steam costs ten years hence. The Swing-Johnson bill before the last Congress carried an interest rate of 4 per cent.

### RETURNS ON THE INVESTMENT

For studying the Boulder Canyon project as a power investment, a price at Boulder Dam of 2 mills per kilowatt-hour will be used. That this is a reasonable estimate may be seen from the fact that in 1924 the engineers of the Reclamation Service estimated the sale price at Boulder Dam of 3 mills per kilowatt-hour, or 1 mill higher than the price it is now proposed to use, whereas in the three years after their report was made, from 1924 to 1927, the fuel cost in southern California, at 55 per cent capacity factor, of large steam plants has shrunk 0.85 mill per kilowatt-hour. It is not a far stretch to assume a further material shrinkage in the next ten years.

The estimate of the Secretary of the Interior that the entire cost of the project could be paid for in 25 years omitted from consideration the item of depreciation. Presumably this was because the project would be paid for before the need for replacements became an important factor. The estimated price for current is so high and the estimated cost of the dam is so low that it is not reasonable to assume such a brief amortization period. The Swing-Johnson bill calls for amortizing the investment in 50 years. For such a period depreciation will have to be provided. A conservative estimate of 0.5 per cent on the dam, 2.5 per cent on the equipment and 2 per cent on the canal will be used.

On the basis of the assumptions heretofore made a project cost of $125,000,000 can be amortized in 50 years, as required by the Swing-Johnson bill, if the power were sold at the dam for 2.6 mills per kilowatt-hour. This is 30 per cent higher than the price heretofore determined as the probable amount for which power can be sold. At the probable competitive price of 2 mills per kilowatt-hour, the project could not be amortized. Annual charges would exceed income.

If the burden of the All-American Canal were removed from the project, at the same time eliminating the anticipated income from the sale of stored water, the remaining $90,000,000 cost could be amortized in 50 years, provided the price of power at the dam were 2 mills per kilowatt-hour. This equals the probable competitive price. In other words, if the cost estimates were correct, the power dam, by a thin margin, could carry flood control storage alone, but not the All-American Canal in addition.

The foregoing figures are based on cost estimates which are considered far too low. If the more probable cost of $215,000,000 for the complete project is used, the investment with or without the All-American Canal never can be amortized at the 2-mill competitive price for power. The deficit during the loading period would increase the amount to be amortized on the complete project to $295,000,000 and the annual deficit at the end of that period would be $6,700,000.

To amortize in 50 years, as required by the Swing-Johnson bill, the probable cost of the complete project ($215,000,000) would require a sale price for power at Boulder Dam of 4.25 mills per kilowatt-hour. To amortize in 50 years the probable cost of the dam and power house alone ($180,000,000) would require a sale price at Boulder Dam of 3.7 mills per kilowatt-hour, a price 85 per cent greater than the probable competitive price ten years hence.

From the preceding analysis it would appear that under most favorable conditions affecting construction costs, the government could make a power investment at Boulder Canyon without losing or making money, provided, however, the cost of the All-American Canal is not saddled on. But lacking the most favorable conditions, the government stands to lose heavily on its investment. This explains why, in the days when steam prices were higher, applicants to the Federal Power Commission who were prepared to proceed with bona fide development on the Colorado proposed smaller dams and uniformly avoided Boulder Canyon as a dam site. The borings and surveys of the Reclamation Service showed them that better power investments could be had elsewhere on the river.

## Electrification in Russia

EXTENSIVE electrification of Russia as a definite government policy is a very recent development. The first comprehensive plan for the electrification of the country was drawn up by the electrification committee appointed by the Soviet Government in 1920. The plan, according to a recent issue of the *Economic Review* of the Soviet Union, calls for the construction, during a period of from ten to fifteen years, of 30 new regional stations, with a total capacity of 1,500,000 kw. Special provisions were made for the utilization of low-grade fuels instead of coal or fuel oil. As a result, a number of plants using peat, lignite and fine coal not suitable for other uses have been built during the past few years.

Since 1922 there have been constructed and placed in operation eight new regional stations with an aggregate capacity of 197,000 kw. and a number of smaller stations. Two of the former are hydro-electric plants, three consume peat and three use low-grade coal. The largest are: The Volkhov, 56,000 kw., hydro-electric, 75 miles from Leningrad, which was placed in operation at the beginning of 1927 and will supply that city with 250,000,000 kw.-hr. annually; the Shatura, 48,000 kw., 80 miles from Moscow, close to large peat deposits, which constitute the source of fuel, and the Kashira, coal burning, serving 32 villages in the Moscow district with a present capacity of 12,000 kw., which is to be increased to 40,000 kw. by the end of 1928.

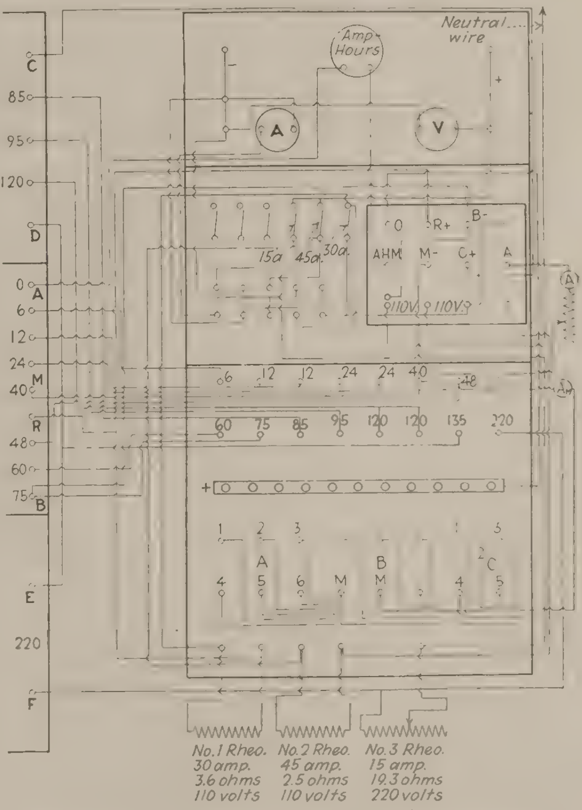
The present total of the three peat-burning plants is 88,000 kw. This is to be considerably increased in the near future. Of the new power stations under construction by far the most important is the Dnieperstroy hydro-electric project. This is to have a capacity of 650,000 hp. Work on it was started this year. Besides furnishing energy its completion will have an important bearing on commerce, for it will render the Dnieper navigable over its entire length. Five other good-sized stations, aggregating 201,000 kw., are reported under construction, according to this report.

## Simplified Control of Battery Group

By H. S. Bueche
*Instructor in Electrical Engineering*
*Kansas State Agricultural College, Manhattan, Kan.*

THE problem of making available for electrical test purposes several different values of direct-current potential from a battery source has been solved rather satisfactorily, in the opinion of members of the electrical engineering department of the Kansas State Agricultural College.

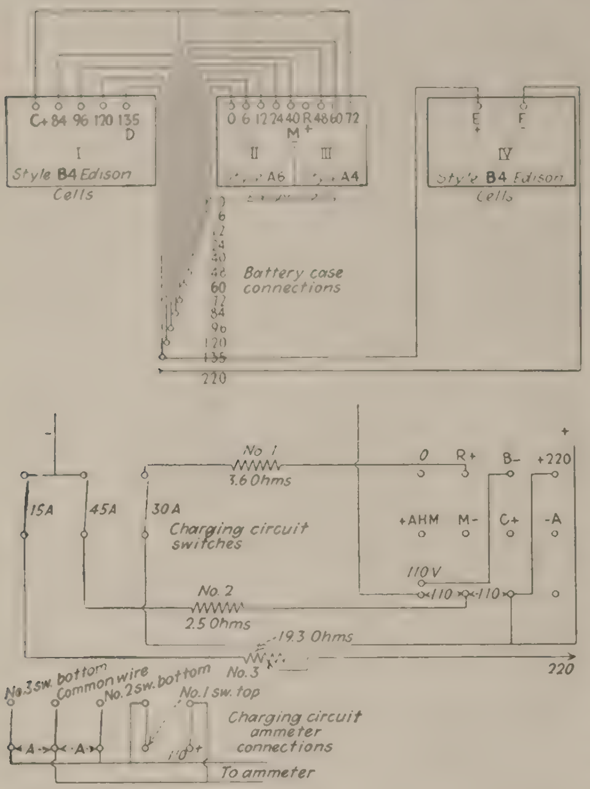
Inasmuch as the laboratory concerned was supplied with three different sizes of Edison cells, the necessity for frequent handling, connection and reconnection of groups of cells to obtain the desired values of potential and likewise to secure proper charging rates for the battery groups was a source of difficulty.



ARRANGEMENT OF WIRING CIRCUITS TO SWITCHBOARD BOTH FROM BATTERY AND FROM CHARGING SOURCE

The accompanying diagrams indicate in some detail the scheme of wiring followed. The switchboard as at present arranged provides for fourteen voltages varying in value from 6 volts up to the maximum of the battery unit (at present 220 volts), which can all be drawn upon simultaneously or not as the occasion warrants. The arrangement is extremely flexible, it being readily possible to add more taps to the board for as many intermediate values of voltage as desired.

A four-pole, double-throw switch with an extra terminal added to one of the circuits is the real feature of the arrangement. By closing this switch in one position the voltage taps on the switchboard front are energized. By closing the switch in the reverse position the three different sizes of Edison cells are reconnected in the proper charging sequence and automatically thrown on charge at the correct rates—namely, 15 amp. for the B-4 cells, 30 amp. for the A-4 cells and 45 amp. for the A-6 units. The rheostats controlling the 30-amp. and the 45-amp. charging circuits have a fixed value of resistance; the third rheostat is a variable one to allow for minor corrections necessitated by variation in the 220-volt source of supply.



*Battery connections and charging circuits in detail*

Batteries I and IV in series charge on 220 volts, 15 amp.; II charges on 110 volts at 45 amp.; III charges on 110 volts at 30 amp. Four-pole double-throw switch closed down connects charging circuits through auxiliary switches; closed up connects taps on board. The 15-amp. charging switch closed with four-pole double-throw switch in up position connects special balanced voltage source to motor-generator set.

A single ammeter which can be cut in independently on each of the three charging circuits in turn provides a ready check on the current values. The ampere-hour meter on the board is used only to give an approximate idea of the drain on the battery unit as a whole. Connected in the line common to all cell groups, whether charging or discharging, the value of this meter lies chiefly in providing a record of extreme conditions of battery charge or discharge.

Individual single-pole knife switches permit the charging of any one of the three groups of batteries independently of the others. Although the supply mains into the charging panel have a rated capacity of only 50 amp., the use of a three-wire system with a balancer set gives 110 volts between so-called neutral and outside wires and 220 volts across the latter. Balancing the 15-amp. and 30-amp. units against the 45-amp. cells keeps the current flow in the outside wires just below the maximum value, while the net flow in the middle wire remains zero.

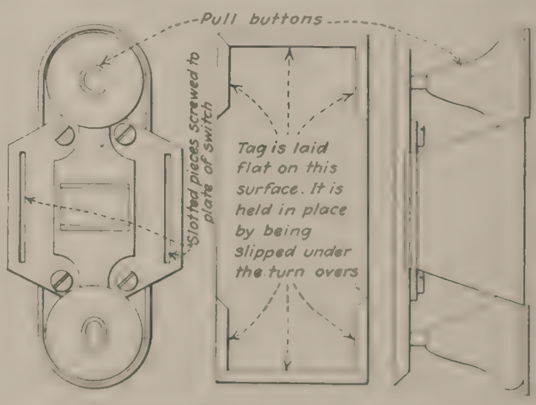
By a connection between the 40-volt terminal on the switchboard and the lug marked *A* on the four-pole, double-throw switch a condition of charging one group of cells can be obtained such that they will "float" on the supply line, maintaining at *M* and *M* of the bottom panel section *B* an unvarying potential of 220 volts irrespective of a changing load thrown upon the line. This scheme has been found most useful when calibration of watt-hour meters was in process.

## Switch Tag Holder

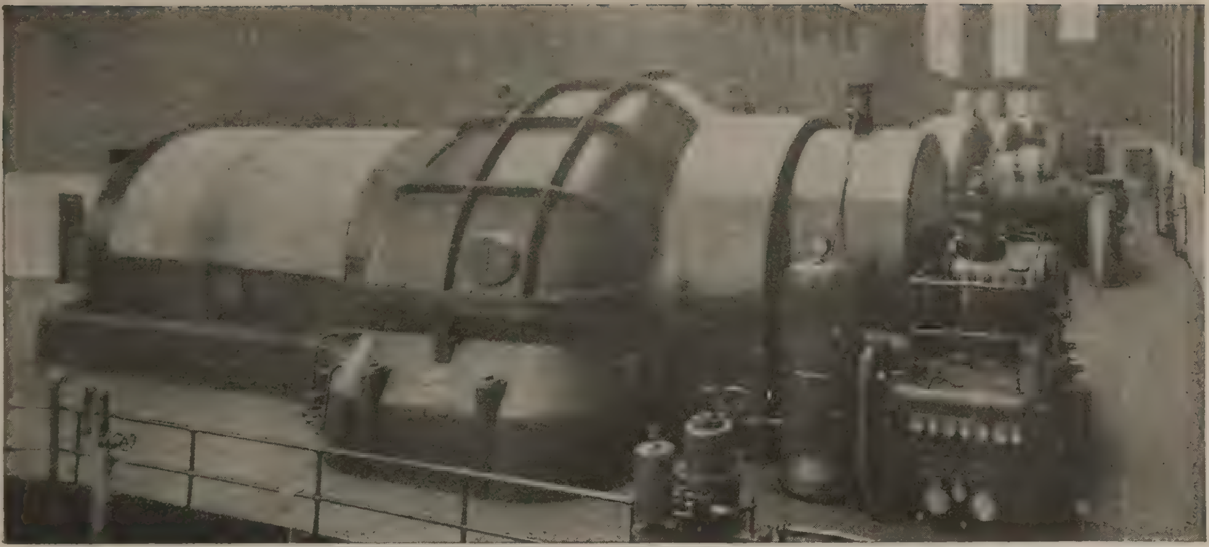
ON MANY electric systems it is common practice to tie "hold" tags (indicating that men are at work on apparatus or lines) to the handle of the controlling switch. In the case of remotely operated switches this practice has been improved upon in the plants and stations of the Northern States Power Company.

Under the heads of the screws which hold the switch-plate to the panel are set pieces of flat metal in which slots about ⅛ in. wide and 2 in. long are cut parallel to the side of the plate. Another piece of flat metal sufficiently long and wide to cover the pull knobs of the switch has tongues bent down at right angles at each side so that by bending these tongues slightly inward they may be inserted in the slots attached to the switch-plate. The outward pressure of these tongues holds the upper piece firmly in position. The ends and portion of the two sides of the flat top of this piece are bent over on themselves so that the "hold off" card may be slipped under them.

This tagging arrangement not only provides a secure method of holding these cards but it also prevents any inadvertent movement of the switch knobs from the front of the board or from the back if they are being worked on. When the switchboard operator receives orders to remove the tags and close the switch which has been held open it is necessary for him to take off this tag holder before the switch can be operated. This is in itself a good thing, since the removal of the holder increases the element of deliberation with which the operation of all switches should be accomplished.


Pull buttons
Slotted pieces screwed to plate of switch
Tag is laid flat on this surface. It is held in place by being slipped under the turn overs

TAG HOLDER FOR CONTROL SWITCHES



# Putting 60,000-Kw. Unit

## in Space Provided for Twenties

Two 100-ton cranes and a lifting beam required to handle installation of monster generator. Station controls grouped to facilitate response to peak-load emergencies

By Raymond P. Moore
*Mechanical Engineer Buffalo General Electric Company, Buffalo, N. Y.*

> *Public service, particularly in the Niagara district, carries with it an unusually heavy burden of responsibility that continued low cost of electric power generation may perpetuate its clientele in their favored economic position.*
>
> *To accomplish this the utility must function not merely as well but materially better than in less favored communities, while "readiness to serve" under such conditions necessitates not only more efficient base-load power but more economical and more quickly responding peak-load reserve. In this and succeeding articles on the Huntley station some of the efforts which are being made to meet demands for peak-load service, while at the same time concentrating on getting more return from existing investments, are depicted by members of the engineering department of the organization.*
>
> William R. Huntley,
> *President.*

As THE peak-load station of the system, the Huntley station of the Buffalo General Electric Company, formerly known as the River station, contained originally 95,000 kw. of rated turbine capacity, divided between three 20s and one 35, and twelve stoker-fired boilers of 12,500 sq.ft. of water-heating surface and 3,820 sq.ft. of superheating surface each.*

When the extension of the generating capacity of the station was decided upon it was felt that, considering the size of the system and the unit costs of machinery and buildings, it would be desirable to obtain 60,000 kw. in one unit if a way could be found to accommodate it.

The original turbine room of the station had been designed for 20,000-kw. units, set crosswise of the room. When the 35,000-kw. machine was installed it was placed with its shaft parallel to the others by use of the simple expedient of leaving a doorway in the wall opposite the generator end of the unit to permit the withdrawal of the rotor.

It was determined that setting the 60,000-kw. machine lengthwise of the room would require a greater extension to the

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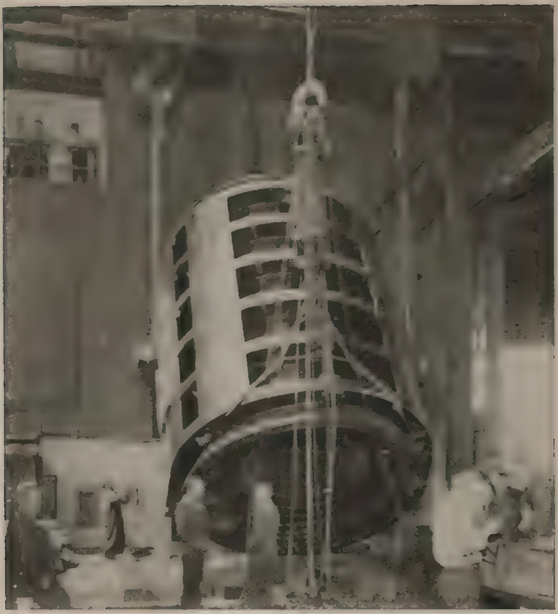
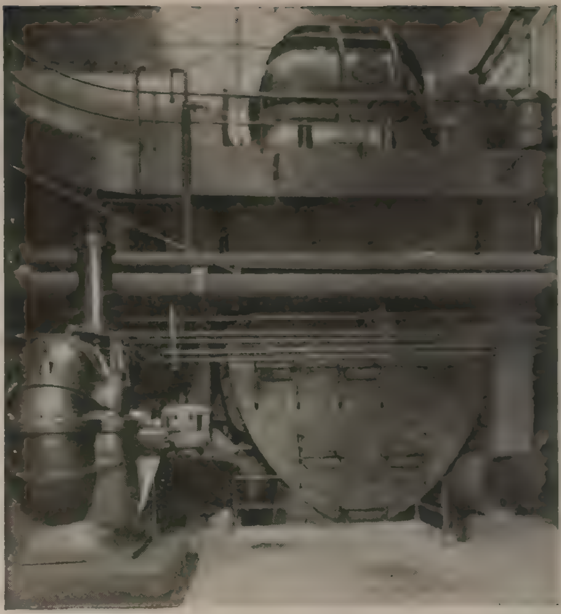
*Reference to previous articles in Electrical World in 1917-1918.*



HANDLING 185-TON GENERATOR STATOR DURING INSTALLATION OF 60,000-KW. UNIT AT HUNTLEY STATION



THE 30-IN. CAMERON CIRCULATOR ON THE LEFT SUPPLIES THE 34,000-SQ.FT., SINGLE-PASS INGERSOLL-RAND CONDENSER

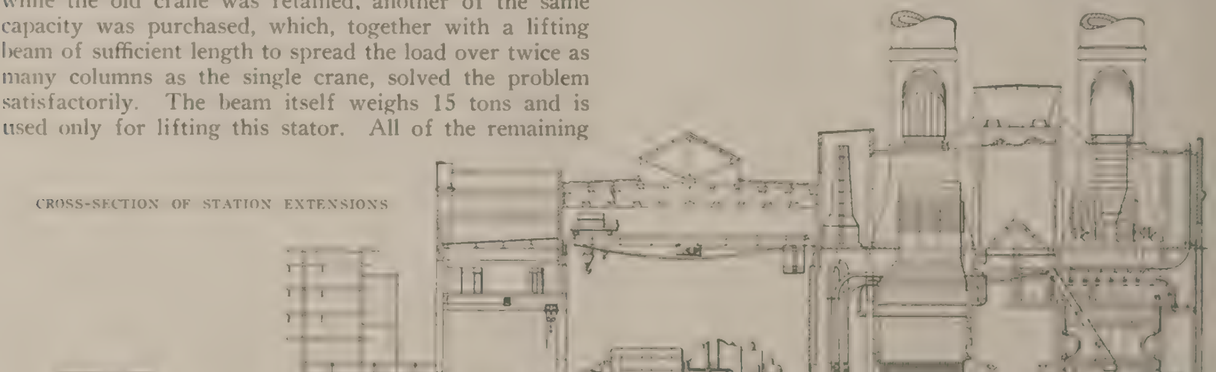
turbine bay, but, on the other hand, the entire unit could be comfortably placed crosswise of the room within the 75-ft. span of the crane if means for removal of the generator rotor could be managed. Since changes in the design of the extension as compared with the old plant included the elimination from the electrical bay of all high-tension switches, that wall of the turbine bay could be omitted, and a 40-ton chain hoist hung from a trolley beam in the electrical bay was arranged to handle one end of the generator rotor during its placement. This arrangement permitted the 60,000-kw. machine to be placed in a turbine room designed for twenties and without necessitating any change in the length of the crane span.

The old turbine-room crane of 100-ton capacity was, of course, by itself too light to handle the generator stator of the new unit, which weighed 185 tons. Another item was the building columns, which had not been designed to carry such a load if concentrated. Accordingly, while the old crane was retained, another of the same capacity was purchased, which, together with a lifting beam of sufficient length to spread the load over twice as many columns as the single crane, solved the problem satisfactorily. The beam itself weighs 15 tons and is used only for lifting this stator. All of the remaining lifts are within the safe carrying capacity of one crane.

The new generating unit is of General Electric manufacture, rated at 60,000 kw., 66,667 kva., 12,000 volts, 25 cycles, 1,500 r.p.m. The turbine is a single-cylinder, two-bearing machine, with seventeen stages, arranged for bleeding at the tenth, thirteenth and fifteenth.

The largest single piece was the turbine end of the bottom exhaust casting. This weighed 60 tons. The last three wheels were too large for shipment assembled on the shaft and these had to be shrunk on in the field. The generator stator frame came in two pieces and the laminations were assembled with the frame on end.

All auxiliaries, with the exception of the air-removal apparatus and the auxiliary oil pump, are motor-driven, designed for full voltage starting with push-button control. Two 30-in. Cameron type FV circulators, duplicates of each other, are capable of pumping together 60,000 gal. per minute. The motors are two-speed, of 250-hp. capacity at 360 r.p.m. and 125 hp. at 240 r.p.m.



CROSS-SECTION OF STATION EXTENSIONS

The condensate pumps are two in number and of equal size, each capable of handling the total condensate at full load on the machine. They are of the Cameron H.W. type, designed for positive pressure on both seals, and are driven by 100-hp. squirrel-cage induction motors. The bleeder heater drip pump is of the same type, but of smaller dimensions.

The tenth stage of the turbine is tapped for steam to a set of evaporators previously existing in the old station. These evaporators were of the high-heat type, taking steam from the high-pressure headers. It is now possible to operate them from either source, as conditions demand, and arrangement is made so that they may exhaust into one of the bleeder heaters.

In view of the requirement for quick starting, particular attention was paid to concentrating instruments and controls. The gages showing the pressures at various vital points in the turbine are grouped together on one end of the oil tank adjacent to the throttle valve. Set into the wall just back of the turbine is the instrument panel, supporting indicating and recording pressure gages and thermometers. Near to the throttle valve are grouped a series of valves for priming the circulators, supplying sealing water and sealing steam and priming indicators. After producing the initial vacuum, the operator can control the auxiliaries and start the turbine without moving more than a few feet from the instrument panel.

TURBINE AUXILIARY CONTROL AND GAGE BOARD FOR THE 60,000-KW. UNIT

The instrument panel is a single sheet of ¼-in. steel, 9⅓ ft. long and 6¼ ft. high. The indicating steam and water pressure gages and thermometers are of Foxboro flush-front construction. The gages have silver faces with black figures and triangular pointers. Three Bailey flow meters occupy the center of the panel. One of them records and integrates the total quantity of drip from the bleeder heaters. The two others show the steam flow in the two 16-in. steam leads to the turbine.

Mounted on the wall to the left of the panel is a Precision mercury column vacuum gage, while on the right-hand side is the Venturi meter, connected to show the condensate from the main condenser. Below the meters are grouped the push-button stations, with their indicating lights, and at each side are the Dean control stations for operating the header valves. The rear of the panel is open on the boiler room side of the wall, where the backs of all meters and wiring are accessible.

Excitation is by a separate unit consisting of a 300-kw. direct-current generator, with a motor and a Terry turbine forming a duplex drive. Normally the motor drives the unit, but the governor of the turbine is so adjusted that after a slight drop in speed due to failure of the motor voltage the turbine will automatically assume the load without interruption of the excitation supply.

# Regulation and the UnstableDollar*

### Plan suggested for preventing losses to security holders resulting from changing price levels

By John Bauer, Ph.D.
*Director American Public Utilities Bureau*

PUBLIC utility regulation has probably suffered more from the unstable dollar than has any other governmental function. This applies particularly to valuation for railroad and public utility rate-making. The great change in the value of the dollar since the beginning of the war has raised grave issues as to the fundamental rights of the companies, and has seriously threatened the future continuance of rate regulation. It now requires special reconsideration of the purposes, scope and methods of regulation to meet the conditions of the unstable dollar—conditions which had not been regarded more than casually when the existing basis of rate-making was first instituted.

The standard of "fair value," so far as the law was concerned, and reproduction cost, less depreciation as to technique of initial valuation, together constituted the procedure which, under the circumstances as existing and understood prior to the war, promised to provide a definite, administrable and financially sound basis of rate-making. Unfortunately, however, it was never directly established by legislative action and had not existed sufficiently long to become generally fixed in the fundamental law. Consequently, when prices shot upward because of the unstable dollar, it was brought immediately into sharp question and litigation. The court decisions, unfortunately, have resulted in upsetting the whole policy and leaving the basis of regulation in uncertainty, confusion and danger of complete disruption. We are thus confronted with the serious problem of adjusting the foundations of rate-making to the new conditions that have developed because of the unstable dollar. What, therefore, shall be done in the face of fluctuating prices, and particularly in view of the fact that there has been a tremendous rise in price level before the system above described had been firmly established in the law?

The cumulative financial instability following reproduction cost and the unstable dollar cannot be casually brushed aside. It cannot be met by the off-hand declaration that the stockholders have taken the risk and must bear it; while they would make inordinate returns during one period, they would be required to take the losses during another. Such a view might be accepted if the public interest at large were not involved; if we were dealing really with private business and its own risks, profits and losses. The fact is, however, that we are concerned with utilities vested with grave obligations; they are essential public functions, so that the broad public consequences must be considered in establishing a sys-

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*From a paper presented recently to the convention of the Stable Money Association.*

tem of regulation. The prevailing financial structure of the companies is likely to be a reality for an indefinite period in the future, just like the unstable dollar. While the value of the dollar fluctuates, the return realizable by most of the investors is limited by contract to the dollar, whatever its change in value. With this situation clearly before us, how shall we place regulation upon an effective basis, workable as to administration and sound as to financial policies and consequences?

### Would Adopt Fixed Rate Base

The proposal that I have made and elaborated in a number of articles and in my book on "Effective Regulation of Public Utilities" is to meet the situation with a direct legislative program. My suggestion is to make a valuation of all existing properties and to adopt the results in each case as a fixed sum for the rate base, modified subsequently only as additional investments and retirements are made and as further depreciation takes place. The investment basis should be generally incorporated for rate-making purposes so far as positive future policy is concerned. In respect to new investments made hereafter, there could be no judicial interference because the investors would have direct notice as to the exact limitations upon expected returns. So far as existing properties are concerned, however, reasonable adjustments would have to be made to meet the present situation, in many instances of a much higher level than existed when the investments were made. There is no doubt that, so far as the common stock holders are concerned, if they were not to be held to a return on their actual money investment, they would be subjected to a loss in purchasing power which they had not directly undertaken in their implied contract with the public. The reasonable course, it seems to me, would be to allow to the stockholders in the proposed initial valuations an adjustment equivalent to the rise in prices that has occurred since the actual investments were made through the issuance of common stock. I see no reason, however, why, upon any grounds of justice or desirable policy, a corresponding adjustment should be made to the bond and preferred stock holders' investments, which, in any case, are limited to the actual returns fixed in the contracts. My proposal, therefore, would furnish a reasonable and definite compromise between the extremes of reproduction cost and actual investment which have been urged upon the commissions and the courts.

This plan would provide in each case for a definite and non-varying rate base for the future. It would start with the initial valuation, which would provide a full adjustment for stockholders' investment on the basis of present day prices, and would thereafter keep this sum unchanged except as additions and retirements are made and further depreciation accrues. This would all be under the supervision of the commissions.

The plan would disregard for the future the general changes in prices due to the unstable dollar. It would base regulation upon the actual dollar and would make no adjustments in the rate base upward or downward except as the price changes are reflected in the installation of plant and equipment from time to time. When any capital expenditure, however, has once been incurred, the amount would be a fixed sum and would not be changed thereafter on account of further changes in prices or variation in reproduction cost.

The reason for not permitting any adjustments in the rate base for future changes in the value of the dollar appears wholly in administrative considerations, and particularly the requirements of financial stability. The proposed system could be effectively administered and would provide the returns actually promised, and would attract all new capital as needed for the development of the properties. As new investments are made, the rate of return would have to be paid according to market requirements at the time. This rate would be included as a definite cost, so that, when an investment has once been made under particular conditions, the return required would be practically guaranteed in future rate-making. This virtual guarantee would attract all the new capital needed to meet the requirements of utility expansions. It is a safeguard both to investors and to the public, for which constantly expanding facilities must be provided.

### Fixed Return on Common Stock

The plan would limit the common stock holders to a fixed monetary return in the future, exactly as the bondholders and preferred stock holders are now limited by contract. It would provide, however, for past investments made by common stock holders a full adjustment for the present value of the dollar. For the future it would not provide any further modifications; it would maintain in each case a fixed and non-fluctuating rate base.

There may be a question whether or not it is desirable to hold the common stock holders in the future to the same policy of a rigid monetary return as applies now by contract to bond and preferred stock holders. Personally, I believe that, because of its definiteness, this would be the preferable and more workable procedure. It would be possible, however, to incorporate in the plan an adjustment for stockholders' investment, even for future changing prices. It would be possible by the use of index numbers to adjust the rate base upward or downward with the change in prices so far as the common stock investments are concerned, but not to extend the adjustment to bond and preferred stock holders' investments. If such a limited variability was included in the rate base, it could be administered without great difficulties and would still assure the full financial stability of the companies. The increase in money return thus allowed to the stockholders during rising prices would be merely in the same proportion as the increase in prices, and, conversely, the decline in the monetary return would be in direct proportion to the fall in prices. There would be no cumulative effect upon the common stock; neither a three- or four-fold increase during one period nor a three- or four-fold decline during the other.

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## Employee Use of Appliances

THE Southern California Edison Company has recently undertaken a survey to ascertain the number of electrical appliances owned and used by its own employees. Twenty-seven per cent of the home owners are using electric ranges, while 19 per cent utilize electric water heaters. The largest ratio of appliances to employees is found under the head of laundry irons, 3,049 being used by the 3,010 employees maintaining homes. The next most popular piece of electric equipment is the toaster, with 1,839 in use. Vacuum cleaners follow very closely, with 1,672. Washing machines offer a total of 1,196. The report indicates that the electric refrigerator is still considered to be more or less of a luxury product by those members of the industry who supposedly know better, as the total number shown is 107.

# Pennsylvania Utilities*

Inquiry into the electric development of the state with respect to service, rates and expenditures since commission regulation became effective reveals striking economies

By W. D. B. Ainey

*Chairman Public Service Commission of Pennsylvania*

THE following are the outstanding features in the electric light and power situation in Pennsylvania during the years 1914-1927 inclusive, in which the electric utilities have been regulated by the state:

Electric consumers in Pennsylvania are today saving on the average approximately $25,000,000 a year over the rates that were in effect in 1914. In other words, if the rates that were in effect in 1914 were applicable today consumers would be paying approximately $25,000,000 annually more than they are presently paying. The exact figures, according to the calculations of the bureaus of the commission, are $24,283,000.

Service to consumers in Pennsylvania has been multiplied nearly six times since 1914. There are today 1,707,000 residential, commercial and power consumers, as against 321,400 in 1914, and the consumption has increased from 1,006,750,000 kw.-hr. to 7,127,900,000 kw.-hr. This period of reduction of rates and extension of service has been coincident with the investment of $640,000,000 in power plants and distribution systems.

Development and co-ordination of the electric industry in Pennsylvania has been a chief factor in the industrial and economic development of the resources of the Commonwealth during the past one and one-half decades.

From the standpoint of conservation, it may be noted that increased plant efficiencies of the electric development within the state of Pennsylvania in 1927 over 1914 represents a yearly saving (or decrease) of 8,200,000 tons of coal.

Under the regulatory supervision of the state this industrial and economic development has, as a natural sequence, been extended to the agricultural industry of Pennsylvania. During the year 1927 rural extension electric lines involving an expenditure of $3,000,000 for the construction of 1,441 miles of rural electrification and the connection of 17,700 consumers were accomplished under the general orders and rules of the Public Service Commission. During the next four years it is estimated that an additional $8,000,000 to $10,000,000 will be spent in the construction of 4,000 to 5,000 miles of rural extension lines for the development of the agricultural industry in Pennsylvania.

### Comparative Statistics

The following remarks give in some detail a statement of the development of electric service in Pennsylvania from 1914 to 1927, inclusive, and have been prepared from data representative of approximately 98 per cent of the total electric energy supplied in the state:

In the thirteen years ended Dec. 31, 1927, electric companies in Pennsylvania increased the number of residential and commercial customers served by them from 305,748 to 1,651,817, an increase of 1,346,069, or 440 per cent, and increased the number of power customers from 15,620 to 55,708, an increase of 40,088, or 256 per cent.

### Great Increase in Energy Consumption

In the same period the kilowatt-hours sold to residential and commercial customers increased from 193,860,000 to 1,151,289,000, an increase of 957,429,000, or 494 per cent; kilowatt-hours sold to power customers increased from 812,893,000 in 1914 to 5,976,613,000 in 1927, an increase of 5,163,720,000, or 635 per cent. Figures are not available to separate the total number of customers and total kilowatt-hours sold in the respective years as between residential and commercial classes. Separation is possible to an extent representing more than 80 per cent of the total residential and commercial customers in 1927. The number of residential consumers thus separated increased from 158,345 in 1914 to 1,135,682 in 1927, while the kilowatt-hours sold to them increased from 37,249,000 in 1914 to 484,008,000 in 1927, representing an increase in the average consumption per residential customer from 235 to 427 kilowatt-hours per annum, an increase of 81.7 per cent. The total revenue from these residential customers in 1914 was $4,069,793 and in 1927 was $32,501,317, reflecting the increase both in number of customers and use per customer.

The number of commercial customers thus separated increased from 66,356 in 1914 to 197,303 in 1927, while the kilowatt-hours supplied to them increased from 122,677,000 in 1914 to 488,589,000 in 1927. This represents an increase in average consumption per commercial customer from 1,848 kilowatt-hours to 2,527 kilowatt-hours per annum, an increase of 36.7 per cent.

The total revenue from these commercial customers in 1914 was $6,632,608 and in 1927 was $25,352,766, also reflecting increases in the number of customers and use per customer.

Gross revenue from residential and commercial customers as a whole was $13,027,698 in 1914 and $71,622,510 in 1927, an increase of $58,594,812, or 450 per cent. Gross revenue from power customers increased from $14,337,789 in 1914 to $90,237,427 in 1927, an increase of $75,899,638, or 530 per cent.

For residential customers, for which separation data are available, the average annual bill per customer in 1924 was $25.70 and in 1927 $28.62, while consumption per customer increased from 236 kilowatt-hours to 435

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*Excerpts from statement before the committee on interstate commerce, United States Senate, Jan. 26, 1928.*

kilowatt-hours. This represents an increase in the annual bill of $2.92, for which 192 more kilowatt-hours were given.

For commercial customers, for which separation data are available, the average annual bill per customer in 1914 was $99.96 and in 1927 $128.50. This is an increase in the annual bill of $28.54, for which 679 more kilowatt-hours were supplied in 1927.

In considering these figures, it must be borne in mind that there has been a marked change in the type of average user of electric service since 1914, particularly as relates to the average use per customer. In 1914, in both large and small cities, the users of electric service were, generally speaking, the larger residences, the owners of which could afford the comparatively high cost of wiring them, and the more progressive and larger stores and commercial establishments. At that time the competition of gas service continued to be strong in our older communities in house and store lighting and many smaller industries continued to use direct steam power or their own small electric plants.

### PREPONDERANCE OF SMALLER USERS

In the period to 1927 this condition has largely changed. As the result of wiring campaigns, with the assistance in financing given by the electric companies, practically all the older houses have been wired for service, while every new house has been equipped for that purpose. Even the smallest stores have adopted the modern method of lighting. The widespread introduction of devices for use of electric service in small industries has added these establishments in large numbers. The effect has been that the number of customers in all classes has been greatly increased and that relatively the larger number of new customers have been found among those who are relatively smaller users.

This preponderance of smaller users among the new customers of all classes has affected the average statistics of the electric industry in comparing 1914 and 1927. The average annual use per customer would certainly have increased by a greater percentage if this preponderance of smaller new customers had not occurred and been averaged into the figures So also the average cost per kilowatt-hour would have been reduced by larger margins. The lower average use by the relatively greater number of small users among the new customers results in a comparatively higher average cost per kilowatt-hour than would be the case if there had been an equal number of larger users among the new customers.

When these conditions are kept in mind the increases in average use per customer and the decreases in average cost per kilowatt-hour shown by the record of this period of thirteen years in Pennsylvania are striking and significant.

On the 1927 volume of business the apparent saving resulting from the application of the difference in revenue per kilowatt-hour realized in 1914 and 1927 is $40,786,000.

The foregoing saving figure has been produced in part by the customer himself through a more liberal use and in part by reduction in rates by the utility companies. A study has been made applying, in so far as possible, the 1914 rates to the 1927 volume of business. The results show that $24,283,000 of the above $40,786,000 is assignable to actual reduction in rates. A like study based on rates in effect at approximately the close of the period of peak prices caused by the war shows that the consumers of 1927 would have paid $33,178,700 more for the service they received if the rates in effect in 1921 had applied.

Between Jan. 1, 1914, and Dec. 31, 1927, electric companies in Pennsylvania made gross additions to fixed capital accounts of $690,000,000. In this period retirements amounted to $62,000,000. The net increase in fixed capital accounts totaled $628,000,000.

Increases in major service facilities are shown by the following three items:

### STEAM POWER PLANT DEVELOPMENT

Among the items provided by the above additions to fixed capital accounts were an increase in steam power plant capacity from 469,899 kw.-hr. to 2,286,000 kw.-hr.

In 1914 there were 160 steam power plants in operation in Pennsylvania for electric service, with average capacity of 2,937 kw.-hr.; at the close of 1927 there were 61 power plants, with average capacity of 37,475 kw.-hr.

In 1914 1,179,000,000 kw.-hr. were generated by steam power and in 1927 6,969,000,000 kw.-hr., an increase of 5,789,000,000 kw.-hr., or 491 per cent.

The coal consumed per kilowatt-hour in 1927 was less than two-fifths of the 1914 consumption per kilowatt-hour, equivalent to a saving of more than 8,233,000 tons of coal per annum on the basis of generation in 1927. The weighted average price of coal delivered to electric companies in Pennsylvania practically doubled during the period 1914 to 1927, or an increase of $1.66 a ton.

### HYDRO-ELECTRIC POWER PLANT DEVELOPMENT

The hydro-electric power plant capacity in 1914 was 98,305 kw.-hr. and increased to 268,415 kw.-hr. in 1927.

In 1914 30 such power plants were in operation in Pennsylvania, with average capacity of 3,276 kw.-hr.; at the close of 1927 there were 36 power plants, with average capacity of 7,456 kw.-hr.

In 1914 354,170,100 kw.-hr. were generated by hydro-electric power and in 1927 1,128,228,100 kw.-hr., an increase of 774,058,000 kw.-hr., or 219 per cent.

Combined steam and hydro-electric plants in 1914 had a capacity of 568,204 kw.-hr. and in 1927 2,554,422 kw.-hr. In the respective years combined energy output was 1,533,170,000 kw.-hr. and 8,096,288,000 kw.-hr., or an increase of 428 per cent.

The average annual output per kilowatt of capacity in 1914 was 2,700 kw.-hr., and in 1927 had increased to 3,170 kw.-hr. At the rate in 1914 the capacity of combined steam and hydro-electric power plants in 1927 to produce the kilowatt-hours of output in that year would have been 2,998,600 kw., or 444,178 kw. in excess of the actual 1927 capacity in these plants.

### TRANSMISSION FACILITIES

The increases to fixed capital accounts are also represented by 8,091 miles of transmission lines in 1927, compared with 1,673 miles thereof in 1914, an increase of 6,418 miles, or 384 per cent. The increase in transmission line mileage of 6,418 miles is equivalent to eighteen times the distance from Philadelphia to the western state line.

### SYSTEM INTERCONNECTION

Twenty-eight electric companies in Pennsylvania have established a total of 76 interconnections with facilities of other companies, having a total capacity of 853,300 kw., by means of which 1,363,110,000 kw.-hr. were delivered and received by the parties thereto in the twelve months ended Nov. 30, 1927.

Of the 76 points, fourteen involve interstate transmission, with total capacity of 314,000 kw., by means of which in the like period 831,704,000 kw.-hr. were delivered and received.

Current may be transmitted in either direction at all of the above interchange points.

### INTERSTATE TRANSFER OF POWER

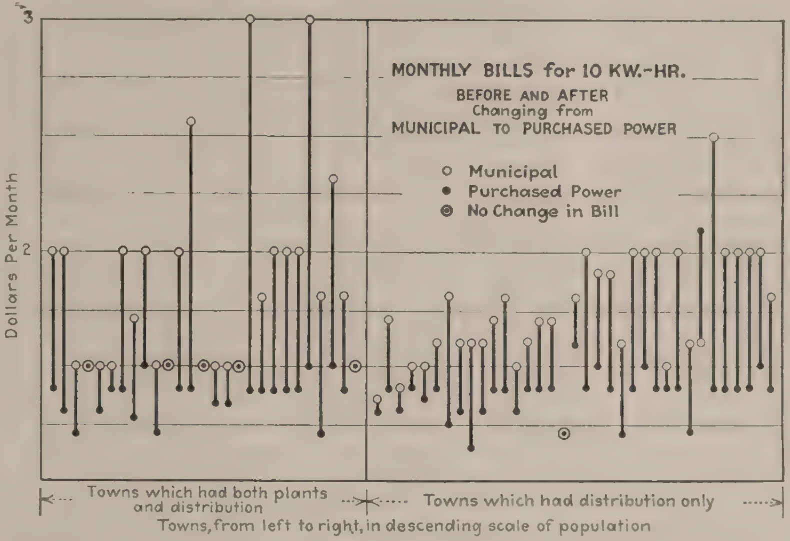
There have been established by electric companies in Pennsylvania 51 points for the interstate transfer of power, including points for transmission one way and for transmission both ways. On the twelve months ended Nov. 30, 1927, 634,084,541 kw.-hr., or 7.83 per cent of the total kilowatt-hours generated in the state, were transmitted out of the state. In the same period 636,607,337 kw.-hr. were transmitted into the state. The net result of all interstate transmission was, therefore, that the energy generated in the state was increased by 2,552,796 kw.-hr., the energy secured from other states being equivalent to only 0.031 per cent of the total energy generated within the state.

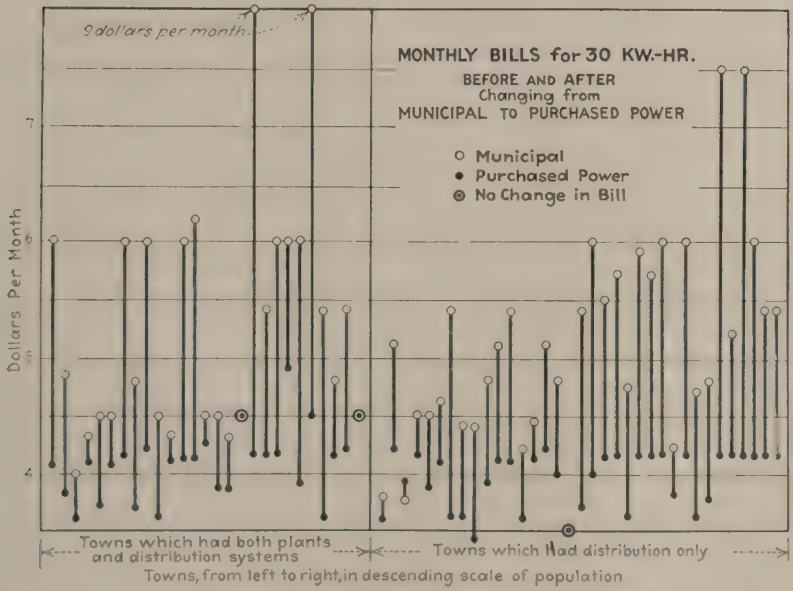
### RURAL ELECTRIFICATION

During the year 1927, in eight months of which General Order 28 was effective, the electric companies in Pennsylvania built 1,441 miles of rural distribution lines at a cost of $2,898,000 and connected 17,663 rural customers, of which 4,317 were farmers. In other words, rural customers are being connected at the rate of 58 customers for each working day of the year. Rural service is being extended rapidly and during the next four years the utilities expect to build 4,000 to 5,000 miles of lines.

## All Customers Benefit by Change from Municipal to Purchased Power

According to a recent analysis of 62 Iowa towns that have changed from municipal to purchased power, Prof. Arthur H. Ford, University of Iowa, concludes that all classes of customers have benefited by the change. The study involved towns ranging from 91 to 1,086 population and a calculation of monthly bills under the rates of the displaced municipal plant and the supplanting utility system. Comparative bills were figured for energy consumptions of 10, 15, 20, 30, 40, 50 and 75 kw.-hr. per month and hence represent effect on small, average and large domestic consumers. In calculating the bills they were figured on municipal rates in effect on date of sale and on utility rates of July 1, 1927. No case was considered in which a change from municipal to utility service was made prior to 1922. In fact, most of the cases involve recent changes, 23 being in 1926, nineteen in 1925 and six in 1924.





SUPPLANTING MUNICIPAL PLANTS BROUGHT SMALL AND AVERAGE DOMESTIC CUSTOMERS 20.8 TO 24.3 PER CENT DECREASE IN BILLS

The towns were divided into two general classes: (1) those that previously had both municipal plants and distribution, numbering 27; and (2) those that previously had only municipal distribution, numbering 35. In the first class the average reduction in bills through purchased service was 24 per cent or greater for all classes of domestic consumers, reaching a maximum average of 27 per cent for the 75 kw.-hr. per month class. In the towns that previously had only municipal distribution, the decrease in bills by purchasing energy was 20.8 per cent or greater for all classes.

In fairness to the municipal systems it may be noted that there were six towns in which a 10-kw.-hr.-per-month customer could obtain electric service just as cheap before the change as afterward; in three of these towns the 30-kw.-hr. customer had the same experience.

# Electric Refrigeration Needs Stabilizing

### Sales disappointing in 1927. Too rapid expansion of market will increase cut-throat competition. A middle ground of sound development suggested

By Observer

ELECTRIC refrigeration in the past year has been something of a disappointment to manufacturers, to central-station companies and other dealers. Sales in many localities have fallen short of quotas and, nationally, the volume of electric refrigeration business has not been so large as was reasonably expected at the beginning of 1927. A good many causes might be assigned for this condition, as, for instance, the flood in the Mississippi Valley, the moderate slowing up of business, or, perhaps, lack of salesman power or quality of salesmen who could be found and trained to the peculiarities of electric refrigeration merchandising.

The real reason, however, has been that electric refrigeration has not hit its stride. In 1926 sales ran ahead of manufacturing capacity, resulting in chaotic conditions as to sales, installation and service methods, with the dire consequences of forced production thrown in for good measure. The year 1927 has been almost the reverse and production has far exceeded selling capacity. The present total market for between 4,000,000 and 5,000,000 domestic units was looked upon as a market of consumers' demand—a seller's market, except for price. The belief prevailed that an electric refrigerator exposed for sale to the eager prospect would result in his rushing to sign on the dotted line. Quite the reverse has been true. The man who is in the market for an electric refrigerator today has become more discriminating. He wants to look around, compare appearance, performance, service record and prices, although the last consideration is not so important to the man who is buying a piece of household equipment which he expects to use for the next ten to twenty years.

### Overproduction Heavy in 1927

With general business conditions for 1928 giving promise for steady improvement over those of 1927 and with the season for electric refrigeration sales approaching, it is well for manufacturers, central-station companies and other dealers to look candidly at what happened in 1927 and try to avoid a repetition of disappointing sales volume. There has been a pretty serious overproduction of electric refrigeration units by a number of manufacturers. This has resulted in a considerable amount of warehousing, which in turn has tied up much working capital for distributors and dealers. To a certain extent this is a healthy condition, as it has the effect of forcing the dealer or distributor to exert himself to the utmost to move his stock to release his capital. However, when it reaches a point where the dealer or distributor feels that he must make sales, regardless, the condition is not so healthy. Price cutting begins to appear and cut-throat competition is on its way. These conditions were particularly in evidence in electric refrigeration sales in 1927.

A good many refrigerator manufacturers, through their local distributor or dealer, have been doing considerable sharpshooting on multiple-unit apartment house jobs. There has been much accusation of unethical practices, knocking of competitors' products and price cutting. Both large and small manufacturers have experienced considerable turnover in dealer representation and there has been a general struggle to get sales volume. In some respects the small manufacturer has been somewhat better off than the large one in having a smaller overhead, a sales and distribution organization that is not unwieldy and his smaller production capacity is proportionately more elastic. On the other hand, the larger manufacturer has the advantage of lower production cost in a large, efficient plant and nation-wide distribution helps to even up the total sales volume when some localities are lagging behind quotas. These conditions have helped to maintain a highly competitive situation which has brought only a fair volume of business, so that if the manufacturer or dealer has broken even he may consider himself well off. The effect of this kind of competition upon the ultimate purchaser of electric refrigeration has not been to stimulate his desire to buy. Rather, it is discouraging in that he assumes an attitude of watchful waiting, believing that he will be able to buy a better machine at a better price later on.

### Central Stations Have Greatest Interest

The central-station companies which have the greatest continuing interest in seeing a large number of their customers purchase electric refrigerators have felt the effect of the existing competition, not only in their own sales but in the total volume of sales in their territory. These companies have also observed with considerable misgiving the consequences of refrigerators sold by dealers who later go out of business and the servicing obligation devolves upon the power company. With this unhealthy condition the local electric utility can have a very stabilizing influence by pushing its own sales to the maximum and in lending its moral support to other refrigerator dealers who have demonstrated their ability and permanence in sales, installations and servicing. Utility companies are well aware of the fact that the competitive conditions so much in evidence during 1927 are not conducive, in the long run, to greatly increased sales volume or in the best interests of their customers. A number of companies have expressed themselves as contemplating some rather drastic steps to stabilize the sale of electric refrigeration in their local territories.

Another element that has concerned the utilities is the sale of commercial refrigeration. There have been a number of misapplications of electric refrigeration in such stores as groceries, delicatessens, butcher shops, etc. A number of companies have set up a department of refrigeration engineering in order that they may be sure that customers purchase proper and adequate equipment to meet their refrigeration needs.

Whether or not 1928 will see the sale of electric refrigeration carried out on a safe and sane basis will depend largely upon the attitude of the electric refrigerator manufacturers, central-station companies and dealers. If they try to expand the market too rapidly there cannot fail to be a continuance of the price-cutting, cut-throat competition seen in 1927. But if the refrigerator manufacturers, as a group, and individual dealers can find a happy middle ground upon which they are willing to develop their business upon a sound and permanent basis the sale of electric refrigeration can be made profitable and the influence of greater confidence on the part of the ultimate user will of itself broaden the market.

## Commission Recommends Purchased Power for Transit System

POSSIBLE economies to be derived from purchasing power from the Edison Electric Illuminating Company of Boston were featured in a valuation report issued recently by the Massachusetts Department of Public Utilities in connection with the future of the Boston Elevated Railway, operated by public trustees under a service-at-cost agreement. The utilities commission said in part:

"We understand that the turbines in the [railway] power station at South Boston are adequate to supply all the electricity at present needed by the system. However, the turbines cannot be utilized to their full capacity on account of the inadequacy of the boiler installation and of the cables leading from the plant. As a result the company has maintained five other generating stations, which, to say the least, are not modern plants. With the exception of the Lincoln station, which is operated daily, and the abandoned Dorchester station, these plants are operated infrequently and for the most part in winter, when there are larger requirements for power due to snow and car heating. Probably these plants are not economical to operate. If so, arrangements might well be made to abandon them, to obtain available salvage value, and purchase such electricity as might be needed for the excess requirements of the company. The trend in recent years in this country is toward the purchase of power by transportation companies similar to the Boston Elevated rather than toward increasing their investment in power plants.

"It might be to the advantage of the commonwealth if a purchaser, to abandon all the power plants, salvage as far as possible and purchase all the required electricity. We are led to this conclusion by a consideration of the present cost to the Boston Elevated of its power and the knowledge that undoubtedly electricity could be purchased and delivered at some convenient point at something less than a cent per kilowatt-hour. In 1926 the company generated 290,544,015 kw.-hr. At 1 cent per kilowatt-hour this would cost $2,905,440. It cost the Boston Elevated $3,795,728 to generate its power in 1926, according to the company's annual return to the board, as follows: Power operating expenses, including depreciation, $2,456,104; interest on investment in plants, $826,515, and taxes on power plant equipment, $513,109. Assuming that the property devoted to power production be sold and power purchased, there would be a saving on the 1926 basis of $900,000.

"Tariffs filed with the commission by the Edison company provide for the sale of electricity in quantities of the amount required by the railway company at 8.9 mills plus a coal clause at present amounting to 1.3 mills, or a total of 1.02 cents per kilowatt-hour. The New England Power Company sold all of its electricity during 1926 for an average of 1.23 cents per kilowatt-hour. We believe that if a long-term contract were entered into, the Edison company or some other company selling power would make a price of less than a cent. As the book cost of the property devoted to electrical generation is $15,420,067, this whole amount could be amortized in about seventeen years, assuming no salvage. On the other hand, we are confident that the company could dispose of its power property for about $4,000,000, which would permit of amortization in about twelve years."

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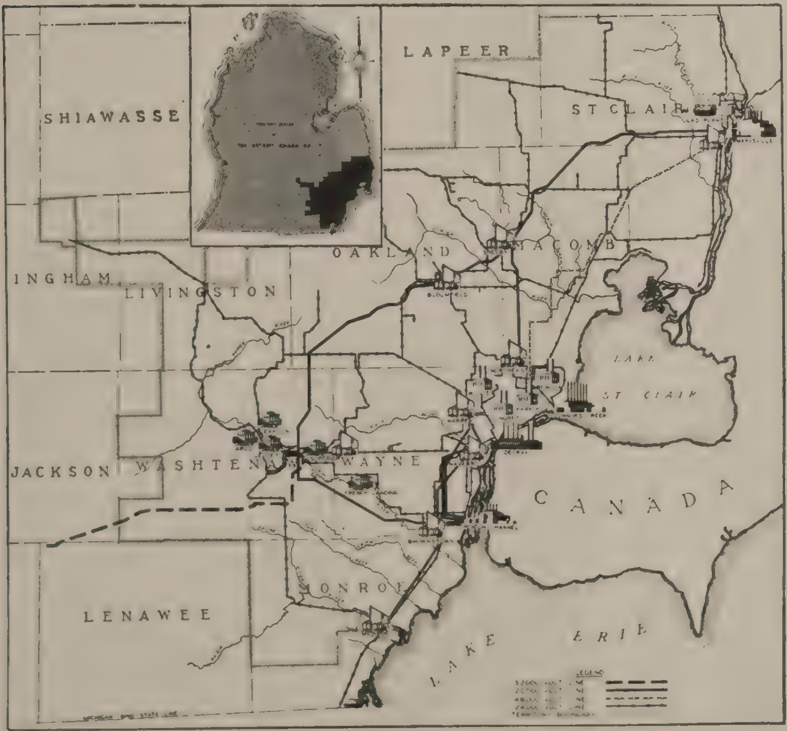
## Visualizing a Company's System for Its Employees



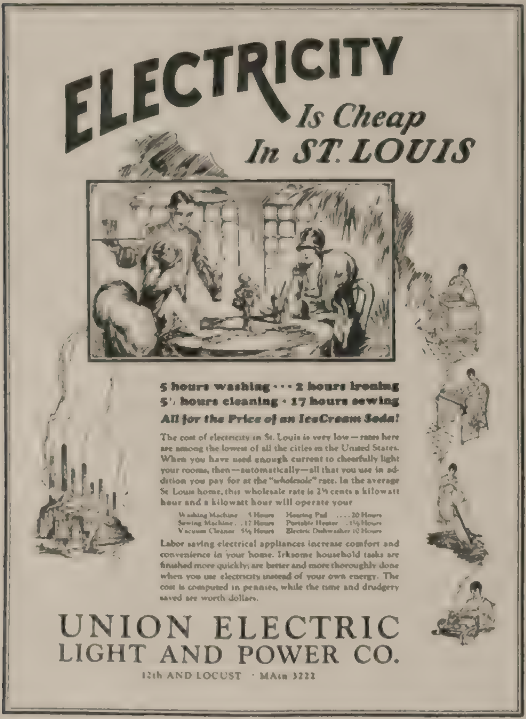
LOCATION OF TRANSMISSION LINES AND GENERATING PLANTS OF DETROIT EDISON SYSTEM

AS POWER companies grow and extend their services into new territory it becomes more difficult for individual employees to know thoroughly the extent of the company for which they are working. From a public relations standpoint, as well as for employees' own information, it is desirable that all should be able intelligently to answer questions concerning the location of power plants, transmission lines and service limits of their company. With this idea in mind, the Detroit Edison Company has prepared a map of its system on which are shown transmission lines of different voltages, the location of all electric generating, steam heat and gas plants, and the whole indicates how the Detroit Edison system serves its territory.

Prints of this map, which is about 25x40 in. in size, have been posted in conspicuous places in the different departments. It was also reproduced and published in the Detroit Edison *Synchroscope* so that all employees might have a copy for their own reference. Since this map was issued it has been found that employees have a much better idea of the Detroit Edison system.

# Teaching Public Low Cost of Energy Usage

DESPITE the fact that the average cost of electricity for residential service has decreased and low follow-on rates have been established by many companies, domestic customers are prone, from a matter of habit, to economize in their use of electric service. This attitude is being effectively overcome by the Union Electric Light & Power Company in St. Louis by development of the thought that "electricity is cheap in St. Louis," which is carried through the company's newspaper advertising and other publicity.


ELECTRICITY
Is Cheap
In ST. LOUIS

**5 hours washing · · · 2 hours ironing**
**5½ hours cleaning · 17 hours sewing**

***All for the Price of an IceCream Soda!***

The cost of electricity in St. Louis is very low—rates here are among the lowest of all the cities in the United States. When you have used enough current to cheerfully light your rooms, then—automatically—all that you use in addition you pay for at the "wholesale" rate. In the average St Louis home, this wholesale rate is 2½ cents a kilowatt hour and a kilowatt hour will operate your

| | | | |
|---|---|---|---|
| Washing Machine | 5 Hours | Heating Pad | 20 Hours |
| Sewing Machine | 17 Hours | Portable Heater | 1½ Hours |
| Vacuum Cleaner | 5½ Hours | Electric Dishwasher | 10 Hours |

Labor saving electrical appliances increase comfort and convenience in your home. Irksome household tasks are finished more quickly; are better and more thoroughly done when you use electricity instead of your own energy. The cost is computed in pennies, while the time and drudgery saved are worth dollars.

UNION ELECTRIC
LIGHT AND POWER CO.
12th AND LOCUST · MAin 3222

EXAMPLE OF LOW COST OF ELECTRICITY

How this thought is being conveyed is shown in the accompanying advertisement, which shows how, after a customer has used the first few kilowatt-hours per active room at the top rate, all additional energy is billed at 2½ cents. The idea of low cost is further emphasized by the use of the term "wholesale" as applying to the lower step in the rate. To illustrate how this applies to the various household appliances the accompanying table of costs of operation and energy consumption has been worked out.

COST OF USING ELECTRIC APPLIANCES IN ST LOUIS

| Appliance | Cost of Operating One Full Hour (Cents) | Estimated Annual Usage Kw.-Hr. | Estimated Annual Operating Cost |
|---|---|---|---|
| Iron | 1.31 | 80 | $1.90 |
| Cleaner | 0.40 | 30 | 0.71 |
| Toaster | 1.07 | 37 | 0.88 |
| Washer | 0.48 | 25 | 0.59 |
| Grill | 1.43 | 38 | 0.90 |
| Percolator | 1.07 | 40 | 0.95 |
| Waffle-iron | 1.43 | 37 | 0.88 |
| Fireless cooker | 1.57 | 120 | 2.85 |
| Heating pad | 0.12 | 13 | 0.31 |
| Fan | 0.18 | 32 | 0.76 |
| Portable heater | 1.43 | 100 | 2.38 |
| Sewing machine | 0.14 | 13 | 0.31 |
| Chafing dish | 1.43 | 15 | 0.36 |
| Water heater (socket) | 1.07 | 30 | 0.71 |
| Milk warmer | 1.07 | 25 | 0.59 |
| Auto radiator heater | 0.36 | 15 | 0.36 |
| Dish washer | 0.24 | 30 | 0.71 |
| Curling iron | 0.06 | 10 | 0.24 |
| Hair dryer | 0.12 | 10 | 0.24 |
| Tank water heater | 5.94 | 1,250 | 29.69 |
| Range | 3.56 | 1,350 | 32.06 |
| Refrigerator | 0.24 | 840 | 19.95 |

With these low operating costs it is shown that electric appliances are the cheapest servants a housewife can hire. The cost of doing this work, it is pointed out, can be computed in pennies, while the drudgery saved is worth dollars.

# Ten Reasons for Better Store Lighting

IN furnishing illuminating engineering consulting service to commercial customers it is the utility's job to demonstrate to the customer that it is economically practicable and advisable for him to make the expenditure necessary to improve his lighting installation. Ten points showing the value of better store lighting to the merchant were enumerated by O. J. Kruse of the Milwaukee Electric Railway & Light Company at the recent commercial section meeting of the Wisconsin Utilities Association as follows:

1. Adds attractiveness and value to even the best of merchandise.
2. Shows the true value of merchandise, thus reducing the returned goods problem.
3. Creates an atmosphere of cheerfulness, which affects customers and clerks alike.
4. Instantly creates an impression of cleanliness, neatness and up-to-dateness upon even the least discriminating shoppers.
5. Overcomes competition by attracting trade from the poorly lighted stores.
6. Saves rent by enabling a store located in the middle of the block to compete with the corner store.
7. Makes it possible to use every foot of floor space and eliminates dingy corners.
8. Brings out the true color and texture of materials, thus eliminating errors in matching goods.
9. Pays for itself may times over, through the increased sales produced by it, for well-lighted merchandise is already half sold.
10. Doubles the attraction and sales power of display windows.

# Electric Ranges Net $50,000 to Seattle Utility

THE ESTIMATED profit to the Seattle Department of Lighting from the sale of electric ranges and energy for their operation, after allowance for liberal range service, is approximately $50,000 a year, according to the annual report compiled by J. D. Ross, superintendent.

The average residence-lighting customer in Seattle uses 420 kw.-hr. per year, for which he pays $16.88. The installation of an electric range raises the average consumption of such customers to 2,563 kw.-hr. per year, and returns a revenue of $63.01. It is estimated that the profit on the energy sold remains almost a constant percentage, so that each additional electric range is the equivalent of three new lighting customers.

During the year covered by this report there were 3,406 ranges added to the city system, of which 2,776 were sold by the department. The total range load amounts to 11,127 installations. This means that one out of every six homes in Seattle is cooking electrically. The range load is doubling every two years and has become very valuable as a domestic revenue producer.

# Letters from Our Readers

## *Time to Clean House*

*To the Editor of the* Electrical World:

The article on "Wiring Materials and Methods" in the Nov. 26 issue of your magazine certainly hits the nail squarely on the head in many respects. While as one of the "oldtimers" I do not fully agree with all the statements, I cannot let this opening pass without presuming to add my "two cents' worth" to the discussion.

When our national wiring methods have reached the stage where, because of pyramiding methods of questionable safety value, the costs have become so excessively high that the average consumer cuts his initial requirements to the bone and every man is his own wiring contractor after "juice" is turned on, it is high time we started to "clean house." If we do the job ourselves we can get rid of the junk and salvage much that is still good and usable. If we don't start, and start soon, then some group of outsiders will, sure as fate, do the job for us. When they start they are going to chuck good, bad and indifferent onto the dump.

The inventive ingenuity of our nation is such that almost before a problem arises some genius has developed a wonderful piece of apparatus to handle it for us. We in general are quick to make use of these multitudinous new devices, but all too often we fail to realize that the new device makes obsolete some other one which once was thought the last word and which because of sentiment or precedent we hate to discard. The natural result to this little industry of ours, which seems never to be able to grow up, is that our systems from end to end are becoming so loaded down with "doodads" and "gimmicks" that both the investment and the operating costs show very distinct signs of becoming top-heavy.

The article in question on wiring methods touches but one branch of the industry, and on this alone we can wear out a whole flock of brooms in just brushing down the cobwebs. Our wiring code of today is being taken far too seriously by both local inspectors and wiring contractors, not to mention engineers and others higher up who are supposed to use judgment in interpreting the code. A job of wiring intelligently done under the real intent of the code is a good, safe job, but it is not by any means the safest or cheapest job.

Just as an example—a few years ago a utility company operating in a certain Middle West city undertook to get the city wiring ordinance modified to require an "all-metal standard" from the point of service attachment to the meter. The object was twofold—first, to prevent theft of unmetered energy; second, to protect against the hazard of tampering with a circuit that had no fuses back of it and on which a short circuit made by the amateur wireman generally meant a hospital case and a damage suit to settle.

After numerous conferences among the utility, the city electrical department and the contractors, initial opposition was broken down and the change agreed to. When the revised ordinance was finally passed by the City Council it required an "all-metal" standard throughout every installation within the city limits with a few minor exceptions. It also required polarized wiring throughout, and today that city has perhaps the best wiring of any city in the country. However, the point is that for frame buildings, where high wiring costs hit the consumer the hardest, knob-and-tube wiring for the branch circuits was plenty good enough and was low enough in first cost to permit ample convenience outlets to be installed. My guess would be that this community is spending at least $100,000 per annum in support of an unnecessary "all-metal" standard. If you think the consumer has been prohibitively handicapped in his use of portable appliances or has had his safety added to, just drop in any of the "five and dime" stores on a Saturday afternoon and watch the land-office business the electrical counter is doing with "Underwriters' approved" fittings.

We need a simplified system of wiring such as that indicated in the article in question, but what we need first is a little common sense in using the systems we already have. After years of argument our code now permits a grounded unfused neutral and three-wire branch circuits. In spite of this it is still required or common practice in many localities to fuse the branch neutrals and run out two-wire circuits—a practice that means distribution cabinets twice as large as necessary, from 15 to 25 per cent excess circuit wire and energy loss double what it need be. On top of this the contractor locates his distribution center so far out of the true load center that the average branch-circuit length is excessive. From $5 to $10 could be cut from most moderate-sized residential wiring jobs if the contractor would plan his layout before he starts work, and if both he and the local inspector would mix 50 per cent common sense with an equal amount of code rule interpretation. We could cut another $5 off the job if we were permitted to use a common neutral throughout the installation and leave off the expensive rubber insulation which we must short circuit by the protective ground on the neutral. We won't try to argue this point—I have been on the wrong side of the fence for thirty years in advocating the grounded neutral, the solid neutral, polarized wiring and a lot more "fool ideas" which are now written into the code. Just as a side bet, you will see the code requiring a bare common neutral—with the wiring channel system, including fixture stems and socket shells, part of this neutral—within the next decade.

In conclusion, while we are trying out other new wiring methods why not give this one a trial: Over a code single-conductor wire wrap a spiral of soft-copper or copper-alloy ribbon for use as the circuit neutral. Over this place a single impregnated braid. Such a conductor would give all the protection needed in locations where knob-and-tube or non-metallic cable is now permitted. For greater protection it could be steel-armored or drawn in conduit of the present or of a new thin-wall type. The neutral ribbon, effectively grounded as now required, would always act as a shield for the "hot" wire of the circuit, would be self-identifying, and could readily be interconnected and bonded to fittings by means of punching with a small hand punch and either bolted together or fastened with eyelets. This form of conductor could be used with present line of outlet boxes designed for flexible non-metallic conduit. Later on, when the industry starts to grow up, perhaps some wide-awake manufacturer will bring out a new line of fittings so that such a shielded conductor will automatically polarize the entire system right through from the main switch to the portable utilization device.

S. Bingham Hood,
Oakland, Calif. Development and Research Engineer.

# Digest of Electrical Literature

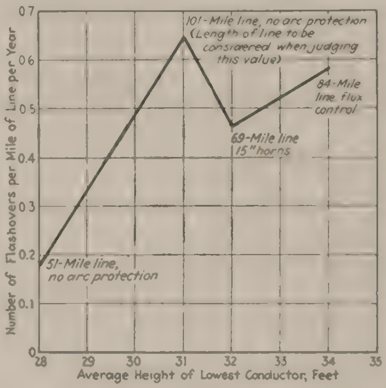
## *Hydro-Electric Development and Steam Equipment*

*The Bunnerong Electric Power Station.* — The rapidly increasing use of electricity in the territory surrounding Sydney, Australia, which is supplied by the Municipal Council, required that provisions be made for future expansion. This station is designed for an ultimate installed capacity of 375,000 kw., but is being constructed at present for 150,000 kw. Six turbo-alternators of 25,000 kw. capacity will feed 21 single-phase transformers for use in stepping up the generator voltage to 33,000. The design will follow modern practice in coal handling by rail and water, steam pressures of 350 lb. per square inch, underfeed stokers and balanced draft equipment being used. The turbines are of the tandem impulse type with multi-exhaust blades on the last low pressure stages. Operating speeds of 1,500 r.p.m. are used and a steam consumption of 10.29 lb. per kilowatt-hour has been specified. The main switchgear is of the iron-clad horizontal drawout type. An imporant feature of the construction of the switch house is that it is entirely sectionalized, the switchgear for each generator group being installed in a compartment of its own, with concrete walls dividing the sections. Access from one compartment to another can be had only by way of the balconies that are built on all floors. The 33,000-volt outgoing feeders from the power station consist of underground cables, communicating with various main substations located throughout the metropolitan area.—*Electrical Engineer* (*Australia*), Dec. 15, 1927.

*Hydro Plant Spullersee* (*Austria*).—A. Hruschka.—The supply of part of the basic load and all of the peak load of the western electrified Austrian main railway lines is furnished by the Spullersee plant. Embodying the latest hydraulic and electric achievements, it not only represents the most modern Austrian hydro-electric installation, but it also has the distinction of utilizing the steepest known penstock line (40 deg.) under a head of 2,600 ft., giving a water pressure at the turbines of about 1,100 lb. per square inch. There are at present three single-runner, single-jet Pelton turbines, each of 8,000 hp. and 333 r.p.m., installed, with an ultimate capacity of three more units. A highly sensitive needle and deflector regulation with remote motor control, specially designed for the unusually high pressure, is an interesting feature of these turbines. Each waterwheel drives a single-phase, 16⅔-cycle generator, with a basic output of 3,000 kva. A load of 5,400 kva. can be carried for 30 minutes, or 7,500 kva. for six minutes. At unity power factor and 7,500-kva. output an efficiency of 95 per cent has been measured at 6,600 volts. This potential is stepped up to the transmission voltage of 60 kv. in 3,000 to 5,400-kva. 16⅔-cycle, water-cooled, shell type transformers, each generator and transformer representing one group. Transformers and the entire switching equipment are installed indoors.—*Elektrotechnik und Maschinenbau*, Nov. 20, 27, Dec. 4 and 18, 1927.

## *Transmission, Substations and Distribution*

*Transmission-Line Lightning Surges.*—R. C. Andersen.—A discussion of the influence of long spans upon the height of line and upon induced lightning surges and of the relative merits of long spans as compared with those of medium length. The author reviews the origin of and experience involved in long-span construction, with particular reference to conditions in Great Britain. The questions of conductor placement and clearances, the method of securing line protection, the ground wire problem, insulator string protection and grounding are all considered. It is stated in conclusion that with modern transmission-line construction there should be relatively little trouble experienced from induced lightning surges. Line height is stated to be a direct function of induced voltage surges, but as the former is under the complete control of the designer, the construction must be so planned that the question of whether it is more economical to use a long span, with its saving in initial outlay but involving possible lightning trouble, or to use the more expensive though more nearly surge-proof medium length span must be decided. — *Electrical Review* (*England*), December, 1927.



FLASHOVERS ON A 140-KV. SYSTEM

*Extra High-Tension Transmission Lines.*—S. Edgar Barratt.—A review of the leading overhead power transmission lines of the world. The subject of insulators, towers, conductors, etc., in various countries, with specific reference to a number of outstanding power lines, is offered in this article. A table of conductor spacings offers interesting comparisons between the practices in various parts of the world.—*World Power (England)*, December, 1927.

## *Units, Measurements and Instruments*

*The Measurement of Intensive Magnetic Fields by Means of the Zeeman Effect on the Zinc Triplet.*—Walter C. Michels.—A plan for utilizing the relation discovered by Zeeman some years ago between magnetism and light has been utilized for the measurement of intensive magnetic fields. A review of the available methods of measurement as well as of the one particularly concerned in the discussion and a comparison of their relative merits is offered. The basis for the computation depends upon the fact that light, viewed normally to the field, produces three observable components, the two outer being plane polarized normally to the field and the middle in a plane at right angles to these. When the light is viewed along the lines of force, two components appear circularly polarized in opposite directions. The probable error in using this method amounts to less than 1 per cent. The measurement of intensive magnetic fields by the application of the Zeeman effect on the zinc triplet has several distinct advantages; no apparatus beyond that ordinarily found in any well-equipped physics laboratory is required; the only standards used are the wave-lengths of certain spectral lines, which are known to a high degree of accuracy and are always available; the results are capable of a high degree of accuracy, with good apparatus and proper manipulation, and by the use of a short spark the entire air gap may be explored and an accurate map of the field may be made.—*Bulletin* 17, *Rensselaer Polytechnic Institute.*

*Investigations on Shunted Current Transformers.*—K. Berger.—It is not unusual to experience flashovers, punctures or grounds on current transformers which are installed near the entrance of lines to a substation. They are stated to be due to overvoltage phenomena, arising from incoming waves, which may set up oscillations and resonance. A suggested remedy is the shunting of the primaries of such current transformers with bridging ohmic resistors. If the transformer is used to measure current the bridging shunt will introduce incorrect indication because it changes the transformation ratio and adds angular fault. Better results can be obtained if the bridging resistor has a characteristic which changes with the impressed voltage. Many laboratory tests were made to study the effect of such shunts for frequencies up to 100,000 cycles and to determine under what conditions resonance occurs with certain cable length next to the transformer. The author believes that probably the best solution will be to bridge the transformer primary with a spark gap in a low pressure gas atmosphere. Laboratory tests were made on six current transformers, with and without overvoltage protection.—*Bulletin de l'Association Suisse des Electriciens,* November, 1927.

## *Motors and Control*

*Starters for Squirrel Cage Motors.*—W. E. Rogers.—A device which permits the starting of squirrel cage induction motors without the use of compensators and which nullifies all possible objections of utility men in connection with the starting characteristics of the motor has been developed under the direction of the author. The underlying principle is an adaptation of the autotransformer starter for polyphase closed rotor motors, the main principle being to provide an infinitely variable choke at starting in each phase of the motor insuring perfect gradation in regard to current increments taken from the line by any appropriate motor, and proved by actual no load tests to be theoretically correct. The starter is provided with two adjustable damped overload trips, one in each phase, and a one-motion pendulum type of no-voltage attachment. The construction of this equipment is said to be such that operating errors may be eliminated from consideration.—*Electrician (England),* Jan. 13, 1928.

## *Traction*

*Operation and Performance of Mercury-Arc Rectifiers.* — Caesar Antonono.—Operating results and experiences obtained with the installation of mercury-arc rectifiers for direct current railway supply as used by the Chicago, North Shore & Milwaukee Railroad Company are outlined by the author. The factors considerd are efficiency, capacity to absorb momentary overload, insensibility to short circuits, lack of synchronizing characteristics, simplified operation and minimized attention, lack of noise and vibration, low maintenance cost, and reliability of service. In the opinion of the author, the mercury-arc rectifier has proved its value for such service, and it is anticipated that within ten or fifteen years a large application of such devices will be evident in the industry. While present costs are greater for the rectifier than for the converter, the increasing number of installations, and the co-operation of manufacturers and users in connection with the development work are foreseen as speeding up progress in this connection and producing a reduction of production costs. —*Journal of the American Institute of Electrical Engineers,* January, 1928.

## *Illumination*

*Airway and Airport Lighting.*—The illumination of landing fields and the installation of airway beacons on the Pacific Coast, under the supervision of the Department of Commerce, have been undertaken. The four types of beacons used and the details of the fixtures found to be desirable for this class of service are given. Emergency field lighting requires special devices, the requirements of which are outlined. Essential features are said to include beacons to indicate from a distance the location of the airport; an illuminated outline of landing fields; an indication of favorable approaches; indication of landing hazards; an arrangement to indicate by proper lighting values the height of buildings and structures so that the pilot may estimate how far he is above the ground; illuminated wind cone; good ground lighting; and a searchlight for use in foggy weather.—*Electrical West,* Jan. 1, 1928.

*Symposium on Office Lighting.*—The many factors involved in the satisfactory illumination of office space have been reviewed by several authors in this symposium of office lighting. The considerations have been developed under the various headings of indirect lighting, inclosed semi-indirect lighting, prismatic semi-indirect equipment, open type semi-indirect luminaries and direct lighting inclosing globe equipment. Photographic illustrations and charts indicate the comparative values of the several types mentioned. It is stated that an illuminating engineer of an electric service company will probably have occasion to recommend, for office lighting, every one of the types presented and that no one of them will be found preferable for all conditions.—*Transactions of the Illuminating Engineering Society,* January, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*Influence of Internal Vacua and Ionization on the Life of Paper-Insulated, High-Tension Cables.* — Alexander Smouroff and Leo Mashkileison.—As a result of investigations conducted by the high-voltage laboratory of the Electrotechnical Institute in Leningrad the authors have reached some interesting conclusions in connection with high-tension cables. The research was especially directed toward the influence of internal vacua and ionization and the life duration of paper-insulated, high-voltage cables and toward an investigation designed to clarify the conditions under which such vacua may occur. Three probable causes of the appearance of internal vacua are recognized as: Temperature changes after installation of the cable; residual deformations, and changes in chemical structure in the impregnating compound under the influence of ionized air. The object of the research was to clear up inadequate determinations concerning the formation of internal vacua and to ascertain the values more closely, as well as to investigate the life duration of the cable under the influence of such vacua. The authors suggest, as the result of this investigation, the use of chemically stable compounds, the arrangement of free ducts in the interior of the cable for air to maintain the atmospheric pressure at that point, the arrangement of free air ducts in the interior of the cable and in the splices for compensation of vacua, the pumping of dry air through ducts in the core of the cable to maintain pressure, or the filling of a cable with transformer oil forced under pressure at the splices of a cable.—*Journal American Institute of Electrical Engineering,* January, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*Pictures by Wireless.*—A. J. Smith. —A brief outline of recent developments in the transmission of pictures by wireless. The difficulties involved in telephotography are enumerated and the specific solutions developed for the elimination of these difficulties are reviewed. The equipment considered employs an annular photo-electric cell. The elimination of time-lag and the perfection of synchronization have been accomplished in the development of this apparatus. It is stated in conclusion that the equipment with which tests have been carried out and which would be used for overseas sending is a 20-kw. short wave transmitter and that the size of the picture would be a maximum of 4x8¾ in. The latest information available is stated to offer a reasonable speed of transmission of twenty seconds for an image measuring 4 in. x 4 in.—*Electrician (England),* Jan. 13, 1928.

## *Miscellaneous*

*The Deflection of Flat Pieces Fixed at the Circumference.*—H. Carrington. —The deflection of elastic materials circumferentially fixed has been investigated by the author both experimentally and mathematically. As a result of the information developed it is concluded that for circular elastic plates deflected by uniform pressure Poisson's theory ceases to be applicable because of the influence of strain upon the metal surface. This is of special significance in the case of thin plates where central deflections comparable to or greater than the thickness are possible without exceeding the elastic limit of the material. It is also probably of equal significance in some cases of the bending of thin curves, plates or shells. Prescott's approximate method for determining the central deflection gives results which agree very closely with those obtained in these experiments. If a plate is deflected by air pressure it was found that the influence of strain in the metal surface causes an increase in the frequencies of lateral vibration. This becomes marked as the ratio of central deflections to thickness increases. —*Engineering (England),* Jan. 13, 1928.

# Book Reviews

## *Steam Turbines*

By E. F. Church, Jr. McGraw-Hill Book Company: New York. 273 pages, illustrated. Price, $3.

A text for colleges covering briefly the details of modern steam turbines is a large undertaking, and even larger is an attempt to give a condensed treatment for text-book purposes. The author has called upon his teaching experience to make a very good presentation of his subject. He deals with turbine types and their characteristics, the flow of steam in nozzles, turbine blading, losses, efficiency and performance, governing, variable-load operation and design principles.

Good illustrations and problems at the end of each chapter help greatly to make the principles clear in the minds of the students. The treatment is fundamental and is held to basic principles and their application. Mathematics is used when and where needed to develop the theory and no attempt is made to give a thorough course in thermodynamics as part of the text. This should be a welcome text for juniors and seniors in American colleges.

## *Overhead Electric Power Transmission Engineering*

By William T. Taylor. London: Charles Griffin & Company, Ltd. 527 pages, illustrated.

A very great amount of time and labor has been spent by the author of this book in the compilation of data, the making of charts and the search for records in all parts of the world, in order to write an engineering treatise on transmission. His work covers economic, design, construction, operating and maintenance features associated with transmission lines. General developments in transmission and an evaluation of the factors included in transmission systems serve to lead into the more detailed chapters. Survey and location of line, conductor characteristics, stress, temperature and sag details, transmission telephone lines, steel-tower lines, wooden-pole lines, insulators, line erection, line protection, costs of lines and line operation are some of the topics treated in detail. Good photographs and a fine series of tables and charts make this book replete with definite material. It is not a mathematical or theoretical text; the author aimed to present a practical engineering treatment of the subject.

In many respects the book is written from the point of view of the English engineer, and some of the opinions given and some of the data presented would be modified by experiences in this country. But there are more transmission-line data of a practical character in this volume than in any other now available. Controversial opinions on methods of line protection and other matters do not obscure the value of the many very valuable data and many engineering opinions and experiences. American engineers can well afford to add this book to their transmission shelf.

## *Electrical Power Transmission*

Principles of Design and Performance. By E. A. Loew. New York: McGraw-Hill Book Company, Inc. 388 pages, illustrated. Price, $4.

Professor Loew has written a splendid text on transmission. It reflects a thorough knowledge of principles and a great amount of practical experience in line design. So much has been written on the subject that little that is new can be expected in the treatment of fundamental circuit equations. Differences in treatment are found largely in the degree of thoroughness, the arrangement of material and the balance or weight given to various elements. The letterpress is well arranged and is notable for its very direct mathematical approach to line problems. Hyperbolic functions for circuit equations and a thorough solution of the catenary for the line design are features of the book.

The first seven chapters discuss and develop the mathematical tools and the electrical circuit theory of transmission. Very little material is given to approximate solutions. In the last part of the book mechanical features of line design are developed, line economics are discussed and illustrative examples are used to make the material tangible. A good indication of the modern aspects of transmission is found in the chapter on power limits and stability of transmission systems. This chapter is an excellent résumé of the theory as at present developed. The book should be welcomed by many transmission engineers who desire basic information. It gives the mathematical tools to apply to rigid line analysis and design and shows how to use them to best advantage.

## *Regelung und Ausgleich in Dampfanlagen*

By Th. Stein. Berlin: Julius Springer. 389 pages, 240 illustrations.

The marked changes that have taken place in the layout of plants for the generation and utilization of steam, involving on the one side automatic control of fuel and air supply to meet changing conditions of load and on the other side the growing use of steam accumulators, as well as combinations of power, heating and process work, render a treatise that surveys the entire field of steam control most timely. The present volume combines, in good balance, practice and theory. It is an engineer's treatise, primarily designed, as the preface states, to present to the operator a unified view of the means whereby the steam supply is caused to adapt itself to the varying demands of the load. This calls for a consideration not only of the devices themselves, such as interlocking regulators, stokers, blowers, pulverized-fuel supply, throttling and reducing valves, but also of thermal and economic problems. The effect on plant efficiency of carrying short-time peaks on stored steam rather than by firing up additional boilers, the placing of a heat process between power stages, and the maintaining of closely regulated temperature in connection with chemical processes, are some of the topics treated. The heat engineer, whether his specialty lies in the field of design or of operation, will find much to interest him in this treatise on an important subject.

## Book Notes

TRADE ASSOCIATION ACTIVITIES. By Irving S. Paull, I. M. Millard and James S. Taylor. Washington, D. C.: United States Government Printing Office. 381 pages. Price, 75 cents.

An outline of the organization problems of trade associations and the way in which these are commonly met, the methods of financing association activities, the legal status of statistical activities, simplification and standardization in industry, public relations and co-operative advertising, trade relations and arbitration, traffic service, industry and public utilities, banking and insurance activities.

LES MOTEURS À COURANTS ALTERNATIFS. By L. Lagron. Paris: Librairie Scientifique Albert Blanchard. Paper, 429 pages, 211 illustrations and diagrams. Price, 25 francs.

This publication, No. 2 in the Nouvelle Encyclopédie Electromécanique, published under the direction of E. Pacoret, who, like the author, is a French electrical engineer of recognized standing, covers the theory, design, construction and application of synchronous and asynchronous alternating-current motors. Particular attention is bestowed upon polyphase and single-phase induction and repulsion motors. Among the fifteen chapters, liberally sprinkled with illustrations, diagrams and mathematical formulas, representative titles are: "Losses and Output of Induction Motors," "Heating of Induction Motors," "Starting and Speed Control of Polyphase Induction Motors," "Compensation in Alternating-Current Installations" and "Speed Control of Induction Motors by Means of Cascade Coupling."

MECHANICAL WORLD ELECTRICAL POCKET BOOK. Manchester, England: Emmott & Company. 338 pages, illustrated. Price, 1s. 6d. net.

This book contains electrical calculations in which the method of attacking various problems is set out in detail, various examples being given to elucidate the methods employed. Other sections deal with estimating for wiremen, and the use of electricity in textile mills. Various new tables are given on power consumption of electrical appliances, energy taken by electric motors, lead batteries and insulated copper conductors.

## Book Received

*Theorie der Wechselstromubertragung.* By Dr. Hans Grunholz. Berlin: Julius Springer. 218 pages, illustrated.

# News of the Industry

## Trade Body May Yet Be the Investigator

### Amendment to Substitute It for a Senatorial Committee in Utility Inquiry Has Chance—Muscle Shoals and Boulder Dam Pursue Their Uneven Tenor

By Paul Wooton
*Washington Correspondent of* Electrical World

As this is written, the Walsh resolution, proposing a searching investigation into the operation and financing of electric and gas utilities, is expected to come up momentarily on the floor of the Senate. An amendment will be offered by Senator George of Georgia providing that the Federal Trade Commission conduct the inquiry rather than a special committee of the Senate. The amendment is expected to prevail.

While the committee on interstate commerce amended the original Walsh resolution so as to confine it to companies engaged in interstate activities, it is recognized that under the amended measure the special committee would find it difficult to stay on its own wave length. There is a difference of opinion among the state public service commissions as to the desirability of an investigation such as would be authorized were the resolution, as amended, to pass. The fact that state lines are recognized in an emphatic way, resulting from the refusal of the interstate commerce committee to report favorably on the resolution originally submitted, is thought to be pleasing to all the state commissions, but some of them fear that an investigation, even of the type approved by the committee, will encroach upon state sovereignty.

The hearings before the interstate commerce committee have done much to allay the fear that an investigation will depress the price of securities. Such a good showing was made as to the fundamental value of these securities, and the case of Senator Walsh was revealed to be so circumstantial and indefinite, that there now is little apprehension, it is said, of any material depression of prices.

### Norris and Muscle Shoals

Four members of the Senate committee on agriculture voted against reporting favorably the resolution of Senator Norris providing for the completion of the government power plant at Muscle Shoals and for the sale of the power to the highest bidder, accruing revenues to be used for the construction of fertilizer plants, one of which is to be at Muscle Shoals; for the manufacture and distribution of fertilizer, and for experimentation with a view of cheapening the production costs of fertilizer materials. The dissenters were Senators Keyes of New Hampshire, Gould of Maine, Ransdell of Louisiana and Heflin of Alabama. It is certain that strong opposition will be encountered when the resolution reaches the floor of the Senate. The measure would be approved very generally were it not for a provision authorizing the Secretary of War to build transmission lines. Ostensibly this is for the purpose of placing the Secretary of War in a position where competitive bidding can be assured. Senator Norris, however, is suspected of wanting to build up a hydro commission in the Tennessee Valley, and it is feared by those who do not want to see the government in the power business that this might be the entering wedge. This opinion was strengthened when on Feb. 7 Senator Norris introduced an amendment to his resolution providing that the Secretary of War may contract with any state, county, municipality or other public or co-operative organization, not organized for profit, for the sale of electricity for a term not to exceed twenty-five years.

In reporting out the resolution the majority of the commission subscribes to the view that "it would be the height of folly and useless expenditure of public money to use the valuable power at Muscle Shoals for the operation of Nitrate Plant No. 2 in the production of fertilizer, when it is so clear that the same results can be obtained so much more economically and at so much less financial investment and expense by using the modern methods now known to the scientific world. Extraction of nitrogen from the air has reached such a point of development that power is but an incident in the process. In the erection of a plant cheap coking coal is of much more importance than cheap power."

After the ways had been greased for the prompt passage by the House of the Madden Muscle Shoals bill, the military affairs committee found itself unwilling to indorse the bill as submitted and, as this is written, no agreement on amendments is in sight. One member of the committee expresses the opinion that the committee will have to bring out a public operation bill.

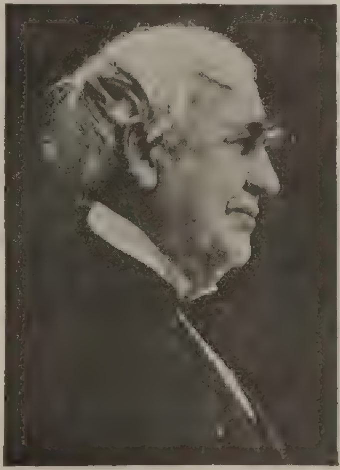
### Boulder Dam Bill in House

The House committee on irrigation and reclamation on Feb. 3 reported out the Swing Boulder Dam bill with the reservation that the report is not to be filed until March 15, in order to give the Colorado River commissions of the seven interested states a final opportunity to come to an agreement. It was learned that there were four members of the committee against the measure – Representatives Douglas of Arizona, Leatherwood of Utah, Allgood of Alabama and Winter of Wyoming.

Mr. Winter's vote was something of a surprise as the members of the committee had for the most part put him down as supporting the bill. Explaining his vote, Mr. Winter said that the measure does not allow the states sufficient time to effect a settlement between themselves. He added that he is fundamentally opposed to government ownership except as a last resort.

The members of the Federal Power Commission—the Secretary of War, the Secretary of the Interior and the Secretary of Agriculture—have addressed a communication to Representative James S. Parker, chairman of the House committee on interstate and foreign com-

## Edison Eighty-one Years Old



Today, Feb. 11, is the eighty-first anniversary of the birth of Thomas A. Edison. The inventor will spend it at his winter home in Fort Myers, Fla., where he has been for some time. He will therefore not be able to be present at the annual banquet of the Edison Pioneers, which, however, will be held as usual. It will take place at 12.30 p.m. at the Hotel Astor, New York. President William H. Meadowcroft will preside. A guest of honor will be "Chief" Isaac Krall, approaching his eighty-fifth year, an employee of the New York Edison Company, a long-time associate of Thomas A. Edison and one of the first chief engineers of the world-famous Pearl Street station.

merce, recommending favorable consideration of a bill to authorize additional employees for the commission. The letter asserts that when the commission was created in 1920 responsibilities many times greater than those connected with water power which had previously been placed upon the three executive departments were placed upon it, but that it was "given no personnel with which to perform its work. In consequence, it has been necessary for the commission to leave the greater part of its duties unperformed."

# William C. L. Eglin Dead

## Vice-President and Chief Engineer of Philadelphia Electric Company, Moving Spirit in Conowingo Development, Five-Time President of Franklin Institute

FATAL termination to the nervous ailment contracted by William C. L. Eglin, vice-president and chief engineer of the Philadelphia Electric Company, while on a cruise in the Caribbean Sea four weeks ago, of which illness note was made in the ELECTRICAL WORLD last week, came on Tuesday evening, Feb. 7, in Jefferson Hospital, Philadelphia, whither he had gone after a hurried trip from Cuba. His death removes one of the eminent electrical engineers of the nation and a man whose varied activities in connection both with the promotion of science and the extension of electrical service had brought him wide public recognition as well as professional eminence. Of recent years the outstanding part played by him in advocating and designing the great hydro-electric plant of the Philadelphia Electric Company, now well on its way to completion, had brought to him fresh distinction, and his election as president of Philadelphia's famous Franklin Institute for five consecutive terms had also added to his laurels.

William Charles Lawson Eglin was born in Glasgow, Scotland, on July 14, 1870, and was the son of a leather merchant. He was educated in the Andersonian University of Glasgow and at the West of Scotland Technological College. As a youth he assisted Rankin Kennedy in his early experimental work on alternating-current generators and transformers. He came to America in 1888 and in the following year went to work for the Edison Electric Light Company, one of the smaller companies that were combined in the 1890's to form the Philadelphia Electric Company. After the consolidation he remained with the latter, of which he was made electrical engineer, until his death. The amalgamation necessitated the standardizing of power-station equipment and distribution methods throughout the city in order to establish a unified and economic system, and all this work was designed and accomplished under Mr. Eglin's direction. The design successively of the five great steam-electric plants built by the company in the city and its environs was also his work, and about three years ago he turned with equal facility to planning the hydro-electric plant on the Susquehanna River, just across the Maryland border. The combined rating of the steam stations is now 575,000 kw., and to this next fall Conowingo will add 378,000 hp.

WILLIAM C. L. EGLIN

Mr. Eglin was made a vice-president of the Philadelphia Electric Company in 1922. Besides his work as chief executive engineer in charge of the company's engineering and operating departments, he took an active part in all matters relating to the company's progress and gave especial attention to the various educational and beneficial organizations within the ranks of the employees. Mr. Eglin also contributed to the proceedings of the Association of Edison Illuminating Companies and of the American Institute of Electrical Engineers. He was a fellow of the Institute and had served both as a manager and as a vice-president. In the National Electric Light Association he occupied successively the offices of secretary and treasurer, second vice-president and president. During his term as president (1908-1909) the membership more than doubled. The establishment of company sections was effected in his administration, and he remained until his death closely identified with the policies of the association.

In 1890 Mr. Eglin served at the International Engineering Congress held in Paris as the representative of the Engineers' Club of Philadelphia and the Franklin Institute. He was first elected president of the Franklin Institute for 1924. He was the author of a number of engineering papers and reports—notably on the steam turbine—and of a lecture, "The Power Company and the Distribution of Electrical Energy," which he delivered before the undergraduates of various colleges as a means of drawing their attention to electrical engineering as a vocation. He also made an intimate study of the relations that should prevail between the employees of the industry and their employing companies, and in a paper, "The Personnel of the Industry," presented before the 1919 convention of the Association of Edison Illuminating Companies, he offered, as the logical and rational solution of this problem, a carefully designed plan of education and advancement that would be applicable to all grades of men in the industry.

The University of Pennsylvania, Swarthmore College and other institutions had conferred honorary doctor's degrees upon him. Besides the technical associations already alluded to, he was an associate member of the Edison Pioneers and a member of the Illuminating Engineering Society, the American Electrochemical Society and many social, scientific, business and fraternal bodies. Mr. Eglin was unmarried.

Funeral services were to be held on Friday afternoon at the Woodland Presbyterian Church, Philadelphia.

# Water-Power Jurisdiction to Canadian High Court

## *Its Dictum and United States Views Awaited at Ottawa Before Taking Up St. Lawrence Question—Quebec and Ontario Hydro Resources*

PREMIER KING of Canada made it clear at Ottawa when the Canadian Parliament opened that negotiations with the United States over the St. Lawrence deep waterway and power development project will not be hurried. The Premier announced also that the question between federal and provincial jurisdiction over water-power rights had been referred to the Supreme Court of Canada. Seven questions covering the whole field respecting both power and navigation are included in the agenda with which the court will have to deal. One of the principal questions is: Has the Dominion exclusive legislative control over the proprietary interest in water powers brought into being by works authorized by Parliament to be erected in an international stream for purposes of carrying out an agreement between Canada and any foreign country looking to the erection of joint works for the improvement of navigation in such stream? If not, what are the powers and rights of the province with regard to such water powers?

It was stated further by the Prime Minister that a dispatch was to be sent to Washington to ascertain the view of the United States government on certain phases of the project, and that until the views of that government had been received it would be impossible for the Canadian government to say whether or not negotiations were going to be possible for the construction of the international waterway. In the meantime the relative situation of Ontario and Quebec in respect to power development is receiving a good deal of consideration in the capital. An examination of the reports of the engineers concerning the St. Lawrence shows Ontario to be in a position of inferiority when compared with Quebec on the basis of hydro-electric power resources. The total potential power available in Quebec is very much greater than that available in central Ontario, leaving aside those powers which are too far north to be of any practical immediate interest. The view, therefore, persists that Ontario will be obliged to look to Quebec for future supplies of power.

Ontario's attitude, however, is that no power shortage whatever is feared, and the twentieth annual report of the Hydro-Electric Power Commission strikes this optimistic note. The report shows that progress during the last fiscal year, ended Oct. 31, 1927, was in no respect inferior to that of former years. Since 1908, when the first supply of electricity was obtained for the use of the co-operating municipalities of the Niagara system, demands for power have so increased that at the end of October last the power supplied by the commission aggregated 949,700 hp. In spite of this, the commission expresses confidence that sufficient power will be available from developments within the province to meet demands for some years to come. The commission has in mind the exploitation of several important undeveloped sites on the Ottawa.

A bill to regulate the exportation of electric power has had its first reading in the Canadian House of Commons. Its object is to amend the present law, which provides that licenses for the export of electric power are to be issued by the Governor-in-Council. Under the bill just introduced licenses can issue only by authority of Parliament and on the terms which Parliament lays down. Nothing in the bill in any way affects the rights of the provinces.

## New England Engineers Meet

With a registration of 150, the Engineering Section of the New England Division of the N.E.L.A. met at Boston, on Feb. 7-9 to discuss current problems and visit plants and factories in the metropolitan district. T. H. Haines, chairman of the section, presided. Among the leading topics and speakers on the program were: "Modern Street Lighting Practice," presented by engineers from the General Electric and Westinghouse companies; "Flood Conditions in New England," S. S. Kent and H. B. Kinnison; "Totalizing and Remote Metering," Harry S. Baker, Hydro-Electric Power Commission of Ontario, and "Obtaining Maximum Steam-Plant Capacity," Vern E. Alden, Stone & Webster, Boston. A. H. Kehoe, chairman national electrical apparatus committee, was to speak at luncheon Wednesday.

## Michael I. Pupin Honored by Technicians

*Western Society of Engineers and the Four Founder Societies Confer Washington Award for Advancement of Human Progress Through Engineering*

IN RECOGNITION of his eminent service in advancing human progress through engineering the Washington Award was tendered to Dr. Michael I. Pupin, professor of electromechanics at Columbia University and former president of the American Institute of Electrical Engineers. at a brilliant dinner given in his honor at the Palmer House, Chicago, on Feb. 2. Nearly five hundred scientists and engineers attended the presentation of the award, which was founded by John Watson Alvord and is administered by the Western Society of Engineers on the recommendation of a commission representing this and the four founder societies—civil, mining, mechanical and electrical.

*"P. & A. Photo."*

DR. PUPIN RECEIVES AWARD FROM R. F. SCHUCHARDT

In the presentation speech R. F. Schuchardt, Commonwealth Edison Company, official nominee for president of the A.I.E.E. and chairman of the Washington Award commission, paid high tribute to Dr. Pupin as scientist, inventor and teacher, telling how he came to America as an immigrant boy more than fifty years ago and worked his way through Columbia University. "Great as have been Dr. Pupin's attainments in the scientific world," said Mr. Schuchardt, "of equal importance is his literary ability. One of his most outstanding accomplishments is that revealing book 'From Immigrant to Inventor.'"

Major Rufus W. Putnam, president of the Western Society of Engineers, told of the founding of the award in 1916 and named the six men who had previously received it, these being Herbert Hoover, Robert W. Hunt, Arthur N. Talbot, Jonas W. Smith, John W. Alvord and Orville Wright.

Greetings and addresses of appreciation dealing with Dr. Pupin's achievements were delivered by Dr. A. N. Talbot, past-president of the American Society of Civil Engineers; Dr. William Kelly, past-president of the American Institute of Mining and Metallurgical Engineers; John L. Harrington, past-president of the American Society of Mechanical Engineers, and Bancroft Gherardi, president of the American Institute of Electrical Engineers and vice-president and chief engineer of the American Telephone & Telegraph Company. Mr. Gherardi dwelt on Dr. Pupin's development of the loaded telephone circuit, which permitted the use of cables for long-distance telephony and without which the present nation-wide system of communication would have been impossible. Among his other important electrical inventions and developments have been the radio-tuned circuit, rectification of alternating current and X-ray photography. Prof. Arthur Compton, Nobel prize winner last year, spoke for President Max Mason of the University of Chicago.

Dr. Pupin received an ovation as he rose to voice his thanks in his inimitable manner. "I accept this award," he said, "in the hope that it eventually will find its way to the Belgrade Museum, to show Serbian youth that they can come to this country and by their own efforts earn the appreciation and approval of its most distinguished citizens." He said that long-distance telephony "has transformed Chicago and New York into one community" and foresaw in it a factor for world peace, because nothing is so conducive to friendship as thought expressed by the living voice.

## Northwest Inspectors Listen and Deliberate

Continuing its deliberations at Seattle on Friday and Saturday, Jan. 27 and 28, the third annual convention of the Northwest Association of Electrical Inspectors, whose first day's events were reported last week (page 268), listened to well-known speakers and heard and discussed committee reports. H. B. Kirkland, Society for Electrical Development, New York, discussed the uniform electrical ordinance; John A. Laing, vice-president Pacific Power & Light Company, Portland, touched on inspection from the standpoint of operating companies; a cure for the fuse-abuse problem was suggested by L. W. Going, chief electrical inspector of Portland, while his associate, J. C. Caine, made a plea for municipal control of electrical equipment; F. W. Carlson, Seattle manager of the Crouse-Hinds Company, read a paper on grounding written by S. W. Borden, grounding engineer of that company, and C. W. Charlton, engineer Electrical Products Corporation, Seattle, gave a technical description of neon signs.

Committee reports brought out a number of points on which the Northwest association desired to make recommendations to the electrical committee of the N.F.P.A. covering revision of the National Electrical Code. At the banquet on Friday night W. D. Shannon, general superintendent at Seattle for Stone & Webster, spoke. H. A. Patton was elected president and T. W. Carlon vice-president.

# Purchases and Mergers

*New England Power Association Takes Over Lowell Electric Light Corporation—Consolidation Planned in Cincinnati—New England Public Service Still Buying*

ACQUISITION of the Lowell (Mass.) Electric Light Corporation by the New England Power Association took place at a stockholders' meeting held last week in Boston. John A. Hunnewell, for the past twenty-two years manager of the company, has been elected president and will sever his connection with the organization of Stone & Webster, Inc., which has been executive manager of the company for about 30 years. The following directors have been elected: F. C. Church, J. C. Reilly, E. J. Gilmore, C. B. Stevens, C. M. Runels, E. B. Carney, J. A. Gagnon, H. I. Harriman, Philip Young, C. W. Rice and Philip Spaulding. Carl S. Herrmann of the New England Power Association has been elected treasurer. Under the new arrangement the Perry Street steam generating station of the Lowell company will be interconnected with the transmission system of the New England Power Company through a substation at Wamesit. The Perry Street station has a rating of 35,400 kw.

Charles D. Jones, president of the Cincinnati Gas & Electric Company, is quoted as admitting that his company has plans to unite the Cincinnati Gas & Electric, Columbia Power and Union Gas & Electric companies under the name of the Cincinnati Gas & Electric Corporation. Stockholders of the merged companies are to receive share for share of their stock in exchange for 5 per cent preferred stock of the new company. Cincinnati Gas and Union Gas are now under 99-year lease to the Columbia Power, but under the present plan the new company is to take over actual ownership of all three properties, according to Mr. Jones.

The New England Public Service Company has purchased the Tilton (N. H.) Electric Light & Power Company at a reported price of $900,000. The company owns a power plant on the Winnipesaukee River and a transmission line is being built to connect it with the Public Service plant on Lake Winnisquam. It is predicted that the Hill Light & Power Company, operating between Franklin and Bristol, will also be acquired by the New England Public Service Company.

No step to comply with the statute requiring the approval of the North Dakota Railroad Board for all public utility mergers and consolidations has been taken by the Hughes Electric Company of Bismarck and the Northern Power & Light Company of Mobridge, S. D., Frank Milhollan, president of the board, asserts. An announcement by E. A. Hughes, reported Jan. 28 (page 220), said that the consolidation had been arranged. Mr. Milhollan points out that the merger will not be legal without the approval of the board.

The Otter Tail Power Company has purchased the electric plants and transmission lines at Garfield and Brandon, Minn. At an election held at Brandon the proposal to sell was carried by a vote of 56 to 1.

The People's Power Company of Moline, Ill., has secured an option on the Rock River Valley Light & Power Company of Hillsdale, Ill., which has a power line running to Silvis.

Sale of the municipal electric plant at Willacoochee, Ga., to Naumann, Hall & Burrus, who recently bought the plant at Alma, Ga., is reported.

Lease for 22 years of the Bell Island power plant of the Oklahoma Railway Company by the Oklahoma Gas & Electric Company is announced by the latter. The lease includes three 33,000-volt transmission lines to Norman, Guthrie and El Reno, Okla.

Consolidation of the street railway companies in Washington, D. C.—the Capital Traction Company, the Washington Rapid Transit Company and the Washington Railway & Electric Company—is thought to be imminent. The last named controls the Potomac Electric Power Company and the Braddock Light & Power Company.

# "Electrical World's" London Letter

## National Electric Week—Interconnecting "Grid" Contract Placed—Electricity Commissioners' Report—Radio Versus Submarine Cables—Industrial Developments

By Bernard C. Holding
Editor of *The Electrician*

London, Feb. 1, 1928.

DECEMBER was a month more than usually full of important electrical happenings. It saw the successful completion of the first National Electric Week to be organized in this country, and it also saw the placing of the contract for the first portion of the national interconnected transmission network and the issue of the annual report of the Electricity Commissioners.

Of the actual results of the National Electric Week it is at this writing too early to speak authoritatively, but there is pretty general agreement that the effort was well worth while, and there is a widespread desire for the arrangement of a similar event next year.

The contract referred to, which is worth approximately $2,000,000 and which has been let to British Insulated Cables, Ltd., is for material required for the Central Scotland Electricity Scheme and calls for the supply of 29 route miles of double-circuit and 199 route miles of single-circuit overhead transmission lines, about 1,500 steel towers and 1,000 miles of aluminum-steel conductors and earth wires.

As was only to be expected, the Electricity Commissioners' report reflects the adverse effect of the 1926 coal strike upon both output and operating results of British supply undertakings, and while the total units generated (8,365,857,198 kw.-hr.) shows an actual increase in output, the rate of growth fell much below the figures attained in preceding years. The actual increase over the year 1925-6 was less than 3 per cent, and instead of the increased output involving a smaller pro-rata increase in fuel consumption, as in former years, the amount of coal (8,493,810 tons) and coke (217,217 tons) consumed was upward of 3 per cent greater than in the preceding year. This was largely due to the inferior quality and unsuitable character of much of the coal available in the abnormal circumstances. The strike was also largely responsible for an increase in the fuel-oil consumption from 38,810 tons to 145,911 tons. Since 1921 there has been an increase of 61.9 per cent in the generation of electricity, while sales show an increase of 57 per cent over 1922. The announcement of the government's policy with regard to the centralization of generation and the introduction of the electricity (supply) bill in March, 1926, had no noticeable influence in causing a deferment of application for consent to the establishment of new, or the extension of existing, generating stations. There was a big increase in generating plant sanctioned, the figure rising from 585,700 kw. to 775,604 kw., mainly for use in new stations. A remarkable increase in loans sanctioned for local authorities made up a record total of $76,907,170, which sum included $1,330,610 for wiring installations for consumers' premises and $674,075 for the purchase of domestic apparatus and appliances to be let out on hire.

The effect of present and prospective competition between the rapidly growing beam wireless services and the submarine cables have excited considerable discussion following reports that the cable companies were seeking government assistance in bringing about a plan for co-operation between the rival means of communication. The difficulty of evolving such a plan is enhanced by the justifiable refusal of the radio interests to be associated with any scheme which would prevent the free development of the newer method. Meanwhile there is considerable activity in the cable world. In December the steamship *Colonia* left the Thames to lay two new cables for the Eastern Telegraph Company between Alexandria and Port Said. The scheme of which this forms a part will enable regenerative working to be carried on between London and India and places further east. Another cable is being laid between Larnaca, Cyprus, and Haifa, Palestine, and work is progressing on the new Le Havre-Newfoundland cable. The first section going direct to Newfoundland will be 2,500 miles long, and a further section of 1,250 miles is to be laid between Newfoundland and New York.

Industrial developments of the month include the first commercial application in Sheffield steel works of a high-frequency induction furnace for the manufacture of high-grade tool steel and the introduction by the British Thomson-Houston Company of a new design of 110,000-volt potential transformer, in which size and weight are reduced very considerably. The General Electric Company has completed the electrical equipment of the *Bermuda*, a 20,000-ton luxury ship which will sail between New York and the Bermuda Islands. This vessel carries a more comprehensive electrical equipment than almost any other ship afloat.

Trade generally continues to improve, and exports of electrical goods during the eleven months to the end of November totaled $85,599,460, an increase of $3,242,975 over the corresponding period of 1926. The balance of exports over imports during that period was $59,292,765.

## Program Ready for Midwest Power Conference

Opening sessions of the third annual Midwest Power Conference, to be held at the Stevens Hotel, Chicago, begin on Tuesday morning, Feb. 14, when Sewell Avery, president of the Commercial Club of Chicago; Major Rufus Putnam and Glenn Frank, president of the University of Wisconsin, will make addresses, Mr. Frank taking as his subject "Power, the Background of Today's Civilization." Under the head of "Power Accomplishments in Factory and Home," the afternoon session will hear W. A. Durgin, Commonwealth Edison Company; Mrs. J. D. Sherman, president of the General Federation of Women's Clubs, and Burke Corcoran, Electrical Association of Chicago.

The two sessions on Wednesday have been given over to the general subject of "The Relation of Power Development to Flood Control and Other River Problems." General Edgar Jadwin, Major G. E. Edgerton, D. W. Mead of Madison, Wis.; Colonel William Kelly, Major L. H. Watkins, E. A. Forward of Montreal, and H. A. Hagemann of Stone & Webster will speak.

Thursday morning's session will be devoted to the general subject of "Economics of Power Stations." Alex Dow, president Detroit Edison Company, will open the discussion, his topic being "Capital Costs with Relation to Economy of Central Stations." G. A. Orrok, New York City, will talk on "High-Pressure Operation" and Thomas E. Murray, New York, on "Trend and Development in Steam Generation." A luncheon symposium will follow, at which H. B. Gear, Commonwealth Edison Company, will speak on "Power Transmission by High-Voltage Cables"; H. W. Eales, H. M. Byllesby & Company, on "Overhead Transmission"; A. C. Montieth, Westinghouse Electric & Manufacturing Company, on "Developments in Apparatus for Power Transmission Systems," and W. S. Clark, General Electric Company, on "Causes of Failure in Impregnated Paper-Insulated, Lead-Sheathed Cables."

"Economics of Power Station Problems" will be the topic for the Friday morning session, with the following speakers: T. A. Peebles of the Hagan Corporation, J. F. Shadgen of the Smoot Engineering Company, Edward Brown of the Allis-Chalmers company, and S. W. Parr and F. C. Straub of the University of Illinois.

## Fall River Electric Service Survives Great Fire

Electric light and power service came little impaired through a conflagration involving the loss of many millions of dollars at Fall River, Mass., on Thursday night of last week, when the center of the city was swept by one of the worst fires in its history and more than a hundred business buildings were destroyed. To a representative of the ELECTRICAL WORLD President Roy F. Whitney of the Fall River Electric Light Company stated on Friday that virtually all the circuits supplying the retail business district are of the underground type and that the company was fortunate enough to escape with a comparatively small loss, confined largely to meters, services and switching equipment in stores, banks and hotels. Many manholes were flooded, but transformers installed underground had given little or no trouble up to Friday afternoon. No residences were destroyed, and service was maintained throughout the fire to all parts of the territory except where falling walls destroyed street lamps or where it was necessary to open service switches in buildings as the fire attacked them. All employees escaped injury.

STREET LAMPS BURNED UNTIL THE WALLS FELL

The company's main offices were evacuated Thursday evening, and all important records were transferred in about an hour by motor truck to the Montaup generating station on the Somerset side of Mount Hope Bay. These were returned on Friday. No active mill load was lost, and the company was prepared on Friday evening to serve any customer desiring service in the burned area. Generating and substations escaped damage. The Western Union and Postal Telegraph offices were burned out and the local exchange of the New England Telephone Company was evacuated from 11 p.m. to 7 a.m., owing to the destruction of adjacent buildings.

## A.I.E.E. at New York and St. Louis

*Everything in Readiness for Winter Convention Next Week—Program of Regional Meeting in the Missouri City in Early March*

PROMISED demonstrations of transatlantic telephony by exchange of greetings with the Institution of Electrical Engineers, the British body which will meet in London simultaneously with the winter convention of the American Institute of Electrical Engineers in New York; lectures by Dr. W. F. G. Swann of the Bartol Research Foundation of the Franklin Institute and Dr. Harold Norinda of Sweden; presentation of the John Fritz medal to John J. Carty and the Edison medal to Dr. W. D. Coolidge, in addition to the excellent technical program and the customary entertainment features and inspection trips, have attracted interest even greater than usual to the A.I.E.E. gathering just referred to, which will be held in the Engineering Societies Building next week from Monday to Friday. A full notice and program of this event were printed on page 167 of the Jan. 21 ELECTRICAL WORLD.

For the regional meeting to be held by the Southwestern District at St. Louis on March 7-9 in the Hotel Coronado four technical sessions will take up respectively electrical machinery, power systems (two sessions) and communication, four papers being allotted to each session, as follows:

### WEDNESDAY, MARCH 7

*Morning.*—Branch conference and students' technical session.

*Afternoon.*—Addresses by Vice-president A. E. Bettis and President Bancroft Gherardi; Electrical Machinery; "Magnetic Leakage and Fringing-Flux Calculations," W. L. Upson and E. L. Furth, Washington University; "Squirrel-Cage Motors with Split Rings," H. Weichsel, Wagner Electric Corporation; "Electric Equipment for Oil and Gas Locomotives," A. H. Candee, Westinghouse Electric & Manufacturing Company; "The Squirrel-Cage Motor," J. L. Hamilton, Century Electric Company.

*Evening.*—Lecture, "Lightning," F. W. Peek, Jr., General Electric Company; entertainment.

### THURSDAY, MARCH 8

*Morning.*—Power Systems ("A"): "The Public Utility Laboratory and Its Relation to Service." G. E. Meredith and D. D. Clark, Kansas City Power & Light Company; "Recent Developments in the Application of Demand-Metering Equipment," Stanley Stokes and Leslie V. Nelson, Union Electric Light & Power Company; "Excitation Systems—Their Influence on Short-Circuit and Maximum Power," R. E. Doherty, General Electric; "Voltage Regulators," R. M. Carothers and C. A. Nickle, General Electric.

*Afternoon.*—Inspection trips.

*Evening.*—Dinner-dance.

### FRIDAY, MARCH 9

*Morning.*—Power Systems ("B"): "Development of Impedance Relays," H. A. McLaughlin and E. O. Erickson, Westinghouse; "Automatic Switching of Incoming Lines and Transformers Supplying Power to Alternating-Current Substations," E. A. Anderson, General Electric; "Quantitative Mechanical Analysis for Power-System Transient Disturbances," R. C. Bergvall and P. H. Robinson, Westinghouse; "Vibration of Transmission-Line Conductors," Theodore Varney, Aluminum Company of America.

*Afternoon.*—Communication: "Vector Calculating Devices," M. P. Weinbach, University of Missouri; "Planning Telephone Exchange Plants," W. B. Stephenson, Southwestern Bell Telephone Company;

"Tuned Radio-Frequency Amplifiers," Prof. R. S. Glasgow, Washington University; lecture, "Television," H. E. Ives, Bell Telephone Laboratories.

## Power Situation in Canada as Year Begins

*Premier of Quebec and Dominion Minister of the Interior Summarize Progress — Saskatchewan's First High-Tension Line—English River Development*

PREMIER TASCHEREAU of Quebec in a New Year message recently made a summary of the progress of electrical power in that province in which he spoke of the 450,000 hp. already installed at Ile Maligne, which will in the near future reach 540,000 hp.; of the 368,000 hp. now within sight, eventually to reach 572,000 hp., at the three Gatineau River developments, and of other water-power plants now operating or under way.

Charles Stewart, Canadian Minister of the Interior, in announcing an increase of 221,000 hp. in the whole Dominion in 1927, bringing the total installation to nearly 4,800,000 hp., to which 378,000 hp. will be added in the next six months and 2,000,000 hp. in the next three years, refers specially to the contemplated 800,000-hp. development of the Alcoa Power Company at Chute à Caron, on the Saguenay, mentioning also the 65,000-hp. plant built by the Montreal Island Power Company on the Rivière des Prairies, the addition of two 10,000-hp. units to the Canada Northern Power Company's plant on the Quinze River, to be ready July 28, and the addition of unit No. 11 of 45,000 hp. to the Duke-Price development on the Saguenay River.

Among the larger Ontario achievements were construction at Alexander Landing of a 54,000-hp. plant to serve Port Arthur and Fort William, the 56,250-hp. plant of the Spruce Falls Company on the Mattagami River, and the International Nickel Company's 28,200-hp. plant on the Spanish River. Actual installation during the year included two plants at Sturgeon Falls and Moose Lake in western Ontario

In New Brunswick the St. John Power Company continued its development of 80,000 hp. at Grand Falls, and the New Brunswick Electric Power Commission extended the transmission lines in its Musquash development to the extent of 65 miles.

It is reported that the Bathurst Pulp & Paper Company is planning for the erection of a 50,000-hp. hydro-electric plant on the Nepisiquit River, with which will be coupled the erection of a new 200-ton newsprint mill. The Power Corporation of Canada is to make a study of the company's power holdings.

In Nova Scotia the Nova Scotia Power Commission completed the construction of the 5,000-hp. Sandy Lake development on St. Margaret's Bay.

The Manitoba Power Company completed the superstructure of its Great Falls plant on the Winnipeg River. News also comes that a tentative agreement, subject to the approval of the three governments interested, has been reached by representatives of the Dominion, Ontario and Manitoba with respect to the proposal to build the Lac Seul Dam in order to make possible a power development on the English River. The agreement will provide for the joint erection of a dam by the Dominion and Ontario upon a cost basis proportionate to the power benefits derived. Engineering surveys have indicated that two-fifths of the power possibilities of the English River, or some 212,000 hp., lie on the Ontario side, while the rest lies in Manitoba. No development has as yet been undertaken on the Ontario section of the river, but work has been done in Manitoba.

George Spence, Minister of Railways in the Province of Saskatchewan, recently lifted the lever that energized the first important high-tension line in that province and sent electrical energy from the city of Regina to a number of nearby towns and villages. The transmission line is 32 miles long with a voltage rating of 13,200. It was so constructed as to be able to stand up under 66,000 volts to provide for future development. Next spring two new lines will be built, one north and one south from Qu'Appelle, and officials are hopeful of having at least 175 miles of lines carrying electrical energy to points in the eastern section of Saskatchewan.

Active consolidations of small light and power companies all over the Canadian Western provinces marked the close of 1927. Interest centers in the new plan of locating large central-power plants in those sections of the prairies where the cheap varieties of soft coal are present in quantities. In Saskatchewan and Alberta coal fields five such central plants are either in operation or under construction. Most of these consolidations have been promoted by the International Utilities Corporation, operating under the Midwest Utilities Company, of which C. J. Yorath of Edmonton, Alberta, is president. The latest acquisition of this combination is the Union Power Company of the Drumheller Valley, in southern Alberta.

In British Columbia the Bridge River Power Company carried on extensive preparatory work in connection with a 500,000-hp. project.

## Operators' Convention Draws Crowd

### Cedar Rapids Meeting of Iowa Section, N.E.L.A., Demonstrates Interest in Commercial and Distribution Problems Which Arise Daily and Affect Public Relations

PROBLEMS encountered in the sale of energy and merchandise and in the distribution of energy occupied the attention of the Iowa Section of the National Electric Light Association at its annual meeting, held at Cedar Rapids on Feb. 2 and 3. This convention, the second in which the Iowa Section has tried the experiment of confining interest to sales and operating matters, demonstrated again the wisdom of the idea. It proved a successful attempt to bring the commercial and distribution men of the state together. Three hundred and fifty men were registered and each one was ready not only to absorb the information offered to him but to discuss and criticise it because it was concerned directly with the problems he ran into daily.

The first session of the convention was general and was presided over by Ray Ingham, chairman of the convention committee. Addresses by C. O. Loftus, Mayor of Cedar Rapids; George A. Neal of the Iowa Light, Heat & Power Company, S. C. Dows of the Iowa Railway & Light Corporation, Don M. Stearns of the Central Iowa Power & Light Company, C. A. Leland of the Des Moines Electric Light Company and Thorne Brown, managing director of the Middle West Division, N.E.L.A., brought home to the auditors the magnitude of their industry, the local effects and causes in the national picture and the never-decreasing importance of good public relations. In a keynote speech by C. A. Leland the indissoluble link between commercial effort and advances in the electrical art was exposed. Improvements in operating practice and equipment are vain if the energy is not sold, Mr. Leland insisted, and selling effort is pointless unless the energy can be delivered more and more cheaply.

Domestic lighting, methods for raising illumination levels, refixturing and lamp sales were features of the first meeting of the commercial men. Progress in artificial lighting in the home was described by E. W. Commery, and selling industrial and commercial lighting was discussed by L. V. James, both of the National Lamp Works. Methods of refixturing in cities and in small towns were discussed by E. J. Otterbein of the People's Light Company and A. C. Jones of the Iowa Public Service Company respectively. These papers drove home the thought that refixturing was a worth-while but difficult job and that results are achieved only by continuous application over long periods. The stimulation of lamp sales by employee campaigns and direct-by-mail selling was illustrated by the results of such efforts as presented by Ira Steele of the Des Moines Electric Light Company and H. D. McKeever of the People's Gas & Electric Company.

On the second day, with C. A. Nash in the chair, there was round-table discussion on electric refrigeration sales methods. A point brought out and generally agreed upon was that there is a distinct trend away from remote to self-contained units in domestic demand. Changes in methods of selling, based upon an easier public acceptance of the idea of electric refrigeration, were discussed. William Dannehauer of the Edison Electric Appliance Company explained range-selling practices that have been successfully used. The nature and the sales possibilities of electrical equipment for the farm and farm home were treated in an admirable paper by Frank D. Paine, professor of electrical engineering at Ames College. Mr. Paine presented the equipments in the order of their preference by the farmers and gave the load characteristics of each from actual use and test. The utilization of sales helps furnished by manufacturers and the tangible results secured therefrom were the subject of a talk by A. W. Grove of the Edison Electric Appliance Company. A. W. Gucker of the Iowa Public Service Company presented a capable analysis of merchandise sales organizations covering compensation, bonuses, prizes and quotas. The commercial meetings were closed with a general discussion on the sales and use of laundry equipment.

The sessions of the distribution men, parallel with those of the commercial men, were devoted to explanations of practices and methods applicable to daily operation. The distribution line best suited to farm service was the subject of a paper by E. M. Ruede of the Citizens' Gas & Electric Company. Concrete example was furnished by a completely equipped pole top set up in the room. J. M. Drabelle of the Iowa Railway & Light Corporation gave, out of his long experience, an excellent address on the handling and installation of transformers and transformer protective equipment. Operation and regulation of transmission lines were covered by E. A. Wisco of the Interstate Power Company. H. H. Carl of the Northwestern Bell Telephone Company presented a detailed analysis of the general problem of inductive co-ordination. Accident prevention in electric utilities was the subject of a fine paper by K. R. MacKinnon of the Nebraska Power Company. Mr. MacKinnon suggested the setting up of a "bogey" at which the work of accident prevention in individual companies could be aimed.

Radio problems affecting electric utilities were covered in two papers, one by F. E. St. Austell, president of the Iowa Radio Listeners' League, on the aims and possibilities of the league, and the other by J. O. Smith, Radio Corporation of America, on common causes of radio interference. Foss C. Hush of the Iowa-Nebraska Light & Power Company talked on equipment and problems of the meter department.

The use by distribution men of Bulletin No. 10 of the National Electrical Safety Code and of the "Overhead Systems Reference Book" was discussed and explained by A. B. Campbell of N.E.L.A. headquarters. A. O. Austin of the Ohio Brass Company described recent tests and results obtained in high-voltage investigations of distribution and transmission line material. The meetings of the distribution men were closed with a symposium on high-voltage live-line maintenance.

## Briefer News

Kansas Gas & Electric Company to Expend $3,000,000 on Extensions and Improvements.—Approval of a general expansion and improvement plan entailing the expenditure of $3,000,000 was granted by stockholders of the Kansas Gas & Electric Company at a meeting held in Wichita last week, according to L. O. Ripley, vice-president of the company. Details of the program have not yet been made.

Broadway Has Sign Consuming 283 Kw.—An electric advertisement of the Dodge automobile — the most brilliant and largest in structural dimensions on Broadway, New York, according to the General Outdoor Advertising Company—was illuminated last week at a dinner of the Broadway Association. The sign, on the roof of the Strand Theatre building, has 5,500 sq.ft. of space, is half a block long, five stories high, and its 8,115 lamps represent a load of 282,855 watts, which is asserted to be the largest consumption by any electrical sign on the "Great White Way." Twenty miles of wire are utilized in the sign, which embodies new principles of illuminating reflectors and construction of the moving message, or motograph, in operation at the foot of the structure.

Emergency Connection for Aurora, Ill.—The Western United Gas & Electric Company is planning connection of its Aurora (Ill.) power house with a 134-kv. line of the Public Service Company of Illinois, according to Fred Pierce, superintendent, and right-of-way between Waukegan and Joliet is being obtained. The emergency line will connect with the Waukegan line at Electric Junction.

First Unit at Avon Park, Fla., Is Ready.—The first 15,000-kw. unit of the Florida Public Service Company's steam-electric generating station at Avon Park has been completed. The new plant, which is similar to that at Benson Springs, Fla., placed in operation about a year ago, is interconnected with the other steam stations of the system and with those of other operating companies, thereby insuring uniform and continuous service throughout the Florida territory of the General Gas & Electric Company, the parent concern.

United Newsprint Companies in Canada Own 500,000 Potential Hydro Horsepower.—The recent Abitibi-Spanish River and associated newsprint companies merger in Canada places the new company in the category of a large holder of water-power sites. The total installed capacity of its water powers is 190,000 hp., but undeveloped water sites indicate a total capacity of 500,000 hp.

Good-Will Convention Drew Many to Okmulgee.—The first of a series of good-will conventions to be held in various sections of Oklahoma by the Public Relations Division of the Oklahoma Utilities Association was held in Okmulgee on Feb. 1. About 75 representatives of utility companies and municipal water departments attended the business sessions, and 250 citizens and public officials the evening banquet, with Mayor Dan Kenan of Okmulgee as toastmaster.

New Orleans' Coming Electrical Show.—Exhibits at the state-wide electrical exposition to be given at the Delgado Trades School in New Orleans during the week of March 5-10 under the auspices of the Electrical League of New Orleans, with W. E. Clement, general manager commercial department New Orleans Public Service, Inc., as chairman, will include a complete miniature model farm and a model airport. A large proportion of the floor space has already been assigned.

St. Louis Going Ahead with Its Street Lighting Program. — Mayor Miller of St. Louis has signed a measure which authorizes the expenditure of $2,250,000 for a downtown lighting system, which it is hoped to complete by next December. After this appropriation shall have been spent there will be only $859,000 left of the $8,000,000 voted by the people, with a large portion of the city still to illuminate. It is estimated that $3,000,000 or $4,000,000 will be needed to complete city-wide lighting, there being still 11,000 gas lights on St. Louis streets.

Tentative Agreement on Texas-Colorado River Development.—If the tentative agreement between the Syndicate Power Company of Dallas and the representatives of the water district of Brownwood, Tex., is carried out, the number of acre-feet of water of the Colorado River which the State Board of Water Engineers will grant the former company for its proposed hydro-electric plants will be reduced from 1,280,000 to 580,000, or less than half. It is asserted that this relinquishment will enable the company to fulfill its power plans and at the same time will satisfy the water requirements not only of Brownwood but also of San Angelo.

Ellensburg, Wash., Cancels Contract with Puget Sound Power & Light.—The city of Ellensburg, Wash., which less than two years ago made a ten-year contract with the Puget Sound Power & Light Company for all energy needed in excess of the output of the municipal plant, has abrogated the contract, which it declares invalid, and refuses, it is said, to pay for energy supplied by the company in the last three months of 1927. A lawsuit will result.

Anderson, Ind., Refuses to Allow Private Emergency Line to Delco-Remy Plant.—By a vote of three to two, the City Council of Anderson, Ind., has rejected a proposal by the Delco-Remy Corporation and the Indiana General Service Company of Muncie for an emergency electric power line to the Delco-Remy plant, employing more than 7,000 and now supplied by the municipal light plant. The Mayor of the city favored the proposition and protested against the action taken.

Carrying Electricity to Remote Spots on the Rio Grande.—Several Texas border settlements in a remote region of the Rio Grande, 60 to 100 miles from a railroad, will, it is reported, soon be supplied with electric light and power by the plant of the Presidio (Tex.) Light & Power Company. Under the terms of a concession granted the company by the Mexican government a power transmission line will also be built from the plant to Ojinaga, Mexico, and other towns on that side of the river. Irrigation pumping plants on both sides of the Rio Grande will obtain power from the wooden-pole transmission lines to be constructed.

Hydro-Electric Plant Near Port Angeles, Wash., Planned. — The Northwestern Power & Light Company, Port Angeles, Wash., seeks an appropriation of 1,200 sec.-ft. of water from the Elwha River, in the Olympic peninsula. Plans filed with the state authorities put the output at 22,000 hp., which would be used for manufacturing. The plant would be built approximately 7 miles southwest of Port Angeles. Rights are also asked for the Rica Canyon Reservoir, which would store approximately 65,000 acre-feet of water. A total fall of about 300 ft. would be utilized for the Elwha River development, which would cost in all about $2,200,000.

Dern and Bannister Clash. — Testimony given by L. Ward Bannister of Denver before the House irrigation committee at Washington has aroused the ire of Governor Dern of Utah and others interested in the Colorado River situation. They charge that Mr. Bannister, a widely known water-power expert, whose testimony is supported by the Mayor of Denver, gave testimony in disagreement with the policy advocated by the upper basin states and favorable to Arizona's contentions. The dispute has waxed warm in Western newspapers, Mr. Bannister insisting that Governor Dern and not he departed from the policy adopted at the Denver conference and challenging him to debate the points at issue.

Coming Station Addition at San Diego.—The major expense item of the San Diego (Cal.) Consolidated Gas & Electric Company for 1928, according to Vice-president W. F. Raber, involves erection of an addition to the company's main generating plant at Kettner Street and Broadway. This 100-ft. x 140-ft. building will house the new 25,000-kw. generating unit already reported as in contemplation, together with auxiliaries and switching equipment, and will be of sufficient proportions to permit the installation of a second unit when needed. The first machine will probably be in operation by early fall. Actual erection of the building will start in two months.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16; St. Louis regional meeting, March 7-9; Baltimore regional meeting, April 17-19. F. L. Hutchinson, 33 West 39th St., New York.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21; Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.

New Mexico Utilities Association—Albuquerque, N. M., Feb. 20-22. Arthur Prager, Albuquerque Gas & Electric Company, Albuquerque.

New England Central Station Associaciation of Power Engineers—Engineers' Club, Boston, Feb. 29. T. D. Bond, C. H. Tenney & Co., Boston.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Madison, Wis., March 17-18. W. Wilke, 4211 Elring Place, Milwaukee.

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N.E.L.A. — Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Dubuque, Iowa, Important Utility Headquarters.—Headquarters of the Central States Power & Light Corporation will be established in Dubuque, Iowa, about Feb. 20, according to H. C. Orton, president of the corporation and vice-president and general manager of the Interstate Power Company. The offices will occupy the second floor of the First National Bank Building. Dubuque is already headquarters of the Interstate Power Company, and the management of all the subsidiaries of both companies, serving 530 communities, will be directed from that city by Mr. Orton.

Gates at Oxford Dam Soon to Be Closed. — Work is progressing so rapidly on the Oxford Ford dam of the Duke Power Company on the Catawba River near Hickory, N. C., that it is estimated the finishing touches will be given and the gates closed by March 1. The Oxford Ford dam is of reinforced-concrete construction and is over 1,100 ft. wide and nearly 100 ft. high. The average thickness of the wall is 87 ft. In the power house two turbines of 35,000 kw. capacity each are being installed. To the left of the power house work is under way on the switching station. The lake formed by the impounding of the waters will extend for 22 miles, the headwaters reaching close to the Rhodiss dam. The lake will be used for boating, fishing and swimming.

Pacific Gas & Electric Has Comprehensive Sales Program.—Under the stimulus of the material reduction in residence lighting rates soon to become effective, the Pacific Gas & Electric Company has embarked upon the most ambitious sales program in its history. Expenditure of $633,000 in 1928 for sales and advertising expense and the employment of 183 salesmen are expected to sell a total of $1,187,000 worth of electrical merchandise, plus $398,000 for wiring and supplies, and add a load of approximately 115,000 kw. to the system. The program is predicated upon adherence to a well-established policy of loading existing facilities, continuance of the plan of co-operation with dealers and an inducement type of domestic rate soon to be filed.

Clarifying the Water Rights Law of Washington State.—In ruling that in order to hold previously issued water rights in Washington State the permit holder must have made some constructional development within ten years, B. B. Adams, Assistant Attorney General, has advised R. K. Tiffany, State Hydraulics Supervisor, that "actual constructional development" is not met by such activities as the carrying on of surveys, stream gaging, preparation of plans or purchase of rights-of-way. The ten-year period, Mr. Adams shows, is defined expressly by the Washington Water Code of 1917. The specific case responsible for the bringing up of this question arose from the recent application of the Great Northern Power Company for extensive water rights in Snohomish County which about ten years ago were filed on by Robert Howes of Seattle.

Bagnell Dam Project Revived in Missouri.—Applying to the Missouri Public Service Commission for continuance of the certificate issued a year ago by that body for the construction of a power dam across the Osage River near Bagnell, Mo., proposed by the Missouri Hydro-Electric Power Company, headed by Walter Cravens and R. W. Street, officials of that company say that work will begin "as early in the present year as flood conditions on the Osage will permit." The dam is to form a lake approximately 100 square miles in size. The organization and financial difficulties which interfered with the progress of this undertaking in 1926 were reported in the Electrical World.

Louisville Shifts to Electric Pumping for City's Water Supply.—Louisville's water supply is hereafter to be pumped from the Ohio River by hydro-electric power furnished by the Louisville Gas & Electric Company, Edward J. Miller, president of the Louisville Water Company, having signed a contract for this service last week. The contract runs for five years and will save the water company an estimated $10,000 yearly, Mr. Miller announced. It calls for a yearly use of 11,000,000 kw.-hr. A new pump, costing with motors of 2,500 hp. $75,000, will operate for eighteen hours each day, throwing 60,000,000 gal. of water into the reservoirs. It is expected to have the equipment delivered and installed within three months. At present a steam plant operates four pumps. These will be kept for reserve use.

International Board of Engineers for St. Lawrence Development Asked.—The report of the International Joint Commission that investigated the St. Lawrence waterway project would be accepted by Congress under a resolution presented by Representative Mapes of Michigan. To put the recommendations in this report into effect, it is proposed to create an International Board of Engineers who would work out detailed plans for the construction and operation of the waterway. Attention would also be paid to ascertaining the maximum efficiency of water power from such a waterway. It is further recommended that this waterway be not less than 30 ft. deep. An appropriation of $100,000 is recommended to defray the expenses of the International Board of Engineers. The expenses of the Canadian section would be paid, of course, by its own government.

## Recent Court Decisions

Requiring Approval of Commission for Utility to Enter Community No Violation of Constitutional Rights.—No violation of the constitutional rights of the Kansas Gas & Electric Company was involved, according to the Supreme Court of Kansas, in barring it from territory it desired to serve by action of the Public Service Commission of the state (against which the company brought suit), since it is within the statutory power of the commission to determine whether permission to a second utility to enter occupied territory would be a needless economic waste, to substitute regulation for competition, or to exclude the applying utility entirely. (261 Pac. 592.)*

No Cause of Action Shown Where Child Was Killed by Climbing on Tank and Accidentally Touching Wire.—The Court of Appeals of Georgia supported the trial court in Mobley vs. City of Monroe in dismissing the suit on the ground that no cause of action was shown. The plaintiff sought damages for the death of her eleven-year-old son, who climbed on a water tank belonging to a cotton mill and came in contact with a live wire belonging to the city and strung at a distance of two feet from the leg of the tank, the boy falling to the ground and being killed. It was held by the plaintiff that the tank constituted an "attractive nuisance" to children and that both the city and the owner of the tank were grossly negligent in permitting the proximity of the wire, but the court sustained demurrers. (140 S.E. 516).

Constitutionality of Law Making It a Crime to Tap Corporation-Owned Wires.—The Vermont Supreme Court has found, in State vs. Shady, that a criminal statute of the state prohibiting the tapping of wires and using the electric current therefrom without the consent of the corporation owning the same was not unconstitutional because it did not make it a crime so to use the current from a line owned by an individual, partnership or association. "The power of classification for such legislative purpose will be reviewed," the court said, "only when exercised in a palpably arbitrary manner. It is established by the decisions that a criminal statute enacted for the protection of a particular class is not unconstitutional simply because the specified class is not all-inclusive, or might have been so enlarged as to include others equally meriting the same protection." (138 At. 777.)

Court Order to Utility to Pay Attorney Fees as Condition of Dismissal of "Ad Quod Damnum" Proceedings an Error.—A power company that has initiated *ad quod damnum* proceedings in connection with acquiring a site for a hydro-electric development may, under a decision of the Nebraska Supreme Court, dismiss the action any time before submission without incurring any other penalty than that of paying the usual court costs. The court held that the District Court of Saline County went beyond its power when it gave its consent to the motion of the Blue River Power Company to dismiss such proceedings on the condition that it also pay $1,000 attorney fees for the defendant land owners. The Supreme Court held that *ad quod damnum* proceedings do not differ in any essential from ordinary actions at law, which the statutes say may be dismissed by the plaintiff on the payment of costs. It holds that the case falls within the judicial classification of losses for which there is no legal remedy, and that as the defendants had lost no substantial rights, since they still have claims for damages and may initiate proceedings themselves, it was an error to require payment of their attorney fees.

## Commission Rulings

North Dakota Commission Law Construed.—Negotiations for the construction of a public utility plant and the attainment of a franchise to operate it prior to the effective date of a regulatory act were held by the North Dakota Board of Railroad Commissioners not to constitute actual construction where there was no evidence of binding contracts made with reference to the construction prior to such date, and it was, therefore, held, in a complaint ticketed as Minor vs. Erickson, that the company involved must procure a certificate from the commission. The commission also held that a statutory provision requiring a certificate from the commission before the construction or operation of a utility plant was not an unlawful invasion of the rights of a municipality under a constitutional provision prohibiting legislation allowing the construction or operation of various utilities within a city, incorporated town or village without its consent.

Wisconsin Commission Bows to Supreme Court Ruling.—An order of the Wisconsin Railroad Commission increasing telephone rates of the Wisconsin Telephone Company at its Green Bay exchange has been modified at a rehearing to comply with the opinion of the Wisconsin Supreme Court as to present value. The commission, reaffirming its views as to prudent investment being the most important element in valuation, said that the Supreme Court had recently stated in substance that it was doubtful whether any valuation not substantially based upon present-day prices would meet the rule of valuation laid down in decisions of the United States Supreme Court. It therefore observed: "As the commission is an administrative body charged with carrying out the provisions of the law and is bound by the authoritative interpretations of the state and national supreme courts, there can be no question that the rate base used in our previous order, which was the book value, must be modified to conform to the law as stated in the Indianapolis Water Company and the Waukesha Gas & Electric Company cases. At the time of the previous decision the commission made no effort to determine the depreciated value of the property as the matter was not material in that case, where the original cost was accepted as the rate base and the allowance for depreciation was computed under the sinking-fund method. With the recent rulings of the Supreme Court, however, it now becomes necessary that we determine the extent of the depreciation in the property, as the depreciated reproduction value on a present-price basis must be given material weight in fixing the fair value of the property."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## Five Westinghouse Staff Men Are Promoted

W. J. Longmore, a member of the executive staff of the manufacturing department of the Westinghouse Electric & Manufacturing Company, has been transferred from the office of general purchasing agent to consulting supervisor of purchases; E. R. Norris from director of works equipment to general works manager of all manufacturing operations, A. W. Bass from director of works records and statistics to assistant to the vice-president, S. E. Marks from director of traffic and shipping to director of traffic, and C. G. Taylor from director of purchases to general purchasing agent. These five promotions have just been announced by Vice-president H. P. Davis.

Mr. Longmore, a veteran of the company, being perhaps the oldest in continuous service, entered the employ of the Westinghouse interests in 1881 as a laborer and has worked his way steadily up. Mr. Norris began his connection with the company in 1892 as a general machinist, subsequently being made assistant works manager. Mr. Bass' employment with Westinghouse was the direct result of his writing an article concerning a new method of analysis for long reports. Mr. Marks entered the employ of the company in 1891 in the purchasing department and in 1906 received charge of the shipping department. Mr. Taylor's employment dates from 1887. He became purchasing agent in 1917 and later director of purchases.

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W. S. Wyman, president of the Central Maine Power Company, has been elected president of the Edwards Manufacturing Company of Augusta.

John E. Davis, manager of the public information department of the Kentucky Utilities Company for the past three years, has been appointed director of public relations for that company.

N. E. Drexler has been appointed acting manager of the Newport News & Hampton (Va.) Railway, Gas & Electric Company, recently acquired by the Insull interests. He succeeds C. D. Porter, formerly general manager. Prior to his promotion Mr. Drexler was manager of the gas and electric light department.

H. B. Heryford, division manager of the West Side division of the Pacific Gas & Electric Company, with headquarters at Red Bluff, Calif., has been appointed division manager of the San Joaquin division to succeed the late Charles S. Northcutt. The West Side division of the company is to be abolished, part of the territory being placed under G. R. Milford, manager of the Shasta division, and part under I. B. Adams, manager of the Desable division. Mr. Heryford has been connected with the electric and gas industries of California for the past 25 years, and his promotion now places him in charge of one of the largest and most important divisions of Pacific Gas & Electric.

George J. Klein of Cleveland was elected president of the Artistic Lighting Equipment Association at its recent meeting in that city, and C. A. Bridges of Milwaukee was elected vice-president.

R. M. Watt, manager of the Mountain district operations of the Kentucky Utilities Company, with headquarters at Pineville, Ky., has recently been elected a director of the company.

Dr. Alfred N. Goldsmith, chief broadcast engineer of the Radio Corporation of America, was elected president of the Institute of Radio Engineers at its recent annual convention. He was formerly its secretary.

William Whitney, formerly assistant superintendent of gas manufacture of the Rochester (N. Y.) Gas & Electric Corporation, has recently been appointed assistant chief engineer.

Joseph K. Choate will resign as a director and vice-president of the J. G. White Management Corporation on March 31. He has had a prominent rank among civil and railroad engineers for many years and has been president or vice-president of various railroad and utility companies, including the Manila Electric Company. Mr. Choate was born in Salem, Mass., in 1853 and was educated at the University of Colorado.

F. D. Mahoney has tendered his resignation as vice-president of the West Penn Power Company, to take effect March 1. He will then take a position with the Electric Bond & Share Company, with headquarters in New York, and will be engaged in the expansion of that company's interests in foreign countries.

## Obituary

Selyron Nivision Blake, a native of Elmira, N. Y., died suddenly at his home in Brookline, Mass., Feb. 3. The major part of his life he was engaged in the ownership and operation of electric and gas utilities.

Ludwig Gutmann, retired inventor and writer of textbooks on electrical engineering, died at St. Louis last week of heart disease. He was 67 years old. Mr. Gutmann was born in Hamburg, Germany, and came to America about 1890. He was formerly connected with the Wagner Electric Corporation.

William T. Gunnison, chairman of the New Hampshire Public Service Commission, died at his home at Rochester, N. H., on Feb. 2. He had been in ill health for several months. Mr. Gunnison, who was graduated from the Harvard Law School in 1895, was a law partner of former Governor Samuel D. Felker. He was born in Greenville, Mass., in 1869.

Bernhard Blitzer, president of the Lightolier Company, New York, died suddenly on Feb. 3 from a stroke of apoplexy. He was 62 years old. Coming to the United States from Austria in 1886, Mr. Blitzer is said to have landed with a capital of only 19 cents. He worked his way up from street peddling to business prominence. After entering the employ of a gas company he became interested in the opportunities for manufacture of lighting fixtures and put his savings into a small venture which grew until in 1916, when it was known as the New York Gas & Electric Appliance Company many years ago, died recently in tributed $15,000 as gifts among department heads and salesmen. Mr. Blitzer was a director of the Gramercy Finance Corporation and the New Jersey Discount Company. He was active in charitable work.

Jonas J. Joseph, organizer of the Shelbyville (Ind.) Electric Light Company, many years ago, died recently in Indianapolis, where he had lived for 22 years. He was born in Germany 80 years ago, coming to America at the age of thirteen.

Harry M. Haven, a member of the mechanical engineering firm of H. M. Haven & A. T. Hopkins, Inc., Boston, died at Winchester, Mass., Feb. 6. He was formerly a member of the firm of Haven & Crosby, Boston, and for some years was a member of the staff of Charles T. Main, Inc., of the same city.

Samuel J. Keese, pioneer southern California electrical engineer, died in Los Angeles on Jan. 20. He made one of the first arc lights seen in Pasadena and installed the lighting plant for the Mount Lowe railway. For a number of years he was a member of the firm of Rhodes & Keese, one of the first electrical supply houses on the Pacific coast. At the time of his death he was president of the Southern California Academy of Sciences.

# Financial and Statistical News

## Seek to End Rate Disputes

### Massachusetts Bill Would Tie Up Companies in Rate Contract With the Commonwealth—Department Viewpoint Is Herewith Presented

IN AN effort to put an end to the numerous rate disputes which have arisen in Massachusetts, the Department of Public Utilities is sponsoring a bill designed to make permanent contracts with the companies whereby the latter agree to accept whatever decision is made by the commission with regard to rate changes, undertaking to refrain from appealing to the courts. The bill will come up for discussion about the middle of February.

In a report recently issued on the situation the Department of Public Utilities gave its reasons for presenting such a bill, as follows:

> Common experience demonstrates that when such cases go to the federal court several years usually elapse before the matter is finally determined, and in the meantime rates fixed by the department, as has already been done in the Worcester case, may be suspended. While it is true that if the United States Supreme Court in the respective cases should finally uphold the order of the department and the company would be compelled to return the excess charges to the customers, it is a fact commonly known that customers move away or many of them do not obtain or attempt to obtain the refund due them.
>
> The danger of the so-called United States Supreme Court's doctrine being enforced in this Commonwealth is so great that we think that we should at this time make preparations to avoid the results of such a doctrine. This doctrine promotes greed and gluttony on the part of the owners of public utilities. It asserts that the owners of the public utilities are entitled to retain and earn a profit upon excessive earnings which they may have exacted from the public. It asserts that the public has no real control over these utilities other than an ineffectual method of regulating rates, notwithstanding that the public gives to them exclusive rights in the highways and confers upon them the sovereign power to take private property by eminent domain. Moreover, it asserts that the property of the utility is increased in value by improvements in the public highways and that the owners of the utility are entitled to increased earnings by reason of these improvements and of the enhanced value upon its property resulting from the growth of the community. It also asserts that the owners of the utility are entitled to earnings upon the reproduction value of the property less depreciation, notwithstanding the service performed by it could be performed as well, if not better, by property that would cost much less.
>
> As a consequence, we feel that the time is now ripe to enact legislation by which the companies engaged in the sale of gas and electricity in this Commonwealth shall enter into a contract with the Commonwealth so that their rates may be speedily and effectually regulated with fairness both to the company and the public, and whereby the investor will be guaranteed that in no event shall rates be so regulated that he cannot sell his securities to obtain his original investment. We accordingly recommend the enactment of a bill to accomplish this result.
>
> Our proposed bill provides for a readjustment of the capital of any company which applies for such readjustment upon a basis which permits the capitalization of the premiums heretofore paid in and any earnings that have been plowed into the property at the expense of the stockholder who has not received on the average a return on his investment of 7 per cent, provided also that it shall not be capitalized beyond its fair value as determined by the department or beyond the amount expended for its property used and useful in the transaction of its business. The adjustment of its capital in accordance with the bill shall effect a contract with the Commonwealth by which the company agrees that it may be regulated by the Commonwealth in such manner as the Commonwealth may determine, so long as such regulation does not prevent it from paying

## No Lack of Confidence in These Stocks

A STUDY of the activities of the power and light stocks in the various markets discloses little fear on the part of investors that the Walsh investigation will bring out any information which could seriously affect the standing of the companies. No single group of stocks has forged ahead so consistently and steadily as power and light common during recent months, and especially during the first few weeks of the present year.

Among the more spectacular of the advances made in the first five months of 1928 is that of Montana Power common, which gained more than 60 points during January alone and now stands at around 160. The stock pays 5 per cent and the low for 1927 was 81. Brooklyn Edison is another stock that has shown a steady appreciation over a period, with an approximate gain of about 28 points in January alone. This stock has appreciated steadily from a low of 148 last year to a present quotation of around 236 and is now 14 per cent above the high point of 1927. A similar trend has been in evidence in the case of Middle West Utilities and Detroit Edison. The former opened the year at around 124 and has since risen to 134, or a gain of ten points during the month, indicating that the trend is shared by holding company stocks and operating company stocks as well, more or less equally. Another stock that has shown a steady advance is Cleveland Electric Illuminating common, which appreciated from 330 at the beginning to 350 at the end of January. This is a 10 per cent stock. Laclede Gas Light Company, which pays 12 per cent on common, appreciated from 200 at the beginning of January to 240 at the end of the month, and Metropolitan Edison Company has shown a gain of more than 60 points during the same period. The Philadelphia Company during January rose from 140 to 163. One of the lower priced stocks, Puget Sound Power & Light Company common appreciated from 36 to 44 during January. One of the Pacific Coast companies, Washington Water Power Company, also showed a spectacular rise. The common stood at 167 at the beginning of January and 215 at the end.

While the following list of ten power and light common stocks comprises some of the most active in the market, they may be regarded also as fairly representative and are well distributed throughout the country. Following are bid prices at the beginning and end of January:

| | | |
|---|---|---|
| Montana Power | 104 | 161 |
| Brooklyn Edison | 207 | 235 |
| Middle West Utilities | 124 | 134 |
| Detroit Edison | 164 | 174 |
| Cleveland Electric Illuminating | 330 | 350 |
| Laclede Gas Light | 200 | 240 |
| Metropolitan Edison | 70 | 125 |
| Philadelphia Company | 140 | 163 |
| Puget Sound Power & Light | 36 | 44 |
| Washington Water Power & Electric | 167 | 215 |
| Average | 154 | 184 |

There is little lack of confidence on the part of investors in an industry the representative stocks of which have shown the trends indicated. Stocks which, as stated, may be regarded as more or less representative appreciated on the average 30 points during the month of January from an average of 154 to an average of 184, which is an increase of 20 per cent. What other industry can show a similar degree of confidence?

dividends upon its stock adequate to maintain such stock at par.

The bill also provides that as to those companies which do not take advantage of the bill the provisions of our statutes which require a municipality to purchase, if the company elects to sell, the latter's property located in the town before it can engage in the business of the sale of gas or electricity shall not apply.

In addition the bill provides that as to such companies as do not elect to come under its provisions, they shall not be given the power to take property by eminent domain and they shall not have the power to increase their capital stock and bonds beyond what they are at present.

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MONTANA-DAKOTA COMPANY INCREASES CAPITAL. — The Montana-Dakota Power Company has increased its authorized preferred stock from $1,000,000 to $2,500,000, par $100.

FLORIDA COMPANY PAYS STOCK DIVIDEND. — Directors of the Tampa Electric Company have declared a semi-annual dividend of one-fiftieth of a share of common stock in addition to the regular quarterly cash dividend of 50 cents a share on the common stock, both payable Feb. 15 to holders of record Jan. 15.

## World Production of Electrical Energy

An estimate of the electrical energy production in various countries shows that while the United States is far in the lead for total output, with 44 per cent of the world's production, in output per capita this country ranks fourth.

ENERGY GENERATED IN VARIOUS COUNTRIES IN 1925

| Country | Kw.-Hr. Billions | Kw.-Hr. per Capita | Per Capita Rank |
|---|---|---|---|
| United States | 77.93 | 675 | 4 |
| Germany | 20.3 | 325 | 6 |
| Canada | 13.1* | 1,400 | 2 |
| Great Britain | 11.0 | 250 | 7 |
| France | 9.8 | 245 | 9 |
| Italy | 7.6 | 185 | 11 |
| Japan | 6.7 | 112 | 13 |
| Norway | 6.2 | 2,270 | 1 |
| Russia | 4.1 | 29 | 16 |
| Switzerland | 3.9 | 1,000 | 3 |
| Sweden | 3.8 | 630 | 5 |
| Belgium | 1.7 | 220 | 10 |
| Austria | 1.6 | 246 | 8 |
| Poland | 1.3 | 45 | 15 |
| Holland | 0.9 | 123 | 12 |
| Rumania | 0.4 | 23 | 17 |
| Denmark | 0.35 | 103 | 14 |
| All other countries | 6.0 | ..... | .. |
|  | 178.38 |  |  |

* 1926.

The accompanying figures, except those for Canada, are for 1925. The estimate is based on data presented at the International Economic Conference at Geneva in May, 1927, having been compiled from the best available sources, and issued as a publication of the League of Nations. It may cause surprise to learn that only a few countries collect official statistics on energy production, and that the data are not strictly comparable because in some instances they relate to total output, in others to output of public utility plants only. To eliminate the disparity as far as possible, an estimate of total output for Canada in 1926, kindly furnished by the Dominion Bureau of Statistics, has been substituted for the original figures which applied only to public utility plants, and for the United States there has been added to the Geological Survey figures an estimated 12,060,000,000 kw.-hr. for energy generated in manufacturing and mining plants, giving a total of 77,930,000,000 kw.-hr. The correction advances this country from fifth place in production per capita and brings her ahead of Sweden. A few of the other items have also been slightly revised to incorporate more recent information. The figures are in general given only to

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Feb. 7 | Low 1927 | High 1927 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, 4% com.—no par | 163 | 140½* | 164* |
| Ala. Pwr., $7 com. pf.—no par | 114½ | 107 | 115 |
| Allis Chalmers Mfg., 6% com. | 124 | 115½* | 125* |
| Aluminum Co. of Amer., com. | 125 | 120* | 129½* |
| Aluminum Co. of Amer., 6% pf. | 106½ | 105½* | 107* |
| Amer. & Foreign Pwr., 7% pf.—no par | 107½ | 105½* | 108½* |
| Amer. & Foreign Pwr., com.—no par | 24¾ | 22¾* | 27½* |
| Amer. Bosch Magneto com.—no par | 19½ | 17* | 22½* |
| Amer. Brown Boveri Elec.† | 15¾ | 11* | 18* |
| Amer. Brown Boveri Elec., pf. $7 | 58¾ | 55* | 63* |
| Amer. Gas & Elec., 6% pf.—no par | 108½ | 106¾* | 109* |
| Amer. Gas & Elec., com. †—no par | 126½ | 117½* | 126½* |
| Amer. Lt. & Trac., 6% pf. | 115 | 115* | 115½* |
| Amer. Lt. & Trac., new com. | 183 | 170* | 191* |
| Amer. Pwr. & Lt., 6% pf. | 106½ | 105½* | 109½* |
| Amer. Pwr. & Lt., com. †—no par | 66½ | 62½* | 69½* |
| Amer. Pub. Serv., 7% pf. | a 99½ | 99* | 100* |
| Amer. Pub. Serv., com. † | k 70 | 65 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | k 90 | 73 | 90 |
| Amer. Pub. Utilities, 7% pr. pf. | k 96½ | 88 | 97 |
| Amer. Pub. Utilities, com. | k 60 | 58 | 70 |
| Amer. States Sec., A | 5 | 2½ | 5½ |
| Amer. States Sec., B | 5½ | 2½ | 5½ |
| Amer. Superpwr., 6% ptc. pf.—25 | k 29½ | 29 | 29½ |
| Amer. Superpwr., 6% 1st pf. | l 103½ | .... | .... |
| Amer. Superpwr., Class A†—no par | 40½ | 37* | 41* |
| Amer. Superpwr., Class B†—no par | 40½ | 37½* | 41½* |
| Amer. Wtr. Wks. & Elec., 6% pf. | 104 | 101½* | 104½* |
| Amer. W.W. & E., com. new—no par | 57 | 55½* | 61* |
| Anaconda Copper cap. $3 | 57½ | 53½* | 59½* |
| Appalachian Electric Pwr., 7% pf. | k 108½ | 100 | 109 |
| Arkansas Pwr., & Lt. 7% pf. | 107½ | 101 | 108 |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 95 | 85 | 98 |
| Assoc. G. & E., Class A, 10—no par. | 47½ | 47½* | 51½* |
| BABCOCK & WILCOX, 7% com. | 122½ | 120* | 124½* |
| Binghamton L., H. & P., $6 pf. | 104 | 93 | 103½ |
| Birmingham Elec., pf. $7—no par | 109 | 105 | 111½ |
| Blackstone Valley G. & E., 6% pf. | k 107 | 105 | 110 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k 128 | 98 | 153 |
| Blaw-Knox, com.† | i 95 | 91* | 95* |
| Brazilian Trac., Lt. & Pwr., $7 com. | f 204 |  |  |
| Broad River Pwr., 7% pf. | 105½ | 97 | 105½ |
| Brooklyn Edison, 8% com. | 233½ | 206½* | 235* |
| Buffalo Niagara & East Pwr., $1.60 pf.—25 | l 26½ | . | .. |
| Buffalo Niagara & East Pwr. com. $1.20—no par | l 36½ | . | . |
| CALIFORNIA ELEC. GENERATING, 6% pf. | k 99 | 96 | 104½ |
| California Ry. & Pwr., 7% pf. | k 135 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | l 110½ | 109* | 110½* |
| Central & S. W. Util., $7 pf.—no par | a 104 | 99½* | 105½* |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a 108 | 105½* | 108* |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 100 | 107 |
| Central Ill. Pub. Serv., $6 pf. | a 98 | 97½* | 98* |
| Central Ind. Pwr., 7% pf. | a 96½ | 95* | 96½* |
| Central Maine Power, 6% pf. | 95 |  |  |
| Central Maine Power, 7% | 106 | 102 | 110 |
| Central Pwr. & Lt., 7% pf. | 105 | 100½ | 105 |
| Central States Elec., 7% pf. | 107½ | 104½* | 107½* |
| Century Elec., 6% com. | b 145 | 140* | 145* |
| Chicago Fuse Mfg., com.—$2.50 no par | a 33 | 31* | 33½* |
| Cincinnati Gas & Elec., 5% com. | g 99½ | 98½* | 100* |
| Cities Service, $6 pf.—no par | l 95½ | 87* | 94½* |
| Cities Service, pf. B—no par | l 9 | 8* | 8½* |
| Cities Service, pf. BB—no par | l 90 | 80½* | 86* |
| Cities Service, com.—20 | l 55½ | 40½* | 58½* |
| Cities Service, Bks. Shrs.—10 | l 27½ | 22½* | 27* |
| Cities Service Pwr. & Lt., 7% pf. | 106 | 105½* | 106½* |
| Cities Service Pwr. & Lt., 6% pf. | m 96½ | 95½* | 96½* |
| Cleveland Elec. Illg., 6% pf. | 113 | 108 | 114 |
| Cleveland Elec. Illg., 10% com. | 360 | 285 | 370 |
| Columbia Gas & Elec., 6% pf. | 108 | 108* | 110½* |
| Columbia G. & E. com. $5—no par | 97½ | 82½* | 98½* |
| Columbus Elec. & Pwr., $2 com.—no par | m 65 | .... | .... |
| Columbus Elec. & Pwr., 7% pf. | 112 | .... | .... |
| Columbus Ry., Pwr. & Lt., 6%, 1st pf. | 105 | 98½ | 108½ |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 107 | 96 | 106 |
| Columbus Ry., P. & Lt. com.—no par | k 105 | 75 | 110 |
| Commonwealth Edison, 8% com. | a 189 | 165* | 189* |
| Commonwealth Pwr., 6% pf. | 103 | 102½* | 104½* |
| Commonw'th Pwr., $2. com.—no par | 65½ | 62½* | 69* |
| Conn. Lt. & Pwr., 8% pf. | 121 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 112 | 119 |
| Cons. Gas of N. Y., pf. | 102½ | 101½* | 102½* |
| Cons. Gas of N. Y., com. $5—no par | 130½ | 119½* | 130½* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e 112 | 112* | 112* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e 110½ | 110½* | 113* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e 110½ | 110½* | 115* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf. | e 125½ | 125½* | 128½* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 70½ | 67½* | 70½* |
| Consolidated Pwr. & Lt., 7% pf. | 105 | 100 | 106 |
| Consumers Pwr., 6% pf. | 104½ | 100 | 106 |
| Consumers Pwr., 6.6% pf. | 106½ | 103 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 107 | 100 | 107 |
| Contl. G. & E. com. $4.40—no par | k 225 | 210 | 265 |
| Crocker Wheeler, com.† | k 26 | 23 | 38 |
| Crocker Wheeler, 7% pf. | 85 | 78 | 88 |
| DALLAS PWR. & LT., 7% pf. | 110 | 107 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108½ | 101 | 109½ |
| Detroit Edison, 8% com. | 185 | 166½* | 194½* |
| Dubilier Condenser, com.—no par | 3 | 2½* | 3½* |
| Duke Pwr., cap. | 139 | 135* | 145* |
| Duquesne Lt., 7% pf. | 116½ | 114½* | 117½* |
| EASTERN NEW YORK UTIL., $7 pf. | k 110½ | 102 | 112½ |
| Eastern New York Util. com. | k 65 | 70 | 75 |
| Eastern States Pwr. $7, com. | k 12½ | 11½* | 15½* |
| Eastern States Pwr., pf. | k 97 | 90 | 99 |
| East. Tex. Elec., 7% pf. | k 107 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d 264½ |  |  |
| El Paso Elec. 7% pf. | 112 | 105 | 112½ |
| Elec. Bond & Share, 6% pf. | l 110 | 109½* | 111½* |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 88½ | 76* | 80½* |
| Electric Household Util.† | a 15½ | 13½* | 15½* |
| Elec. Investors, 6% pf.—no par | 102 | 92 | 101 |
| Elec. Investors, com.†—no par | 44 | 40½* | 45½* |
| Elec. Pwr. & Lt., ctfs. pf. | 108 | 106½* | 108* |
| Elec. Pwr. & Lt., ctfs., 40% pd. | k 123 | 120½* | 123* |
| Elec. Pwr. & Lt., ctfs., com.—no par | 32½ | 28½* | 34* |
| Elec. Refrig. cap.† | 11½ | 11½* | 13½* |
| Elec. Ry. Securities, com.—no par | 6½ |  |  |
| Elec. St. Battery com. $5.25—no par | 70½ | 69½* | 75½* |
| Elmira Wtr., Lt. & R.R., 7% pf. | k 105 | 99 | 105½ |
| Empire Pwr., ptc.† | 34½ | 27½* | 35½* |
| Engr. Pub. Serv. $7. pf.—no par | 108½ | 107* | 109* |
| Engr. Pub. Serv., com.—no par | 34½ | 34* | 36½* |
| Eureka Vacuum Cleaner, com. $4—no par | 73½ | 72½* | 79* |
| FAIRBANKS MORSE, 7% pf. | k 106 | 104* | 106½* |
| F.-M., com.—$3—no par | 32½ | 32½* | 40½* |
| Federal Lt. & Trac., com. $1.40 | 49½ | 42* | 55* |
| Federal Lt. & Trac., $6 pf.—no par | 101½ | 98* | 105* |
| Florida Pwr. & Lt., 7% pf. | 107½ | 104½* | 107½* |
| Ft. Worth Pwr. & Lt., 7% pf. | l 113½ | 113* | 114½* |
| GALVESTON-HOUSTON ELEC., 6% pf. | 76 | 68 | 85 |
| Galveston-Houston Elec., com. | 32 | 26 | 32 |
| General Cable, Cl. A $1 no par | 57½ | 56½* | 60* |
| Gen. Elec. $3 com.—no par | 130½ | 127½* | 138½* |
| Gen. Elec., special 6% | 11½ | 11½* | 11½* |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 37½ | 35½* | 39½* |
| Gen. G. & E. (Del.) pf. A $8—no par | k 123 | 123½* | 126½* |
| Gen. G. & E. (Del.) pf. A $7—no par. | k 110 | 108½* | 110½* |
| Gen. G. & E. (Del.) pf. B $7 | k 106½ | 105½* | 106½* |
| Gen. Pub. Serv., $7 cum. pf., no par | k 110 | 102 | 112 |
| Gen. Pub. Serv., com., no par | 18½ | 16½* | 20* |
| Ga. Lt., Pwr. & Rys., com. | k 59 | 50 | 70 |
| Ga. Ry. & Pwr., 8% pf. | k 125 | 119 | 125 |
| Ga. Ry. & Pwr., 7% pf. | k 113½ | 106 | 115 |
| Gt. Western Pwr., 7% pf. | h 105½ |  |  |
| IDAHO PWR., 7% pf. | 108½ | 103 | 110 |
| Ill. No. Utilities, 6% pf. | a 99 | 95½* | 99* |
| Ill. Pwr. & Lt., 7% pf. | 104 | 99 | 104½ |
| Ingersoll Rand com. | 92½ | 91* | 94* |
| Int. Combus. Engr., com. $2—no par | 52½ | 49* | 55½* |
| Int. Combustion Engr. 7% pf. | 105½ | 104* | 105½* |
| Int. Util., Class A, $3.50—no par | 48½ | 48* | 51½* |
| Int. Utilities, Class B—no par | 9 | 8½* | 10½* |
| Interstate Pwr., pf.—$7—no par | 100 | 93 | 100 |
| Interstate Pub. Serv., 7% pf. | 102 | 98 | 104 |
| Iowa Ry. & Lt., 7% pf. | k 103 | 97 | 100 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 106 | 97½ | 105 |
| Johns-Manville com.†—no par | 119½ | 114* | 124* |

Stock Exchange. aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; f Montreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Feb. 4. lBid price Wednesday, Feb. 8. mLatest quotations available. †Dividend rate variable. *1925

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Feb. 7 | Low 1927 | High 1927 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | k115½ | 115* | 115¾* |
| Kansas Gas & Elec., 7% pf. | l109 | 107* | 109* |
| Kentucky Hydro-Elec., 7% pf. | a103½ | 102* | 103½* |
| Kentucky Sec., 6% pf. | 91 | 83 | 90 |
| Kentucky Sec., 5% com. | 140 | 100 | 135 |
| Kentucky Utilities, 6% pf. | k101 | 95 | 101½ |
| LACLEDE GAS LT., 12% com. | 246 | 200* | 260* |
| Lehigh Pwr. Sec., com.—no par | 25½ | 19¾* | 27⅜* |
| Long Island Ltg., 7% pf | 111 | 107 | 112½ |
| Long Island Ltg., com †—no par. | k170 | 139 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 106½ | 98 | 105 |
| Louisville Gas & Elec., cl. A. $1.75 | 28½ | 28¼* | 29½* |
| MAN. ELEC. SUPPLY, cap. $5—no par | 51¾ | 50* | 54¾* |
| Manila Elec., com.†—no par | 50 | 40* | 60* |
| Maytag Mfg., com. .50—no par | 33½ | 32½* | 34½* |
| Memphis P. & L., pf.—$7—no par | k109½ | 107 | 111 |
| Metropolitan Ed., pf.—$6—no par | 106½ | 93 | 106 |
| Metropolitan Ed., pf.—$7—no par. | 109 | 104 | 110 |
| Metropolitan Ed., com. $5—no par. | k124½ | 60 | 72 |
| Middle West Utilities, 7% pf | a124½ | 116½* | 124½* |
| Middle West Util., 7% pr. lien | a127½ | 125½* | 128½* |
| Middle West Util., com. $6—no par | a135 | 123½* | 135* |
| Midland Utilities, pr. ln. 6% pf | a106½ | 105* | 106½* |
| Midland Utilities, 7% pf. A | a103½ | 103* | 104½* |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k 99 | 98 | 101¾ |
| Minn. Pwr. & Lt., 7% pf. | l109 | 107* | 109* |
| Miss. River Pwr., 6% pf. | 108 | 94 | 108 |
| Miss. River Pwr., 3% com. | m 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | l109 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7 no par | k105 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 31 | 29½* | 31½* |
| Montana Pwr., 5% com. | 163½ | 102¼* | 165⅜* |
| Montreal Pwr., 7½% com. | f 92 | .... | .... |
| Mountain States Pwr., 7% pf. | k103 | 97 | 103 |
| Mountain States Pwr., com.† | 16 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109 | 98 | 110 |
| National Carbon, 8% pf. | a138½ | 138* | 139* |
| National Elec. Pwr., A† | a 32½ | 27½* | 32⅜* |
| National Lt., Ht. & Pwr., com. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | k109 | .... | .... |
| National Pwr. & Lt., com †—no par. | 25½ | 21⅜* | 27⅜* |
| National Pub. Serv., 7% pf. | 100 | 93 | 102 |
| National Pub. Serv., 7% ptc., pf | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 26¾ | 22* | 27¼* |
| National Pub. Serv., B com.—no par | 29⅜ | 24⅜* | 30* |
| Nebraska Pwr., 7% pf | l110½ | 110* | 111½* |
| Nevada-Calif. Elec., com. | k 33 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | k 60 | 69 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k106 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | k104 | 95 | 100 |
| New Orleans Pub. Serv.—7% pf. | 108½ | 103 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf | k103 | 101 | 104 |
| New York Power & Light 8% pf. | 114 | .... | .... |
| New York Power & Light, 7% pf. | 114½ | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | k109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | k109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28⅜ | 28* | 28⅜* |
| No. Amer., 6% pf.—50 | 54½ | 53½* | 54⅜* |
| No. Amer., com.—10 | 61¾ | 58⅜* | 62¼* |
| No. Amer. Edison, $6 pf.—no par | 105¾ | 103⅜* | 105¾* |
| No. Caro. Pub. Serv., pf.—$7—no par | 109 | 93 | 105 |
| Northeastern Pwr., com. | 21½ | 19⅜* | 23* |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 22¾ | 18* | 24¼* |
| No. Ont. Lt. & Pwr., 6% pf. | 98¼ | 98* | 98¼* |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 108¾ | 108¼* | 109½* |
| No. States Pwr. (Del.), 8% com. | 135½ | 123* | 136⅜* |
| No. Texas Elec., 6% pf. | 50 | 45 | 70 |
| No. Texas Elec., com. | 17½ | 5 | 36 |
| OHIO BRASS, com. B $4—no par. | 97½ | 89* | 98⅜* |
| Ohio Brass, 6% pf. | k106 | 100 | 111 |
| Ohio Pwr., 6% pf | k106 | 96 | 106 |
| Ohio Pub. Serv., $6 pf | k103 | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | 110½ | 103 | 111 |
| Ohio River Edison, 7% pf. | 109 | 103 | 109½ |
| Oklahoma Gas & Elec., 7% pf. | 111 | .... | .... |
| PACIFIC Gas & ELEC., 6% pf. | 27⅜ | 26¾* | 27⅜* |
| Pacific Gas & Elec., 8% new com. | 49⅜ | 47½* | 49⅞* |
| Pacific Pwr. & Lt., 7% pf | l109 | 106* | 108½* |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 79 | 77⅜* | 79* |
| Penn-Ohio Edison, 6% pf. no par | 95 | 94* | 91* |
| Penn-Ohio Edison, 7% pf. | k107½ | 97½ | 104 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l110¼ | 109½* | 110½* |
| Penn Wtr. & Pwr., $2.50 com., new | e 71½ | 68* | 72½* |
| Phila. Co., 5% pf.—50 | k 46½ | 46½* | 48¼* |
| Phila. Co., 6% pf.—50 | 53 | 52* | 53* |
| Phila. Co., com.—50 | 163 | 149½* | 163* |
| Phila. Elec., 8% com.—25 | c 58½ | 55½* | 58¾* |
| Portland Elec. Pwr., 7% pf. | 103 | 97½ | 102½ |
| Portland Elec. Pwr., 6% pf. | 92 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 70 |
| Portland Elec. Pwr., com. | k 43 | 22 | 30 |
| Potomac Elec. Power, pf. | k111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | 59 | 61* | 62½* |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf., | l108 | 99* | 103* |
| Pub. Serv. of N. J., 6% pf. | 106¼ | 103⅜* | 106¼* |
| Pub. Serv. of N. J., 7% pf. | 120 | 118* | 120¼* |
| Pub. Serv. of N. J., $2 com.—no par | 44 | 41⅜* | 45* |
| Pub. Serv. of No. Ill., 6% pf. | a111½ | 110½* | 113½* |
| Pub. Serv. of No. Ill., 7% pf. | a121 | 120* | 121* |
| P. S. of No. Ill., com. $8—no par. | a180 | 159½* | 180* |
| Pub. Serv. of No. Ill., $8 com. | a180 | 159⅜* | 180* |
| Pub. Serv. of Okla., 7% pr. ln. | k103 | 90 | 103 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109¾ | 109* | 110¾* |
| Puget Sound Pwr. & Lt., 7% pf. | 111 | 109* | 113* |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 98 | 92* | 98* |
| Puget Sound Pwr. & Lt., com. | 44 | 34⅜* | 46⅜* |
| RADIO COPR. OF AMER., $3.50 pf. 50 | 56 | 54½* | 57¾* |
| Radio Corp. of Amer., com.—no par. | 101¼ | 88½* | 104⅜* |
| Rhode Island Public Service, pf. $2—no par | 31 | 30⅜* | 31½* |
| Rochester Gas & Elec. 6% pf. D | k105¾ | 101 | 103½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105¾ | 101½ | 103½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf | k111 | 105 | 112½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel Corp. | 7⅛ | 4¼* | 7⅜* |
| Sierra Pacific Elec., 2% com. | 34 | 29* | 34* |
| Sioux City Gas & Elec., 7% pf. | 107 | 99 | 105½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l110 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 66½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 44 | 42* | 44⅜* |
| So. Calif. Edison, 8% pf. | k 45 | 36½ | 40 |
| So. Calif. Edison, 7% pf. | k 28 | 27½ | 28½ |
| So. Calif. Edison, 6% pf. | 27 | 25¾* | 27¼* |
| So. Calif. Edison, 8% com. | 46⅜ | 43½* | 47½* |
| Southern Cities Utilities, 7% pf. | k 74½ | 67 | 90½ |
| Southwestern Lt. & Pwr., A $3 | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 92 | 83 | 91½ |
| Southwestern Pwr. & Lt., 7% pf. | 111½ | 110* | 111⅜* |
| Standard Gas & Elec., 8% pf | 67 | 65* | 67⅜* |
| Standard Gas & Elec., 7% pr. pf. | 111 | 103 | 113 |
| Standard G. & E., com. $3.50 | 62½ | 57¼* | 65* |
| Standard Power & Light, com. | 36 | 29½* | 37½* |
| Standard Pwr. & Lt., 7% pf. | k104 | 103⅜* | 105* |
| Staten Island Edison, pf.—$6—no par | 102 | 99 | 103 |
| Superheater, $6 com.—no par | 175 | 164* | 178* |
| Syracuse Lighting, 7% pf. | k111 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 62½ | 62* | 64* |
| Tenn. Elec. Pwr., 6% pf. | 103 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109¾ | 103 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf | k 26 | 20 | 30 |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf | l113½ | 113½* | 115* |
| Tide Water Pwr., 8% pf. | 111½ | 105 | 111 |
| Timken Roller Bear., com.—$4 no par | 126⅜ | 121½* | 134* |
| Toledo Edison, 7% pf. | l109 | 102* | 107* |
| Toledo Edison, 6% pf. | k103 | 95 | 105 |
| Toledo Edison, 6% com. | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | k 97½ | 96 | 99 |
| UNITED GAS & ELEC., 6% pf. | k100½ | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 74 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c116½ | 111½* | 117⅜* |
| United Lt. & Pwr., pf.—$4—no par | m 53 | 53* | 55* |
| United Lt. & Pwr., pf.—$6.50—no par | a100 | 95* | 100* |
| United L. & P., com. A .48—no par. | a 17½ | 14* | 17½* |
| United L. & P., com. B .48—no par. | a 20 | 19* | 20* |
| Utah Pwr. & Lt., 7% pf. | l111½ | 109½* | 111* |
| Utica Gas & Elec., 7% pf. | 103 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 99½ | 93 | 100 |
| Utilities Pwr. & Lt., com. A $2 | 29½ | 28⅜* | 30⅜* |
| Utilities Pwr. & Lt., com. B $1—no par | k20½ | 20* | 20⅜* |
| VERMONT HYDRO-ELEC., 7% pf. | k 97 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k108 | 105 | 110 |
| WAGNER ELEC., 7% pf. | g 98 | 96½* | 99½* |
| Wagner Elec., com.—no par | b 38½ | 37* | 40* |
| Washington Ry. & Elec., 5% com. | k460 | 180 | 475 |
| Washington Ry. & Elec., 7% pf. | 102¾ | .... | .... |
| Washington Wtr. Pwr., 8% com. | k215 | 136 | 182 |
| West Penn Elec., 7% pf. | 110¾ | 109½* | 114⅜* |
| West Penn Elec., Cl. A $7 | 109½ | 106½* | 109½* |
| West Penn Pwr., 7% pf. | 115½ | 114⅜* | 116⅜* |
| West Penn Pwr., 6% pf. | 110 | 109⅜* | 113* |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf | k102 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 102 | 96 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 95⅜ | 88⅜* | 100⅜* |
| Weston Elec. Instrument, Cl. A $2—no par | 33 | 30¾* | 34¾* |
| Weston Elec. Instrument, com.—no par | k 14½ | 12½* | 14½* |
| Wheeling Elec., 6% pf. | k103 | 95 | 104 |
| Worthington Pump, 7% pf. A | 53¾ | 46½* | 55* |
| Worthington Pump, 6% B | 48 | 41* | 49⅜* |
| Worthington Pump, com. | 29½ | 28* | 34⅜* |
| YALE & TOWNE com. $5—25 | 72½ | 72½* | 75* |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Feb. 4. *l*Bid price Wednesday, Feb. 8. *m*Latest quotations available. †Dividend rate variable. *1928

the nearest hundred million kilowatt-hours, as the accuracy of the original data seems scarcely to warrant any greater precision. In determining the energy output per capita, the population in 1925 has been used as nearly as it could be ascertained.

## Allis-Chalmers Net Profits Down 11 Per Cent

Net profits of the Allis-Chalmers Manufacturing Company for the last quarter of 1927 were lower than for any preceding quarter of 1927 or of 1926. This reduced net for the year by 11 per cent to $3,182,472. Bookings in 1927 aggregated $30,651,807, a decrease of 4.72 per cent from the 1926 total, while billings for the year were $33,352,252, a gain of 8.7 per cent.

## New Set-up Makes Possible Long-Term Financing

Plans for simplification of the capital structure of the Indiana Service Corporation, involving the retirement of about $4,800,000 in bonds, were announced today. As a part of the program, provision has been made for a new mortgage, and under it $5,000,000 first lien and refunding mortgage 5 per cent bonds, due Feb. 1, 1963, have been issued and sold to Halsey, Stuart & Company.

Changes being made will build a sounder capital structure for the company. The mortgage under which the first and refunding mortgage bonds were issued provided that they are all to mature not later than Jan. 1, 1950. Continuing under just this mortgage would limit the company to comparatively short-term financing as this date approached. The new mortgage makes it possible to finance on a long term basis.

The new capital structure will consist of the first and refunding bonds, which now become first mortgage bonds, totaling $7,566,500; the new series of $5,000,000 first lien and refunding 5 per cent bonds, and $145,000 non-callable underlying bonds, which are gradually being exchanged for an equal amount of first mortgage bonds which are on deposit with the trustee for this purpose.

The Indiana Service Corporation furnishes electric light and power in Fort Wayne, Ind., and 41 other communities in northeastern Indiana and is controlled by the Midland Utilities Company. The company also owns extensive electric railway properties.

## Cities Service Gross Up 30 Per Cent

An increase of 31 per cent brought Cities Service net earnings up to $31,952,951, which is the highest earnings figure on record for the company. Gross revenue rose 30 per cent, to $33,061,062, as a result of expanding business in virtually all branches.

As a result of this radical improvement in the company's earnings position the net revenue available for common stock and reserves amounted to $22,604,925, which is a 45 per cent rise over 1926. Preferred dividends were earned 4.32 times, against 3.52 times the previous year, leaving 27.34 per cent on the average amount of common stock outstanding, against 20.03 per cent in 1926. Net earnings of the company for the past five years were: 1923, $16,093,616; 1924, $16,773,744; 1925, $18,989,071; 1926, $24,462,662, and 1927, $31,952,951.

Last year's earnings show that the company has made very substantial progress. Net earnings for 1927 were equal to more than twelve times interest and discount on its debentures, as compared with 9.2 times for 1926. Net earnings to stock and reserves was 4.32 times preferred dividends, as against 3.52 times for the previous year. Net to common stock and reserves in 1927 was $22,604,925, or 27.34 per cent of the average amount of common stock outstanding, which is the equivalent of $5.46 per share of $20 par value of common stock. This compares with $15,611,466 for 1926, which was equivalent to 20.03 per cent, or $4 per share of common stock then outstanding.

## New Issues $48,968,000

The week's largest piece of financing in the power and light industry is an issue of $20,000,000 Pacific Gas & Electric Company first and refunding mortgage bonds bearing a 4½ per cent coupon. This is series E, due 1957, and brings the total amount outstanding to $120,000,000. The issue is sold at 99 and interest, which represents a yield of more than 4.56 per cent.

Another sizable issue is the $6,000,000 first refunding mortgage bonds of the Pennsylvania Water & Power Company, series B, also bearing a 4½ per cent coupon. This issue, which is sold at 99, to yield 4.55 per cent, is to retire two other issues, a 5½ and a 6 per cent issue.

The Indiana Service Corporation sold a $5,000,000 issue of first lien and refunding mortgage 5 per cent bonds at 99½ and interest. The proceeds are for capital expenditures already made and for additions and improvements.

The National Gas & Electric Corporation carried out two pieces of financing this week, selling a $3,400,000 issue of 5½ per cent first mortgage collateral bonds, series of 1928, and a short term issue, totaling $1,800,000, of 5½ per cent convertible gold notes maturing in 1931. Both issues are to help pay for the subsidiaries acquired by the National Gas & Electric Corporation and for other purposes.

A $2,750,000 issue of 6 per cent first lien collateral bonds, series A, was sold this week by the Western Power, Light & Telephone Company. The proceeds are to be used, presumably, in the acquisition of a group of subsidiaries in Missouri, Kansas and Oklahoma.

Another 4½ per cent issue just sold is the $10,018,000 first and refunding mortgage bonds, series D, of the Ohio Power Company, which retire the same amount of series C, 6 per cents.

## Reduces Capital Stock

The Eastern New York Utilities Corporation has filed a certificate in the office of the Secretary of State reducing its shares from 34,750 of preferred stock, $100 par value, and 25,000 of common stock, no par value, to 21,000 of preferred stock, $100 par value, and 13,750 of common stock, $100 par value.

## San Diego Company Plans Record Construction Program

New construction investments of the San Diego Consolidated Gas & Electric Company for the year 1928, as shown in tentative budget estimates, will exceed those of any previous year in the company's history, according to William M. Raber, vice-president and general manager. This company's plans are of especial interest in view of the restrictive program in force in many sections of the Pacific Coast.

In stressing the fact that the construction is greater than ever before Mr. Raber made the statement that anticipated increased demand for its product and steady territorial growth experienced in this section warrants the expansion. The major expense item of 1928 involves erection of an addition to the company's main generating plant, Station B. Alterations are also planned at the main office of the company in the Electric Building. Figures showing the actual expense of this year's construction have not yet been given out.

# Pennsylvania Water & Power Company Earns $3.49 on Common

An increase of 14 per cent in gross earnings and a 7 per cent growth in net income enabled the Pennsylvania Water & Power Company to report net earnings of $3.49 a share in 1927, against $3.26 in 1926. This is a favorable showing in view of the rise of 33 per cent which took place in combined operating expenses, taxes and maintenance. The total of these items last year was $1,272,816, against $956,721 in 1926.

Last year was undoubtedly the best year Pennsylvania Water & Power Company has had. As in 1926, the year 1927 showed a river flow well above the normal and, as a result, a substantial sum has been transferred directly to "contingent fund" without appearing in the gross revenue figure. The loads of the majority of customers have increased considerably.

The company's common stock, with a former par value of $100 a share, was converted last May to no-par stock on the basis of four new shares for each old. During the first two quarters of the year the dividend was at the rate of 2 per cent on the old $100 par, while for the last two quarters the rate was 62½ cents on each new share.

As will be noted from the earnings statement, a substantial depreciation reserve is set aside. Last year the amount was $243,143, against $230,053 in 1926. This is approximately 7 per cent of gross revenue. There was also distributed to contingent fund $200,000 in accordance with the company's policy of "building up this fund to an amount necessary to equalize such fluctuations in income as result from variations in river flow above and below the normal, in accordance with a careful study which has been made of observed river stages for a number of decades in the past."

It is evident from what has been said that this company is working into a very sound position. A loan of $6,000,000 in first mortgage 4½ per cent bonds is being incurred to simplify the capital structure, including the retirement of $3,000,000 of the company's 5½ per cent bonds of 1952 and $2,750,000 6 per cent bonds of the Holtwood Steam Power Company, which company was recently acquired. A substantial interest saving is evident. The new stock is currently quoted around $70, earns $3.49 (1927) and is now paying at the rate of $2.50 per share.

## Westinghouse Electric Earns $4.92 a Share

A continued gain is shown in the earnings of the Westinghouse Electric & Manufacturing Company for the last quarter of the year. The gain of $5,205,562 reported increased net profits for the nine months to $11,679,901, after expenses and federal taxes. These nine months profits were equal to $4.92 a share on the 2,370,063 shares outstanding. This figure combines the 7 per cent cumulative participating preferred as well as the common stock, which has a par value of $50 a share.

Contributing toward the increase in business were new orders received in the nine months period amounting to $127,878,766 and in the third quarter $40,939,380. Sales billed for the nine months aggregated $130,800,523, as against $146,887,186 for the corresponding nine months period of 1926.

# Business News and Market Conditions

## January Contracts Show Change in Type

*Commercial and Engineering Construction Declines — Condition Probably Temporary—Public Building Increases*

JANUARY construction contracts did not reach the high record of December. Private commercial building work has fallen off, though public building shows an increase. Contracts reported in January by *Engineering News-Record* total $197,984,000, or $49,500,000 per week, which is 35 per cent less than for the average December (the record) week, but 9 per cent more than the figure of January, 1927. Increases over December are in water-works (low last year), excavation, public buildings and federal government work. There was a definite drop in lettings for private commercial buildings and for that important engineering division, "unclassified"—which includes tunnels, subways, wharves, pipe and transmission lines, and power developments. Awards in New England were about the same as in December, but elsewhere there was a uniform decrease of more than 20 per cent.

The 5 per cent increase in value of water-works contracted for in January as compared with the preceding month was due to large awards in the Middle West, where the total was $1,159,000 in January and only $124,000 in December, 1927. In spite of a general decrease in industrial building the states west of the Mississippi and in the Far West showed increases of 12 and 63 per cent respectively. Commercial buildings were contracted for in larger volume in New England and in the South. New York state contributed $65,740,000, or about 43 per cent of the total private commercial building awards in December, 1927, and in January only $24,955,000, which was 32 per cent of the total.

Five classes of construction increased over January, 1927. These increases in percentages are: Bridges, 12; streets and roads, 10; federal government, 47; unclassified, 288; excavation, 493. The increase in excavation contracts is due less to unusual activity in current contract-letting than to subnormal conditions a year ago, when the total for the first month was only $603,000, the average month for the year being $3,500,000. January contracts in the unclassified division include the Michigan-Ontario international tunnel, $10,000,000, and several pipe lines in Texas totaling $10,000,000.

The sectional changes show increases over January, 1927, in all except the New England and Far Western states. The South increased 50 per cent; the Middle Atlantic, 41; west of Mississippi, 30; the Middle West less than 1 per cent. In the South the value of awards for commercial and public buildings in January, 1928, was 100 per cent greater than last year. Industrial buildings and unclassified showed the most appreciable increases in the Middle Atlantic group.

The construction volume index number for January is 208, which compares with 319 (the record) in December, an average of 228 for all of 1926, 262 for all of 1927 and 187 for January, 1927. The construction volume index refers to the actual volume of contract letting (not the mere money value of the contracts let).

## N.E.M.A. Appliance Division Organized

The appliance division of the National Electrical Manufacturers' Association was organized on Jan. 24. The heating appliance and the electric range and water heating sections are included in the new division. The first activities to be undertaken are the development of a market for electrical appliances in co-operation with other associations which have marketing problems in common and the establishment of sound merchandising policies.

## Orders for Electrical Goods

New orders booked during the fourth quarter of 1927, as reported to the Department of Commerce by 86 manufacturers of electrical goods, were $239,247,023, as compared with $235,557,857 for the third quarter of 1927 and $260,078,082 for the fourth quarter of 1926. The total orders booked for 1927 were $954,883,416, as compared with $1,011,870.102 for 1926. This indicates a decrease of about 5½ per cent in 1927. The accompanying table gives the totals of bookings for each quarter since the beginning of 1922. They are presented not as a complete statement of the industry but as probably sufficiently representative to indicate the trend.

ORDERS FOR ELECTRICAL GOODS

| Quarter | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 |
|---|---|---|---|---|---|---|
| First | $143,320,453 | $225,399,383 | $228,760,838 | $233,023,182 | $262,677,736 | *$243,651,415 |
| Second | 165,370,750 | 240,542,824 | 221,167,876 | 227,502,652 | 248,000,075 | *236,427,121 |
| Third | 167,984,466 | 201,910,099 | 185,747,314 | 232,933,532 | 241,114,209 | *235,557,857 |
| Fourth | 192,473,402 | 218,165,415 | 231,470,552 | 244,597,050 | 260,078,082 | 239,247,023 |
| Total | $669,149,071 | $886,017,721 | $867,146,580 | $938,056,416 | $1,011,870,102 | $954,883,416 |

* Revised.

## Purpose and Development of National Electrical Code

The purpose and development of the National Electrical Code has been described in a booklet published by the National Electrical Manufacturers' Association, 420 Lexington Avenue, New York. In the foreword it is pointed out that the code is one of the fundamental documents of the electrical industry and is the product of an evolution which has progressed steadily for the last 35 years. The procedure for making "field" changes in the code also is covered and there is brought together for the first time a series of "route sheets" giving the successive steps in procedure for making both field and new material changes as well as important data about the Underwriters' Laboratories. A list of the N.E.M.A. committees whose efforts over a period of years have contributed to the strength and prestige of the code also is included.

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA DURING JANUARY, 1928

Totals for 1927 and 1926 (Thousands of dollars—000 omitted)

| | New England | Middle Atlantic | South | Middle West | West of Mississippi | Far West | United States | Total for January, 1927 | Canada |
|---|---|---|---|---|---|---|---|---|---|
| Waterworks | $60 | $328 | $150 | $1,159 | $187 | $263 | *$2,147* | $2,080 | $30 |
| Sewers | 147 | 677 | ........ | 1,394 | 152 | 701 | *3,071* | 4,697 | 62 |
| Bridges | 17 | 895 | 1,804 | 552 | 1,237 | 156 | *4,661* | 4,161 | 750 |
| Excavation, drainage, etc | ........ | 42 | 1,945 | 150 | 72 | 770 | *2,979* | 603 | ........ |
| Streets and roads | 1,744 | 1,893 | 6,947 | 5,345 | 8,188 | 2,664 | *26,781* | 24,233 | ........ |
| Industrial buildings | 1,050 | 11,178 | 498 | 4,031 | 2,940 | 1,318 | *21,015* | 21,578 | 600 |
| Commercial buildings | 13,858 | 42,631 | 6,718 | 20,342 | 4,623 | 7,817 | *78,140* | 111,285 | 5,485 |
| Federal government | ........ | 2,195 | 112 | 767 | 428 | 2,113 | *5,615* | 3,825 | ........ |
| Unclassified | 431 | 12,965 | 903 | 6,536 | 13,854 | 1,000 | *35,722* | 8,678 | 5,648 |
| January, 1928 | *$17,340* | *$72,804* | *$19,077* | *$40,280* | *$31,681* | *$16,802* | *$197,984* | ........ | *$12,575* |
| December, 1927 | 21,650 | 134,125 | 30,049 | 66,727 | 99,950 | 25,343 | *377,844* | ........ | 51,076 |
| January, 1927 | 18,525 | 51,381 | 12,716 | 40,104 | 24,441 | 34,573 | ........ | 181,740 | 5,028 |

## *Value and Destination of Electrical Exports for November, 1927, Compared with Corresponding Month in 1926*

(Issued by Bureau of Foreign and Domestic Commerce)

| Articles | November 1926 | November 1927 |
|---|---|---|
| Generators: | | |
| Direct-current: | | |
| Under 500 kw. | $111,083 | $85,025 |
| 500 kw. and over | 12,746 | 243,951 |
| Alternating-current: | | |
| Under 2,000 kva. | 21,225 | 6,658 |
| 2,000 kva. and over | ........ | 268,602 |
| Steam turbine generator sets | 352,191 | 109,112 |
| Accessories and parts for generators | 123,373 | 130,945 |
| Self-contained lighting outfits | 124,540 | 96,035 |
| Batteries: | | |
| Flashlight batteries | 203,062 | 222,573 |
| Other primary batteries | 161,355 | 187,422 |
| Storage batteries | 301,132 | 317,141 |
| Transforming or converting apparatus: | | |
| Power transformers | 338,873 | 198,959 |
| Other transformers | 108,273 | 76,791 |
| Rectifiers, double-current and motor-generators, dynamotors, synchronous and other converters | 106,151 | 158,363 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephone | 103,413 | 230,396 |
| Switches and circuit breakers over 10 amp. | 177,103 | 278,682 |
| Fuses and fuse blocks | 35,357 | 37,649 |
| Watt-hour and other measuring meters | 49,412 | 17,049 |
| Volt, watt, and ampere meters and other recording, indicating, and testing apparatus | 213,461 | 260,676 |
| Lightning arresters, choke coils, reactors, and other protective devices | 70,824 | 104,622 |
| Motors, starters, and controllers: | | |
| Motors, under 1 hp. | 131,065 | 220,140 |
| Stationary motors: | | |
| 1 to 200 hp. | 311,190 | 313,671 |
| Over 200 hp. | 47,487 | 72,278 |
| Railway motors | $84,706 | $68,753 |
| Electric locomotives: | | |
| Railway | 22,904 | ......... |
| Mining and industrial | 144,906 | 974,281 |
| Starting and controlling equipment for: | | |
| Industrial motors | 156,701 | 115,133 |
| Electric railway and vehicle motors | 17,843 | 45,641 |
| Portable electric tools | 52,874 | 138,332 |
| Accessories and parts for motors | 172,983 | 203,141 |
| Electric appliances: | | |
| Electric fans | 66,623 | 43,940 |
| Electric lamps: | | |
| Metal filament | 128,913 | 122,197 |
| Other electric lamps | 34,482 | 47,618 |
| Flashlights | 175,671 | 226,682 |
| Searchlights and projectors | 102,380 | 34,979 |
| Motor-driven household devices | 135,617 | 195,235 |
| Domestic heating and cooking devices | 231,504 | 136,989 |
| Industrial electric furnaces and ovens | 46,736 | 139,459 |
| Therapeutic apparatus, X-ray machines galvanic and faradic batteries, etc. | 140,956 | 135,590 |
| Signal and communication devices: | | |
| Radio apparatus: | | |
| Transmitting sets and parts | 130,421 | 14,277 |
| Receiving sets | 463,208 | 577,398 |
| Tubes | 80,678 | 72,207 |
| Receiving set components | 240,303 | 255,112 |
| Receiving set accessories | 330,663 | 340,770 |
| Telegraph apparatus | 113,084 | 56,895 |
| Telephone apparatus: | | |
| Telephone instruments | 44,491 | 27,263 |
| Telephone switchboards | 83,473 | 10,014 |
| Other telephone equipment | 245,051 | 173,335 |
| Railway signals, switches, and attachments | $56,002 | $52,087 |
| Bells, buzzers, annunciators, and alarms | 19,173 | 23,016 |
| Other electric apparatus: | | |
| Spark plugs, magnetos, and other ignition apparatus | 108,282 | 128,694 |
| Insulating material | 104,184 | 129,930 |
| Metal conduit, outlet and switch boxes | 88,535 | 81,058 |
| Sockets, receptacles and lighting switches | 172,680 | 157,334 |
| Electric lighting fixtures, interior and street | 167,693 | 215,889 |
| Other wiring supplies and line material | 78,706 | 84,200 |
| Other electrical apparatus, not elsewhere stated | 654,153 | 609,977 |
| Rubber and friction tape | 35,497 | 40,325 |
| Globes and shades for lighting fixtures | 46,966 | 60,855 |
| Electrical glassware except for lighting | 53,897 | 26,291 |
| Electrical porcelain: | | |
| For less than 6,600 volts | 38,778 | 55,729 |
| For 6,600 volts and over | 45,544 | 38,416 |
| Carbons, carbon brushes and electrodes: | | |
| Electrodes for electric furnaces | 107,908 | 150,459 |
| Other carbon products | 157,016 | 106,998 |
| Insulated wire and cable (iron and steel) | 17,296 | 10,589 |
| Copper, bare wire | 170,665 | 200,453 |
| Copper, insula ed wire and cable | 354,933 | 444,730 |
| Refrigeration sets up to 1 ton capacity | * | 328,297 |
| Domestic washing machines | 75,190 | 156,564 |
| Total | $9,153,585 | $10,048,385 |

*Not collected in 1926.

DESTINATION OF ELECTRICAL EXPORTS

| Country of Destination | November, 1927 |
|---|---|
| EUROPE: | $1,810,445 |
| Belgium | 82,321 |
| France | 92,667 |
| Germany | 122,926 |
| Italy | 90,181 |
| Netherlands | 73,219 |
| Spain | 170,311 |
| United Kingdom | 632,153 |
| Other countries | 546.667 |
| WESTERN HEMISPHERE: | $5,975,542 |
| Canada | 2,420,373 |
| Mexico | 511,575 |
| Cuba | 511,288 |
| Argentina | 584,901 |
| Brazil | 673,620 |
| Chile | 369,179 |
| Colombia | 227,545 |
| Peru | 51,876 |
| Venezuela | 92,892 |
| Other countries | 532,293 |
| ASIA, AFRICA AND OCEANIA: | $2,262,398 |
| British India | 182,881 |
| China | 76,236 |
| Japan | 750,506 |
| Philippine Islands | 142,515 |
| Australia | 508,873 |
| New Zealand | 111,188 |
| British South Africa | 168,431 |
| Other countries | 321,768 |

# Market Conditions

DIVERSIFIED sales mark the trade in the New England district and small motor orders were active. Arc-welding equipment is selling well and street lighting is attracting attention. In the Eastern district central-station sales trend upward. Orders covering $750,000 worth of substation apparatus were placed by a New Jersey utility company. A 6,000-kw. turbine unit was purchased for McCamey, Tex. Large industrial motors were a feature of current commitments. Electric pumping machinery business looks promising.

An order for $135,000 worth of substation equipment was placed in the Southeast for a plant at Jacksonville, Fla., and $100,000 worth of power transformers was ordered by a company in the Carolinas. A steel mill in Alabama purchased $65,000 worth of motor equipment, and there is a satisfactory number of small industrial projects under way. In St. Louis business is normal. An order for 100,000 ft. of street-lighting cable was reported. The volume of sales continues on the same level in the Middle West, with a slight acceleration in some lines. On the Pacific Coast small motor sales are excellent, there is considerable activity in the Kern oil fields, and industrial buying is good and well distributed among various industries. The Great Northern Railway Company ordered about $250,000 worth of apparatus in connection with the Cascade Mountain electrification. The Northwest Power & Light Company plans a 22,000-hp. hydro-electric plant and the British Columbia Electric Railway Company plans four substations totaling $140,000.

## *Metal Sales Moderate at Slight Concessions*

Prices on the metal market are slightly easier than a week ago. The situation in copper and lead is practically unchanged since early in December. Copper sales were very satisfactory last week Wednesday, Thursday, and Friday, with the result that the producing group that has been holding for some time at 14⅛ cents delivered in the East and 14¼ cents in the Middle West were able to book several orders at those levels. A large buyer entered the market for prompt shipment, cleaning up all the spot copper in sight at varying prices up from 14.075 cents. The last-mentioned quotation has been made by one seller all week, and the

NEW YORK METAL MARKET PRICES

| | Feb. 1, 1928 Cents per Pound | Feb. 8, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14⅛ | 14.075 |
| Lead, Am. S. & R. price | 6½ | 6¼ |
| Antimony............ | 11¼ | 11 |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots............ | 6 | 6 |
| Tin, Straits........... | 54½ | 53 |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price Feb. 8, 1928, 15⅞ cents.

market in the last two days has settled down to that level, so far as actual business is concerned, the 14⅛-cent Valley quotations of the large producing interests being largely nominal for the time being. A comparatively small quantity of lead changed hands. It is significant that virtually every transaction was for prompt shipment and many of the orders were marked "immediate."

## *Central-Station Sales Trend Upward in Eastern District*

Central-station buying for early spring delivery has started in the Eastern district and there is marked activity in the market. Current inquiries are directed largely to substation equipment. A New Jersey central-station company has placed commitments in this line to an amount of $750,000, divided between two large manufacturers, and has also given orders for equipment for close to 300 gasoline-electric buses, aggregating $600,000. Ford, Bacon & Davis, Inc., New York, has contracted for generating and other machinery to be installed at the plant of the Pecos Valley Power & Light Company, McCamey, Tex., including a 6,000-kw. power unit. Transmission line equipment also gives promise in the early future and sizable orders are anticipated by several manufacturers. Inquiries for wire and cable for this service are improving. A leading manufacturer of marine-electric equipment states that very satisfactory business has been transacted in this line since the beginning of the year, with every indication of continuance for several weeks to come. The city of New York will soon be in the market for electric machinery for a fireboat and ferry-boat.

Industrial sales are good, with heavy type motors easily the feature of current commitments. A large manufacturer has secured a contract for motors and auxiliary equipment for a rock-crushing plant in the East totaling more than $200,000. Electric pumping machinery shows signs of developing sizable business within a few weeks. Camden, N. J., has plans for four such pumping plants with a gross capacity of 5,000,000 gal. daily, to cost close to $100,000, and Clayton, N. J., will soon be in the market for similar units for water service. A leading producer of electric clocks states that orders have been good since the first of the year. A survey of the Philadelphia district shows a better demand for substation apparatus and important commitments are looked for within a few weeks. Textile mills are more prominent in the market, as are some of the larger metal and iron concerns in the eastern Pennsylvania territory.

Immediate construction operations in the district include the following: The Public Service Electric & Gas Company, Newark, N. J., plans a substation on Monroe Street, Rahway, and probably a similar station at Princeton. The British-American Metals Company, Plainfield, N. J., will rebuild its plant recently destroyed by fire with loss of about $450,000. The Ossining Ice Company, Ossining, N. Y., will proceed with an ice plant to cost about $150,000. The Baltimore & Ohio Railroad Company plans rebuilding its locomotive repair shops at Connellsville, Pa., recently destroyed by fire with loss of $500,000. Dreamland-in-the-Bay, Inc., Love Point, Md., plans transmission lines to Chester, Stevensville and vicinity. The Bureau of Supplies and Accounts, Washington, D. C., is asking bids until Feb. 14, for six motor-generator sets for the Anacostia navy yard (Schedule 8451). The Bureau of Yards and Docks, Navy Department, Washington, will receive bids (no closing date announced) for electric-operated refrigerating equipment for the marine barracks, Mare Island navy yard (Specification 5523).

## *Volume of Sales on Same Level in Middle West*

Little change in conditions is noticeable in the Middle West. The volume of business remains virtually the same as the previous week with a slight acceleration in some lines. The railroads contemplate large commitments, according to published budgets, and industrial activity is increasing. The various utility companies are busy with construction work and maintenance purchasing is quite heavy. Among the interesting items ordered were four economizers complete with appurtenances, twelve 500-kva. distribution transformers, two 16,000-amp. solenoid-operated air circuit breakers, 43 73-kv. 600-amp. disconnecting switches and 69 25,000-volt potheads.

Construction plans are as follows: Centralia, Ill., plans a municipal power plant. The Nu-Art Engraving Company, Chicago, plans a ten-story addition to cost $400,000. The Rapid Roller Company, Chicago, plans a new plant to cost $250,000. The Iowa Southern Utilities Company, Centerville, Iowa, plans a transmission line and distributing system at different points in Des Moines County. The Providence Hospital, Detroit, Mich., plans an addition to its power plant to cost $45,000. The Consolidated Paper Company, Monroe, Mich., plans a four-story addition to cost $300,000. The Interstate Power Company will build a transmission line from Spencer to Bristow and Lynch, Neb. The Central States Electric Company plans a transmission line from Walthill to Macy, Neb. The Iowa-Nebraska Light & Power Company, Lincoln, plans a 13,200-volt transmission line in the vicinity of Smartville, Neb. The Great Northern Railway Company, St. Paul, Minn., plans electrification of its shops at Grand Forks, N. D., to cost $500,000. M. A. Erickson, operating the Rugby Light & Power Company, Rugby, N. D., plans a power plant at Kenmare, N. D., to cost $75,000. The Dakota Public Service Company will improve its plant and system at Hettinger and Reeder, N. D. The Northern Power Company plans a transmission line to connect with the system of the Hughes Electric Company. Sioux Falls, S. D., plans an ornamental lighting system. The Terminal Warehouse Company, Milwaukee, will soon take bids for a five-story cold storage plant and terminal building to cost $1,000,000.

## *Substation Equipment Ordered in Southeast*

The largest order placed in the Southeast was for substation equipment amounting to about $135,000 for the municipal power plant at Jacksonville, Fla., and the next order in point of size was from a central-station company in the Carolinas for $100,000 worth of power transformers. A power company in Tennessee ordered oil circuit breakers amounting to $40,000, while a Georgia company's order for similar equipment amounted to approximately $30,000. Line material shows an increased activity, some of the orders placed calling for $29,000 worth of aluminum cable and joints, bare and weatherproof copper wire amounting to $14,000, creosoted pine poles totaling $5,600 and $2,600 worth of crossarms and insulators. A central-station company in South Carolina ordered switchboard equipment amounting to $4,000 and a Georgia company purchased distribution and small power transformers amounting to approximately $5,000.

Central station merchandising activities are getting off to good start for the year with many successful sales campaigns under way. One company completed a three weeks range campaign and sold 125 ranges. Orders and inquiries from industrial firms continue to show a healthy increase, the largest order placed being by a steel mill in Alabama for motor equipment amounting to $65,000. Another motor equipment order was from North Carolina and involved $7,000. There is a satisfactory number of small industrial projects under way.

Construction projects include: The St. Petersburg Cold Storage Company, St. Petersburg, Fla., plans a cold storage and refrigerating plant to cost $275,000. The Southeast Georgia Power Company will make extensions in its power plant at Alma, Ga. The Baker County Power Company, Moultrie, Ga., plans a power plant, using Diesel engine units. The Edisto Public Service Company has acquired power plants and waterworks at Allendale, S. C., and vicinity, and will make extensions. The Diamond Ice Company, Knoxville, Tenn., plans an ice plant to cost about $200,000. The Southern Utilities Company will construct a 110-000-volt transmission line from Ridgely to Tiptonville, Tenn.

## *Diversified Sales Mark Trade in New England District*

Wide range in variety, rather than large orders, mark the trend of buying in New England. Small motor orders are outstanding among equipment and supplies and total over $45,000. Orders for loom motor reached a good volume, one of which, amounting to about $5,000, is of interest. Central-station supplies are quiet and confined to small single orders, while wire and hardware are moving well. A manufacturer of switch and control equipment reports an encouraging trend, with orders in view for steady plant operation for some time to come. Arc-welding equipment is selling well. An order was recently placed with a steel fabricating company for a 10-hp. unit, and garages are making inquiries.

Bids will soon be placed on equipment for a 15-mile transmission line in Maine. The Mechanical Devices Company, Inc., Concord Junction, plans to install machinery amounting to about $250,000 and begin operation at an early date. Building contracts filed last week exceeded $14,000,000. The New England Public Service Company plans enlargement of the hydro-electric plant of the Utility Power Company, Bristol, N. H., recently acquired.

## *Industrial Plants Active on Pacific Coast*

Small motor sales are excellent on the Pacific Coast. There is considerable activity in the Kern oil fields. Industrial plant buying is good and well distributed among various industries. Such orders include an electric oven for lumber kiln drying at a value of $2,500, a $1,500 welding equipment for a San Francisco steel company, and 100 1/20-hp. motors for a manufacturer of calculating machines. Power company orders comprise four metering transformers for San Joaquin Valley installation at a cost of $4,000, an assortment of fiber conduit for $30,000 for the city of Los Angeles, a 1,000-kw. turbine generator, valued at $15,000, for Milton, Ore., and $17,000 worth of motors and feeder regulators for the city of Glendale. Miscellaneous bids awarded include a $10,000 wiring contract for an Oakland municipal freight pier; 5 miles of bare copper trolley wire for the San Francisco municipal car system, and 7,500 dry batteries for a steam railroad. New construction announced includes $700,000 for two buildings for chemistry and physics instruction at the southern branch, University of California; a new San Francisco stock exchange building, to cost $1,250,000; a new wing for a children's hospital in San Francisco at a cost of $600,000; an Orpheum theater in Sacramento to cost $800,000; a complete refrigerating system for U. S. Marine Barracks at Mare Island, and a new Masonic temple to cost $500,000.

The St. Paul offices of the Great Northern Railway Company awarded contracts to Seattle electrical concerns for furnishing approximately $250,000 worth of apparatus in connection with completion of electrification of the road over Cascade Mountain. Scattered sales of small motors were made to lumber mills and allied plants by various Seattle jobbers, totaled about 50 units. The Northwest Power & Light Company, Port Angeles, plans another 22,000-hp. hydro-electric unit, costing $2,200,000 on the upper waters of the Elwha River in Clallam County, and the British Columbia Electric Railway Company has completed plans for two substations costing $70,000 in Vancouver, B. C. A $20,000 substation at New Westminster and a $50,000 substation in West Vancouver. Construction of plant buildings for a 50-ton sulphite mill is planned by the Shaffer Box Company at Tacoma. The Kelso Paper Company plans immediate construction of a $300,000 pulp mill to be in operation within six months.

Other construction projects are as follows: The Fresno-Madera Ice Company, Fresno, Calif., will build an ice plant to cost $100,000. The San Joaquin Light & Power Corporation, Fresno, Calif., plans a substation on Ashland Avenue, with 60,000-volt transmission line. The Bowering Soap Company, Long Beach, Calif., plans a new plant to cost $600,000. The Fleischman Company, Los Angeles, Calif., plans a yeast manufacturing plant to cost about $100,000. The Modesto Irrigation District, Modesto, Calif., is asking bids until Feb. 20, for watt-hour meters, transformers and other equipment. The Untica Mines Company, Sacramento, Calif., plans a hydro-electric plant on the north fork of the Stanislaus River to cost about $150,000. The Apple Growers' Cold Storage Company, Watsonville, Calif., plans a one-story cold storage and refrigerating plant to cost about $250,000. The Northern Utilities Company plans a steam-operated power plant in vicinity of Shelby, Mont., to cost about $400,000. Alameda, Santa Rosa, Tulare, Madera, and San Jose, Calif., and the General Development Company, Los Angeles, plans installation of ornamental lighting systems.

## *Street-Lighting Cable Bought in St. Louis District*

The only order of contract size reported in the St. Louis district was for 100,000 ft. of street-lighting cable costing about $10,000. Transformers and control apparatus for three small substations were purchased for industrial concerns. Several electrical sign installations are reported. Manufacturers are shipping stock sizes of motors in good volume. The demand for lighting fixtures and building construction material continues good.

Construction projects are as follows: The Harding Glass Company, Fort Smith, Ark., will extend its sheet glass plant at a cost of $200,000. Marshall, Mo., plans a transmission line for light and power service. The Southwestern Light & Power Company plans to extend its station at Frederick, Okla. The Morgan Utilities Company has secured a franchise at Brownwood, Tex., and plans early construction of transmission line, substation, etc. The Gulf States Utilities Company plans extensions in power plants and transmission lines in vicinity of Port Arthur, Orange, Hull and Jasper, Tex., and plans have been filed for a substation at Beaumont, Tex. Muskogee, Okla., Palestine, San Marcos, Yoakum, and Sweetwater, Tex., and Little Rock, Ark., plan the installation of ornamental street-lighting systems.

# Activities of the Trade

## Westinghouse Gets Condenser and Steel Mill Orders

The Dayton Power & Light Company has placed with the Westinghouse Electric & Manufacturing Company an order for a 33,000-sq.ft. radial-flow type surface condenser together with the necessary auxiliary equipment. The condenser will serve a 25,000-kw. turbo-generator unit recently purchased and will be installed in the Millers Ford station of the Dayton company.

The Westinghouse company also has recently sold a 6,500-hp. reversing blooming-mill motor to the Illinois Steel Company, South Works, Chicago, and a 4,600-hp. motor to the Tata Iron & Steel Company, Punjab, India. The first order includes, besides the motor, a motor-generator set and switching equipment. Another order recently has been received by the company from the Milwaukee Electric Railway & Light Company for a synchronous — visual type of supervisory control equipment. This equipment will control and supervise 29 oil circuit breakers, provide for a transformer temperature alarm, six different current readings and seven voltage readings.

## Simplex Electric Heating Sells Appliance Business

On Feb. 1 the Simplex Electric Heating Company, 85 Sidney Street, Cambridge, Mass., sold its entire wall outlet appliance business to the Edison Electric Appliance Company, Inc., Chicago, which will continue the manufacture and sale of these devices. The Simplex company states that the sale of the wall outlet appliance business does not in any way affect its electric ranges, the manufacture and sale of which will be continued by that company as heretofore.

## General Electric Gets Order for High-Pressure Turbines

Stevens & Wood of New York have recently placed an order with the General Electric Company for two 53,000-kw. steam turbines together with a 12,000-kw. high-pressure turbine for installation in the new Deep Water station in New Jersey opposite Wilmington, Del., to be jointly owned by the American Gas & Electric Company and the American Electric Power Corporation. The 53,000-kw. turbines are of the cross-compound type to operate on an initial steam pressure of 1,200 lb., the steam being reheated in the boilers between the 12,000-kw. high-pressure element and the 41,000-kw. low-pressure element. The temperature of the steam entering into the elements will be 725 degrees. The 12,000-kw. high-pressure unit will be arranged so that the exhaust steam will furnish the process steam requirements of the adjacent plant of the DuPont company.

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Fairbanks, Morse & Company, Chicago, announces that C. H. Jernberg has become manager of the New York office, succeeding A. C. Dodge, who in the future will be at the main offices at Chicago.

The Hendrick Manufacturing Company, Carbondale, Pa., manufacturer of "Mitco" interlocked steel grating, etc., announces the opening of a Chicago district office at 223 Railway Exchange Building, in charge of Lon Sloan.

The Graybar Electric Company, Graybar Building, Lexington Avenue and Forty-third Street, New York City, has appointed Jerald F. Davis, formerly manager of the Pittsburgh branch, as manager of the Boston branch succeeding T. E. Burger. Mr. Davis was sales manager of the Western Electric Company (predecessor of the Graybar Electric Company) at Boston from 1919 to 1923, and after three years as sales manager of the New York branch was appointed to his Pittsburgh post.

The A. F. K. Fountain Works, 375 Reed Street, Milwaukee, has placed on the market the "A. F. K." vise-work support, by the use of which, the manufacturer says, one man can quickly and safely place a heavy armature in a vise.

The Curtin-Howe Corporation, 11 Park Place, New York City, which holds the commercial rights to the new wood-preservative developed by the engineering laboratories of the Western Union Telegraph Company, has appointed C. Marshall Taylor vice-president and general manager.

The Dampney Company of America, Hyde Park, Boston, Mass., announces that the sale of its "Apexior" protective coatings for power plant equipment will be handled in the Province of Quebec, Canada, by the W. K. Davidson Company, 332 William Street, Montreal, and in central and western New York by the Stone Company, 1219 Commerce Building, Rochester. The company also announces that the new address of its Connecticut representative is 151 Union Avenue, New Haven, Conn.

The Trumbull-Vanderpoel Electric Manufacturing Company, manufacturer of "T. V." safety switches, announces the appointment of Wallace L. Fleming as district representative with headquarters in Chicago.

The Driver-Harris Company, Harrison, N. J. manufacturer of "Nichrome" and other special alloys, announces the opening of an office at 7016 Euclid Avenue, Cleveland, in charge of L. H. Waldrip.

The Benjamin Electric Manufacturing Company, 120 S. Sangamon Street, Chicago, announces an entire new line of Benjamin-Starrett panelboards and steel cabinets for light and power service.

The Riley Stoker Corporation, Worcester, Mass., announces that it is supplying 25 9,000-lb.-per-hour "Atrita" unit pulverizers for the new Hams Hall station, which will supply the city of Birmingham, England.

The Commercial Electrical Supply Company, St. Louis, Mo., has appointed Freeman D. Phillips director of sales. Mr. Phillips was formerly general manager of the H. E. Roberts Electrical Supply Company, of Syracuse, N. Y.

The Frigidaire Corporation, Dayton, Ohio, is presenting to its field organization during the course of eight regional meetings in February, when the 1928 sales campaign is being launched, new household models recently announced by the company and a new electric water cooler designed for use in offices. The first meeting took place at Dayton and regional meetings are being held at Chicago, Omaha, San Francisco, Dallas, Atlanta, New York and Boston.

The Westinghouse Electric & Manufacturing Company announces that W. L. Newmeyer, who has been with the Westinghouse Electric Company of Japan, has been selected to represent the company in China.

The Robbins & Myers Company, Springfield, Ohio, has placed on the market its new 8-in. model 50 and 10-in. model 51 alternating-current nonoscillating fans in golden green finish.

The Corning Glass Works, Corning, N. Y., announces that Henry M. Hughes has been appointed representative with headquarters at the Oliver Building, Pittsburgh, to handle the sales of "Pyrex" power insulators in the state of Pennsylvania west of Harrisburg, West Virginia and counties in Ohio adjacent to the Pennsylvania and West Virginia lines.

The Graybar Electric Company, Graybar Building, New York City, has opened an office and warehouse in Roanoke, Va., at Salem Avenue and Sixth Street, with W. E. James as sales manager.

The Eureka Vacuum Cleaner Company, Detroit, is manufacturing a new cleaner known as the Eureka auto cleaner for many special cleaning purposes in homes, garages and business establishments.

The Martindale Electric Company, 1260 West Fourth Street, Cleveland, announces that stocks of the most popular sizes of commutator stones are being carried at the New York branch, in charge of E. H. Mitcham, 6 East Forty-sixth Street, New York City, and the Los Angeles branch in charge of John M. Dexter, 210 East Third Street.

The Bryant Electric Company, Bridgeport, Conn., announces the No. 6279 standard heater type switch as one of the complete Bryant line of heater and range type switches. It is rated at 20 amp., 125 volt or 10 amp., 250 volt. It has reversible rotation with indicating handle and is a single pole, series parallel, three-heat unit.

The Pacific Electric Manufacturing Company, 5815 Third Street, San Francisco, announces the appointment of W. G. Robertson as sales representative at Atlanta, Ga. Mr. Robertson was formerly with the Phoenix Utility Company.

The Sentinel Manufacturing Company, 5100 Superior Avenue, Cleveland, has purchased the "Laun-Dry-Ette" wringerless electric washing machine and is now making shipments of the latest model. F. C. Maxhimer is president of the Sentinel company, Albert G. Cook, vice-president and treasurer, J. L. Davis, secretary, and Fred C. Bach, sales representative.

The Boiler Engineering Company, 931 Federal Trust Building, Newark, N. J., announces that it now owns and controls the Turner baffle wall and henceforth can supply customers with either the "Beco" or the Turner.

The Candalite Company, 410 Eleventh Street, West New York, N. J., is producing a new type of lamp, known as the Candalite, which is a replica of a hand-dipped candle.

The Roller-Smith Company, 233 Broadway, New York, manufacturer of instruments, relays and circuit breakers, announces the following changes in its sales organization: S. H. King has been added to the sales force in New York and will operate in the Metropolitan district; Albert Milmow, Latonia Building, Charlotte, N. C., has been appointed exclusive agent for the states of North and South Carolina; M. B. Mathley, Monadnock Building, Chicago, has been appointed exclusive agent for the Chicago territory, superseding M. Frankel, who has been representing Roller-Smith in the Chicago territory for many years. Mr. Mathley has been associated with Mr. Frankel during that period, and W. J. Schuhmann, who has been connected with the New York office of the company for many years as a sales engineer, has been transferred to the works at Bethlehem, Pa.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Jan. 24, 1928)

1,656,898. Metallic Vapor Lamp; R. L. M. Belleaud and J. Barrollier, Courbevoir, France. App. filed Jan. 30, 1924.

1,656,912. Double Pole Electrical Connecter; C. E. Foster, Letchworth, England. App. filed Aug. 6, 1924. Of the concentric kind.

1,656,952. Push Button for Electric Switches, Etc.; B. W. Nutt, Lakewood, O. App. July 10, 1924.

1,656,962. Synchronizing Mechanism; E. A. Sperry, Brooklyn, N. Y. App. filed Sept. 18, 1920. Means for insuring the driving of a member at a constant speed and in synchronism with a constant speed device such as a clockwork mechanism.

1,656,972. Electric Converting Apparatus; J. E. Calverley, Preston, and W. E. Highfield, London, England. App. filed April 25, 1925.

1,656,989. Lightning Arrester; R. G. Sands, Waukegan, Ill. App. filed Sept. 11, 1925. As used on telephone circuits.

1,657,000. Cord Grip for Electric Fittings and Appliances; W. V. Butterfield, Greenfield, England. App. filed July 1, 1926.

1,657,001, 1,657,002, 1,657,003. Electric Switch; G. L. Cragg, Chicago, Ill. Apps. filed Jan. 24, Feb. 18 and March 17, 1927. Current conducting winding elements and circuit controlling switches.

1,657,004. Circuit Connecter; H. A. Douglas, Bronson, Mich. App. filed Sept. 3, 1925. Plug contact type.

1,657,035. Suspension Insulator with Hood and Deformable Pivoting System Forming an Articulated Joint; A. Richard, Milan, Italy. App. filed April 9, 1923.

1,657,040. Electric Switch; W. Schmid, Bronson, Mich. App. filed April 11, 1927. Wherein reciprocable rods are employed for effecting their operation.

1,657,053. Electrical Contact; J. A. Weiger, Union City, N. J. App. filed Oct. 9, 1926. Supports for tungsten contact points.

1,657,056. Intermittently Operating Electric Regulator; A. Ytterberg, Ludvika, and A. Garge, Vasteras, Sweden. App. filed April 22, 1926. Which may be applied to voltage, current, speed, or any other quantity of the machinery capable of being regulated in an analogous manner.

1,657,060. Incandescent Electric Lamp and Method of Producing the Same; A. L. Becket, East Orange, N. J. App. filed Jan. 30, 1925.

1,657,103. Current Flow Indicator; C. Berger, New York, N. Y. App. filed Dec. 31, 1921. Applying thermoscopic substances for indicating visually by readable characters temperature conditions which are a function of temperature, such as flow of current in an electric circuit.

1,657,105. Wireless Synchronizing Clock System; J. W. Bryce, Bloomfield, N. J. App. filed March 23, 1925.

1,657,144. Electric Steam Generator; A. N. Armstrong, Norwich, N. Y. App. filed Feb. 10, 1926.

1,657,149. Diathermy Apparatus for Sinus Treatment; De Forest B. Catlin, Boston, Mass. App. filed Aug. 11, 1926.

1,657,189. Cigar Lighter; F. Bain, Chicago, Ill. App. filed Oct. 16, 1926.

1,657,191. Electrical Indicating System; P. D. Barrett, San Francisco, Cal. App. filed Nov. 30, 1925. For theaters and the like.

1,657,204. Electric Griddle; K. Ehrgott, Erie, Pa. App. filed Sept. 12, 1925.

1,657,205. Electric Bake Oven; K. Ehrgott, Erie, Pa. App. filed Nov. 12, 1925.

1,657,207. Electrical Fuse; A. Fernandez, New York, N. Y. App. filed Sept. 4, 1926. Socket fuses.

1,657,232. Light Signal; C. S. Snavely, Pittsburgh, Pa. App. filed Aug. 11, 1923.

1,657,239. Motor Control; C. C. Clymer, Schenectady, N. Y. App. filed Dec. 23, 1926. Control of electric motors operating in what is known as the Leonard system.

1,657,248. Carrier Wave Coupler; W. Dubilier, New York, N. Y. App. filed Sept. 3, 1924.

1,657,249. Capacitance Transformer; E. D. Eby, Pittsfield, Mass. App. filed May 27, 1927

1,657,251. Electric Control System; A. C. Finney, Schenectady, N. Y. App. filed June 5, 1924. For the control of field windings.

1,657,252. Secondary or Storage Battery; B. Ford, Philadelphia, Pa. App. filed May 2, 1927. Sealing closure.

1,657,253. Connecter for Electric Conductors; P. R. Fortin, Schenectady, N. Y. App. filed Sept. 10, 1924.

1,657,258. Electric Protective Device; M. R. Hanna, Erie, Pa. App. filed March 19, 1925. For preventing the frame or other normally insulated part of the electrical apparatus from acquiring an excessive or dangerous potential in case the insulation should become defective.

1,657,262. Electric Metering System; V. Karapetoff, Ithaca, N. Y. App. filed Oct. 5, 1923.

1,657,303. Phase-Failure and Phase Reverse Protective Device for Polyphase Alternating Current Circuits; C. T. Evans, Milwaukee, Wis. App. filed Jan. 3, 1921.

1,657,306. Curling Iron; H. D. Gursky, Gloversville, N. Y. App. filed Nov. 26, 1926.

1,657,320. Automatic Circuit Breaker; A. Roth, Bron, near Lyon, France. App. filed March 24, 1926.

1,657,336. Electric Switch; C. E. Anderson, Stratford, Conn. App. filed Aug. 15, 1923. Flush switch.

1,657,337, 1,657,338. Electric Switch; C. E. Anderson, Stratford, Conn. Apps. filed Sept. 24, 1924, and Jan. 23, 1925. Rotary snap switch.

1,657,340, 1,657,341. Insulator Pin; A. O. Austin, Barberton, O. Apps. filed May 12, 1920, and Sept. 4, 1925.

1,657,358. Cigar Lighter; I. I. Hance, Meriden, Conn. App. filed Sept. 2, 1926.

1,657,433. Turbo-Generator Installation; K. Frey, Ennetbaden, Switzerland. App. filed April 11, 1927.

1,657,445. Induction Regulator; P. Suter, Baden, Switzerland. App. filed Jan. 25, 1926.

# New Trade Literature

RELAYS. — The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-847 describing and illustrating the type IJ induction differential relays, giving their method of operation and general application.

INSULATING MATERIALS.—The Mica Insulator Company, 200 Varick Street, New York City, has issued a price list effective Feb. 1, 1928, covering its "super micanite" and other electrical insulating materials.

NICKEL-CAST IRON—Bulletin No. 205, entitled "The Practical and Economic Value of Nickel and Chromium in Gray Cast Iron," has been issued by the International Nickel Company, 67 Wall Street, New York City.

LIGHTING UNITS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-715A covering the "Novalux" ornamental lighting units, form 12, for street lighting. The company is also distributing bulletin GEA-907 describing aviation beacons.

MAGNETIC SEPARATORS.—The Cutler-Hammer Manufacturing Company, Milwaukee, has issued catalog P-26, entitled "Magnetic Protection," giving complete information on magnetic separator pulleys. The catalog gives in detail the construction and design of all types of separator pulleys and contains tables giving the cubic-feet per hour capacity of all separator pulley sizes and the correct width and thickness of the belts to be used.

DISTRIBUTION TRANSFORMERS. — The Packard Electric Company, Warren, Ohio, is distributing bulletin 200-B, in which it describes and illustrates its distribution transformers. It also contains a description of its coil and core construction supplemented by photographs of various departments such as the assembly department, coil winding department, etc.

ELECTRIC WELDERS.—The Thomson Electric Welding Company, Lynn, Mass., has issued a bulletin describing its various types of spot welders, butt welders and seam welders. Photographs and a complete description of each type of welding machine are included. Enlarged views of the working parts of some of the welders are shown.

PIPE HANGERS, FIXTURE HANGERS, UNIONS AND CONNECTORS. — The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletin No. 2,107, describing and illustrating the various types of "Wedgtite" pipe hangers, flexible fixture hangers and self-threading unions and connectors.

ELECTRICITY FOR THE FARMER.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-444A, the third edition of "The G-E Farm Book," in which it calls attention to the things that electricity can do for the farmer. Many illustrations are given showing the various uses of electrical devices on the farm.

BLOWERS.—Catalog No. 32 issued by the Bayley Blower Company, Milwaukee, describes and illustrates the Bayley "Aerovane" blowers. Dimension diagrams and complete blower data are also included in the catalog.

FANS.—The Robbins & Myers Company, Springfield, Ohio, has issued a pamphlet describing its 8-in. model 50 and 10-in. model 51 alternating-current, non-oscillating fans in golden green finish.

RECORDING WATTMETERS.—Catalog No. 1502 issued by the Bristol Company, Waterbury, Conn., describes and illustrates the Bristol round chart and strip chart recording wattmeters and recording frequency meters. Wiring diagrams and a sample chart are included and attention is called to the electric motor operated clock furnished with Bristol's recorders when desired.

DRY-QUENCHING OF COKE.—The Dry Quenching Equipment Corporation, a subsidiary of the International Combustion Engineering Corporation, 200 Madison Avenue, New York City, is distributing catalog DQ-2, describing the Sulzer system for the dry quenching of coke.

LABORATORY APPARATUS.—"Laboratory Apparatus for Educational Institutions" is the title of a 48-page circular published by the Westinghouse Electric & Manufacturing Company. The circular gives complete information of apparatus for the school or engineering laboratory, arranged in convenient form. Many photographs, line drawings and characteristic curves are included.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Duranzo, Uruguay (No. 29,395), of storage batteries for automobiles and trucks.

An agency is desired in Penang, Straits Settlements (Nos. 29,458), for flash lights and other electrical supplies.

An agency is desired in Dresden, Germany (No. 29,386), for floor-surfacing machines, and electric portable tools.

Purchase and agency are desired in Hong Kong, China (No. 29,407), for household electrical appliances.

An agency is desired in Zurich, Switzerland (No. 29,413), for household electrical appliances.

An agency is desired in Prague, Czechoslovakia (No. 29,397), for electric refrigerating units using sulphur dioxide.

Purchase and agency are desired in Koonstanz, Germany (No. 29,393), for household gas-electric refrigerators.

An agency is desired in Magdeburg, Germany (No. 29,396), for electric safety razors.

An agency is desired in Medellin, Colombia (No. 29,476), for electric signs, electric stoves and floor lamps.

An agency is desired in Sydney, Australia (No. 29,455), for telephone apparatus.

Purchase or agency is desired in Le[illegible], Germany (No. 29,394), for washing and ironing machines.

An agency is desired in Catania, Italy (No. 20,410), for wiring supplies.

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## *The Lesson of Careers Like That of William Eglin*

MOURNED by a host of friends, W. C. L. Eglin, vice-president and chief engineer of the Philadelphia Electric Company, was laid to rest on Feb. 10. His life's work with the Philadelphia Electric Company, his labors in behalf of the historic Franklin Institute, his contributions to the National Electric Light Association and kindred organizations, as they flash upon the remembrance, all teach a lesson to every one in the industry struggling for his place in the sun. Mr. Eglin started at the bottom as a switchboard attendant and rose step by step to the positions of honor and authority he held at the time of his death. No work was too arduous, no task too exacting for him to undertake. Handicapped at first as all self-made men are, he overcame the difficulties which stood in his way and, under the urge of ambition and in the confidence begotten by years of struggle, he progressed and finally triumphed. What he may have lacked in brilliance he more than made up in service, and it was for service that Philadelphia respected and honored him and that his fellows in the industry admired him. This country abounds with opportunities for those eager and willing to work, and its greatness is predicated as much on the labors of myriads of men who, like Mr. Eglin, have fought "a good fight with all their might" as on the largess that it is able to bestow.

* * * *

## *Values in Management*

BECAUSE of management the light and power industry has grown into mass production of energy, long-distance transmission, interconnection, rural service, industrial applications and home conveniences. It is the product of the energy, the brains and the ideals of the men who direct it, and because of their ability it has grown, continued to extend its service and remained financially healthy. Management is often forgotten in a stock taking of the industry. It is not generally recognized that the material accomplishments so evident on every hand are only monuments to individual enterprise and initiative. Management is responsible for a constantly improved and extended service at a constantly decreased price. The situation has developed a logical succession of engineering and economic steps taken by courageous leaders of men.

Capital requirements of the light and power industry have increased faster than the revenues. But management never hesitated on this account and went ahead with its program for better and more extended service. It offset higher fixed charges by lowering interest rates and operating costs. Mass production and interconnection are characteristic. One pound of fuel in 1927 did as much work as three pounds of fuel did in 1913, and other economies in labor, material and reserve equipment, to say nothing of standardization and concentrated purchases, kept the price of electric service progressively decreasing. Feats of management lie behind the figures and structures that represent the physical assets of the industry.

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## *Decentralized Purchasing Seeks Its "Place in the Sun"*

CENTRALIZED management is synonymous with headquarters purchasing on many properties. Many economies have been reaped through bulk buying and will continue to be gained in this way, but of late the opinion has been expressed in manufacturing circles that in some cases the pendulum has swung too far away from local executive authority to yield the best all-around results. This viewpoint is not confined to purchasing problems, but appears every now and then in connection with nearly every phase of holding-company management in relation to the conduct of affairs in subsidiary properties. The subject is too large for exhaustive treatment in a few paragraphs, but it is especially important in the readjustment period through which many companies are now passing as a result of the transfer of financial control.

The picture of the headquarters purchasing agent and his supporting technical advisers nonchalantly awarding contracts to equipment and supply manufacturers' executives for a year's requirements of a dozen or two local properties to whose managers little voice in the selection of apparatus and material has been given has doubtless been drawn with exaggerated lights and shades by many who fear that decentralized purchasing has lost its place in the scheme of things. A word of warning has its uses, however. With all the recognized benefits of centralized management—and these are undeniable—it would be most unfortunate if headquarters policies, intentional or otherwise, should be such as to produce the "rubber-stamp" type of subsidiary property executive. Increased responsibility is the key to success rather than diminished influence.

Obviously the crux of the purchasing problem is to obtain the best equipment and material for a given purpose at the lowest over-all cost. The line of solution is sharply defined in the maintenance of close and continuous contact between headquarters and local properties, in inviting advice and suggestions from local executives and staff members as to the choice of material and apparatus for particular needs, in allowing reasonable latitude for routine local purchases, and in co-ordinating whenever possible the demands of scattered systems. Final decisions in important cases may still reside at headquarters; but if these problems are determined along engineering and economic lines, the chances in favor of awards satisfactory both locally and at the home office of the syndicate will be multiplied. Perhaps the most essential point in the whole affair is that nothing shall be overlooked that will help in making local needs clear to those far from the scene. As time passes adjustments take place which tend to bring about a proper division between centralized and decentralized buying in any particular organization. With a proper approach to the problem and an open-minded desire to meet the conditions most efficiently, neither headquarters men nor local managements nor manufacturers need expect other than successful purchase administration.

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## *Serving Two Masters Successfully*

NEGLECTING the corporate economy or desirability that may result from combining the electric company and the gas company in the same community, there remains the question of separate or unit service in those instances in which close financial or managerial conditions exist. Many utilities have found it to be desirable to have one trouble gang take care of complaints and emergency work for both electric and gas services. The economies in labor, supervision, equipment, time and money are obvious, but the suggestion is often productive of heated derision from those who have never tried it. Gas men are incredulous of the ability of their otherwise intelligent partners in utility service to comprehend the problems of a kindred activity. Men of the electrical division are, with at least understandable misgivings, dismayed at the thought of a mere gas man being able to grasp the somewhat exaggerated complexities of their field.

Where the electric-gas service-man plan has been tried for any considerable period of time there are few objections manifested. Some interdivision training is necessary, but the difficulties are few and the merits numerous. There are still many opportunities of a similar character in most organizations. The old story of lost hours and energy, of idle dollars, is never downed; it is as always a relative thing and not an absolute one.

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## *Another Commercial Contest and a Good One*

CONTESTS are one of the oldest forms of sport. It is natural enough therefore that in the field of business the competition idea should have been seized upon as a stimulus to salesmen; and though each new contest is apt to be greeted with the exclamation "What? Another!" it is still a good idea. In the electrical industry the criticism most often has been that the competition was a complicated affair, involving much labor and expense with an intricate scheme for evaluating results. But the "residence-kilowatt-hour contest" announced by the N.E.L.A. Commercial Section is refreshingly simple and appealing. It is a direct drive at a most desired objective. It is open and fair to all. It will entail no extra cost or work either to enter, to participate or to report. And so no wonder that letters are rapidly coming into the merchandising committee from power companies in all sections of the country saying that their sales departments are going to battle for the $9,000 prize money.

In a word, three first prizes of $2,000 and three second prizes of $1,000 are offered to those power companies, classed in three groups, that show the greatest increase in average consumption per residence customer during the year 1928. The groups embrace those companies whose present status might be called backward, average and advanced as concerns the development of residence load. Their achievement for the year will be reckoned by comparing their total average annual consumption for 1927 with the like figure for 1928. Each company will compete in its own class.

Two features of the contest are very appealing. First, as the ratings of the contesting companies are published from time to time, it will focus the attention of each company upon its own average residence consumption. All are ridiculously low when one compares the present possibilities of the market. Some are "plain pathetic." Some companies do not even know what their average is. But before this contest is done many sales managers and executives will have discussed why their company is classed as backward or compares so unfavorably with this community or that, and hurt pride will have goaded much inertia into action.

The fact that the prize money for the contest is being given in small amounts by a large number of manufacturers and others is also excellent. The industry has gone too often to a few large companies for special contributions. This time there will be a long list of subscribers, with nobody burdened and everybody interested. This contest should do a lot of good. Every central-station company should enter.

* * * *

## *Supervising Power Sales*

SUPERVISION of power sales activities varies widely among electric utilities. In some cases the commercial manager is responsible for the work of specialists in motor applications, industrial lighting, heating, rate making and contract drafting. He may have a pretty free hand, coming in contact with executives only for approval of budgets, requests for special reports and general guidance based on their broad knowledge of company development and its larger relations to the communities served. In other instances the power sales head may report directly to the general manager and perhaps maintain contact with a vice-president in the absence of a sales manager. Supervision may be close or elastic.

It is natural for a high-grade man of the type of a trained power sales engineer to function most effectively with a moderate amount of supervision. In a sense, such men are picked officers of the commercial advance guard, and the best results come from permitting them a large degree of freedom. Combat aviators cannot do their best work under the normal rigidities of military rule, and power engineers in their own way need to be free to go and come at will and to attain their objectives largely along their own lines of attack if maximum success is to be realized in customer relations and volume business. This kind of work involves sustained effort without regard to office hours; in fact, it is highly professional in character and as such deserves the privileges as well as the responsibilities of such an occupation.

The responsibility of the power engineer has increased steadily in late years, and his outside contacts and the breadth of his interests are putting him in a position to render more and more useful service to his superiors. His executive does well to expect certain definite results from his service without imposing narrow restrictions upon how these shall be achieved. On the other hand, executive interest in the work should be active and always in close touch with major negotiations in progress, familiar with the trend of economic studies in the power department, appreciative of when best to join forces with the power sales staff in direct dealings with customers and "prospects," and skilled in guiding the general procedure in harmony with company policies. All this can be done without requiring the executive to become too deeply immersed in detail if the power sales staff prepares first-class reports, summarizing situations with skill and including supporting data for such checking as executives may care to undertake directly or with the aid of outside advice. Unless close supervision, without narrow oversight, is accorded, it becomes difficult for executives to capitalize their own relations with industrial leaders and other important power customers in helping the power sales department to obtain and hold business. On the whole, a very high grade of team work is evident in the power industry in the above directions; sales engineers as a rule have deserved the liberty of action given to them, and apparently the principal opportunity for improvement lies in the direction of more complete economic reports. These are admirably prepared in a host of companies, but in many others are still lacking in comprehensiveness and in "make-up," to borrow a term from the editorial office.

* * * *

## *How Much Light Does the User Want?*

HUMAN eyes evolved outdoors under thousands of foot-candles of daylight. This fact alone points a questioning finger at the intensities of a few foot-candles which generally prevail in artificial lighting. However, to convince the user of light that he needs higher intensities of illumination for efficient work at maximum comfort actual data are necessary. These are being obtained in research laboratories, in factories and other workplaces. The consequence is that progressive executives are beginning to give some attention to the matter of lighting at these higher intensities. Already there are a number of unusual installations. An automobile-body plant is using 50 foot-candles with the so-called tungsten "daylight" lamp. A tile factory employs 150 foot-candles where the product is sorted. A few factories are using 30 to 40 foot-candles, and one large office at least is provided with 25 foot-candles in some places.

As we look back a decade or two we find a steadily increasing tendency toward higher intensities of illumination. Much of this is due to the glowing examples of the productiveness of good lighting. However, there is another very interesting phase—the user's natural tendency to use more light when he can get it. This was recently investigated by a laboratory noted for its researches in lighting and vision. About twenty-five observers were used, and they were permitted to choose independently the intensity of illumination desired for reading. Unknown to the observer, the maximum intensity of illumination available was different on each of five days, ranging from 10 foot-candles to 100 foot-candles. It is interesting to note that the average intensity chosen always depended upon the maximum intensity available For quite a range it was very roughly half the available intensity. The lighting conditions were satisfactory and the intensity of illumination was the only factor which was altered.

From this the interesting conclusion may be drawn that the user will choose to use more light if more is available. With this tendency supported by the demonstrated economic value of good lighting, it should not be difficult to have higher intensities of illumination introduced in most workplaces. Furthermore, the upper limit does not seem to be in sight.

* * * *

## *New Type of Street-Lighting Rate Desirable*

ON THE larger utility systems serving many cities and towns several different street-lighting rates often are in effect. Usually a flat rate per lamp is charged, and the rate is not always logical and equitable. Often the rates are based upon expediency and do not recognize quantity use and other principles entering into costs and rates. A solution has been suggested whereby the street-lighting rate includes a charge for energy based on the prevailing commercial lighting or power rate and another covering maintenance and fixed charges. The resulting rate would recognize demand, load factor and energy consumption—three factors that should enter into all rates. Based upon these charges, a rate per lighting unit could be worked out for groups of 100, 200 and on up to any maximum number of lamps desired. Any city or town would then earn the rate to which it was entitled according to the number of street lamps. The rate could be a matter of published tariff and as easily justified as the commercial lighting or power rate applicable to the particular community.

Utilities are interested in street lighting from many aspects and can well afford to put some thought on rate systems which more nearly reflect the technical and commercial aspects of the art as it exists today. Street lighting can be made good business if it receives adequate attention.

* * * *

## *Maintenance of Primary Customers' Service Equipment*

WHO should take care of the maintenance of transformers and circuit breakers at the plants of industrial customers? The reconditioning of insulating oils and the proper adjustment of contacts and mechanism is as important at one end of the circuit as at the other, yet privately owned equipment goes untouched or incompetently serviced for long periods—often to the point of failure. Except in large installations where a definite provision is made for such work, the industrial plant operators have neither the equipment nor the familiarity with procedure which is requisite for satisfactory results. The job, when recognized as important, is postponed even unto the day of inevitable reckoning. The oil used for replacement has probably stood in containers exposed to a climate of destructive propensities, reclaiming equipment is in the condition induced by disuse, and instruction books are mislaid.

It is one of the many and increasingly numerous duties of the electric light and power companies to advocate definitely, ascertain, and if necessary perform, the servicing of transformers and main breakers in the plants of industrial customers. It takes but little persuasion to convince the customer that the power company should do the job. The cost charged should, if necessary, be nominal. It is a vital and important phase of service.

# *Modern Construction in North Boston*

*Broadway substation, Everett, Mass., is in a residential area on a busy highway*

*Attractive ornamental lighting, Everett, Mass.*

*Interior of Everett substation shows good design*

*New Medford substation of Malden Electric Company has pleasing architecture and landscape gardening*

# Residential Water Heating

Investigation and tests made by the Northern States Power Company in order to serve electric water-heater load at attractive rate and at a comparatively low investment cost per customer

By R. R. Herrmann and K. R. McClung
*Northern States Power Company, Minneapolis, Minn.*

In nearly all range-equipped residences the hot water problem is not satisfactorily solved, especially during the summer months. Customers enjoying the convenience of an electric range also demand some practical means of heating water, and the desire of electric companies to render such service is manifested by their present and past interest in the subject.

An electric water heater will be a relatively large kilowatt-hour user. Assuming an average use of 50 gal. of water per day, heated through a temperature rise of 100 deg. F. (50 deg. to 150 deg. F.), the energy used per month will be approximately 400 kw.-hr. This means that the water heater will use more than double the kilowatt-hours used by the range, lights and appliances combined and will more than treble the present kilowatt-hour consumption of a residence so equipped. Although a large number of kilowatt-hours are used per month, the value of the service rendered will not permit too great a charge except in special cases. A low rate is, therefore, necessary for this class of service.

The operating company has in this class of business a method of increasing its summer load, improving its load factor, using otherwise idle distribution and generation equipment and, at the same time, increasing its net revenue.

A survey of the various types of electric water heaters on the market shows that all makes may be grouped into the following classes:

I—Instantaneous Systems.
    (A) Automatic control.
        1. Large wattage heater; no storage tank.

II—Storage Systems.
    (A) Automatic control; thermostat.
        1. High-wattage circulation type heater; comparatively small tank, fairly well insulated.
        2. Small wattage "immersion" or "clamp-on" heater; large storage tank, well insulated.
    (B) Manual control.
        1. Large wattage circulation type heater; comparatively small tank.

The instantaneous system operating without storage tank and supplying hot water instantaneously must have a heating element of high wattage. If water is drawn at the rate of 1 gal. per minute and is heated from 50 deg. F. to 150 deg. F. the heater will be required to supply 100×8.33, or 833 B.t.u. in one minute. At this rate of consumption about one-fourth of a kilowatt-hour will be used in one minute, which is equivalent to a demand of 15 kw. Obviously, this type of heater cannot be used on residential lines where loads of such size would cause serious voltage fluctuations.

Storage systems of the automatic and manually controlled types have been most commonly used in the past. Circulation and immersion heaters of comparatively high wattage (5,000 watts) have been used in connection with comparatively small storage tanks. Storage systems employing low-wattage heating elements and large storage tanks are of later development.

Since some manufacturers advocate a small heater with a large tank, well insulated, and others a small tank with a large heater, steps were taken by the Northern States Power Company to ascertain, if possible, what sort of water heater should be advocated and sold to its customers at the present time. The high-wattage circulation type of heater, being the type most largely in use, naturally was given first consideration. Data on installations of this type indicated that there would be little improvement in load factor resulting from its use. Furthermore, with heaters of this type, either manually or automatically controlled, it was felt that even with a large diversity in use the average peak demand would be too large to merit a low rate. Accordingly, an attempt was made to devise a system which would have a good load factor and little peak responsibility.

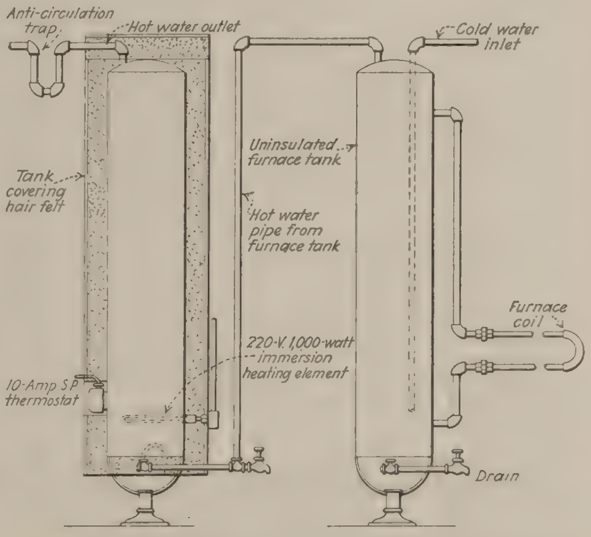


FIG. 1—ELECTRIC WATER HEATER INSTALLED WITH FURNACE TANK

Having in mind the desirability of a good load factor, and at the same time the satisfaction of the customer, the following method of water heating was suggested:

Two heating elements, one of small capacity, approximately 150 watts, and the other of large capacity, possibly 3,000 watts, were to be used. The small element was to be located at the bottom of the storage tank and to be in operation continuously. The large heater was to be placed in a circulating pipe along the side of the tank and was to be turned on manually, with a suitable means for turning it off, either when the temperature of the water reached the desired point or after a certain time had elapsed. The idea back of this suggestion was that the small heater would supply the radiation losses of the tank and would just equal these losses when the temperature of the water reached 220 deg., which would be the condition when no water was withdrawn from the tank for a period of a day or so, thus eliminating any temperature control for the small element. Since the small element would, therefore, give a 100 per cent load factor, it was felt that the energy for the same could be sold very cheaply. Since the large heater would be operated intermittently throughout the day and would have a much poorer load factor, it seems reasonable that this large heater should not deserve the same rate for energy as the small heater, but, instead, a higher rate. The rate schedule in Minneapolis has a low step of 3 cents per kilowatt-hour with 5 per cent discount for prompt payment, and it was suggested that the energy for the large heater should be metered through the regular house meter and thus be billed at the 3-cent rate.

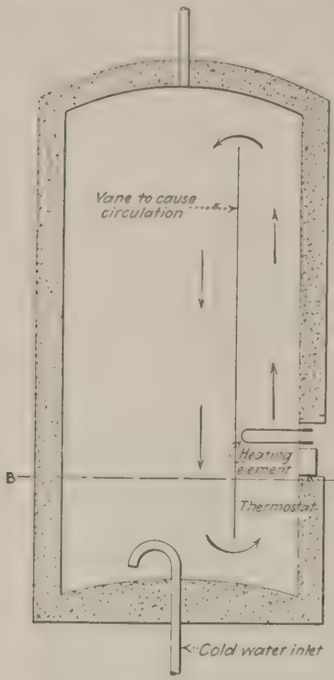


*Fig. 2 — Cross-section of electrically heated tank with circulation plate*

Note.—When sufficient water is used to bring cold water up to line *BB*, the thermostat operates, turning on the heating element. Heating element stays on until portion below *BB* is heated, due to circulation.

Accordingly, several installations were made in the homes of employees along the lines suggested. With the small heater just large enough to take care of radiation losses, it was found that the large heater (3,600 watts) was being used so frequently that the customer's bill at the rates suggested above would be too great to promote the business.

### Tests on Types of Water Heaters

Discussion of the system raised the point regarding the relation between the kilowatt-hours consumed by the large size heater and the size of the small heater. If the small heater were increased in size from 150 watts to 500 watts or so, besides supplying the radiation losses, this small heater would supply an additional amount of hot water, thus reducing the number of times which the large heater would be used. In this case, however, it would be necessary to have the small heater thermostatically controlled, since the temperature of the water would rise to an unduly high point if little or no water were used during an interval of a day or more.

In order to ascertain what size of small heater would supply the majority of requirements the large heater (3,600 watts) in the side arm circulating pipe of several installations was then placed in automatic operation, turning on when the temperature of the water fell to a certain point and turning off when a certain temperature had been reached. Fig. 4 shows the variation in the temperature of the water in one tank during a 24-hour period with this arrangement.

It will be seen that there is a great variation in the temperature of the water as recorded by a thermometer placed 4 in. from the top of the tank. This is due to the fact that the thermostat controlling the large heater was placed at the bottom of the tank and the circulation of water was not free enough to keep a more even temperature between the bottom and the top.

The wattage of the large heater was next reduced to 1,800 and the small heater was left the same as before and, also, in operation continuously as before. A temperature and demand chart are shown in Fig. 5. There is not as great a variation in the temperature of the water as before, which is probably accounted for by the fact that as rapid circulation as before was not required to distribute the temperature.

The improvement in the operating conditions shown by this last arrangement suggested reducing the size of the large heater from 1,800 to 900 watts, leaving it thermostatically controlled as before. A temperature chart is shown in Fig. 6 and is a considerable improvement over the temperature chart shown in Fig. 5. Besides the improvement in the temperature chart, there is also an improvement in the load factor over the previous two conditions of operation, as may be noted by referring to the demand charts.

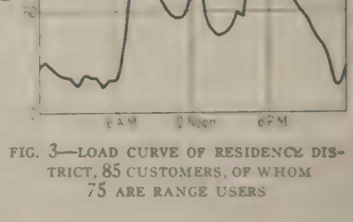


FIG. 3—LOAD CURVE OF RESIDENCE DISTRICT, 85 CUSTOMERS, OF WHOM 75 ARE RANGE USERS

It will be noticed that under the last condition of operation the wattage of the two heaters combined is close to 1,100. In this particular installation the tank was a 30-gal. tank covered with 2 in. of hair felt. The radiation loss of the tank alone amounted to approximately the capacity of the small heating element. The radiation loss of the large heater in the circulating pipe was, however, a considerable amount, being approximately 125 watts. The small immersion heater was next increased in size to 800 watts and was controlled by the thermostat. The circulation, or 3,600-watt heater, was rewired so that it was manually controlled, the idea being to find out how often this large heater would be turned on to take care of such cases when all water would have been withdrawn from the tank and more hot water desired immediately. Fig. 7 shows a temperature chart of the water, and the accompanying demand chart shows that the large heater was not turned on during this period, which means that the 800-watt heater supplied all of the hot water used by this household during the 24 hours. Charts taken over a two-week period show that only twice during this time was it

Fig. 4—Gallons of water consumed, 75; kilowatt-hour consumption circulation heater, 22; kilowatt-hour consumption immersion heater, 4; total, 26.

Immersion heater (187 watts) in operation continuously. Large heater (3,600 watts) controlled by thermostat operating between 90 deg. and 120 deg. F.

Fig. 5—Gallons of water consumed, 90; kilowatt-hour consumption circulation heater, 20; kilowatt-hour consumption immersion heater, 5; total, 25.

Immersion heater (187 watts) in operation continuously. Circulation heater (1,800 watts) controlled by thermostat operating between 90 and 120 deg. F.

Fig. 6—Gallons of water consumed, 67.5; kilowatt-hour consumption circulation heater, 16; kilowatt-hour consumption immersion heater, 5; total, 21.

Immersion heater (187 watts) in operation continuously. Circulation heaters (900 watts) controlled by thermostat operating between 90 and 120 deg. F.

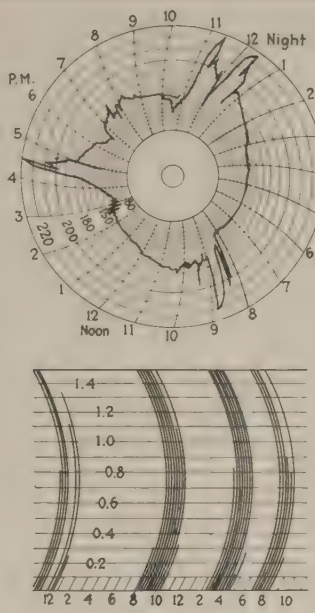


FIG. 4

*Temperature and demand charts show effect of different methods of control and types of heaters*

Fig. 7—Gallons of water consumed, 67.5; kilowatt-hour consumption immersion heater, 19.

Immersion heater cut to 800 watts. Operation controlled by thermostat operating between 90 and 120 deg. F.

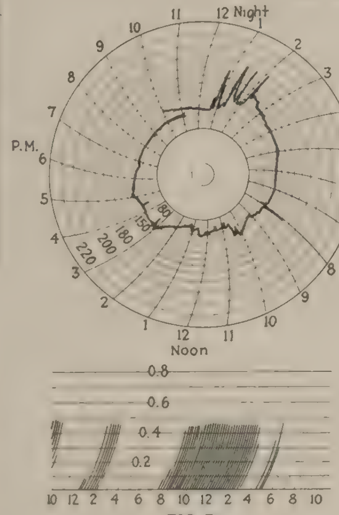


FIG. 5

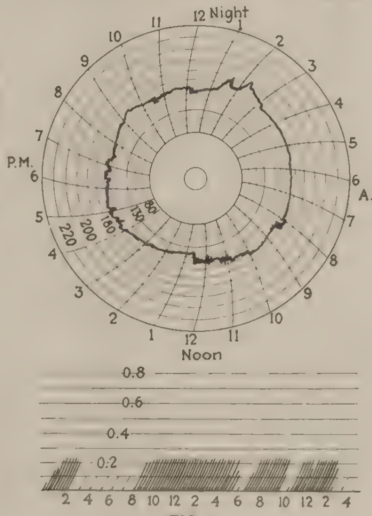


FIG. 6

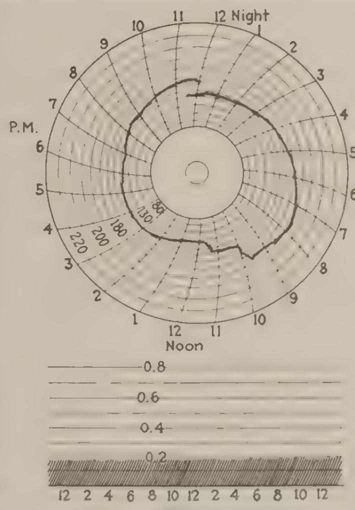


FIG. 7

necessary to utilize the 3,600-watt circulation type water heater.

If the size of the tank had been 60 gal. instead of 30 and had been well insulated it is doubtful whether the large heater would have been turned on at all during the two-week period. This led to the recommendation that for the time being a 1,000-watt heater would be supplied with a well-insulated tank of fairly large capacity. Installations made along these lines during the spring and summer have resulted in no complaints whatever.

Table I shows more in detail the results of the tests described above. It will be seen that the 800-watt immersion heater supplied all of the hot water required, even though the 3,600-watt heater remained in the circulating pipe, with its consequent radiation loss. This customer is a rather large user of hot water. Other installations show a consumption as low as 30 gal. per day.

Table II shows the kilowatt-hours consumed by five customers selected at random. Each of the tanks was equipped with a 1,000-watt immersion heater automatically operated, to cut out when the water reached a temperature of about 150 deg. Several thermostats set to operate at about 175 deg. caused complaints of water being too hot, so they were reset to operate at 150 deg.

In deciding upon the proper rate and apparatus for supplying household requirements, the following conditions must be carefully considered: First, the value of the service to the customer necessitates a low rate for energy; second, hot water service, not electric, is desired by the customer; third, for a given hot water use a certain number of kilowatt-hours must be supplied during any given period and the time during which these are supplied directly affects the cost to both customer and company.

In comparing electric heating with other forms, such as gas, oil, coal or wood, it must be remembered that the thermal efficiency of the electric heater is the greatest. Other systems require a vent pipe to carry the burned gases while in operation and, at the same time, cool the

TABLE I—COMPARISON OF TEST RESULTS ON ELECTRIC WATER HEATERS AND CONTROL

(30-gal. tank; 2 in. hair felt covering; three persons in family)

| Size of Immersion Heater, Watts | Size of Circulation Heater, Watts | Control of Immersion Heater On | Control of Circulation Heater | Kw.-Hr. per Day of Immersion Heater | Kw.-Hr. per Day of Circulation Heater | Length of Test, Days | Gallons of Water per Day |
|---|---|---|---|---|---|---|---|
| 187 | 3,600 | Continuously | Thermostat | 4.53 | 20.33 | 6 | 52.5 |
| 187 | 1,800 | Continuously | Thermostat | 4.7 | 15.66 | 16 | 67.0 |
| 187 | 900 | Continuously | Thermostat | 4.8 | 18.00 | 10 | 72.8 |
| 800 | 3,600 | Thermostat | Manual | 18.6 | 0 | 5 | 70.5 |

TABLE II—ENERGY USED BY FIVE ELECTRIC WATER HEATER CUSTOMERS

(Each equipped with 1,000-watt immersion heater)

| Customer | No. in. Family | Size of Tank in Gallons | Period | Kw.-Hr. | Kw.-Hr. per Day |
|---|---|---|---|---|---|
| A | 3 | 30 | July 11–Aug. 11 | 344 | 11.1 |
| B | 4 | 30 | July 28–Sept. 9 | 359 | 8.3 |
| B | 4 | 30 | Sept. 9–Oct. 10 | 235 | 7.6 |
| C | 4 | 60 | June 7–July 9 | 518 | 16.2 |
| C | 4 | 60 | July 9–Aug. 10 | 488 | 15.2 |
| C | 4 | 60 | Aug. 10–Sept. 15 | 676 | 18.8 |
| D | 4 | 30 | Sept. 15–Oct. 26 | 473 | 11.5 |
| E | 3 | 30 | Sept. 14–Nov. 8 | 857 | 15.6 |
| F | 3 | 60 | June 13–July 13 | 129 | 4.3 |
| F | 3 | 60 | July 13–Aug. 12 | 93 | 3.1 |
| F | 3 | 60 | Aug. 12–Sept. 14 | 109 | 3.3 |
| G | 4 | 40 | June 16–July 13 | 363 | 13.4 |
| G | 4 | 40 | July 13–Aug. 15 | 319 | 9.7 |
| G | 4 | 40 | Aug. 15–Sept. 14 | 218 | 7.3 |

water when not in operation by cold air being drawn through the coils because of the vent pipe. This may be partially controlled. Suppose, however, that gas sells for $1.50 per 1,000 cu.ft. and has a heating value of 500 B.t.u. per cubic foot. Assuming a thermal efficiency of 50 per cent, 3,400 B.t.u. (1 kw.-hr.) will cost 2.1 cents. Suppose again that the gas heater is of better design and is 75 per cent efficient. In this case 3,400 B.t.u. will cost 1.3 cents. Or, take oil, having a heating value of 140,000 B.t.u. per gallon at 50 per cent efficiency and at 10 cents per gallon, 3,400 B.t.u. will cost 0.5 cent. The difference is, of course, much more marked in this case, but when one considers the almost insignificant number of oil heaters in gas districts the competition from this source is also negligible.

About 833 B.t.u. are necessary to raise the temperature of one gallon of water 100 deg. F., which means slightly more than 4 gal. per kilowatt-hour. At 50 gal. per day the kilowatt-hours per month will be about 400, exclusive of any radiation losses. Unless the rate is lower than 2 cents, the cost will be greater than the majority of people will care to pay, especially when the cost of electrical equipment exceeds that of gas-operated apparatus, as it usually does.

The total cost to the customer, however, includes the initial cost of the equipment. What can be reasonably invested in a storage tank will, of course, depend upon two factors: (1) How many gallons of water will the customer use per month, and (2) what rate must he pay for electrical energy?

The cost to the utility can likewise be segregated into (1) fixed costs, due to increase in local and general investment, and (2) variable costs, depending upon the amount of hot water used.

It is at once apparent that these two parties to the transaction are in opposition. For example, from the central station viewpoint the most desirable water heating load would be during the valleys of the load curve. This would necessitate (1) a large storage tank and (2) clock-switching mechanism or the equivalent. An electric heater of large capacity would require the smallest tank and no clock mechanism. It would, however, require additional investment in transformer and generator capacity and in wires. The question to be decided, then, is: What size heater and tank is the most economical for the customer, since he is the one who pays the cost ultimately.

## Cost to the Utility

Assuming that all equipment inside the customer's dwelling, except the meter, is paid for by him and all other cost is paid for by the utility, an attempt will be made to discover what size heater and tank is the cheapest, all things considered.

The assumption will be: (1) 50 gal. of hot water per day; (2) water heated from 50 deg. to 150 deg.; (3) each residence equipped with an electric range; (4) a peak load of a group of range-equipped residences to occur between 5 and 6 p.m., and to total 1 kw.; (5) an insignificant residential load between 12 midnight and 6 a.m.

## Comparison of Methods

The first method (designated as method No. 1) considered is the supplying of sufficient kilowatt-hours between midnight and 6 a.m. to heat 50 gal. of water 100 deg. and to supply radiation losses. This means heating the water to a somewhat higher temperature than 150 deg., since the temperature will constantly fall during the other eighteen hours due to radiation losses to the air and the cooling effect of the incoming cold water.

The cold water will, of course, enter the bottom of the tank and hot water will be drawn off at the top. Turbulence of incoming cold water as well as heat con-

TABLE III—VARIATION IN DEMAND AND COST TO SUPPLY 200 TO 1,200-WATT HEATERS

| Size of Small Heater (Watts) | Hours Small Heater Is On | Kilowatt-Hours Supplied by Small Heater | Kilowatt-Hours Supplied by 3-Kw. Heater | Kilowatts—Demand of Small Heater | Kilowatts-* Station Demand of Large Heater | Kilowatts Total Station Demand | Investment of Company at $200 per Kilowatt | Investment of Customer and Company |
|---|---|---|---|---|---|---|---|---|
| 100 | 24.0 | 2.4 | 12.6 | 0.1 | 0.70 | 0.8 | $160.00 | $405.00 |
| 200 | 24.0 | 4.8 | 10.2 | 0.2 | 0.57 | 0.77 | 154.00 | 400.00 |
| 300 | 24.0 | 7.2 | 7.8 | 0.3 | 0.43 | 0.73 | 146.00 | 391.00 |
| 400 | 24.0 | 9.6 | 4.4 | 0.4 | 0.24 | 0.64 | 128.00 | 373.00 |
| 500 | 24.0 | 12.0 | 3.0 | 0.5 | 0.16 | 0.66 | 132.00 | 377.00 |
| 600 | 24.0 | 14.4 | 6 | 0.6 | 0.03 | 0.63 | 126.00 | 371.00 |
| 700 | 21.5 | 15.0 | 0 | 0.6 | 0 | 0.6 | 120.00 | 365.00 |
| 800 | 18.8 | 15.0 | 0 | 0.6 | 0 | 0.6 | 120.00 | 365.00 |
| 900 | 16.7 | 15.0 | 0 | 0.6 | 0 | 0.6 | 120.00 | 365.00 |
| 1,000 | 15.0 | 15.0 | 0 | 0.6 | 0 | 0.6 | 120.00 | 365.00 |
| 1,100 | 13.6 | 15.0 | 0 | 0.6 | 0 | 0.6 | 120.00 | 365.00 |
| 1,200 | 12.5 | 15.0 | 0 | 0.6 | 0 | 0.6 | 120.00 | 365.00 |

* Assumes necessary killowatt-hours supplied during eighteen hours of the day.

duction will cause a considerable lowering of the temperature. There will be very little convection currents, since the hot water is already at the highest point. To keep the conduction from the top 50 gal. as small as possible, an additional 25 gal. of capacity should be provided. This means a 75-gal. tank. Radiation losses for a well-insulated tank of this size will be about 75 watts and for a poorly insulated tank three times this amount and more. The kilowatt-hours to be supplied per day will then be 12.5 for raising the temperature of the water and about 2.5 for radiation losses, making a total of 15 per six hours, or 2.5 kw. capacity. Since the demand of a group of residences was assumed to be 1 kw., the peak demand will now be 2.5 and will occur between midnight and 6 a.m. While this may be of no consequence to companies having a large power load in the daytime, it may be to companies having a large portion of their load residential. Considering the residential business by itself, 1.5 kw. of additional capacity must be provided or set aside for water heating. At $200 per kilowatt, this means an investment of $300 on the part of the company. The customer will have an investment of approximately $250, including tank, clock-switching mechanism and the installation of the same. The total cost of the service will then be 1 per cent of $550 monthly, or $5.50 plus 450 kw.-hr., at an assumed cost of 1 cent per kilowatt-hour, or $4.50, making a total cost of $10 per month.

### Two-Heater and Relay Combinations

The second method will be designated as the two-heater method, which was described previously and which consists essentially of the following: A heater of small wattage, on continuously except when disconnected by a thermostat when all water in the tank is at 150 deg., and a manually operated auxiliary heater of 3-kw. size, also disconnected by a thermostat when the entire contents of the tank are at 150 deg.

In Table III is shown the variation in cost with small heaters varying from 200 to 1,200 watts, assuming the water to be used by a group so that no peaks will result. This is not the case, however. Each residence will use hot water for dishwashing after mealtimes, so that the majority of small heaters will be on the line at that time. The heaters of 700 watts and larger will, therefore, cause a demand greater than 0.6 kw., as shown in Table III.

This feature, however, can be eliminated to a certain extent by a contrivance which would not turn on the heater until 10 gal. or so of hot water is withdrawn from the full tank and which would not turn off the heater until the entire contents of the tank are heated. By placing the small heater, say, one-third the length of tank from the bottom, inserting the thermostat about 1 in. below the heater and providing a plate or pipe is inserted so the water heated will immediately rise to the top of the tank, that is, circulate, this feature can be accomplished. This is shown in Fig. 2.

The third method is a modification of method No. 1 and consists in permitting the heater to be connected a greater number of hours per day. By placing a relay in the range circuit which will operate when one element of the range is in use it can be made to disconnect the water heater when the range load is, for example, 1,000 watts or more. Load curves of residence districts equipped with electric ranges will show the peak to occur between 5 and 6 p.m. (see Fig. 3). A relay such as this would then keep the peak caused by water heaters down to a very low amount per heater. If the relay were set to operate at 500 watts the peak would not be increased as much. There is one point which must not be overlooked at this time, and this is that a considerable amount of water for dishwashing at the present time is heated on the electric range. A water heater will, therefore, take this range load away from the range and give it to the heater. Assume that the large element of the stove, say 1,500 watts, is used for heating water for dishwashing and the water heating element is only 1,000 watts, there is a direct reduction of 500 watts. This reasoning leads one to believe that a contrivance which will disconnect the water heater when the range is in use will probably lower the peak caused by ranges; at least it will not increase it.

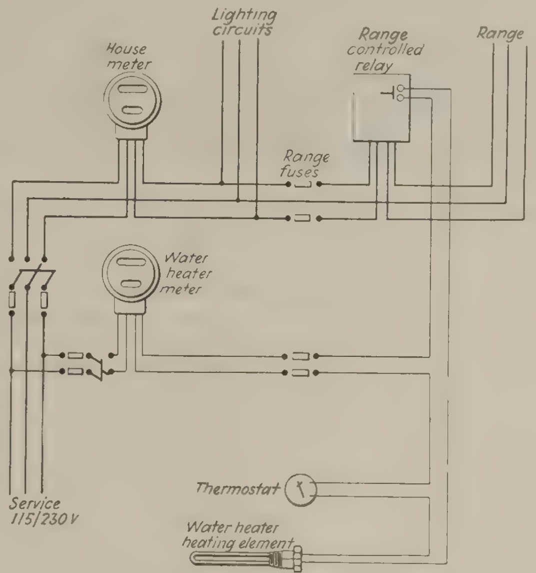


FIG. 8—SWITCHING CONNECTIONS FOR METERING AND CONTROLLING ELECTRIC WATER HEATERS

Referring to the tank shown in Fig. 2, it may be well to mention that experiments made on tanks with the heater located inside of a metal pipe, which is in turn located in the center of the tank, show very little circulation with a 1,000-watt heater. This is due possibly to the condition whereby the metal pipe conducts the heat to the surrounding water so fast that there is no tendency toward circulation. When a 3,000-watt heater was used the water circulated, showing that the conduction of heat was too slow to keep the temperature of the water in the inside pipe from rising. The inside pipe or vane must, therefore, be constructed of other material, something which will conduct heat very poorly, if a 1,000-watt heater is to be used. No experiments along this line have as yet been made by the writers, but the advantage of this scheme appears to be of sufficient importance to warrant experiments.

### Load Characteristics

The reason for assigning importance to this feature is apparent by referring to the daily load curve of a district equipped with ranges. The demand of this group of residences rises rapidly at 4 p.m., reaches a peak at 5:30 and then drops to its former value at about 8 p.m. With a relay in each range circuit to disconnect the water heater when 1,000 watts of range capacity is in use the residence demand between 4 and 8 p.m. may increase, due to the water heaters. Although the heater in any one residence may be disconnected, nevertheless the range in the residence next door may not be in use and its water heater may be on, resulting in 1,000 watts more in demand than would obtain if no water heaters were installed. By imposing the condition that 10 gal. or more of water must be withdrawn from a tank completely filled with hot water before the heater will again be turned on, the chances of an increase in demand becomes extremely remote. The range relay will then accomplish what a clock-switching mechanism would and at much less expense.

### VALUE OF RANGE RELAY

Such a scheme immediately eliminates any demand charge. The only expense is the manufacturing cost of the energy, together with the copper losses between the power house and the heater. Since this cost is in the neighborhood of 0.5 cent per kilowatt-hour for large plants, a rate of 1.5 cents less 5 per cent leaves a very good margin.

The wiring diagram for the above method is shown in Fig. 8. Assuming twenty hours per day, this method will supply 600 kw.-hr. per month. A tank sufficient to take care of peak requirements must be provided. Opponents to this scheme may ask why not use a small tank with a large heater (3 kw. or more), manually operated. This can be done, but it must be remembered that under the manually operated system a demand charge must be made against the water heater. The heater demands will occur between 6 a.m. and 12 p.m. with the manually operated, whereas with the automatic small heater with the large tank a goodly portion will be sold by the utility between midnight and 6 a.m., a highly desirable feature.

Customers should still be given the privilege of installing a large heater, energy for which is to be measured on house lighting and range meter and, hence, pay a higher rate. Some customers may prefer to do this. In general, however, the extra expense of installing a large heater as an auxiliary, together with the necessary heavy wiring and switches, is far more than the additional cost of a large storage tank, to say nothing of the added inconvenience and extra charge for energy necessary.

### WATER HEATING AN ATTRACTIVE LOAD

For the sake of argument, assume that a 3-kw. manually operated heater will use only 300 kw.-hr. per month. A company would be obliged to charge between 2½ and 3 cents per kilowatt-hour for this energy. This would cost the customer from $7.50 to $9 per month. Then assume a 1-kw. heater operated in conjunction with a "peak-limiting" relay. The radiation loss of 50 kw.-hr. would be supplied in addition to the 300, making 350. At a low rate of 1.5 cents per kilowatt-hour, the cost for energy would be $5.25, which is $2.25 to $3.75 per month less. Assuming a use of only six months during the year gives $20 approximately, which is very good interest on $100 additional investment.

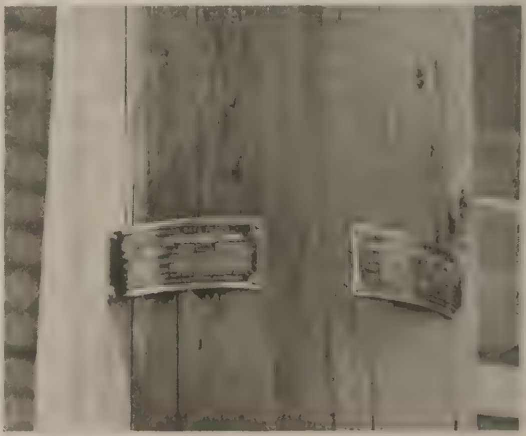
When a customer desires to use a tank having a heating coil in the house furnace the electric heater should be placed in series with the furnace tank, the hot water outlet pipe of the furnace tank entering the electric tank at the bottom, as shown in Fig. 1. When the water is not sufficiently heated by the furnace coils the electric heater will operate. The customer will thus be assured of hot water of about the same temperature all year around and the company will have no worry about demands caused by the water heaters in those cases where the winter load is larger than the summer.

There will be cases arising where the 1,000-watt heater will not be large enough on the average, which can be ascertained by noting the amount of energy used by the heater. In such cases the size of the heater can be increased and an extra charge per kilowatt per month made. In case the complaint is due to an abnormal use at some particular time, the size of the tank can be increased. This can be ascertained by noting the kilowatt-hours consumed.

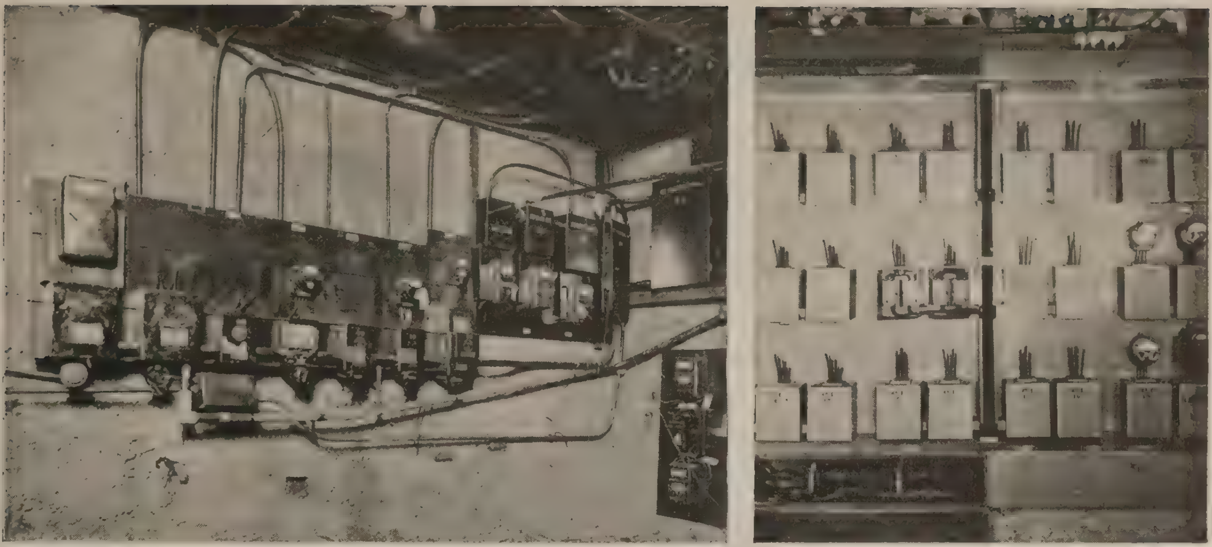
Referring again to Fig. 3, which is the load curve of a district having about 85 residences, with ranges in 75 of them, and assuming, also, 75 water heaters of 1,000 watts each, the demand between 6 a.m. and 4 p.m. will not be increased to more than 150 kw., the peak at 5:30 p.m. Since the water heaters will not be on at 5:30, there will be no increase in peak of the district due to the heaters.

In time to come, when the average use per residence becomes more than 1,500 kw.-hr. per year, it may be desirable to increase the size of the heater from 1 to 5 kw. All secondary distribution lines will have been increased to take care of the heavy demand for energy under such great use, and the diversity of the water heaters will cause little increase in station demand. The supplying of energy to a small heater during the night hours is especially attractive and, for that reason, is being tried out at this time.

## Transformer Data Plate Placed on Pole



TO facilitate field checking of transformer capacities, voltage rating and serial numbers and to aid in distribution of load and laying out of extensions, the Southern Sierras Power Company, Riverside, Cal., places transformer data plates on transformer poles as shown in the accompanying illustration. The plates are stamped by the company to indicate manufacturer, rating, serial number, type, phases and high- and low-tension rating. The blank plates cost 8 cents each and it is estimated that the total cost stamped and installed will not exceed 25 cents each. The Southern California Edison Company uses a similar plate for pole-type oil circuit breakers as well as for distribution transformers.



*Old and new type of underground service and meter installation in Portland*

Wire runways with removable covers replaced nipples, adding to the appearance and flexibility of the installation without increasing the cost

# Iron-Clad Services Protect Against Theft

By S. B. Clark

*Superintendent Underground Northwestern Electric Company, Portland, Ore.*

FOR a number of years the Northwestern Electric Company, Portland, Ore., has followed the practice of making an "iron-clad" type of underground service and grouped meter installation, primarily to protect against current theft, but also for convenience and economy in reading and testing meters.

Earlier installations were of the type shown in the left-hand view in the accompanying illustrations. This consisted of standard steel cabinets connected with pipe nipples. Service cables from the street enter the large cabinet containing the mail line switch shown at the upper right-hand side of the illustration. Rubber-covered wires were carried from one meter position to the next through the pipe nipples. Taps were taken off for each meter and fuses of proper size were provided for the several tenants. This type of construction became very inflexible as time passed when a new tenant with greater current requirements occupied an old location with small fuses. While the feeders from the main line switch are installed with capacity to care for a 50 per cent increase in load, frequently it was found less expensive to abandon the old meter position, with consequent additional expense to the serving company in changing the customer's feed wires, rather than attempt to increase the size of the box to take larger fuses.

These objections have been overcome in the newer type of installation, shown in the right-hand illustration. Here each position will accommodate a load varying from 50 watts to 50 kw., with a maximum cost for the change not to exceed $10. Open 240-volt copper buses are supported on transite blocks in the large horizontal gutter at the bottom. Holes are drilled in the buses for the maximum number of positions the board will care for. Cabinet covers and wire-ways are removable. The nipples between boxes in the old type installation are replaced with short square wire-ways with snap-on covers and are bonded to the boxes with stove bolts. In wiring this type of installation measurements of wires can be taken, lugs sweated on and all wires then laid in place, after which the covers are placed on. Feed wires to the various customers are usually passed from the meters through the vertical wire-ways to a collecting gutter at the top of the board which contains a neutral bus.

Material for this type of installation is more expensive than the old, but the total cost is less, due to a reduction in the unit labor cost per meter from $5.50 to $2.50. Moreover, the new type requires only 2.75 sq.ft. per meter, as against 4.3 sq.ft. for the old, which is an item of importance where space is valuable. In the newer type of construction a make of fused test block is used which permits meters to be tested without interrupting service.

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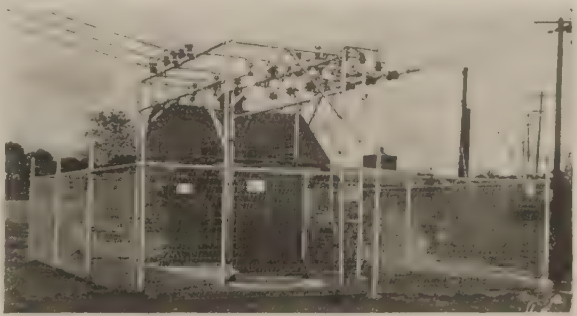
# Simplicity a Feature of 13,000-Volt Outdoor Substation



THE 13,000-VOLT outdoor Brookhaven (Miss.) substation of the Mississippi Power & Light Company is constructed largely of 2½-in. galvanized-iron pipe. Space requirements have been minimized without sacrifice of clearance or working space and construction economies have been realized. Transformation is from 13,000 to 2,300 volts

# Reducing Distribution Losses

EIGHTH ARTICLE

## *Graphic Voltmeter Tests*

By J. B. Moorhouse

*Electric Distribution Engineer Central Illinois Public Service Company, Springfield, Ill.*

A COMPLETE voltage survey of an electric distribution system of a town or city requires the use of graphic voltmeters which must be placed on all primary phases at the source of energy supply. By keeping these instruments running throughout the test a check of regulation of the supply voltage is obtained. Furthermore, these charts are necessary in order to determine primary voltage drop at any time during the test.

Our graphic voltmeters are set at the ends of secondaries farthest from the transformers, at points of heaviest load and at points where voltage complaints have been turned in. To separate secondary loss of voltage from primary it is necessary also to set a voltmeter at the terminals of the transformer which supplies the secondary system under test. To avoid setting a voltmeter at each transformer under test two or more voltmeters may be set at points of heaviest loading, connecting them to the primary lines through potential transformers. By keeping these instruments running throughout the test an appreciable amount of time may be saved. Also, a smaller number of voltmeters is required when using this method.

GRAPHIC VOLTMETERS INSTALLED IN PORTABLE METAL CASE ON POLE

Charts are taken at different seasons of the year and for different lengths of time, depending on the nature of the load and the amount of information required. For example, a voltage check in a business district must always include the Saturday night lighting load. Voltage complaints caused by excessive range and appliance load connected to lighting secondaries are not likely to occur during the summer months, even though the cooking load is heaviest at that time. Much reconstruction work can be laid out with the guidance of voltmeter charts. The checking of new and rebuilt distribution facilities with graphic instruments furnishes an excellent record for future reference in case trouble arises on these systems.

The accompanying illustration shows a steel test box containing two type "U" graphic voltmeters connected so as to record the voltage on each leg of a transformer secondary. The box is securely and easily fastened to the pole by a chain which is wrapped completely around the pole. It is mounted low enough to permit access from the ground for attending the instruments. The box is weatherproof and has a fairly tight door. Sufficient heat is given off by the instrument resistors to prevent the clocks from stopping due to cold weather. Connection may be easily made to the overhead secondary circuits by employing a four-conductor cable fitted with clamps, which may be attached to the wires.

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# Safeguarding Operators of Mercury-Vapor Turbine Units

By T. H. Soren

*Vice-President Hartford (Conn.) Electric Light Company*

THE Hartford Electric Light Company is at present installing in its South Meadow generating station one 10,000-kw. mercury boiler and turbine. The pioneer installation made by this company at its Dutch Point station had a capacity of about 1,800 kw. and its operation was highly satisfactory and economical. We obtained from this all the necessary information and experience to warrant the installation of a larger unit and we have abandoned the operation of the small unit. The new unit will give 10,000 kw. from the mercury vapor and in addition approximately 125,000 lb. of steam per hour at 260 lb. pressure superheated to a temperature of 700 deg. F.

Many inquiries have been made regarding the safety of this process. No chronic cases of mercury poisoning (due to continuous absorption of small amounts of mercury into the system) have occurred because the room in which the turbine was installed was well ventilated. A few acute cases of poisoning resulted from men entering the condenser when it was hot and thus being subjected to mercury vapor from leakage or other causes. Both possibilities have been eliminated by the design and construction features involved in the new installation.

None of the cases of poisoning we had in the pioneer installation was serious and the men recovered within a very short time with fresh air and a little outdoor exercise.

The walls of the building will be hard-finished surfaces, so that in case of leakage any mercury can be flushed down with water. All hot parts of the mercury turbine and piping will be inclosed with light sheet iron and wire glass openings for inspection and a slight suction will be maintained from the inclosure to the stack. Any leakage will thus be drawn up the stack and will not enter the operating room.

During extensive repairs or inspection, there is liable to be a certain amount of mercury spilled or opened to the atmosphere, and under such conditions our operators or mechanics are expected to wear masks. If work is to be done requiring heat, such as welding or expansion of wheels by gas flame, it is necessary for the operators to wear masks.

The General Electric Company has developed a paper which is very sensitive to mercury. This is placed in different parts of the room and will indicate the presence of extremely small amounts of mercury in the atmosphere. A strip of this paper is also maintained in steady contact with continuous flue gas samples to indicate any leakage in any part of the system.

We expect to have the installation in operation within a few months and at that time many details of the installation will be available for publication. The economies will also be published when determined by operation.

# Super-Excited Condensers

### Three 30,000-kva. units at Plymouth Meeting substation of Philadelphia Electric Company regulate receiver-end voltage of 220-kv. line and also increase its power limit during short circuits

By O. A. Gustafson
*General Electric Company*

IN LINE with the present increasing interest surrounding transmission and system stability, an interesting synchronous condenser installation has recently been undertaken, wherein the condensers are to be equipped with a special excitation scheme designed to permit their maximum utilization in raising the transmission system power limit during short-circuit disturbances.

Three 30,000-kva. synchronous condensers are to be installed for the Philadelphia Electric Company at its Plymouth Meeting substation, the receiver end of the 220-kv. transmission line from the new Conowingo hydro development.

The requirements for normal voltage regulation by power-factor control will call upon these condensers to operate at only one-third load, but the excitation system is designed to increase this output to approximately twice normal in one-half second whenever system disturbances demand a sudden and large increase in leading kva.

To obtain the results, an excitation system of unusual effectiveness is required, so much so that, as a matter of distinction, the term "super-excitation" has been used in designating such class of excitation.

The following discussion will cover in some detail the component parts of the equipment with their design limits and operating characteristics, along with a short description of a pertinent test, conducted to indicate in miniature what is expected of the total equipment of the 30,000-kva. condensers.

### Equipment Used on Condensers

The synchronous condensers are rated 30,000 kva., 600 r.p.m., 13,800 volts, and are horizontal units of standard design. The excitation equipment connected to each consists primarily of:

(a) *A main exciter,* direct-connected to one end of the condenser shaft, eight poles, compound wound, with a nominal rating of 165 kw. at 250 volts.

(b) *A sub-exciter,* direct-connected to the other end of the condenser shaft, six poles, compound wound, with a continuous rating of 40 kw. at 250 volts.

(c) *An alternating-current voltage* regulator for the main exciter.

The maximum momentary output of the synchronous condensers was fixed at 55,000 kva. as, due to saturation present in a normal machine, additional output above this value could be obtained only by an impractical and uneconomical amount of field current. Therefore, the maximum load current of the main exciter will be determined by the condenser field current corresponding to 55,000 kva. The maximum working range or "ceiling" voltage was chosen to be approximately 1,000 as a reasonable compromise between the desirability of putting the increased excitation on the condenser as quickly as possible and the proper appreciation of what momentary maximum voltages should be applied to standard 250-volt synchronous-condenser field insulation. It will be seen from the calculated saturation curve (Fig. 1) of the main exciter, however, that this "ceiling" of approximately 1,000 volts is not the saturation limit of the machine. This maximum allowable voltage is established by means of a resistance in the main exciter field, which, in conjunction with the working voltage on the sub-exciter, will just give the required "ceiling" voltage. This resistance, therefore, also fixes the maximum current demand on the sub-exciter.

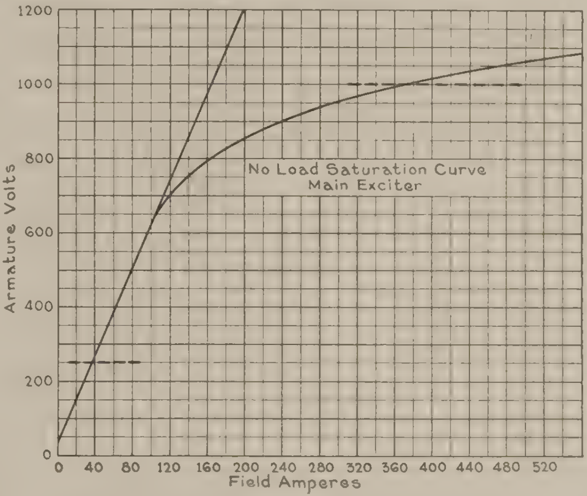


FIG. 1—NO-LOAD SATURATION CURVE FOR 165-KW., 250-VOLT EXCITER

Thus, the main exciter will be called upon to commutate momentarily the field current required by the condenser for an output of 55,000 kva., and this current must be commutated at the "ceiling" voltage of approximately 1,000 volts. The voltage of the sub-exciter is held at approximately 250 volts, thus assuring a constant source of voltage for producing the excitation in the field of the main exciter.

If the transmission system suffers a disturbance, causing a major drop in voltage on the high-voltage side of the transformer to which the condenser is connected, the voltage regulator causes the exciter voltage to rise to its ceiling value, at a rate of 6,000 to 7,000 volts per second. This rate of rise, though extraordinary, is in line with the other general design characteristics of super-excitation. This ceiling value of nearly four times normal voltage immediately forces the condenser field current and armature current above the short-circuit values at a very rapid rate. If system conditions demand it, the regulator will permit the condenser field current to rise to its maximum allowable value, which will result in an output of 55,000 kva., assuming normal voltage.

### Momentary Output Adjusted by Excitation

It should be appreciated that this maximum momentary output may be decreased to any value desired by adjustment of excitation equipment, if system conditions indicate that a 55,000 kva. upper limit is not necessary.

When the major system disturbance subsides, the regulator causes the exciter voltage to drop to any value commensurate with the condenser load requirements following the disturbance. This completes the cycle; the condenser has given the system its assistance and is now ready to resume normal operation.

The advance outlined in the art of providing fast excitation is the result of much extensive calculation and experimentation on the part of the General Electric Company. A program of tests made in this connection, with miniature apparatus, so accurately parallels the situation expected on this transmission system that it seems justifiable to make some detail reference to it here. A 100-kva., four-pole, 1,800-r.p.m. synchronous condenser was connected to a 5,000 kva. source of power as an approximation of the relation between the 30,000 kva. condensers and the system to which they are to be connected. The field of the condenser was adjusted to give approximately one-third leading current to correspond to the expected normal operating load of the 30,000-kva. condensers. In the test room there was available 550 volts direct current, which was approximately seven times the field voltage necessary to obtain one-third leading current. This voltage of 550 was then suddenly applied to the small condenser field and oscillograms of stator amperes and volts, and field amperes were taken to show what happened.

The rate of rise of stator amperes, as evidenced by the swing of the ammeter needle, was impressive. In spite of the natural lag in the instrument, its needle traveled the meter scale with remarkable speed.

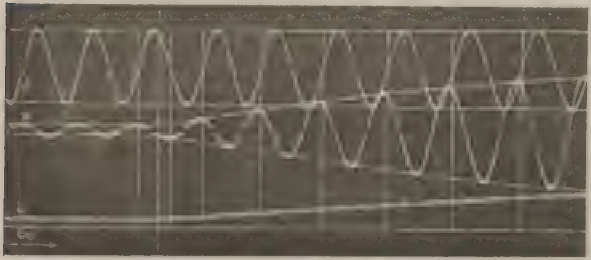


FIG. 2—OSCILLOGRAM OF TEST ON 100-KVA. SYNCHRONOUS CONDENSER WHICH IS INDICATIVE OF RESULTS EXPECTED ON THE 30,000-KVA. MACHINES

A—60-cycle terminal voltage
B—Stator current
C—Field current
$C_0$—Zero line of field current

Fig. 2 shows the resulting oscillogram. The point where the 550 volts was applied is clearly evident in the oscillograms of the field current. Fig. 3 shows curves plotted from data taken from Fig. 2, which are self-explanatory and indicate clearly the very high speeds obtained. Calculations made on the test machine check very closely with the results of the test. It is evident that the rate of increase of kilovolt-ampere obtained in the above machine is much higher than expected in the very much larger 30,000-kva. condensers under discussion, but after correcting for the difference in design constants which affect the calculations, the results expected from the 30,000-kva. synchronous condensers are entirely in line with the test results obtained on the small machine.

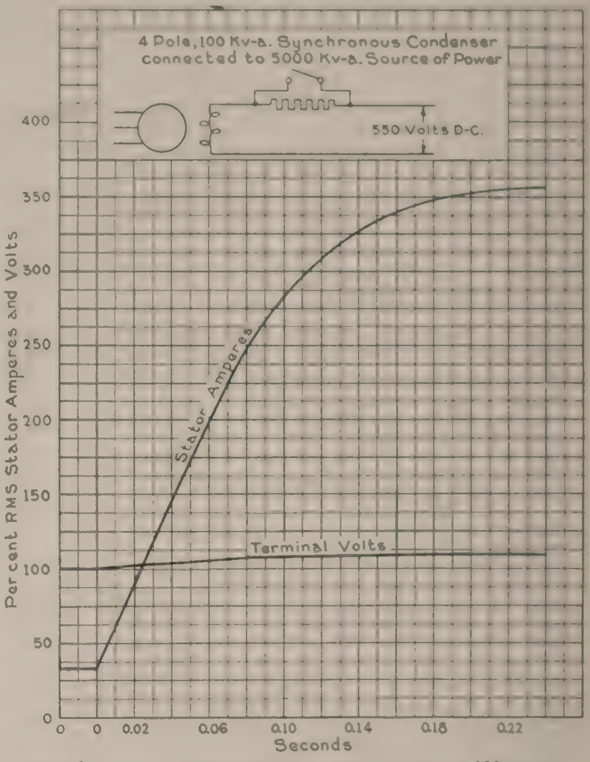


FIG. 3—PLOT OF CONDITIONS OBTAINED IN TEST OF 100-KVA. SYNCHRONOUS CONDENSER, CALCULATED FROM THE OSCILLOGRAM SHOWN IN FIG. 2

A word of caution might well be injected into the discussion as the evident remarkable increase in kilovolt-ampere might indicate the desirability of always providing super-excitation on synchronous condensers. It must be remembered that fast excitation is only one of many ways of increasing stability and is by no means to be considered a cure-all. Unless applied with judgment and full knowledge of all factors involved, it may have harmful potentialities, which increase with the degree of excitation speed considered.

## 55 Per Cent of Belgian Homes Served Electrically

According to the result of a recent survey reported by the Belgian Union for Electrical Development it appears that about 55 per cent of the homes in Belgium have an electrical service connection. This is a material increase over the percentage reported in *Commerce Reports* of Dec. 6, 1926, and subsequently quoted in the Electrical World. The date to which the earlier figure applies is not reported; the difference presumably represents several years' growth.

# Beauty and Utility in Hydro Plants

## By harmonizing generating stations with adjacent summer resort property objections thereto were avoided

By H. W. Gochnauer
*General Manager Northern Electric Company of Wisconsin, Green Bay, Wis.*

THE Northern Electric Company of Wisconsin has completed a hydro-electric plant on the Menominee River at Chalk Hill, Wis., which is somewhat individualistic in appearance, although its layout does not deviate in general from the stock power house.

Two beautiful lakes will be formed by the developments. The shores are mostly high and rugged, fronted by deep water with many interesting bays, fingers and islands. Pines, firs, birches, aspens and oaks produce wonderful changing color effects throughout the summer, bringing the season to a kaleidoscopic climax in the fall with a riotous brush.

The Northern Electric Company, realizing the high value of this lake-shore property, expects this year to place estates for summer homes on the market. In keeping with this project, careful thought was given to the external and internal design of the power houses. An endeavor was made to make them jewels in the wooded landscape, rather than commercial buildings.

The Chalk Hill plant is built of tapestry face brick of dark red and brown shades with a dark raked joint. A precast light yellow-brown trim stone is used for belt courses and copings, which, with the massive columns, give the structure a solid appearance in harmony with the solidity of the concrete substructure. The high, triple Gothic arch windows are glazed with lead-stained glass. The borders and tops of each window panel are composed of rather deep blues, greens and ambers in squares, triangles and rectangles, and the center section is of amber glass, graded upward from a very light to a rather dark shade.

The interior walls are built of salt-glazed brick of a light straw color. The tile floor is of darker shades, containing rich browns, reds and blues. Borders of square tile are laid around the outer walls and around the generators. The generators, governors and ornamental wrought-iron railings are painted a light blue, harmonizing with the blue in the windows. The machinery and rails are trimmed with a light yellow, conforming in shade with the brick side walls. Cathedral lights of cast bronze, supported on wrought-iron brackets, adorn the side walls.

Nearing completion at the White Rapids plant is a similar plant which will, however, surpass in beauty the one at Chalk Hill. The favorable comments on the project received from visitors are most gratifying, and the most pleasing fact is that only a slight additional expenditure was made to produce the general effects desired.

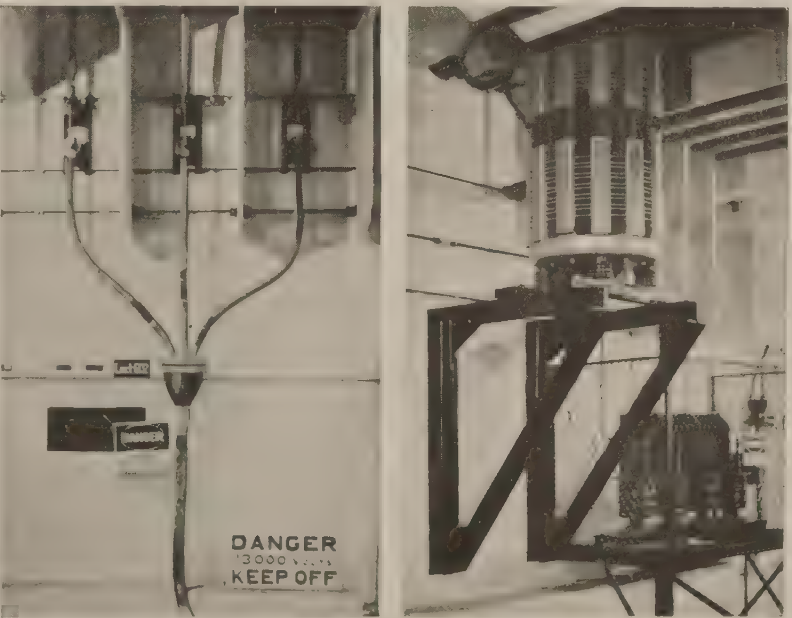
The installation at Chalk Hill comprises a dam of eleven 12x24-ft. Tainter gates and a power house containing three vertical units. Both generators and turbines were furnished by the Allis-Chalmers Manufacturing Company and the switchboard and transformers by the General Electric Company. Nagler adjustable-blade runners, permitting flexibility of operation with various quantities of water, are connected to 3,250-kva. generators. The total capacity of the plant is about 11,500 hp., with a 28-ft. head.

The White Rapids plant will be very similar, excepting that a 29-ft. head is available and the dam consists of nine Tainter gates, 14x24 ft. The wheels at White Rapids are Francis type vertical turbines furnished by the S. Morgan Smith Company, and the generators are furnished by the General Electric Company. In this installation, two 3,750-kva. and one 2,500-kva. generators at 100 and 120 r.p.m. are being installed. The two sizes are being used to provide flexibility for various quantities of water. Due to the facts that the heads are practically the same and that each plant will receive the same amount of water, it will be interesting to compare the amount of power produced by the two types of water turbines.

Views of one station were published on page 1028 of the Nov. 19, 1927, issue of ELECTRICAL WORLD.

# Flexibility of Arrangement and Operating Safety

OPERATING safety is afforded in the No. 6 substation of the United Electric Light Company, Springfield, Mass., by mounting reactors on steel brackets and installing cable-disconnecting switches out of ordinary reach from the floor. Apparatus near the level of operators' bodies is screened against chance contacts. By the use of channeled slots in the concrete wall the spacing and arrangement of switch bases and barriers may be varied to meet local conditions and service requirements.



CABLE DISCONNECTS AT SAFE DISTANCE FROM FLOOR; REACTOR ELEVATED ON BRACKETS, AND APPARATUS BELOW IS SCREENED

*Magnetic across-the-line starters with push-button control*

Left—Iron-clad service switches are connected with the magnetic starters by adapters for 900-hp. supersynchronous motors.

Center—These solenoid-operated feeder breakers automatically protect the magnetic across-the-line starters on short circuits.

Right—Magnetic across-the-line starters for 2,300-volt high-torque motors ranging from 20 to 100 hp.

# Push-Button Across-Line Starters in Cement Mill

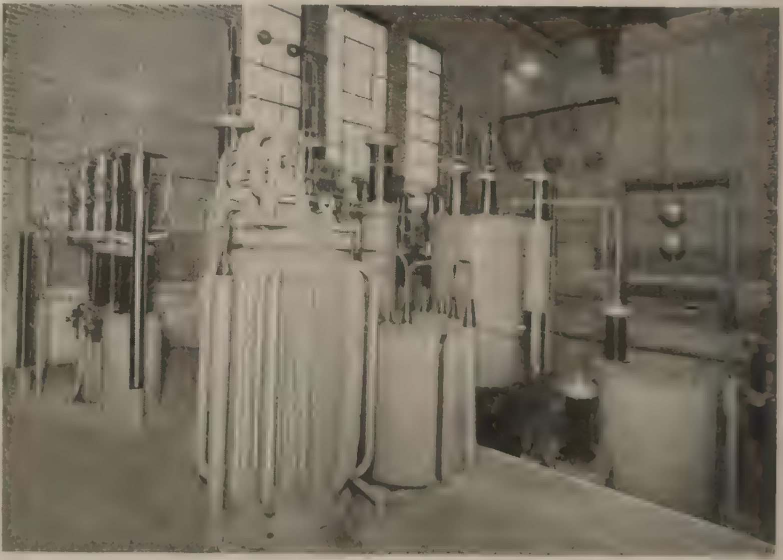
By I. T. Hockaday
*General Electric Company, Houston, Tex.*

With the exception of the motors in the machine shop, all the motors in the new plant of the Trinity Portland Cement Company, Houston, Tex., are controlled by across-the-line starters. The motors which are involved range from two 900-hp., super-synchronous down to $\frac{1}{2}$-hp. sizes. The super-synchronous motors have automatic across-the-line push-button control, the push button being located near the motor and the control apparatus in the basement. The induction motors, ranging in size from 100 hp. down, are controlled by push buttons located near the motors and magnetic starting switches in the basement. Because of limited space, it was found necessary to place the switching equipment in a separate room and the basement was found to be the logical location.

Since the magnetic starting switches used have a comparatively low interrupting capacity and are controlled by temperature overload relays, short-circuit protection was given serious consideration. The motor bus runs from the switchboard to the bus on a pipe framework in the basement on which the starting switches are mounted, and from the latter bus several motors are fed. There being no oil circuit breakers between the bus and the starting switch, relays are used for short-circuit protection. The contact points on these relays are connected in series with the low-voltage device of the oil circuit breaker on the main switchboard. Thus, in case of short circuit, the relay involved will open the oil circuit breaker on the feeder involved. All relays have a hand-resetting device.

To feed the kiln, adjustable-speed, alternating-current motors with shunt characteristics are used, the motors being located at the feed end of the kiln far from the kiln operator. Push-button stations are situated so the chemist can control the feed of the kiln. The rate of feed into the kiln is determined from tachometers connected with each motor.

# High-Tension Test Set for 132-Kv. Cable



To test 12-mile, 132,000-volt underground cable between the Hell Gate generating station and the Dunwoodie substation the New York Edison-United Companies utilize the 400,000-volt kenotron testing outfit shown.

# Sinking-Fund Accumulation

### Effects of long-lived items. Errors in average lives caused by compound interest affect rates of interest. Lives must be estimated within careful limits

By W. G. Cross

*Assistant Valuation Engineer Southern California Edison Company, Los Angeles, Calif.*

MANY depreciation reserves are set up on the life-table basis under the sinking-fund method. The theory of this procedure is that the cost of a major article of plant belonging to a utility and wearing out in the service of the public should be reimbursed at the end of the life of the article. Under the conditions where the sinking-fund method is considered applicable, there is set aside an annuity each year, which is assumed to draw interest while remaining in the reserve. At the end of the term of years originally estimated as comprising the life of the article these annuities, through the effect of compound interest at a certain specified rate, will produce in the depreciation reserve the amount of money necessary to so reimburse the utility. Theoretically, the life used for each article is the estimate of the actual term of years during which the article will function properly and, if there were no functional depreciation, would be the life sustained until wearing-out processes, such as decay, attrition, depletion, etc., had stopped its further usefulness. Entering of functional depreciation shortens the expectant life and the lives used, therefore, are usually somewhat shorter than the natural life would be.

## Compound Interest Affects Accumulations

The case of articles which may be expected to have a long natural life, but which are subject to the exigencies of functional depreciation, has always presented a somewhat puzzling problem which is magnified under the sinking-fund method. The case of concrete or masonry diversion dams forming a portion of a hydro-electric project has been referred to already in previous articles. It is probable that the natural wearing life of many dams of this type will be very long. Records show the existence of certain bridges and highways constructed at the time of the Roman Empire, and it is most certainly true that some dams can be pointed to where the life has already been in excess of 100 years. Many dams now in existence have lived for a considerable period of time without showing any appreciable wear, and it is well within reason to assume that the concrete or masonry of which they are composed may continue to exist in place for a century or more. This does not, however, justify an infinite life for dams, nor can it be proved that possible functional depreciation shortens the life to 100 years, 50 years, 40 years or any exact term of years. It must be conceded that the life cannot be accurately predicted.

Still bearing in mind that depreciation annuities are being discussed on the life-table basis and that the sinking-fund method for future retirement is being considered, the author believes that such a method sets 40 to 50 years as the maximum life that logically can be assigned to any item of plant whatsoever and still stay within the limits of practicability. Compound interest produces an increase from an original sum of $1 to $10.29 in 40 years and to $339.30 in 100 years, at a 6 per cent rate. An amount of $1 set aside annually will produce $154.76 in 40 years and $5,638.37 in 100 years at 6 per cent. On the other side of the slate, if we desire to accumulate $1,000 at the end of two years, assuming 6 per cent interest, there will have to be set aside $485.44 annually. If the time period be taken as five years, the annuity will be $177.40; if 40 years, $6.46, and if 100 years, $0.18. The geometrical relationship of these figures should always be borne in mind. Referring to the annuity accumulation figures, we note that an annuity laid aside for a definite time, such as mentioned above, will grow to 37 times as much in 100 years as it will in 40 years. When setting the probable life of the dam, it is just as logical to estimate a 100-year life as a 50-year life, or vice versa, owing to the known uncertainty of what the future will bring. It may perhaps be difficult to define the point of departure and say that life predictions become vague after 40 years or after 50 years or, possibly, after twenty years, but the author herein attempts to show that beyond a certain point compound interest renders such predictions absurd.

## Predictions May Involve Large Error

In the case mentioned, if 40 years be estimated and if the item lives 100 years, an accumulation will theoretically have been made 37 times too great; if the life is estimated at 100 years and the article lives 40, the accumulation will be only one-thirty-seventh of what it should have been. In the former case, the utility will have been protected and can stop the accumulation when the full amount has been collected, but in the latter case there is practically no recourse available.

Looking at the annuity side of the picture, it is found that for a $1,000 dam the annuity would be only $0.18 under the assumption of a 100-year life. This is a little more than two one-hundredths of 1 per cent of the cost of the dam. Very practical difficulties exist with respect to the theoretical accumulation of compound interest on $0.18 annuities, and here is a case where theory has to give way to practical fact. Such an annuity is too low for this item when considered from the practical standpoint. The $0.18 annuity theoretically accumulates some $28 in 40 years instead of the $1,000, and no one can integrate the uncertainty of functional depreciation and say that the dam may not be superseded in 40 years. It would be better in this case, as far as the stability of the enterprise and its consequent serviceability to the public is concerned, to set aside $6.46 annually, rather than $0.18, on the $1,000 article, considering the balance of $6.28 annually as applicable to the stability of the utility. This insurance charge is less than two-thirds of 1 per cent on the investment and offsets the possibility of loss of thirty-six-thirty-sevenths of the investment, which is the amount of the risk involved under the conditions outlined.

From the practical point of view, therefore, it becomes evident that the uncertainty of life after 40 years leads to absurd results in accumulation, with possible disaster to a utility if the reserve is insufficient, while, on the other hand, the additional cost of the annuity to insure against such possible disastrous results is so small that it is well within the realms of ordinary business prudence to base all calculations on the lowered lives. The author believes that 40 years is the maximum life that should be assigned to any depreciable item of plant when considering sinking-fund annuities which are computed at an interest rate which is equal to or in excess of 4 per cent.

### Assigning Average Lives

A most interesting phase of annuity calculations on the sinking-fund basis relates to the average life assigned to groups of items. It is quite customary to assign lives to groups covered by primary capital accounts under which the utility operates. The accounts in question may be those of the Federal Power Commission, the classification of the board of utility commissioners or that required by state regulatory bodies, etc. The items in certain accounts appear to be described by their nomenclature. The account Dams and Reservoirs naturally calls to mind imperishable structures such as masses of concrete and masonry, together with large excavations in the ground. The account Poles and Fixtures leaves in the mind the idea of wood poles standing in the ground, while the account Conductors immediately brings up the picture of copper wire remaining in the air through many years. This natural tendency to judge the contents of an accounting segregation by the name of the account is responsible for a great deal of error in the accumulation of the annuities which we have described above.

In the first place, the account Dams and Reservoirs includes not only a large amount of money relating to concrete and masonry structures, as well as large excavations designed to store water, but also includes a certain smaller amount of money in gates, water-measuring devices, spillway apparatus, booms, screens and innumerable other items pertaining to different types of installations. Poles and Fixtures account includes not only poles but also guy wire, anchors, machine bolts, etc. Conductors account includes not only copper wire but also insulators, insulator hardware, iron wire and conductor clamps. In almost every case the smaller items are of lesser life than the main items for which the accounts are named. It is common practice to assume that the amount of money comprising the lesser items is so small that it cannot materially affect the reserve accumulation. This is a most erroneous assumption.

Taking, for example, the dam discussed previously, and assuming, for the sake of argument, an estimated life of 100 years, an annuity of $0.18 would theoretically be sufficient to produce the required amount at the right time. Let us assume, however, that the dam is a complex structure and consists of two portions which may be separately considered in replacements. One, the major portion, consists of the concrete mass in the structure, with an assumed life of 100 years; the other consists of steel gates, guides and bolts, with a life of five years. amounting to much less in cost than the concrete alluded to. An $0.18 annuity will take care of $1,000 worth of concrete having a 100-year life, but this same annuity laid aside to cover steel gates and bolts which are replaced at the end of five years will cover only $1 of original cost. In a case such as this an amount of short life equipment of the nature of one-tenth of 1 per cent of the remaining long life equipment will modify the annuity materially.

The above example is somewhat extreme, but it is very logical to have situations which may be typified by an account covering both steel penstocks with a 40-year life and recording devices with a ten-year life. Mathematical calculation will show that 8 per cent of ten-year life equipment will require the same annuity as 100 per cent of 40-year life equipment. In a property comprising 8 per cent of ten-year life equipment and the remaining 92 per cent of 40-year life, the annuity, if calculated on the 40-year life, would be slightly over 50 per cent of what it should correctly be. Very careful consideration should be given to this fact when setting up sinking-fund annuities, for the above calculations make clear that a minor amount of short life equipment can so seriously distort the reserve accumulation structure that the utility may easily find itself without proper reserves at a period some time in the future, if life tables be based upon the mental impression received from the name of the account.

### Determination of the Interest Rate

The question of interest rate to be used in connection with sinking-fund accumulations may or may not be open to decision by the utility. In some cases the interest rate is definitely fixed by the regulating commission and the latter may even go so far as to insist that strict accounting for the reserve be made and reported in the same manner as other phases of company activity covered under governmental regulation. There is a general theory involved here, however, based upon the economic law that capital will flow only to such points as will assure a return commensurate with the interest earned by similar risks in other situations. If a utility sets aside depreciation annuities, it is logical to assume that this money should be invested in some interest-bearing security which will be of a degree of risk similar to that of the business of the utility itself. The risk of the utility is measured by the risk of the bonds, for the bonds, in the last analysis, are only as secure as the going property. The reserve may be invested in the property itself, and this is commonly done. It follows naturally, therefore, that depreciation reserve accumulations invested in plant may logically carry an interest rate similar to that of bond money for utilities, for the utility usually has the option of either borrowing outside money or using its own reserve.

The argument is sometimes advanced that preservation of the integrity of the reserve is of utmost importance and that a degree of safety commensurate with deposit in the savings bank should require the utility to allow only 4 or 5 per cent interest on the amounts under accumulation. If, in such a case, the utility invests the reserve in its own business, it must, by the same token, assume the risk of preserving the integrity of the money with an implied guarantee backed by surplus. While this argument has often been advanced, the procedure is not in common use and sinking-fund accumulations are more often at an interest rate commensurate with the cost of borrowed time money. Six per cent is a common interest rate for sinking-fund accumulations. With the present tendency toward lowering of money rates and the possibility that economic conditions in the United States may cause a permanent lowering of the interest level, it is somewhat problematical what the future will bring in this respect.

### Approaches Straight-Line Method

In general, the lower the interest rate, the more nearly the calculation approaches the conditions inherent in the straight-line method of accumulation discussed in previous articles, and it is true that the special conditions attaching to compound interest rates as described in this article are effective in a constantly increasing ratio as the interest rate increases.

The use of the sinking-fund method of accumulation, therefore, introduces the danger that theoretical assignment of extremely long lives to items of plant may produce detrimental results in the actual practice of the utility, and common business prudence demands that estimated lives must be kept within careful limits, for the most beautiful theory might be completely wrecked by the actuality of some advance in the public utility art. To preserve the stability of utility properties requires not only the theory of the mathematician but also the practical judgment of the business man and the exercise of good judgment in laying aside reserves to cover property being used in the service of the public. Common sense and business acumen are vital factors, not only from the utility point of view but from the point of view of future successful and adequate service to the public.

## Commercial Lighting Campaign Increases Load 200 Kw.

By E. F. Champion

*Illuminating Engineer Georgia Power Company*

THE Georgia Power Company recently completed its third commercial lighting campaign, the results of which far exceeded the quota and expectations. A merchandising profit of more than $2,300 was realized. The total number of units sold was 1,615, which represents an increase in kilowatts of connected load of approximately 200, since the majority of the units replace 100, 150 and 200-watt equipment.

During this campaign it was decided to make a concerted effort on one type of fixture. The one chosen consisted of a 6-in. bronze suspension hanger with Mogul socket and 6x16-in. plain opal glassware. The unit was offered complete with 300-watt lamp, but if this size would overload the customer's present circuit, or cause an objectionable increase in his light bills, a 200-watt lamp was substituted for the same cost.

The selling price of the unit installed on present outlet, complete with lamp levolier switch, was $12. Where outlets or wiring required changes, an extra charge was made. Terms of $1 down and $1 per month were offered, with a discount of 5 per cent for cash within 30 days. The cost of the unit was $5; lamp, 80 cents; switch, 50 cents; hanging, $1.50; salesmen's commission, $1.75; advertising, $1; total, $10.55. This left a gross profit of $1.45 per unit.

The regular members of the sales department were used during this campaign. The territory served was divided into districts, each under the charge of a supervisor with entire control of sales and installation. The men worked in pairs and, since demonstration units were carried, while one salesman was connecting and preparing for the demonstration, the other salesman was selling the customer on the idea of better illumination. The salesmen alternated in carrying the unit and making demonstrations. Commissions were divided equally. Each salesman was given a territory or street each day, and was required to make a report on all the customers called on. These reports were carefully checked to be sure that the salesmen did not miss any of the prospects, and to furnish information to the illuminating engineers to follow out for the prospects on special application of lighting. The contracts for hanging the units were awarded to the three contractors submitting the lowest bids.

The principal prospects were the small stores and old office buildings. In many instances old glassware and lighting units were replaced by the newer type opal fixtures. In almost every case it was found necessary to sell the prospect on better illumination and what better illumination would do for him. After this, getting the signed orders for the fixtures was comparatively easy.

## Substation Architecture Conforms With Adjacent Apartments

SUBSTATIONS erected by the Edison Electric Illuminating Company of Boston are being designed to harmonize with surrounding structures. One built recently in the Commonwealth Avenue apartment house terrritory is illustrated. A self-cooled, 12,000-kva., three-phase transformer with a 25-hp. motor-driven blower for cooling the transformer room is housed in the reinforced-concrete tower. A 3,500-gal. receptacle permits the transformer to be drained of oil if necessary. Energy is received from the Edgar generating station at 25 kv. and delivery is at 13 kv. An important connection with the system of the Cambridge Electric Light Company is also made at this point.

# Fractional-Horsepower Motors Standardized

### Final report of committee. Two lines of motors based on hours of use. Efficiency, power factor and apparent efficiency values fixed

BY A PROCESS of open discussions between all interested groups and through the workings of a cordial spirit of co-operation the joint committee on fractional-horsepower motors has obtained agreements which are expected to bring about very desirable results. In a series of meetings held during the past twelve months the committee has brought about a greatly improved situation in the industry. This committee was composed of representatives of the National Electric Light Association, the National Electrical Manufacturers' Association, the American Washing Machine Manufacturers' Association, the Association of Edison Illuminating Companies and, in addition, unorganized appliance manufacturers were represented by individuals. The committee was initiated by Prof. C. F. Hirshfeld of the Detroit Edison Company and worked with L. W. W. Morrow of the ELECTRICAL WORLD as chairman.

The work of the committee dealt with improving fractional-horsepower motors through agreements as to minimum specifications for efficiency, power factor, starting current and apparent efficiency. The economic cost to the industry as a whole has been weighed and each group has contributed a share of the burden. The committee feels that its work will react to the benefit of the industry and will stabilize the fractional-horsepower motor situation for some years. It asks for the hearty co-operation of all groups in the industry so that its recommendations may be put into operation.

### SUMMARY OF ACTION

After careful consideration the committee decided that there should be two general classes of fractional-horsepower motors, as follows: (1) Long-hour use motors. (2) Short-hour use motors. Long-hour use motors are those which operate a large number of hours per month in the aggregate and consume sufficient energy to make efficiency of economic importance. Specific applications for these motors agreed upon by the committee are electric refrigerators and electric oil burners. Short-hour use motors are those which are in operation a relatively small number of hours per month so that their consumption of energy is small. Typical applications of these motors are washing machines, dish washers and home food choppers.

Minimum specifications for long-hour use motors and for short-hour use motors operating on 110-volt, 60-cycle circuits at 1,800 r.p.m. as agreed on are given in the accompanying tables. The short-hour and long-hour use motors have the same current specifications and approximately the same power-factor specifications. The major difference is in efficiency values. These efficiency differences are expected to be reflected in motor prices.

### EXCEPTION FOR WASHING MACHINE MOTOR

The values given apply to all 4-pole, 110-volt, 60-cycle fractional-horsepower motors with the exception of the washing-machine motor. It must conform to efficiency, power factor and apparent efficiency specifications, but not to locked rotor ampere values. After careful study the joint committee felt that time should be given for working out the washing machine problem and it agreed that the washing machine situation warranted, for the present, an exception in regard to the locked rotor ampere values for all other applications.

The ¼-hp. long-hour use motor should meet these specifications as of Jan. 1, 1928. Motor manufacturers agreed to develop the other sizes and types to meet the specifications as soon as possible and an ultimate date of Jan. 1, 1929, was agreed upon as the time all new motors should conform to the new specifications. Motors characterized by these specifications represent a great improvement on existing motors and necessitate a complete redesign of the majority of fractional-horsepower motors now made. The time element was considered a minimum in view of the time required to redesign, retool and get production in factories.

These specifications apply to motors which are normally connected to lighting circuits and which may be expected to operate at times during lighting hours. The values given are minimum values obtained by test after the motor has operated a reasonable time (at least 24 hours) to limber it up. It was agreed upon as desirable that motors of the 1,800-r.p.m. ¼-hp., 110-volt, 60-cycle size should be produced as soon as possible with a full-load efficiency of at least 70 per cent and a full-load power factor of 65 per cent, giving an apparent efficiency of at least 45.5 per cent. It was thought such motors for refrigerators and oil burners would be justified in price by capitalizing the cost of energy used as compared to a cheaper but less efficient motor.

The joint committee adopted the new specifications for use in this country. Motor manufacturers are committed to an expense of upward of $1,000,000 in redesign and retooling costs. The utilities promised to do their part toward securing the use of the proposed motors and to urge that all central-station companies adopt uniform rulings in agreement with the recommendations of the joint committee because the use of present motors seriously affects utility service. Appliance manufacturers promised to follow the specifications and principles agreed upon by the joint committee.

The report of the committee was submitted for approval to the associations represented on the committee and already has the approval of the majority of the individual appliance manufacturers. The joint committee believes prompt action should be taken by the parent organizations and that, if approved, this report be distributed to each member so that he may be guided by the committee findings.

MINIMUM SPECIFICATIONS FOR LONG-HOUR USE MOTORS OPERATING ON 110-VOLT, 60-CYCLE CIRCUITS AT 1,800 R.P.M.

| Rating in hp. | ⅛ | ⅙ | ¼ | ⅓ | ½ | ¾ |
|---|---|---|---|---|---|---|
| Power factor in per cent | 52 | 56 | 60 | 61 | 63 | 65 |
| Efficiency in per cent | 53 | 58 | 62 | 63 | 65 | 67 |
| Apparent efficiency in per cent | 30 | 36 | 42 | 44 | 47 | 49 |
| Locked rotor amps | 20 | 20 | 20 | 20 | 26.6 | 40 |
| Locked rotor amps. at 75 per cent load | 15 | 15 | 15 | 15 | 20 | 30 |

MINIMUM SPECIFICATIONS FOR SHORT-HOUR USE MOTORS OPERATING ON 110-VOLT, 60-CYCLE CIRCUITS AT 1,800 R.P.M.

| Rating in hp. | ⅛ | ⅙ | ¼ | ⅓ | ½ | ¾ |
|---|---|---|---|---|---|---|
| Power factor in per cent | 50 | 52 | 56 | 58 | 60 | 62 |
| Efficiency in per cent | 41 | 46 | 51 | 54 | 58 | 61 |
| Apparent efficiency in per cent | 24 | 27 | 32 | 35 | 39 | 42 |
| Locked rotor amps | 20 | 20 | 20 | 20 | 26.6 | 40 |
| Locked rotor amps. at 75 per cent load | 15 | 15 | 15 | 15 | 20 | 30 |

NOTE.—Where the product of the minimum values of power factor and efficiency, as shown in the table, do not equal the apparent efficiency it is understood that either the power factor or the efficiency values will be increased by the manufacturer to make the product of power factor and efficiency equal to the stated apparent efficiency.

# Southern Pine and Creosoting

Characteristics of wood. Woods operations and treating processes. Applications and service experiences. Purchases and specifications

By L. W. W. Morrow

*Managing Editor* Electrical World

WHAT are the characteristics of creosoted Southern yellow pine? What are the service experiences of those using treated timber? What specifications are advisable for purchasing creosoted poles, ties and structural lumber?

The use of creosoted pine is growing rapidly, and with that use, the foregoing are some of the questions that arise in the minds of prospective purchasers and users unfamiliar with this treated wood.

It is important that these questions be answered, for the near future will see the timber markets supplied largely from the forests of the South and of the West. A significant fact in this connection is that the annual statistics compiled by the government show twice as many creosoted pine poles used in 1924 as in 1923. Creosoted Southern pine and timber from the forests in the far West are used in increasingly large quantities, for the chestnut, Northern cedar and other familiar woods of the East and Middle West have been used more rapidly than they are produced. The South has large forests of pine, and new trees grow so rapidly that exhaustion of the supply is impossible if ordinary precautions are taken. In from 20 to 25 years a pine tree can be grown that will give a pole 20 ft. long with a 6-in. top.

### Three Kinds of Pine Used

The general term Southern yellow pine applies to three principal types of conifers. These are the "longleaf," the "shortleaf" and the "loblolly." Their strength characteristics as compared with that of other woods used for poles are indicated in the accompanying table. As among themselves there is a slight difference in the density, in the number of growth rings per unit cross-section, in the length and arrangement of needles and in the depth of sap wood, but their structural difference is so slight that, once away from the stump, they can be distinguished only with difficulty. All possess structures which admit of creosote oil preservative treatment to best advantage both as regards the depth of penetration and the quantity of creosote absorbed in the wood.

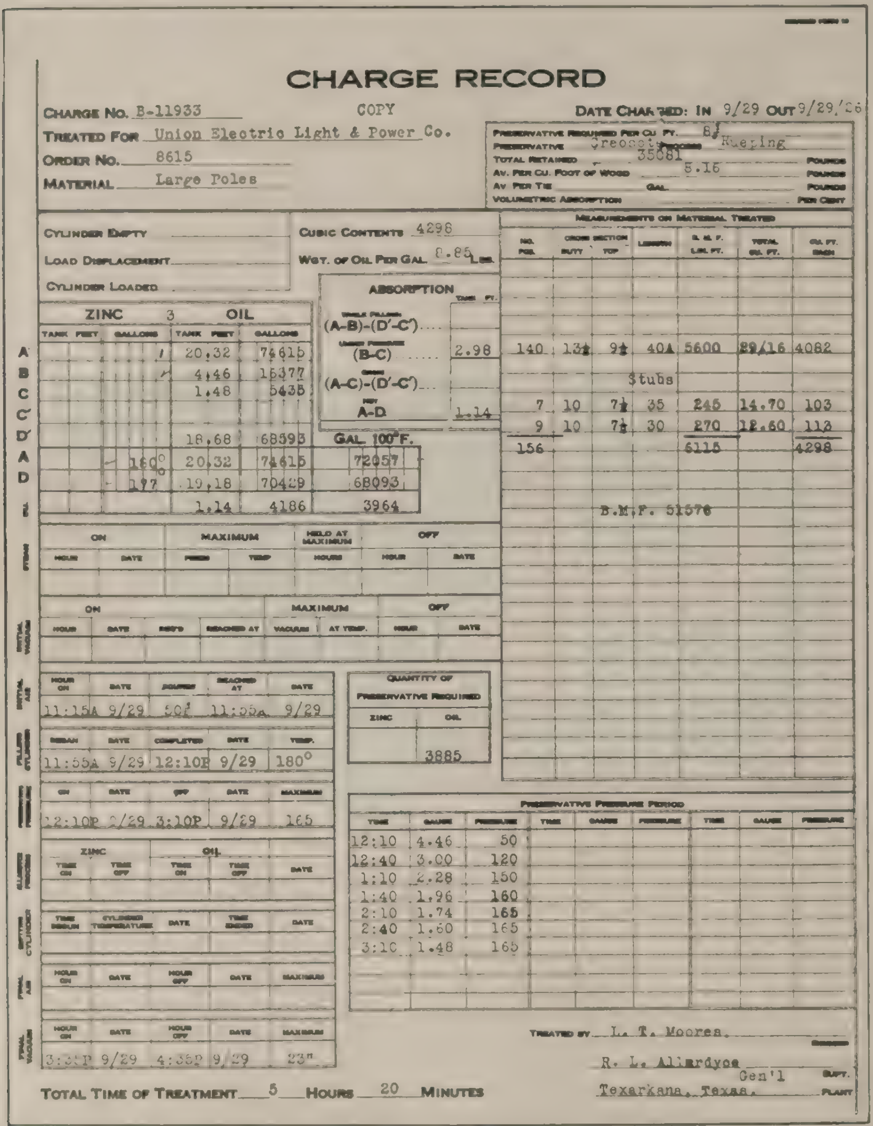
The untreated timber is subject to rapid decay under outdoor service conditions, and the creosote treatment is used to insure the quality and strength of the wood over a long period of time independently of weather exposure in service.

Through the courtesy of the International Creosoting & Construction Company the writer was privileged to visit and inspect its operations from woods to plant at Texarkana, Tex. The pine in this region is purchased from local producers within a 300-mile radius of Texarkana. Division organizations with a staff of inspectors care for the product until it arrives in the large yards in Texarkana. The pines are cut by hand labor, using crosscut saws. The branches are removed, then the top, and finally all the bark is peeled from the trunk, after which the pole in embryo is inspected for dimensions and condition and then is accepted or rejected. A frequent cause of rejection is the presence of a "punk knot." This is a defect in the tree which may show only as a small opening on the surface and yet the interior of the trunk may be rotted for several feet above and below the knot. Railroad ties are produced by local crews in a similar manner to the poles and are hewed to dimensions. In order to pass inspection they must meet the specifications of the American Railway Engineering Association. The inspectors work in pairs and must have had a previous training in woodsmanship and treating methods used at the plant and finally must serve a woods apprenticeship under an experienced inspector.

PEELED POLES IN A SOUTHERN WOOD

After the woods inspector has passed upon the timber and classified and marked it, the material is placed on cars and shipped to the plant at Texarkana. Upon arrival in the yard the poles are unloaded by locomotive cranes. All the timber is inspected carefully at this time, and if it is to be treated immediately, it is framed and roofed and loaded on cylinder trams. If the timber is to be air seasoned, it is taken to the storage yard and placed in stacks, with creosoted separators inserted to give ample air space between pieces. The yard is well drained by tile sewer lines and no grass or other vegetation is permitted to grow. Evaporation of moisture from the stacks is further facilitated by the fact that the bottom of each stack is at least 2 ft. above the ground and rests on creosoted blocks.

The seasoning operation is very important; the timber in the yards is watched closely and borings for moisture are taken regularly. When the moisture content is about 30 per cent, the wood is ready for treatment. It is inspected carefully for the third time and either receives the full treatment specified by the purchaser or a 4-lb. per-cubic-foot treatment, which is sufficient to preserve the wood for the short time it will be retained in yard storage previous to the full treatment required on a purchase order.



CHARGE RECORD

CHARGE NO. B-11933 COPY DATE CHARGED: IN 9/29 OUT 9/29/'26

TREATED FOR Union Electric Light & Power Co.

ORDER NO. 8615

MATERIAL Large Poles

PRESERVATIVE REQUIRED PER CU. FT. 8

PRESERVATIVE Creosote PROCESS Rueping

TOTAL RETAINED 35081 POUNDS

AV. PER CU. FOOT OF WOOD 8.16 POUNDS

AV. PER TIE GAL. POUNDS

VOLUMETRIC ABSORPTION PER CENT

CYLINDER EMPTY

LOAD DISPLACEMENT

CYLINDER LOADED

CUBIC CONTENTS 4298

WGT. OF OIL PER GAL. 8.85 LBS.

| | ZINC TANK | FEET | GALLONS | OIL TANK | FEET | GALLONS | GAL. 100°F. |
|---|---|---|---|---|---|---|---|
| A | | | | | 20.32 | 74615 | |
| B | | | | | 4.46 | 16377 | |
| C | | | | | 1.48 | 5435 | |
| C′ | | | | | | | |
| D′ | | | | | 18.68 | 68593 | |
| A | | | 160° | | 20.32 | 74615 | 72057 |
| D | | | 177 | | 19.18 | 70429 | 68093 |
| | | | | | 1.14 | 4186 | 3964 |

ABSORPTION

| | TANK FT. |
|---|---|
| (A-B)-(D′-C′) | |
| (B-C) | 2.98 |
| (A-C)-(D′-C′) | |
| A-D | 1.14 |

MEASUREMENTS ON MATERIAL TREATED

| NO. PCS. | CROSS SECTION BUTT | CROSS SECTION TOP | LENGTH | B. M. F. LIN. FT. | TOTAL CU. FT. | CU. FT. EACH |
|---|---|---|---|---|---|---|
| 140 | 13½ | 9½ | 40 | 5600 | 29.16 | 4082 |
| | | Stubs | | | | |
| 7 | 10 | 7½ | 35 | 245 | 14.70 | 103 |
| 9 | 10 | 7½ | 30 | 270 | 12.60 | 113 |
| 156 | | | | 6115 | | 4298 |

B.M.F. 51576

| ON HOUR | ON DATE | MAXIMUM | MAXIMUM TEMP | HELD AT MAXIMUM HOURS | OFF HOUR | OFF DATE |
|---|---|---|---|---|---|---|
| | | | | | | |

| ON HOUR | ON DATE | | REACHED AT | MAXIMUM VACUUM | AT TEMP. | OFF HOUR | OFF DATE |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

| HOUR ON | DATE | POUNDS | REACHED AT | DATE |
|---|---|---|---|---|
| 11:15A | 9/29 | 50 | 11:55A | 9/29 |

| BEGAN | DATE | COMPLETED | DATE | TEMP. |
|---|---|---|---|---|
| 11:55A | 9/29 | 12:10P | 9/29 | 180° |

| ON | DATE | OFF | DATE | MAXIMUM |
|---|---|---|---|---|
| 12:10P | 9/29 | 3:10P | 9/29 | 165 |

| ZINC TIME ON | ZINC TIME OFF | OIL TIME ON | OIL TIME OFF | DATE |
|---|---|---|---|---|
| | | | | |

| TIME BEGUN | CYLINDER TEMPERATURE | DATE | TIME ENDED | DATE |
|---|---|---|---|---|
| | | | | |

| HOUR ON | DATE | HOUR OFF | DATE | MAXIMUM |
|---|---|---|---|---|
| | | | | |

| HOUR ON | DATE | HOUR OFF | DATE | MAXIMUM |
|---|---|---|---|---|
| 3:35P | 9/29 | 4:35P | 9/29 | 23" |

QUANTITY OF PRESERVATIVE REQUIRED

| ZINC | OIL |
|---|---|
| | 3885 |

PRESERVATIVE PRESSURE PERIOD

| TIME | GAUGE | PRESSURE | TIME | GAUGE | PRESSURE | TIME | GAUGE | PRESSURE |
|---|---|---|---|---|---|---|---|---|
| 12:10 | 4.46 | 50 | | | | | | |
| 12:40 | 3.00 | 120 | | | | | | |
| 1:10 | 2.28 | 150 | | | | | | |
| 1:40 | 1.96 | 160 | | | | | | |
| 2:10 | 1.74 | 165 | | | | | | |
| 2:40 | 1.60 | 165 | | | | | | |
| 3:10 | 1.48 | 165 | | | | | | |

TREATED BY L. T. Moores.

R. L. Allardyce Gen'l SUPT.

Texarkana, Texas. PLANT

TOTAL TIME OF TREATMENT 5 HOURS 20 MINUTES

CHARGE RECORD USED WITH RUEPING PROCESS OF WOOD-POLE IMPREGNATION

A large treating plant was found in operation at Texarkana. Two large cylinders, four creosote tanks of 90,000 gal. each, a creosote storage tank with a capacity of 300,000 gal., a boiler plant of 700 hp. and accessory equipment for producing, transmitting and using steam, air and creosote comprise the essential equipment used in the treating process. One of the steel-treating cylinders has a diameter of 9 ft. 6 in., is 165 ft. long and is made of 1-in. steel plate. Steel doors are located at each end of this cylinder and a standard narrow-gage track is installed upon which the loaded cylinder trams may be operated. The cylinder has a capacity of from 80,000 to 85,000 ft. and is used to treat poles, ties and structural timber as desired. The second cylinder is 6 ft. in diameter, is 125 ft. long and has a capacity of about 20,000 ft. of timber. Poles with 10-in. tops and 110 ft. long have been treated in these retorts.

There are three processes for treating poles with creosote: the Rueping empty cell, the Lowry and the Bethel full cell. The International Creosoting & Construction Company is equipped to use all of these processes, but uses the Bethel full cell and the Rueping empty cell processes. For poles it is customary to use 8 lb. of creosote per cubic foot in the empty cell process and 12 lb. in the full cell process.

### EMPTY CELL PROCESS

In the Rueping process, as the first step, air is pumped into the cylinder and thus into the wood under high pressure; then while the air pressure is maintained the cylinder is filled with creosote at a temperature of between 180 and 200 deg. F. As the oil enters, the air is gradually released but without allowing the pressure to drop. In this way the cylinder is filled with oil, but a considerable quantity of air is entrapped in the wood. More oil is then pumped in and the pressure increased until it finally reaches a maximum of 165 to 200 lb., the exact figure depending on the individual characteristics of the wood under treatment. After sufficient creosote has been injected this pressure is released, the oil is drained from the cylinder and a final vacuum is applied. This release in pressure allows the air entrapped in the wood to expand and force much of the oil out of the

SAWING A PINE TREE INTO LENGTHS FOR MAKING TIES

wood, leaving partly empty wood cells and the final retention of creosote specified by the customer.

In the Bethel process, after the material is placed in the cylinder, a vacuum of about 26 in. is maintained until the wood is as dry and free from air as practicable, and then, without first breaking the vacuum, the cylinder is completely filled with the creosote oil. The vacuum not only accelerates the entrance of the preservative into the retort but also makes it possible to force the preservative into the timber more quickly and with less pressure than is the case when the preservative must displace or compress the air in the wood. After the retort is filled, additional creosote is forced into the cylinder by means of pressure pumps, the pressure being gradually raised to and usually maintained at not less than 125 lb. per square inch at a temperature of 180 to 200 deg. F., until the required amount of the preservative has been forced into the wood. The pressure is then released, the oil drained from the cylinder and another vacuum drawn. The object of this final vacuum is to remove the surplus creosote from the surface of the timber and hasten the dripping so that the treated wood can be removed from the cylinder as soon as possible. The final vacuum also makes the wood drier on the surface and cleaner to handle.

In either treatment 100 per cent of the quantity of creosote specified by the customer's order is the minimum quantity retained by the wood.

The creosote used in the treatment conforms to A.R.E.A. specifications, and a laboratory with a staff of three graduate chemists is maintained to test the creosote, to supervise the treatments and to do development work. The usual tests on the creosote are based on fractional

MAKING A SQUARE-EDGED TIE

TABLE I—CHARACTERISTICS OF WOODS USED FOR POLES
Taken from U. S. Department of Agriculture Bulletin 556

| Type of Wood | Breaking Strength, Lb. per Sq.In. Modulus of Rupture | Impact Strength Height of Drop (In.) Causing Complete Failure When Using 50-Lb. Hammer | Shearing Strength, Lb. per Sq.In. | Crushing Strength, Lb. per Sq.In. |
|---|---|---|---|---|
| Chestnut | 5,600 | 24 | 800 | 2,470 |
| Western red cedar | 5,200 | 17 | 720 | 2,840 |
| Northern white cedar | 4,200 | 15 | 620 | 1,990 |
| Southern longleaf | 8,700 | 34 | 1,070 | 4,390 |
| Southern shortleaf | 8,000 | 39 | 890 | 3,810 |
| Loblolly | 7,500 | 32 | 900 | 3,580 |

distillation whereby a given quantity of creosote is heated and the fractions distilled at successive temperature increments are measured. The residue is then subjected to a standard test and the complete test results are balanced against the specifications. A skilled chemical control of the curing and treating process is considered essential to good products.

## SAMPLE SPECIFICATIONS

A large utility in the South which has used creosoted poles for many years presented the writer with a copy of the specifications now used for the purchase of these poles. This utility reports splendid service from the creosoted poles and purchases them in large quantities each year. The specifications are as follows:

*Quality of Poles.*—All poles shall be cut from live, sound, dense Southern yellow pine, well proportioned from top to butt with a maximum sweep or curvature in one direction only of 1 in. for each 10 ft. of length measured at right angles to a line from the top of pole to a point 6 ft. from the butt. Poles must be free from large season checks, blisters or other irregular markings, and must be peeled free of inner bark. Knots must be trimmed close and the butt sawed along a plane which shall not be out of square with the axis of the pole by more than 2 in. per foot of butt diameter. A maximum of 3 ft. of boxed section of a tree may be included in a pole, measured from the butt, and this must not reduce the cross-section of the butt by more than 20 per cent.

*Seasoning.*—It is essential that all poles be air seasoned in the yard for a minimum of 30 days or as much longer as local experience will allow before sap wood decay of any nature will set in. In the air seasoning, care must be used in stacking the poles to permit of minimum contact between poles and to eliminate any contact from pole to ground. Where the time permitted for air seasoning is restricted, suitable modifications are required in the tank seasoning process. (See particulars for treatment).

TABLE II—ANNUAL CHARGES OF CREOSOTED TIMBER*

TIE IN OPEN TRACK

| | Plain Tie | Creosoted Tie |
|---|---|---|
| Life, years | 7 | 15 |
| Cost of tie | $1.02 | $1.15 |
| Cost of installation | 0.75 | 0.75 |
| Total | $1.77 | $1.90 |
| Interest, 7 per cent | 0.12 | $0.13 |
| Depreciation | 0.25 | 0.13 |
| Cost per year | $0.37 | $0.26 |
| Saving per tie per year | ..... | 0.11 |
| Saving per mile per year | ..... | $290.40 |

30-FOOT POLES, CLASS A

| | Chestnut Plain | Pine Creosoted |
|---|---|---|
| Life, years | 5 | 22 |
| Cost of pole | $9.00 | $11.35 |
| Cost of setting | 10.00 | 10.00 |
| Total | $19.00 | $21.35 |
| Interest, 7 per cent | $1.33 | $1.49 |
| Depreciation | 3.80 | 0.97 |
| Cost per year | $5.13 | $2.46 |
| Saving per pole per year | ..... | $2.67 |
| Saving per mile per year (105.6 poles) | ..... | $281.95 |

1,000 BOARD-FEET OF BRIDGE TIMBER

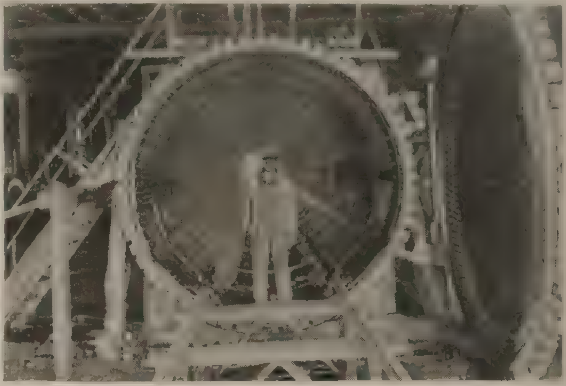
| | Plain | Creosoted |
|---|---|---|
| Life, years | 12 | 25 |
| Cost, erected | $65.00 | $75.00 |
| Interest, 7 per cent | $4.55 | $5.25 |
| Depreciation | 5.42 | 3.00 |
| Cost per year | $9.97 | $8.25 |
| Saving per year per 1,000 b.ft. | ..... | $1.72 |

* C. A. Smith, Georgia Railway & Power Company

*Dimensions.*—The top dimensions of the poles shall be not less than the dimensions specified on purchase order, with a minimum taper of 1 in. in 10 ft. of length.

*Framing Poles.*—Before poles are subjected to the creosoting process, they shall be roofed and gained as indicated by drawing number specified on purchase order. Each gain shall be not more than ½ in. deep unless otherwise specified. Where more than one gain is required, they must be parallel and all holes must be squared with the axis of the pole. When a pole has a sweep or curvature, the gains must be made on the concave side. These requirements must be fulfilled and all work performed in a neat and workmanlike manner.

*Selection of Timber for the Charge.*—In order to secure uniform oil admittance in each pole in a specific batch prepared for a charge in the closed tank consideration must be given in selecting the batch, seasoning, proportion of heart to sap wood, proportion of size of resinous to pitch wood rings, number of rings per inch, and local conditions, together with the experience of the practical operator of the tank or cylinder.


EMPTY RETORT WITH A TALL NEGRO IN THE OPENING

*Creosote Treatment of Poles.*—In lieu of a specific process for the various methods of creosoting timber, the procedure outlined by the American Wood Preserving Association covering the 10 lb. "open cell treatment" shall be used unless otherwise specified. Attention is called to the necessity of each bidder submitting a graphic chart of the method used in treating timber. Treatment must be given a minimum of 1½ in. penetration when sap wood is 1½ in. or less in thickness. Where greater than 1½ in. in thickness, complete penetration of sap wood is required.

*Specifications for Creosote Oil.*—The grade of oil used in the treatment of timber shall be of a quality similar to that specified by the American Railway Engineering Association as No. 1 oil.

*Inspection of Material.*—Adequate facilities must be provided by the manufacturer for the inspection of timber by an authorized representative of the purchaser, and the purchaser reserves the right to reject any or all timber not conforming to the above specification.

The waiving of inspection by the purchaser does not relieve the manufacturer of the responsibility of conforming to the specifications, and the purchaser reserves the right to reject any or all unsatisfactory uninspected timber at the point of delivery.

Approximately 100 commercial plants in the South are creosoting pine poles, and several utilities have installed a creosoting plant for their own work. It is the opinion of purchasers of creosoted timber that many of these plants can do much to produce a uniformly good product and one that does not require rigid inspection by the purchaser. In the present highly competitive market it is advisable that purchases should be made on the basis of detailed specifications and careful inspections by men who know timber and understand creosoting and from reputable creosoting companies. One large purchaser reports a rejection of about 2 per cent on poles bought from local creosoting companies and states that a uniform product is difficult to secure.

# Who Pays the Cost of Price Cutting?

A frank discussion of the warfare now being waged between the purchasing agents and the sellers in this buyers' market

By Earl Whitehorne
*Commercial Editor* Electrical World

WITHIN the memory of this generation there has never been a time when business men were talking more about the ethics and the economics of price cutting. It is an engrossing subject of conversation in the electrical industry right now. It concerns the power companies because they are large buyers. It concerns the electrical manufacturers because they are selling to these large buyers. It concerns them in the same way that the same conditions are involving other large buyers and sellers in numerous other industries. But the fact that these conditions are general does not make them any less particularly a problem which the electrical industry must face in its own field and work out for itself.

## In a Buyers' Market

We are, of course, in a buyers' market. There is excess capacity and overproduction in manufactured products and an intense competition for orders. But that is not all. We have had other periods when the buyer was in the saddle, riding the salesman whip and spur, just as we have had sellers' markets, when demand exceeded supply and the pressure was upon the purchaser; during the war, for instance. And whereas then the salesman was playing one buyer against another for a better price, the purchasing agent today is juggling one seller against another for a lower figure. It is not unnatural. The purchasing agent feels that it is now his time to be the wolf. It is his night to howl. But times have changed, and what was once considered a fair game of bartering has come to be a matter of the economics of an industry.

For there has been much progress in the thinking of American business. The pack peddler and the patent medicine man have gone their way with their wooden nutmegs and fake nostrums. The days of barter in the village store have given place to a one-price policy in retail trade. Modern business ethics have purged the manufacturing field of many practices that once were looked upon as quite legitimate, but now are recognized as unfair either to the customer or the competitor. And now a new advance in the evolutionary process has introduced another idea—the responsibility of business men to protect the economic health of the industry in which they are engaged.

In other words, the growth of American industry has brought with it an extremely complex inter-relationship among manufacturers and between buyers and sellers throughout the land. Specialized production has developed a tremendous volume of interindustry trade in materials, equipment and services. And also large concentrations of capital and industry have resulted in a degree of interdependence between the buyer and the seller in such an industry as ours as has never been known before. And the present discussion of the prevalence of price cutting by manufacturers and profiteering by large purchasers has to deal with these new conditions.

### Some Experiences in Price Cutting

*THE purchasing agents of large buyers are being accused of profiteering. The complaining manufacturers are being charged with lack of price courage. What is it all about?*

*In this article Mr. Whitehorne arrays the major factors in the situation. There will follow a further discussion of "Some Experiences in Price Cutting," in which the methods that are at present demoralizing the market for electrical apparatus will be described. The editors will welcome a frank expression from our readers on this important and much-disputed issue.*

## An Industry Concern

Obviously it is poor business to be a party to a transaction in which either side is going to lose money. That is just common sense. For it usually costs more to win a new customer than the profit on the first order he gives. It is the continuing business from the account that pays. And it costs money also for a large buyer to take on a new supplier and establish an understanding of special needs and a dependable service. Usually it costs more than is gained by changing to another line just to seize a slight price advantage on the initial order—which is too often offered as a bait.

But there is more to it than that today. For so vast is the flow of goods and so greatly is the modern buyer sustained in his own business by his suppliers that a large industrial organization has come to be vitally concerned with the prosperity of the other organizations from which it draws. Put a manufacturer out of business by rendering it impossible for him to make money and you must look elsewhere for your next shipment of whatever it is you need. Let him live and he will continue to help you make more money. And that is precisely the philosophy that has dominated in those much-heralded cases where a large buyer has examined into a seller's costs and refused to accept cut prices that netted him a loss, knowing that either this seller must hereafter skimp on quality or service or ultimately go to the wall—unless the price level is restored.

## Three Recommendations

1. *That bids on standard listed apparatus should be offered for examination by any bidder who is called back and asked for a reduction of his price.*

2. *That salesmen should demand this as evidence of good faith on the part of the buyer whenever asked to cut a price after bids are in.*

3. *That post-mortems on competitive bids should be made standard practice among all manufacturers so that losers may understand their lost business.*

In the electrical industry, where an expensive engineering type of equipment is involved, the buyer also relies upon the manufacturer for another vital resource. He looks to the manufacturer to advance the art, to conduct expensive research, to carry forward the progress of engineering development. And if the manufacturer is denied profits that are adequate to finance the cost of it, then this will gradually cease and the industry must sacrifice one of its most priceless assets, unless the buyer assumes the burden.

Samuel Insull stated it well for electrical men in a much-quoted address in Chicago not so long ago. He said:

> You men who are in the branches of the business other than the central station—you have problems of your own. But the interdependence of the industry makes your problems ours, as it makes our problems yours. Central-station development creates the market for you and keeps it expanding. Development on your side assists our efficiency and facilitates use of our product.
>
> If competition in the sale of turbo-generators or cables or transformers is so keen as to hamper research work and threaten the quality or the rate of development; if too narrow margins restrict the wholesaler's ability to carry adequate stocks, supply sales service and extend credit to the retailer; if the keenness of competition between contractors impairs the adequacy or quality of wiring; if construction is hampered or not properly remunerated on account of policies in other branches of the business—if any of these things happen, the central-station companies, which use those materials and services, finally suffer the most.
>
> And, finally, the paramount responsibility, imposed upon all of us by our common interests, is to see to it that no obstacles are placed in the way of general electrical development—a development that is not yet nearly completed, but has already done so much to make our country the envy of all the world.

### How It Is Done

Coming down to cases—just what is the situation in the electrical industry? Two things are happening:

**1. Purchasing agents of large buyers are rigorously applying the thumbscrews to the manufacturers' salesmen and beating down price levels by ingenious methods of induced competition.**

**2. Manufacturers in their eagerness for volume are weakly submitting to this pressure and cutting prices to get orders that net a loss and demoralize their market.**

The first reaction is to just say, "Well, under the circumstances the purchasing agents are smart and the manufacturers are not. Why worry?" But when you look ahead and ask yourself what the consequences may well be within this highly interdependent community of business interests if this condition should continue very long, you realize that in the end the buyer would suffer with the seller, and the entire industry would be the loser by it all. Large-scale profiteering by purchasers, widespread price cutting by manufacturers in this day and age soon become a common problem.

What is to be done? It would seem that the burden of reform would rest upon the manufacturers, who possess the right to accept an order or decline it as they wish. But as every manufacturer knows, the demand for volume is a remorseless pressure upon the sales department that must feed orders into the hungry hopper of a modern factory. And since the Sherman law forbids competing manufacturers to organize for mutual protection against the snares and pitfalls of a buyers' market, each one must take his chances in the open strife, and the price that can be charged depends upon the level of the market for competing lines. Let one sales manager weaken in the face of a persistent price squeezer and let a second fall in line and no other bidder can hope to hold to his figure and secure the business.

Apparently there remains but one legal and practical defense to which the manufacturer may have recourse. That is the organizing of industry opinion, to correct uneconomic practices and improve the standard of executive policy among both the buyers and the sellers. In other words, he must broaden the vision of the purchasing agent and stiffen the spinal structure of the sales manager.

### Too Much Secrecy

The seat of the present trouble, it would appear, lies in the old tradition of the secrecy of bids, for here is the keenest weapon that the buyer is employing at the moment. A group of manufacturers are invited to submit bids on equipment to be purchased. The bids are in. The salesmen call. The purchasing agent thereupon proceeds privately to play each man against the others, telling each that he is high, inciting each to telephone the factory, whipsawing them with fear and hope, until the last price cut has been exacted and the last unhappy concession wrested from the profit margin on the goods. Too often he who was the low man at the outset is the low man at the end, but minus profit. Too often, also, the order was all the time intended for him for some good consideration of the quality or service offered, in return for which he has been mulcted of his company's earning power on that sale. Because of the traditional sanctity of bids, he has been unable to demand a showdown when the bids are in, a chance to see whose price is really high—"which bird is early." For there are lying purchasing agents as well as lying salesmen and the temptation to play tricks with truth is sometimes great in buying.

Clearly, therefore, there are three things to be done as an approach to remedy:

1. Secrecy should be eliminated on bids for standard listed apparatus. Bids are published on government orders. Bids for private purchasers should be open to examination by any manufacturer who is called back and asked for a revision of his price. At present it is not supposed to be morally right to show a bid to a competitor. Where the bid entails a large element of engineering or other variables this secrecy will undoubtedly continue. But on standard listed apparatus—and this covers the major volume of the sales of industry—the buyer should show the bids when asking any bidder to reduce his price.
2. The salesman should demand this frank showdown whenever called upon to cut a price after the bids are in. He should expect it as an evidence of good faith on the part of the buyer. Manufacturers should refuse to consider a concession without this evidence.
3. The holding of post-mortems on competitive bids should be made standard practice among all electrical manufacturers, so that losers may analyze all bids and understand their lost business. This is lawful and already is being done to some extent, the exchange of bids being made by the bidders. The National Electrical Manufacturers' Association is actively promoting this idea and serving as a clearing house for its members. The practice should be made universal.

Of course, this would not end all cutting of prices. It would simply bring the practice out into the open and improve its morals. It would just be two steps toward an eventual one-price system.

But the seller should not be made to fight for this reform unaided. Purchasing agents individually and as nationally organized should also become the exponents of this idea. It is another step to be taken in the debunking of business, the banishing of deceit and trickery from trade. In this era of economic intelligence the gentle art of profiteering by purchasers should be laid away in shrouds along with the wooden nutmeg and that once popular commercial slogan, *caveat emptor!*

For men do not buy for price alone. Price is important. But other factors are equally important because they themselves constitute the value, for which the price is paid. The chief concern of the buyer should be to see that he obtains a value proportionate with the price. The chief concern of the seller should be to see that he obtains a price commensurate with the value. And these two ideals are not antagonistic. They go together like the well-known words *e pluribus unum,* to use more Latin.

Who pays the cost of price cutting, then? Both the buyer and the seller pay it. And in the end the entire industry suffers.

## Analyzes Employees' Attitude Toward Electric Range

A SURVEY was made recently by the Northwestern Electric Company, Portland, Ore., to determine to what extent its employees use electric ranges in their homes. Out of 514 employees, 70 per cent, or 362, replied to a questionnaire, and of this number 37.5 per cent of those maintaining a home were using electric ranges. This is more than double the range saturation of domestic customers served by the company.

Employee use of ranges tabulated by class of work showed that 53 per cent of the employees in the commercial department used electric ranges. Classes showing the lowest use of ranges were station operators and line department and accounting department employees.

CENTRAL-STATION EMPLOYEES' IDEAS ON THE ELECTRIC RANGE

**If you do not use an electric range now would you like to have one?**

| | |
|---|---|
| Yes | 135 |
| No | 39 |
| Doubtful | 2 |

**What features do you like best about electric cooking?**

| | | | |
|---|---|---|---|
| Cleanliness | 207 | Uniformity | 19 |
| Automatic control | 50 | Good looks of range | 13 |
| Less operating cost | 40 | No odor | 30 |
| Convenience | 55 | Safety | 14 |
| Better cooking | 29 | No waste | 7 |
| Less heat radiation | 14 | Less work | 16 |
| Efficiency | 31 | Cool | 19 |
| Quicker | 17 | Dependability | 8 |
| More palatable food | 12 | | |

**If you do not use an electric range, what is your objection?**

| | | | |
|---|---|---|---|
| Initial cost | 43 | Not married | 20 |
| Off company lines | 12 | Eat in restaurant | 5 |
| Not living at home | 13 | Have satisfactory range | 2 |
| None | 75 | Cost of operation | 3 |
| Use gas range | 17 | Not in permanent home | 4 |
| Use wood range | 6 | Range in use serves as heater | 2 |
| Rent, not wired | 10 | | |

**Do you take every opportunity to tell your friends of the advantages of electric cooking?**

| | |
|---|---|
| Yes | 272 |
| No | 2 |
| Sometimes | 5 |

Replies to several pertinent questions contained in the questionnaire are given in the accompanying table. This shows that cleanliness, automatic control, less operating cost and convenience were the features liked best, and that initial cost was the greatest objection of those who voiced any objection. The fact that 75 employees had no objection at all to the use of an electric range indicates that it should not be difficult to develop a much greater employee use of ranges than now exists.

## Floodlighting Sells Homes, Says Realtor

STARTING with November, 1927, the McDonald Realty Company, Schenectady, utilized floodlighting as a silent salesman to attract attention to its houses after dark. Experimentation with illumination to determine its sales influence was recommended by L. N. Lamboy of the New York Power & Light Corporation. Thirteen houses on one street were so illuminated. Five 500-watt L-09 and one 250-watt L-11 General Electric floodlighting projectors were employed.

2,750 WATTS FLOODLIGHT HOUSES, ASSISTING SALES

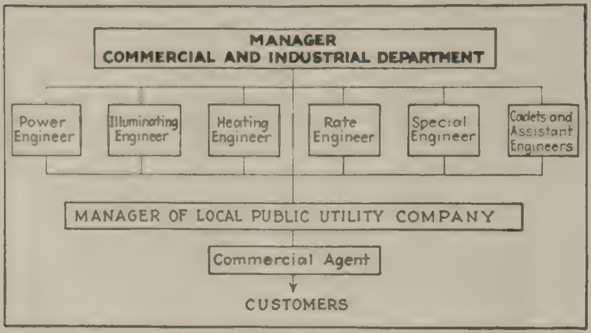
Commenting on the value of the floodlighting in creating sales, the realty company had the following to say:

"We are glad to say that many people were attracted, with the result that every evening large numbers of visitors turned out to inspect these homes, which resulted in furnishing a number of prospects and contributed to a great many of our sales. We are so pleased with this experiment that it is our intention to continue this form of advertising in our future building operations."

## Commercial and Industrial Set-Up of a Management Company

FROM a single power sales engineer in 1920, the personnel of the commercial and industrial department of Charles H. Tenney & Company, Boston, Mass., has increased to an organization of from fifteen to 25 persons, depending on the amount and importance of the work in hand from time to time. The public utilities under this management serve a total of about 145,000 electric and 182,000 gas customers. The duties and staff set-up of this department were recently described by its manager, V. M. F. Tallman, in the pending rate case of the Malden Electric Company before the Massachusetts Department of Public Utilities, and through the courtesy of Palmer York, president of the Tenney organization, the accompanying chart summarizing its commercial and industrial activities is reproduced.

The department is composed of specialists or key men in the sale of power, light and heat to commercial and industrial establishments, in the design of rates, drawing of contracts and conduct of special investigations. Five specialized engineers and a number of assistant engineers and cadets report to the manager. The work done is grouped under three sets of activities, as indicated on the chart. Electrical and gas appliance merchandising is conducted by the Tenney company's general sales department. The commercial and industrial department serves all client companies and others retaining the Tenney organization, besides conducting special investigations and tasks for the executives of the management group, and, as occasion warrants, carries on work involving the study of industry developments in its own field. In the field of residential rates alone fourteen investigations and reports have been made by the department within the past seven years.



*Activities of Department*

COMMERCIAL & INDUSTRIAL BUSINESS (Elec., Gas, Steam), POWER, LIGHTING, STREET & TRAFFIC LIGHTING, HEATING

a. Survey and analysis of territory.
b. Solicitation of all business.
c. Following inquiries from present plants.
d. Following inquiries from prospective plants.
e. Follow up of all business—present and prospective.
f. Sales policies and sale of equipment.
g. Sales engineering — efficient use of service.
h. Customer's installations.
i. Change over, from one form or type to another.
j. Tests, trial installations, etc.
k. Rates and contracts; analysis, design, preparation and filing.
l. Relations with customers, contractors, engineers, architects and manufacturers.
m. Special investigations.
n. Research and development.
o. Publicity.
p. Customer's adjustments.
q. Following practices of other companies.
r. Training of local personnel.
s. Statistical and graphical analysis.
t. Maintaining technical and sales reference library.

RATES & CONTRACTS (Electric, Gas, Steam), RESIDENTIAL, COMMERCIAL, INDUSTRIAL, MUNICIPAL, OTHER PUBLIC UTILITIES

a. Administration and execution.
b. Cost analysis.
c. Design of rate schedules, application cards, and service terms and conditions.
d. Preparation of contracts for power, lighting, wholesale service and street lighting.
e. Estimating effect of rate changes on revenues.
f. Publicity and announcements.
g. Special reports on rate matters.
h. Investigation and research work.
i. Preparation of rate schedules for filing with commissions and general publication.
j. Following rate practices of other companies.

SPECIAL WORK.

Responsibility for the preparation of all surveys of a commercial or industrial nature, and such other special work as may be requested, ordered or approved by the client company executive.

## Letters from Our Readers

### *Blueprint Ethics*

*To the Editor of the* ELECTRICAL WORLD:

Apropos of the article on page 1358 of the Dec. 31 issue of the ELECTRICAL WORLD, I cannot resist the temptation of a few comments. The blueprint story is, in fact, but one of the many phases of a complex situation involved in buyer and seller relationships.

The viewpoint of the buyer would, in my opinion, be far more tenable provided his buying ethics do not permit him to obtain prices nor to use the drawings and general information secured from one manufacturer as a means of educating some one else of obviously inferior engineering capacity and general ability to contribute his share to the art. Obviously, in such a case the original furnisher of the blueprint would have no opportunity whatever to improve his own work as a result of drawings that might be traded to him in exchange.

The only way in which the buyer's viewpoint could be supported in practice would be to make certain that he did not request prices nor attempt an interchange of drawings excepting among those firms which were organized on a parity and whose information and general practice, to say nothing of manufacturing costs, would place them on the same plane or in the same class.

I am sure the abuse has not resulted from following this rule, but from a sometimes irresistible desire on the part of the buyer to secure a cheaper price by taking the designs prepared in one company, which is organized with an engineering overhead and cost to do business such as makes it competent, and handing them to some machine shop from which good work may be secured, but which in itself would be entirely incompetent or lacking in the ability to produce the original ideas. If the organization with a good engineering design and the ability to produce it cannot market its product based upon such design and receive its worth from the buyer, what, then, is the incentive to maintain an organization and instill within it the pride of accomplishment, to say nothing of the ability to accomplish if only for the purpose of supplying ideas for others to bid upon in competition with themselves.

After all, and as usual, it is a matter of the buying policy of the institution. Some buyers are inherently and temperamentally quick to see the justice and importance of this argument and to proceed accordingly. The buying policy, however, will not be completely corrected until it is laid down by the responsible executives themselves. "MANUFACTURER."

# Digest of Electrical Literature

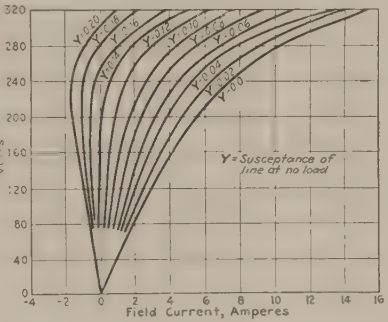
## *Hydro-Electric Development and Steam Equipment*

*A New Hydro-Electric Station.*—The Norrfors hydro-electric station built by the Swedish Government operates under a fall of water of approximately 127 ft. and has a number of unusual features, including the mounting of the generator 85 ft. above the turbine. The turbines have their own guide bearings, but no supporting bearings. The total weight of the rotating part of each set is carried by special bearings provided on the generators. Each stator frame is of ordinary open construction, with small radial depth behind the core plates and furnished with a great number of openings through which the warm air can escape into a duct placed round the stator in the building but under the machine room floor. It is claimed that the machine may be regarded as completely proof against short circuit. By means of hydraulic brakes each generator may be brought to a standstill from full speed in about two minutes and can be held stationary against water leakage through the turbines when the gates are closed. Special lifting apparatus permits the whole rotating system to be raised to allow of inspection of the supporting bearing and other lower parts. The rotating load is transmitted from the shaft through a steel ring to a supporting plate of cast iron furnished on its underside with a steel surface running on babbitt-covered self-adjusting segments. The whole bearing is immersed in oil, the sliding surfaces being below the level of the oil in the well, which is surrounded with a cooling spiral fed from a forced feeding pump for all the bearings. It was found on test that the machine could be run continuously with the separate cooling device out of action.—*Electrical Review (England)*, Jan. 13, 1928.

## *Generation, Control, Switching and Protection*

*The Application of Relays for the Protection of Power System Interconnections.*—L. N. Crichton and H. C. Graves, Jr.—A compilation of many of the new methods for relay protection required by superpower interconnections. The ideas have been obtained from various sources and represent what seem to be good present-day practices. Particular reference is made to protection against phase-to-phase short circuits in which the current is less than the full-load current. The clearing of accidental grounds is discussed and a new study of residual currents on systems of different types is given. This study indicates the usefulness of certain inverse time-limit relays on systems having dead grounded power transformer neutrals at all switching stations. Bus protection and "back-up" methods are described. Some of the new relays which have been developed, or improvements which have been made in older types in order that the new demands may be met, are described, and there is particular mention made of a recent relay installation similar to that being used in service on a 220-kv. interconnection.—*Journal American Institute of Electrical Engineers*, February, 1928.

*Alternator Characteristics Under Conditions Approaching Instability.*—John F. H. Douglas and Edward W. Kane.—The subject of generator instability is discussed in connection with the method of testing synchronous machinery in the unstable, as well as in the stable range. The results of tests performed upon several machines are given in connection with data and characteristic curves. As a result of this investigation, the authors conclude that by a reduction of the value of the transverse reaction with improved design, the production of machines of greater stability and consequent improved behavior under conditions of low leading power factor may be anticipated. It is stated that the problem of stability is likely to become more acute as the voltages, lengths of transmission line and the number of system interconnections increase, so that it is particularly desirable that the manufacturers be able to improve the stability of their machines.—*Journal American Institute of Electrical Engineers, January*, 1928.



RELATION BETWEEN GENERATOR VOLTAGE AND FIELD CURRENT WITH DIFFERENT VALUES OF LINE SUSCEPTANCE

## *Illumination*

*Tungsten Arc Lamp.*—F. Skaupy.—The glass-inclosed tungsten arc lamp is said to be gaining in popularity for purposes of projection, microscope illumination, etc. In this type of lamp two small balls of tungsten, suspended on wires which are as fine as possible, are inclosed in an evacuated glass bulb. The arc between the slightly separated balls is started by one of three methods: Ionization by an auxiliary heater, high-voltage impulse, or low-voltage glow discharge by suitable choice and pressure of the inclosed gas. Representative designs of these three classes are described. A European concern has recently perfected a tungsten arc lamp in which a bimetallic thermostat separates the electrode balls, starting the arc. Lamps of 100 to 1,000 cp. are marketed, consuming on an average $\frac{3}{4}$ watt per candle. The current rectifying properties of the tungsten arc are utilized in specially designed bulbs, for the conversion of alternating current into direct current. Such a lamp may also be connected into an oscillating circuit to change direct current into high-frequency alternating current. For example, 220-volt direct current may thus be transformed into 500-cycle alternating current with an efficiency of 35 per cent.—*Elektrotechnische Zeitschrift*, Dec. 8, 1927.

## *Transmission, Substations and Distribution*

*Power Transmission Over Long High-Voltage Lines.*—G. Oberdorfer.—Simple approximation methods have been made known in late years which permit rapid calculation of the characteristics of high-voltage lines. For the sake of simplicity, certain factors were neglected and the methods were limited as to line length. The recent trend of long transmission and tie lines makes it desirable to present a method which is not limited by the length of the line, and which is, at least as accurate and simple. A graphic-vectorial method is described which fulfills these requirements.—*Elektrotechnische Zeitschrift*, Nov. 17, 1927.

*Economic Base Width of Transmission Towers.*—C. R. Young, W. B. Dunbar, and C. E. Lewis.—An analysis of the various ratios utilized in the construction of transmission towers led to an investigation intended to establish an economic base width for such structures. A detailed study of the weights, specifications, and stresses, in a number of different towers resulted in the conclusion that the least-weight spread of base at the ground line of a typical square-windmill-suspension tower depends on the specification to which the tower is made, and on the slenderness ratio limits; that the reduction in the number of stories in a tower, using more stay members, and beginning the batter of tower legs at the level of the lower crossarm, has the effect of reducing tower weight, but adds to the pound cost of manufacture and erection; and that weight, in general, is saved by proportioning the diagonals to take both tension and compression, rather than tension resistance alone. Arbitrary limits with respect to slenderness ratio, areas of sections available, number of bolts practicable in end connections, and permissible allowances for over-stressing, tend to make actual weight curves irregular and not in accordance with any continuous mathematical function. This is one of three papers in the same publication upon the subject of transmission tower design. The others treat of the behavior of model transmission towers under load, and the effective length of bracing struts in transmission towers.—*Bulletin No. 7, University of Toronto*, 1927.

## *Units, Measurements and Instruments*

*An Electromagnetic Cyclograph.*—Takeo Akahira.—The instrument described in this article has been devised for the purpose of recording the relation between two given varying currents as a two-dimensional figure. In principle it is an electromagnetic oscillograph of the moving coil type. There are two single loops of four conducting strips stretched between two guide pieces of ivory and placed in a strong magnetic field. Thin and flexible cross wires are bridged over the strips of both loops midway between the guide pieces and a small circular mirror is cemented at the center of the cross fibers. The mirror vibrates around two rectangular axes simultaneously as actuated by currents passing around both loops. The current sensibilities are in the range of 0.2-2 milliamp. per millimeter of deflection at one meter scale distance and the natural frequency is about 2,000 cycles per second.—*Journal of the Institute of Electrical Engineers of Japan*, December, 1927.

## *Electrophysics, Electrochemistry and Batteries*

*The Time Lag of Spark and Surface Creepage.*—Matsunosuke Iwatake.—The comparative natures of the time lag of spark between needle electrodes and sphere electrodes in air, in oil, or in solid dielectric have been investigated for several sets of conditions. The method is characterized by several features including the utilization of the positive Lichtenberg figure; the application of two parallel electrodes to the photographic plate; and the use of an induction coil as the source of potential. The time was measured by the rotating film method, which is said to be simpler and easier to apply than the Dufour oscillograph method. The author concludes that in air the time lag of a needle gap is shorter than that of a sphere gap, while in oil the time lag of the needle gap is greater when using electrodes with spherical characteristics; that the time lag of spark across a needle plane gap in air or in oil or across a needle sphere gap in air is shorter when the needle is made positive, and longer when the plane or sphere is made positive; that the time lag of spark in a solid dieelectric is greater than in air, that there are few solid dielectrics which have greater value than oil; and that the time lag of a sphere gap in air or in oil does not depend upon the diameter of the spheres.—*Technology Report of the Tohoku Imperial University (Japan)*, 1927.

*The Electrostatics of the Thunderstorm.*—A. W. Simon.—The author has considered the phenomena involved in lightning discharges through the use of electrostatic analyses and reference to the generation of charges and potentials, induction and precipitation of charges, sudden application of electric stress and the numerical relations as involved in the gradients and similar influencing factors.—*Journal of the Franklin Institute*, November, 1927.

## *Motors and Control*

*Electrical Equipment for Boiler House Control.*—The opportunity for further economy in boiler house operation has led to the development of improved English electrical equipment. The various factors of operation are, in general, satisfactorily taken care of, but it is stated that the operation of the coal and ash handling plant is a separate problem from the control of the equipment which determines the amount of fuel and air which is actually fed to the boilers and that it is the former operation in which appreciable economies may be realized. A comparison is offered of the relative merits of: Direct current, alternating current with rotor regulation, alternating-current drive with pole-changing equipment and alternating-current computator motors, for the achievement of speed control of draught fans and other motor-driven equipment. Because of the desirability for the control of boiler house equipment from the firing floor, push-button devices are recommended for this service.—*Engineering (England)*, Jan. 20, 1928.

## *Heat Applications and Material Handling*

*Arc Welding Dynamo.*—E. Rosenberg.—The long-known "crossfield" generator, developed originally by the author for train-lighting purposes, has recently been improved for arc-welding service in which voltage regulation must be obtained with least attention. The designer succeeded in doing away entirely with all electrical regulation by equipping the generator with two magnetic poles, the flux of which can be changed mechanically to any desired density, depending upon the desired maximum welding current. The pole-pieces are attached to the yoke through thin steel tubes, within which slide steel pistons. Depending upon the position of the pistons within the steel tubes, the pole flux will be more or less restricted, thus limiting the short-circuit welding current to any desired maximum value. Hand wheels at the poles permit easy adjustment. The characteristics of such a generator are explained and presented on curve sheets. Portable sets are being manufactured with one induction motor and one or more cross-field generators. The latter can be used singly or in parallel for heavier welding work. The machines are entirely automatic, requiring no choke coils or rheostats.—*Elektrotechnische Zeitschrift*, Jan. 12, 1928, and *Elektrotechnik und Maschinenbau*, Jan. 15, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*Symposium on Television.*—A group of five papers describing the apparatus and methods used in the experimental demonstration of television over communication channels of the Bell System. The chief problems presented in the accomplishment of television are discussed, including the resolution of the scene into a series of electrical signals of adequate intensity for transmission, the provision of a transmission channel capable of transmitting a wide band of frequencies without distortion, means for utilizing the transmitted signals to recreate the image in a form suitable for viewing by one or more observers, arrangements for the accurate synchronization of the apparatus at the two ends of the transmission channel. Each of these factors is considered in detail with reference to the technical problems involved in their accomplishment. In the discussion of the radio transmission signals for television the engineering of a radio system for television purposes is featured and a description of the facilities actually employed in the demonstration included. The tests to which the system were submitted to determine its suitability are outlined and the measured frequency characteristics are shown.—*Reprint B-274, Bell Telephone Laboratories, Inc.*

## *Miscellaneous*

*The Dimensional Theory of Steam Nozzle Flow.*—J. C. Oakden.—An investigation of the flow of steam through nozzle and blade passages of steam turbines. It is stated that one of the chief difficulties associated with investigations of such phenomena is the extreme complication resulting from the large number of independent factors upon which the amount of the energy loss depends. The friction loss in a steam nozzle is affected not only by the size, shape and roughness of the metal surfaces, but also by the velocity, density and viscosity of the steam at every point in its passage through the nozzle. The number of independent variables renders it difficult to compare the results obtained with different nozzles, or by different observers, since it is only on rare occasions that any two tests will be found to have been performed under exactly similar conditions. The author develops the equations and expressions for consideration in the investigation of steam nozzle flow, has enumerated the factors influencing the efficiency and has endeavored to incorporate them in the various statements.—*Engineering (England)*, Jan. 20, 1928.

# News of the Industry

## Federal Trade Commission to Investigate

### By a Vote of 46 to 31 Senate Substitutes That Body for Proposed Committee of Upper House—Warm Discussion Rages for Nine-Hour Session

NO LITTLE acrimony characterized a protracted fight in the United States Senate on Wednesday over the amendment moved by Senator George of Georgia to substitute the Federal Trade Commission for the committee of five senators proposed in the report of the interstate commerce committee of the Upper House as the body to conduct an investigation of the electric and gas industries, inquiring into activities and relations over which the federal government has or may assume jurisdiction. The final vote came at 9 o'clock in the evening after a debate which lasted for nine hours and was marked by frequent clashes between senators who defended the Federal Trade Commission as the logical and proper body to conduct the inquiry and senators who insisted that to select it was tantamount to burying the Walsh resolution and dropping the whole matter. Finally Senator George's amendment was adopted by a vote of 46 to 31, but not before the resolution before the Senate had been altered in other respects besides the substitution of the Trade Commission for a senatorial investigating committee. The amendment was opposed by the group of Republican "progressives" and by 20 Democrats, 18 Democrats and 28 Republicans voting for it.

The resolution as passed, including the George amendment, directs the commission to inquire into and report to the Senate "within each thirty days after the passage of this resolution and finally upon completion of the investigation" on the financing of electric and gas companies furnishing power and light in interstate business. Another provision authorizes an inquiry into the alleged political activities of corporations. It was decided to limit the investigation to events since 1923, to eliminate any mention of investigating the election of House members, and to dispense with a clause which would "direct" the investigating body to go into that phase. The investigators are merely "empowered" to proceed. The Senate also accepted an amendment by Senator Black of Alabama providing that the sessions of the commission during the investigation should be open to the public.

Senator Walsh of Montana, advocating the adoption of the original resolution, declared that the scope of the investigation would not be changed by the committee amendment limiting the probe to companies doing an interstate business. It never was his intention, Senator Walsh declared, to investigate the small companies doing an entirely intrastate business. The intention is to go into the financing and other operations of the great combinations with business extending into various states. The underlying corporation that sells its securities in interstate commerce would be subject to investigation under the resolution reported out by the committee, Senator Walsh said.

Senator Walsh had much to say about the "lobby" assembled by the industries affected, but made no reference to the "lobby" of those who are urging the investigation. He cited instances in which utilities are alleged to have expended large sums in efforts to control legislation in certain states.

In the course of his remarks, the Senator from Montana declared that the Federal Trade Commission had been packed to prevent it from functioning. He made a scathing attack on Chairman Humphrey. He also criticised Commissioner Myers.

Senator George of Georgia defended the Federal Trade Commission as being a properly qualified body to continue the study which it already had started. He held the state commissions competent.

Other senators who took part were Bruce of Maryland, who assailed Senator Walsh and vigorously repudiated the allegations that a great power lobby was influencing the course of the Senate; Watson of Indiana and Copeland of New York, who favored the George amendment, and Dill of Washington, Norris and Howell of Nebraska and Blaine of Washington, who opposed it.

### *Text of the Resolution as Passed by the Senate*

RESOLVED, that the Federal Trade Commission is hereby directed to inquire into and report to the Senate, by filing with the secretary thereof, within each 30 days after the passage of this resolution and finally on the completion of the investigation (any such inquiry before the commission to be open to the public and due notice of the time and place of all hearings to be given by the commission, and the stenographic report of the evidence taken by the commission to accompany the partial and final reports), upon: (1) the growth of the capital assets and capital liabilities of public utility corporations doing an interstate or international business supplying either electrical energy in the form of power or light or both, however produced, or gas, natural or artificial, or corporations holding the stocks of two or more public utility corporations operating in different states, and of non-public-utility corporations owned or controlled by such holding companies; (2) the method of issuing, the price realized or value received, the commissions or bonuses paid or received and other pertinent facts with respect to the various security issues of all classes of corporations herein named, including the bonds and other evidences of indebtedness thereof, as well as the stocks of the same; (3) the extent to which such holding companies or their stockholders control or are financially interested in financial, engineering, construction and/or management corporations, and the relation, one to the other, of the classes of corporations last named, the holding companies and the public utility corporations; (4) the services furnished to such public utility corporations by such holding companies and/or their associated, affiliated and/or subsidiary companies, the fees, commissions, bonuses or other charges made therefor, and the earnings and expenses of such holding companies and their associated, affiliated and/or subsidiary companies, and (5) the value or detriment to the public of such holding companies owning the stock or otherwise controlling such public utility corporations, immediately or remotely, with the extent of such ownership or control, and particularly what legislation, if any, should be enacted by Congress to correct any abuses in the organization or operation of such holding companies.

The commission is further empowered to inquire and report whether and to what extent such corporations or any of the officers thereof, or any one in their behalf or in behalf of any organization of which any such corporation may be a member, through the expenditure of money or through the control of the avenues of publicity, have made any and what effort to influence or control public opinion on account of municipal or public ownership of the means by which power is developed and electrical energy is generated and distributed, or since 1923 to influence or control elections of President, Vice-President and referred to shall be limited to the elections of President, Vice-President, and members of the United States Senate.

The commission is hereby further directed to report particularly whether any of the practices heretofore in this resolution stated tend to create a monopoly or constitute violation of the federal anti-trust laws.

# First Transatlantic Engineering Session

## American Institute and British Institution of Electrical Engineers Meet Jointly, Using International Radio Telephone—Symposium on Interconnection—Medals Awarded

BY MEANS of transatlantic telephony the American Institute of Electrical Engineers and the corresponding body in Great Britain, the Institution of Electrical Engineers, were enabled on Thursday morning of this week to hold a joint meeting of the two societies in New York and London. This epoch-making occurrence lent public as well as professional interest to the sixteenth winter convention of the A.I.E.E., held from Monday to Friday at the Engineering Societies Building. President Bancroft Gherardi, President F. B. Jewett and Colonel John J. Carty on the American side and President Archibald Page, Colonel T. F. Purves, of the British Post Office, and Sir Oliver Lodge on the English side exchanged greetings and indulged in spoken international amenities that were heard clearly in both countries.

When Harry P. Charlesworth, plant engineer with the American Telephone & Telegraph Company, had announced that all was in readiness, Mr. Gherardi spoke into the transmitter, saying, "Good morning, Mr. Page," to which Mr. Page responded, "Good afternoon, Mr. Gherardi." Mr. Gherardi then asked Mr. Page to preside over the joint meeting. Taking the chair in London, the British president asked the American to address the meeting. Mr. Gherardi did so briefly and Dr. Jewett and Colonel Purves followed him. Then John J. Carty moved a resolution expressing deep satisfaction with the joint session and giving form to the idea that the two societies should become jointly an agency for international good will. Mr. Page called on Sir Oliver Lodge to second the resolution, which he did felicitously. After the motion had been enthusiastically carried, Mr. Page made a few further remarks, Mr. Gherardi thanked him for presiding, and the session, which had lasted a little more than half an hour, was declared over. More than a thousand persons crowded the New York meeting, while five hundred in an overflow meeting in another room also listened to the proceedings, and a similar overflow meeting was reported from London. Just previous to the session motion pictures depicting the method of transmission were shown at both conventions.

The transatlantic messages were an interlude between the papers of the session on communication—two of these preceding and two following it.

### Electrophysical Sessions

Sessions of the convention opened on Monday afternoon, when papers dealing with electrophysics and dielectrics were presented. These, as well as all the papers of the subsequent sessions, will be briefly abstracted, with a report of the discussions, in next week's Electrical World. The warmest discussion on Monday was aroused by the paper of two Russian engineers, Alexander Smouroff and Leo Mashkileison, on an investigation into the influence of internal vacua and ionization on the life duration of paper-insulated high-tension cables. This paper was read by William Del Mar, the authors having transmitted it from Leningrad. Those who discussed it held that its conclusions were somewhat invalidated by the circumstance that the tests were performed upon cable of poor quality in comparison with American standards.

### Interconnection a Chief Topic

Interconnection experiences furnished the subject of an entire session on Tuesday morning, and so well were these presented that one speaker declared, amid apparent general agreement, that the papers formed the "best national presentation of the subject ever made." Four well-known engineers—the late W. C. L. Eglin (whose paper was read by Nevin E. Funk), W. E. Mitchell, H. B. Gear and P. M. Downing—covered respectively the interconnection situation in the Middle Atlantic States, the Southeast, the Chicago district and on the Pacific Coast. Nine other authorities in the utility field took part in the discussion.

On Tuesday afternoon one event was a lecture by Dr. Harold Norinder of Sweden on the use of the cathode-ray oscillograph in the study of lightning and other surges on transmission lines. The speaker urged research in the United States along the lines indicated by him, his own researches having been in some degree academic on account of the comparative rarity of thunderstorms in Sweden. Several miscellaneous treatises were also presented at this session.

Wednesday was devoted to electrical machinery, with sessions both morning and afternoon. In the evening the Edison medal was presented to William D. Coolidge and the John Fritz medal to John J. Carty. The presentation ceremonies included an address by Dr. Michael I. Pupin, who outlined the achievements of Dr. Coolidge; the presentation of the Edison medal by President Gherardi and the response of the medalist; the announcement of the John Fritz medal award by Chairman J. V. W. Reynders of the board of award, an outline of the achievements of General Carty by Mr. Gherardi, the presentation of the John Fritz medal by Robert Ridgway, chairman of the board when the award was made, and the response of General Carty.

Inspection trips to plants of the metropolitan light and power companies, the studio of the National Broadcasting Company, the Electrical Testing Laboratories and the Bell Telephone Laboratories were held, most of them on Thursday afternoon. The annual dinner-dance took place Thursday evening at the Hotel Astor, with its usual success, and a "get-together" smoker was held Tuesday evening at the same hotel. Dr. W. F. G. Swann's lecture on "The Earth's Electrical Charge," delivered Monday evening, was a graphic discussion of the electronic theory in language understandable by the laymen as well as the technicians in his audience.

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# Coolidge Describes His 900-Kv. Tube

*Experiments with Cathode-Ray Apparatus with Three Times the Power of That Demonstrated Two Years Ago Are Recounted*

IN HIS address of acceptance of the Edison medal, awarded to him "for his contributions to the incandescent electric lighting and the X-ray arts," on Wednesday evening Dr. W. D. Coolidge described a new 900,000-volt cathode-ray tube built by him with which experiments have just begun. This tube has three times the power of the 300,000-volt tube which he demonstrated in 1926. That produced enormous streams of high-speed electrons which changed gases into solids, caused many minerals to glow with phosphorescence for hours and caused profound alterations in living cells.

In his address Dr. Coolidge gave generous credit to his associates and forerunners in the work of developing high-power X-ray and cathode-ray tubes. Hitherto, he said, it had been impossible to construct tubes of very high voltage without puncturing the tube or getting the effect called the "runaway-arc discharge."

"More recently we have found that we can remove this limitation by subdividing the total potential difference applied to the tube between different pairs of tubular electrodes," he continued. "The electrons coming from the cathode are then given successive accelerations as they pass between successive pairs of electrodes. This in effect divides the tube up into sections, each of which may be good for as much as 300,000 volts. We have already successfully operated such a cathode-ray tube, with three sections, on 900,000 volts.

"This opens a vista of alluring scientific possibilities. It has tantalized us for years to think that we could not produce in the laboratory just as high-speed electrons as the highest velocity beta rays of radium and just as penetrating radiations as the shortest wavelength gamma rays from radium. According to Sir Ernest Rutherford, we need only a little more than twice the voltage which we have already employed to produce X-rays as penetrating as the most penetrating gamma rays from radium, and about 3,000,000 volts to produce as high-speed beta rays."

## Quebec Fights Ottawa

*Province Objects Strongly to Some of the Questions on Power Rights That Dominion Government Is Submitting to Canadian Supreme Court*

A NEW development in the water-power controversy in Canada is that the Province of Quebec has raised strong objection to the draft of questions which the Dominion government has drawn up for submission to the Supreme Court in an effort to secure a settlement of the differences which have arisen between the federal and provincial governments over power rights on navigable streams, particularly the St. Lawrence River. The matter of the rights of the provinces as against the Dominion has already been before the British Privy Council—court of last resort—and the provincial interpretation is that by its judgment the beds of the rivers belong to the provinces. The Ottawa government raises several points in this regard, however. It contends especially that the St. Lawrence is and always will be a navigable river and that other matters in connection with it are merely incidental.

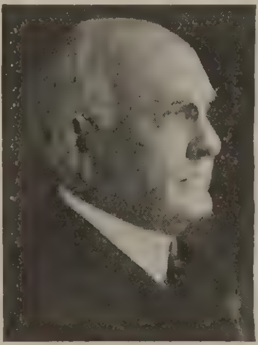
Considerable interest centers in the fight which is developing for the right to develop Quebec's share of St. Lawrence power. Three separate and distinct factions are believed to be clamoring for the power resources which will be developed if the St. Lawrence is deepened to the Great Lakes. The most imposing embraces what are termed the Holt interests—Montreal Light, Heat & Power, Shawinigan, etc. They are meeting competition from a newly formed group of Canadians headed by Frank P. Jones, who, it is stated, will emerge as president of the Beauharnois Power Company, which has an application before Parliament to build a combined shipway and power canal. Information in Ottawa is to the effect that the Beauharnois development is a minor step in an undertaking which is ready to invest hundreds of millions if the promoters are successful in acquiring rights. In this broader project the Sifton interests are believed to be concerned. The third factor in the situation is said to be a group of United States capitalists with unlimited backing. The weakness of their position is that they apparently are against a stone wall in the attitude of Premier Taschereau of Quebec as regards exportation of power from Quebec. However, there appears to be an impression in the capital now that international development of the St. Lawrence will include a broader policy with respect to exportation of power.

## Congressional Delay on Radio Said to Threaten Chaos

According to the National Association of Broadcasters, federal control of radio, and with it the whole structure on which broadcasting and the radio industry have been developed, is in imminent danger of collapse as a result of hesitation and delay in both houses of Congress. The association points out that although the Federal Radio Commission is supposed to consist of five members, at the present time Judge Sykes is the only member whose appointment has the seal of congressional approval. Commissioners Caldwell, Pickard and Lafount have not been confirmed, and no appointment has been made to fill the place of Admiral Bullard. If no action is taken by Congress by March 15, control will revert to the Department of Commerce, which, the association says, would have to build up a new and very extensive regional organization in order to deal with the problems still pending. The commission would on the date named become merely an appellate body. The continuation of the commission for another year, the confirmation of its members, the prompt appointment of a member from the second zone and the "removal of the threat of dishonorable discharge at the end of another year" are, the association declares, absolutely essential if radio broadcasting is not to return to the condition in which it was a year ago.

## Philadelphia Electric Has New President

### William H. Taylor Succeeds Walter H. Johnson, Who Becomes Assistant to Arthur W. Thompson, the New Chairman of the Board


W. H. JOHNSON

W. H. TAYLOR

A. W. THOMPSON

IMPORTANT changes in the officers of the Philadelphia Electric Company—the outcome of the consolidation of its interests with those of the United Gas Improvement Company, which has just gone into formal effect—were announced on Tuesday of this week after the monthly directors' meeting. William H. Taylor, vice-president in charge of operation and maintenance of the U.G.I., becomes president in succession to Walter H. Johnson. Arthur W. Thompson, president of the U.G.I., becomes chairman of the board, and Mr. Johnson is named as Mr. Thompson's assistant. The position of chairman has been vacant since the death of Joseph B. McCall. Mr. Taylor on his election to the presidency resigned as vice-president of the U.G.I.

Mr. Taylor, who is 48 years old, is a graduate of Stevens Institute of Technology and has been connected with the United Gas Improvement Company since 1903, serving in engineering and executive capacities in Omaha, Neb., Johnstown, N. Y., Charleston, S. C., Atlanta, Ga., and elsewhere. He became vice-president at Philadelphia a year ago.

In a statement to the press Mr. Taylor said: "With the hearty co-operation of the fine body of employees which has been built up for so many years by the late Joseph B. McCall and Mr. Johnson, I am confident that we shall be able to render a still higher standard of service to the consumers and the public. In its future operations the Philadelphia Electric Company will have the advice and counsel of the U.G.I. consulting organization and will be able to call upon the invaluable experience of Mr. Johnson, whose services to the company date back to the time of its organization in 1899."

Resolutions on the death of Vice-President W. C. L. Eglin, chief engineer of the Philadelphia Electric, were passed.

## St. Louis Company May Develop Osage River

The Union Electric Light & Power Company of St. Louis, Mo., has for several weeks been conducting a survey to ascertain whether it can profitably develop water power on the Osage River 6 miles above Bagnell, Mo. This is the site on which a federal permit was obtained by the Missouri Hydro-Electric Power Company, whose revived plans were referred to last week (page 325). An option on this company's rights has, it is understood, been obtained by Stone & Webster, who are in agreement upon terms for turning it over to the Union Electric. A definite decision on the project will, it is reported, be made within 60 days.

The project comprehends a dam 100

ft. high, creating a lake 100 miles long, and a power house with a capacity of 100,000 hp. The entire project would cost approximately $25,000,000. Louis H. Egan, president of the Union Electric, is quoted as saying that data so far compiled indicate that the cost of power generated on the Osage River and delivered to St. Louis would be approximately the same as the cost of power generated at the Cahokia plant of his company.

At Osceola, about 40 miles southwest of Bagnell, the Ozark Utilities Company has begun the construction of a dam near the junction of the Osage and the Sac, which, it is said, will supply power to 35 towns, besides making the Osage navigable for 30 miles and the Sac for 20 miles above Osceola. L. K. Green is behind the enterprise, in which $500,000 is being invested.

## Suggested Adjustment for Columbia Projects

Through the use of an amended application for water rights at "Z" Canyon, on Clark's Fork of the Columbia River, Hugh L. Cooper may expect permission from the State of Washington to proceed with plans for development of about 260,000 hp. at that point, subject to action of the Federal Power Commission. This statement was made at Spokane on Feb. 4. Mr. Cooper's application should ask the use of 7,000 sec.-ft. and an additional 1,500 sec.-ft. from the same source for 50 years, Ross K. Tiffany, State Hydraulic Engineer, was informed by the State Attorney-General's office. The "Z" Canyon project is close to the Canadian line and would entail construction of a dam 425 ft. high and 350 ft. long, the development to cost $17,600,000, it is estimated.

The Clark's Fork of the Columbia also would supply water to the Columbia Basin irrigation project at a dam at Albany Falls. Plans for the irrigation project would permit 7,000 sec.-ft. to pass after the project is developed. This accounts for the 50-year limitation on the 1,500 additional second-feet suggested for the Cooper application.

Recently the Spokane Lead & Zinc Company filed for water rights at Metaline Falls, on the same Clark's Fork of the Columbia, locally known as the Pend Oreille River. This application was confused with Cooper's in an item that appeared in these columns on Jan. 21. The site sought is a few miles upstream from "Z" Canyon and would be flooded by the Cooper development. This Metaline Falls development will be held up until final state and federal action is taken on the "Z" Canyon proposal, Eugene Logan, engineer, stated. Possibility of the mining company buying 50,000 hp. from the "Z" Canyon plant was expressed, that being the amount of power which the Metaline Falls development is designed for.

A hearing for the Federal Power Board on the "Z" Canyon proposal was called at Newport, Wash., for Feb. 16.

## Purchases and Mergers

*Immense North Atlantic Consolidation Talked Of—Insull Company Readjustments—Three Times Its Cost Bid for Kinston (N. C.) City Plant.*

NEWSPAPER reports, apparently not without foundation, which point to a coming union of the Consolidated Gas Company of New York City (with the New York Edison and its other metropolitan electrical subsidiaries), the Brooklyn Edison Company, the Brooklyn Union Gas Company and variously named smaller utilities in territory contiguous to Greater New York are attracting wide attention. Such a consolidation would itself, according to rumor, be only part of, or preliminary to, a gigantic amalgamation reaching from Philadelphia along the Atlantic Coast to New York City and north to Albany, and including all the largest groups in this stretch of territory. This possibility—involving rather a bankers' than an operators' negotiation—is discussed in more detail under "Financial and Statistical News" (page 377).

The National Electric Power Company, now an Insull property, makes two announcements concerning readjustment of Insull holdings which are of interest. The first is that the National Electric Power Company has acquired a substantial majority interest in the common stock of the New England Public Service Company, whose subsidiaries furnish electric service to an extensive territory in Maine, New Hampshire, Vermont and New York. The second is that the National Electric Power Company has disposed of its properties west of the Mississippi River to the Middle West Utilities Company of Chicago. These properties are the Northwestern Public Service Company, operating in 100 communities from the North Dakota line down into Nebraska; the Watertown (S. D.) Public Service Company; the Kansas Electric Power Company, operating in Lawrence, Parsons, Emporia, Leavenworth and other Kansas communities, and the Southwest Power Company, operating in Oklahoma and Arkansas.

When bids for the Kinston (N. C.) municipal electric plant were opened on Feb. 6 it was found that several bidders had offered more than $1,000,000. R. Livingston of New York and E. C. Gregory of Charlotte made the high bid—$1,357,000—agreeing also to construct a "white way" and other improvements. The City Council, however, accepted the Carolina Gas & Electric Company's bid of $1,271,000 and "extras," subject to approval of the voters at a special election. Messrs. Gregory and Livingston have protested. The plant cost about a third of the sum offered. The municipal ownership element is strong in Kinston, and it is by no means certain that the bid will be accepted, despite its size.

The Illinois Power & Light Corporation acquired seven small private companies and one municipal lighting plant in central Illinois last year, while the North American Light & Power Company, of which the Illinois Power & Light is a subsidiary, acquired two private concerns, serving four towns. The Weldon plant was the municipal concern acquired, this purchase having been made quite recently. The Cisco and Maroa Electric Light Companies, which maintained only distribution systems; the Bondville Electric Light Company and the Seymour & White Heath Electric Light Company, also distributors in the Champaign district, were acquired, and in the Bloomington section the Shirley Light & Power (serving Funk's Grove also), the Stanford Electric Light, Power & Heating Company and the Carlock Electric Light & Power, which also served Congersville and the Mackinaw Dells rural community, were taken over. The North American took over the Prather & Hill Electric Company, serving Sherman, Williamsville and Broadwell, and the Elkhart Electric Light Company.

The Public Service Commission of New Hampshire has approved the purchase of the Ossipee (N. H.) Water & Electric Company, by the Public Service Company of New Hampshire for $30,000.

## Is New York's "Great White Way" to Disappear?

At a meeting of the New York Section of the Illuminating Engineering Society on Feb. 9 E. G. B. Fox of the Edison Lamp Works of the General Electric Company at Harrison, speaking on "Electrical Advertising Activities," called attention to the fact that in New York City there is pending a restriction that will blot out all electric signs in the heart of the city, including a long section of Broadway north and south of Forty-second Street. Mr. Fox said that the number of illuminated signs in 1926 in the United States was 425,000. It was estimated that these signs contained about 22,000,000 sockets, that the average wattage per lamp was 17 and that revenue from these signs was $28,000,000. Increase in electrical advertising in 1927 should mean to the sign manufacturer a business of $15,000,000, he thought. Mr. Fox referred to the need for a model sign ordinance that will safeguard the public interest and give the electrical sign industry a solid foundation on which to build.

F. E. Carlson of the National Lamp Works of the General Electric Company, Cleveland, spoke on "Design, Methods and New Developments in Electrical Advertising." He illustrated his talk with a series of lantern slides.

W. J. Moore of the Society for Electrical Development referred to the central station's part in the sign business and cited the example of a company serving a town of 100,000 population which in 1922 added to its revenue from signs installed in that year the sum of $450. In 1927 the revenue from signs installed during that year was $40,000, and for 1928 a quota of $50,000 has been set. Mr. Moore said that this great increase was owing entirely to the attitude of the central-station company toward the sign business and was typical of what could be done by other companies

## Wisconsin Water Power

*Interim Committee of Legislature Will Begin Hearings Next Week—Forty-eight Undeveloped Hydro-Electric Sites Discovered*

PUBLIC hearings by the legislative interim committee which has been delegated to investigate the operations of the electrical industry in Wisconsin will, it is reported, begin on Feb. 23. Originally the committee intended only to investigate the practicability of taking over the water powers for the state, but it is understood that a decision to broaden the scope of the investigation has been reached.

There are now in Wisconsin 48 unused water-power sites, according to Alvin C. Reis of Madison, secretary of the committee. These are on the following streams and rivers: St. Croix, two sites; Namekagon, one; Chippewa, seven; Flambeau, ten; Red Cedar, four; Wisconsin, seven; Tomahawk, one; Wolf, five; Oconto, two; Peshtigo, four, and Menominee, five. In addition to these there are seven undeveloped sites on boundary streams of the state.

Mr. Reis, in discussing the work of his committee, pointed out that one of the most important phases of this question to his state is the decision of the United States Supreme Court sustaining the recapture clause of the Wisconsin law. This clause provides that a state may recapture a water-power site from a private corporation after a lapse of 30 years by paying the original franchise value. "This means," Mr. Reis said, "that the state can have a permanent water-power policy on a basis of a reasonable initial cost, the unearned increment going entirely to the state." After water-power sites shall have been recaptured by the state Mr. Reis believes the state could either lease them again to private companies with a proportionate increase of rates to accord with the increased value of the property or, under proper legislation, could operate them directly, just as cities operate their municipal waterworks. Although the recapture clause affects only those sites whose franchises have been in operation for 30 years, Mr. Reis said that other sites could be taken over by the state by condemnation. Such water-power sites would have to be paid for at their present valuation rather than at the value placed upon them at the time the franchises were granted.

Before the state can purchase such properties or launch upon an enterprise of state-owned power-producing companies, it will be necessary to have constitutional authority for such activity, Mr. Reis added, since there is a provision in the constitution which prohibits the state from expending money for or engaging in any work of internal improvement other than road and forest preserves. It was the intent of a joint resolution introduced at the last session of the Legislature by Mr. Reis to give the state authority to acquire, construct and maintain water-power plants for the furnishing of light, power and heat to the public. This resolution, although it passed the Assembly, was killed in the Senate. Two-thirds of the water power of the state is already under private or municipal control, according to him.

## Edison Pioneers Gather

*Early Associates of the Inventor Meet in New York to Celebrate His Eighty-first Birthday—Edward Dean Adams Elected President.*

ABOUT 150 persons—members of the Edison Pioneers, their families and friends—met at luncheon at the Hotel Astor, New York, on Saturday, Feb. 11, in celebration of the eighty-first anniversary of the birth of Thomas A. Edison and for the annual meeting of the society. From his winter home at Fort Myers, Fla., Mr. Edison sent this message:

"I am glad to hear from my old boys and appreciate your congratulations and good wishes. Regret I cannot be with you today, but have no doubt you will enjoy meeting each other again. I am having a fine time on my present job. Cordial regards to you all."

EDWARD D. ADAMS

W. H. Meadowcroft, historian and retiring president of the organization, presided at the luncheon and described the inventor's latest undertaking, which has for its aim the production of rubber from American-grown weeds, vines, shrubs and bushes.

Among those present at the luncheon were Edward D. Adams, W. S. Barstow, Charles L. Edgar, Thomas A. Edison, Jr., Charles Edison, C. E. Estabrook, W. J. Hammer, Joseph Insull, Francis Jehl, Walter H. Johnson, Peter Junkersfeld, Isaac Krall, John W. Lieb, W. S. Mallory, Preston S. Millar, F. A. Scheffler, F. A. Wardlaw, Theodore Beran, James Burke, Douglass Burnett, Adolph Hertz, J. J. Kennedy, A. W. Kiddle, Hermann Lemp, James Lyman, H. V. A. Parsell, Theodore Stebbins, C. W. Stone, W. G. Wetmore and Arthur Williams.

Edward Dean Adams, the veteran who played a leading part in the development of power at Niagara Falls, was elected president for the ensuing year; Sydney B. Paine, William H. Francis, Walter S. Mallory and Francis Jehl vice-presidents; **F. A.** Wardlaw secretary and Charles E. Estabrook treasurer.

## Illinois State Electric Association Meets March 14-15

The eighth annual joint convention of the Illinois State Electric, Illinois Electric Railways and Illinois Gas associations will be held at Springfield on March 14 and 15. Two general sessions in the mornings will take place at the Hotel Abraham Lincoln with addresses by presidents of the associations and others. In the afternoons the associations will meet separately, the State Electric Association assembling at the St. Nicholas Hotel to listen to reports and papers as follows:

### WEDNESDAY, MARCH 14

Report of industrial relations committee, Robert Hallenberg, Illinois Northern Utilities Company; "Street Lighting as a Source of Revenue," R. J. Malcomson, Public Service Company of Northern Illinois; "Residential Refixturing in Illinois — Present Status and Market," R. G. Raymond, Electric Association, Chicago.

### THURSDAY, MARCH 15

Final report on Illinois experimental farm line, Prof. E. H. Lehmann, University of Illinois; "Proposed Accounting in Connection with Farm Lines," J. Paul Clayton, Central Illinois Public Service Company; "Progress in Connection with Superpower Transmission Developments," E. S. Hight, Illinois Power & Light Corporation.

## Commonwealth Power Is to Spend $25,000,000 in 1928

Subsidiaries of the Commonwealth Power Corporation plan to spend approximately $25,000,000 in 1928 for additions and improvements. About 70 per cent will be for the electric department. The more important projects contemplated include immediate additions to the steam-electric generating stations at various points in the territory served. Preliminary work will be started on the construction of a new dam and hydro-electric installation on the Muskegon River in Michigan to have a capacity of 35,000 hp. This job when completed will be the largest hydro-electric development in Michigan. Large expenditures also will be made in Michigan, Tennessee, Ohio, Illinois and Indiana for substations, transmission and distribution lines and other equipment.

The operating subsidiaries of the Commonwealth Power Corporation include the Consumers Power Company, with headquarters in Jackson, Mich.; the Tennessee Electric Power Company, Chattanooga; the Ohio Edison Company, Springfield, Ohio; the Southern Indiana Gas & Electric Company, Evansville; the Central Illinois Light Company, Peoria; the Illinois Electric Power Company, East Peoria, and the Illinois Power Company, Springfield, Ill.

# Briefer News

TRANSMISSION EXTENSIONS IN TENNESSEE.—A 66,000-volt transmission line of the Jackson (Tenn.) Railway & Light Company between Brownsville and Ripley, Tenn., has just been completed, and work is starting on a 110,000-volt line from Memphis to Ripley.

BUFFALO GETTING RID OF HER GAS LAMPS.—Adam B. Gunn, superintendent of distribution of the Buffalo General Electric Company, says in a recent report that 3,510 electric street lamps were installed in Buffalo in 1927. The great majority of these were for new streets in the northern and eastern portions of the city. Buffalo gas lamps are being quickly converted to the electric type.

PROJECTED HYDRO PLANT FOR EEL RIVER, CALIF.—The Benbow Power Company has applied to the California Railroad Commission for authority to engage in the distribution of electric light and power in Humboldt and Mendocino Counties. The applicant proposes to construct a dam across the South Fork of the Eel River at a point approximately 2,600 ft. west of Benbow and to construct a hydro-electric power plant, but pending its construction to operate a Diesel-engine plant.

WELL-SALTED POLES APPEAL TO OREGON STOCK.—Range horses and cattle in southern Oregon are being supplied with rock salt at the expense of the California-Oregon Power Company in order that the stock may be allured away from the utility's transmission-line poles, which have been treated with a saline solution. The animals, discovering the salt on the poles, began chewing the wood, and considerable damage resulted before the company solved the problem by liberally salting the territory.

KENTUCKY LEGISLATURE MAY BROADCAST ITS PROCEEDINGS.—It is announced that a joint resolution will be introduced in the Kentucky General Assembly at the present session providing that $15,000 be appropriated and a commission of three, to serve without pay and to be appointed by the Governor, named for the purpose of installing and looking after a radio broadcasting station, to be used during the regular and special sessions of the Kentucky Legislature, by the House and Senate, to keep the public informed of what is being done at Frankfort.

SWEDEN HAS NEW ELECTRICAL PAPER.—The Association for Rational Utilization of Electricity has been founded in Sweden along lines corresponding in some ways to the Society for Electrical Development. It is backed by the Swedish national central-station and electrical-industrial associations and has begun the publication of an independent semi-popular electrical engineering paper called *Era,* an abbreviated form for *Tidskrift för Elektricitetens Rationella Användning.* Of this paper Edy Vilander is editor. Mr. Vilander spent several years in the United States, during part of which he was associated with Dr. A. E. Kennelly in laboratory experiments at Harvard University.

POTOMAC ELECTRIC COMPANY ORDERS ANOTHER 30,000-KW. UNIT.—The Bennings station of the Potomac Electric Company at Washington, D. C., is to have a second 30,000-kw. turbo-generator unit. It is to be of General Electric manufacture and will be identical in rating and steam conditions with the one installed last December.

NEBRASKA MUNICIPAL SYSTEM GOES ON LINES FROM GOVERNMENT PLANT.—The Gering (Neb.) municipally operated plant has abandoned the manufacture of electrical energy and contracted with the government for electricity from the irrigation dam at Guernsey, Wyo. This has been followed by a reduction in rates. Gering owns its distribution system and will hold its plant in reserve.

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]**

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21; Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.

New Mexico Utilities Association—Albuquerque, N. M., Feb. 20-22. Arthur Prager, Albuquerque Gas & Electric Company, Albuquerque.

New England Central Station Associaciation of Power Engineers—Engineers' Club, Boston, Feb. 29. T. D. Bond, C. H. Tenney & Co., Boston.

American Institute of Electrical Engineers—St. Louis regional meeting, March 7-9; Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11. F. L. Hutchinson, 33 West 39th St., New York.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Madison, Wis., March 17-18. W. Wilke, 4211 Eiring Place, Milwaukee.

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N.E.L.A. — Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Middle West Division, N.E.L.A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

CANADIAN NIAGARA POWER COMPANY BUILDING NEW OFFICES.—Work is progressing rapidly on a new office building for the Canadian Niagara Power Company at Fort Erie, Ontario. The building, which will be a short distance from the Canadian end of the new Peace Bridge, will probably be completed by March 1. Built in Spanish design and finished in stucco with stone trim and tile roof, it will give facilities for displaying electrical appliances and will also afford ample office space.

CENTRAL ILLINOIS PUBLIC SERVICE COMPANY TO CONNECT LINES WITH POWERTON.—The Central Illinois Public Service Company has obtained authority from the Illinois Commerce Commission to construct and operate a 33,000-volt transmission line in Fulton, Mason and Tazewell Counties connecting its present distributing system with the new power plant at Powerton. Principal lines will extend from Powerton to Canton and from Powerton to Havana.

MAYOR OF TOLEDO OPPOSES "EXTRAVAGANT" LIGHTING.—Declaring that to place two electric lamps on each pole in a system where the poles are 100 ft. apart is an extravagant use of public money, Mayor Jackson of Toledo, Ohio, has vetoed an ordinance for a "white way" on Monroe Street. He says that a single lamp to a pole is enough and that 282 lamps, as planned, are too many. "The city's street-lighting bill is now reaching a huge sum," the Mayor said, "and it is becoming a heavy burden upon the taxpayers of the city."

CINCINNATI RATE DISPUTE GOES TO SPECIAL MASTER.—Appointment of a special master to examine the suit brought by the Union Gas & Electric Company against the city of Cincinnati in regard to reduced rates for electricity, as imposed in a recently passed city ordinance (ELECTRICAL WORLD, Oct. 29, page 904), was agreed to by counsel representing both parties in the United States Court at Cincinnati last week. A great mass of data is to be examined, and no definite date for court hearing was set.

DIVIDED AUTHORITY OVER OREGON UTILITIES BRINGS SUGGESTED LEGISLATIVE REMEDY.—An amendment to the Oregon utilities commission code which will vest the department with authority to regulate and supervise utility financing, purchases, sales and mergers will again be recommended to the 1929 Legislature. Commissioner H. H. Corey has submitted this amendment at previous sessions, but the authority still rests in the hands of the State Corporation Commission as regards the extent of bond and stock issues. The Corporation Commissioner, however, favors a plan either to extend the authority of the regulatory department in regard to transfers and mergers of utility properties or to place the entire matter of financing under the direction of the Corporation Commission.

Litchfield (Conn.) Customers Get Optional Rates. — The Connecticut Public Utilities Commission has decided that a new rate schedule of the Litchfield Electric Light & Power Company shall be optional with customers, who may stay on the former schedule if they wish, and a petition to upset the new rates was withdrawn. The optional plan is to have a trial of one year.

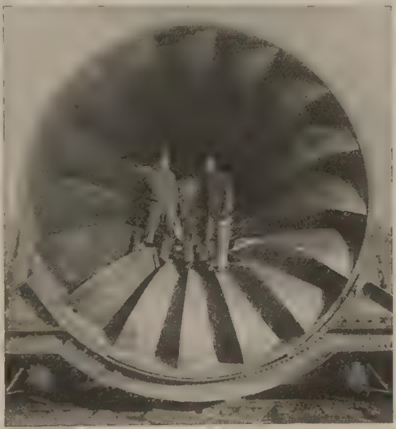
Houston Will Start "White Way" for Democrats.—Houston, Tex., is to install 88 new double-standard 2,000-cp. lamps on Main Street between Franklin and Polk Avenues in preparation for the National Democratic Convention, which will be held in the Texas city in June. This will give Houston a modern "white way" of an imposing kind.

Proposed 90-Mile Transmission Line in South Alabama.—The Alabama Power Company has authorized a right-of-way survey for the construction of a 90-mile power transmission line from Linden to Jackson, Ala., via Thomasville. The cost is estimated at $400,000. The company owns plants at both Thomasville and Jackson, but they have been isolated from its main power transmission system.

Southeastern Power Company Behind Savannah River Project?—According to a dispatch from Greenwood, S. C., the 120,000-hp. hydro-electric project of the Savannah River Electric Company, for which a license was granted in January by the Federal Power Commission, has the backing of the Southeastern Power Company, of which the Georgia Power and Alabama Power companies are subsidiaries. The site is at Clark's Hill, 15 miles above Ausgusta, Ga., where a 90-ft. dam will be built, forming a reservoir which will cover 40,000 acres.

Public Utility Commission Demanded for Texas. — Major Alfred Petsch of Fredericksburg, Tex., administration leader in the State Legislature, predicts that Governor Dan Moody will champion a measure to create a state public utility commission. "The most important economic matter to come before the Legislature will be the regulation of public utilities," Mr. Petsch says. "The Railroad Commission, hog-tied by constitutional limitations and personnel, is hopelessly inadequate. We must have a public utility commission which will have jurisdiction over all public utilities as the Railroad Commission now has over railroads. This is of supreme importance to the interests of the people and to the honest and fair utility. A constitutional amendment is the only solution of this question. There will be enough opposition in the Legislature by those utilities which, for various reasons best known to them, want no regulation at all to defeat the resolution in the Legislature unless the Governor champions the measure. It is safe to predict that the leadership of the Governor may be expected in favor of creating a public utility commission."

Shipping 16-Ft. Wheel from Philadelphia to the Tallassee.—One of the largest waterwheels to be cast, shipped and operated in one piece has been received at the Upper Tallassee hydro-electric development of the Alabama Power Company, now being reconstructed to produce 50,000 hp. The wheel, the first of two to be installed, weighs 130,000 lb. and required a special freight car for handling. Its largest diameter is 16 ft. and its extreme height is 10 ft. 3 in. Owing to its dimensions, the waterwheel, made by the I. P. Morris Corporation of Philadelphia, had to be shipped from Philadelphia to Cape Charles, Md., from there across the Chesapeake Bay by boat to Norfolk, Va., and thence by rail to Tallassee. This took seven days. It was in process of manufacture from early June until December.



University of Wisconsin to Conduct Its First Short Course in Electric Farming.—Third among American universities to conduct short courses in rural electrification, the University of Wisconsin held one on Feb. 14-16, in order further to promote the use of labor-saving devices on farms and in farm homes and to guide farmers in purchasing electrical equipment. University professors, light and power men and manufacturers' representatives took part in the discussions. The first of these courses was held last October at Purdue and the second was held on Jan. 23-28 at the Oregon State Agricultural College.

Erie (Pa.) Company to Be Advised by U.G.I. Officers.—An unusual contract has been signed by the United Gas Improvement Company and the Erie County (Pa.) Electric Company under which the U.G.I. will act as consultant and assist in the management of the Erie company, according to an announcement by Arthur W. Thompson, president of the U.G.I. This agreement, signed by Mr. Thompson and Charles H. Strong, president of the Erie County Electric Company, provides that the Erie company, which supplies power in that city and vicinity and is owned, operated and controlled by Erie citizens, shall receive the advice and assistance of U.G.I. management in the operation of the property, although that organization has no financial interest in the Erie property.

North Central Men Hold Meeting at St. Cloud, Minn.—About one hundred members attended a sectional conference of the North Central Electric Association at St. Cloud, Minn., on Feb. 15. Wheelock Whitney, Northern States Power Company manager at St. Cloud, was to preside. The program included illustrated lectures by C. P. Wagner of Minneapolis on "Developments in Rural Electrification" and by Secretary John W. Lapham on "Some Developments in the Electrical Industry." Round-table discussions covered the sale of electric cookery, better lighting and appliances and a general discussion on "Company and Dealer Co-operation," as well as a talk on reducing transmission losses by J. A. McCutcheon.

Manitoba Government Wants Seven Sisters Falls Site.—A complete survey of the water-power resources on the Winnipeg River and an estimate of the cost of development of the Seven Sisters Falls site in northern Manitoba, including, if necessary, expropriation of the Pinawa plant of the Winnipeg Electric Company, will be made by T. H. Hogg, chief hydraulic engineer of the Ontario Hydro-Electric Power Commission. This decision has been reached as a result of a conference between Mr. Hogg and members of the Manitoba government. Premier Bracken of Manitoba had wired the federal government urging that no lease of the power site at Seven Sisters Falls be granted to the Winnipeg Electric or any other company inasmuch as the provincial government plans to develop the site.

Transatlantic Television. — A demonstration of transatlantic television using apparatus invented by John L. Baird of England was made last week in the home of R. M. Hart, a short-wave radio operator in Hartsdale, N. Y., just outside New York City. The demonstration was witnessed at the American end by an Associated Press man, who reported that on a whirling screen, about 6 in. by 4 in., installed in Mr. Hart's cellar, two outlines of heads became visible as the result of the conjunction of innumerable points of light. In neither case could the features be clearly discerned, though it was said to be evident that one head was a man's and the other a woman's. Capt. O. G. Hutchinson, manager for Baird's company, was elated over the results and, it is said, predicted that with more power (only 2 kw. was available from the London station) transatlantic television would shortly approach perfection and that in a short time two-way television across the ocean would be a commonplace.

Quebec Utility Men Complain of Unfair Taxation Compared with Ontario Hydro.—An influential deputation from the Province of Quebec, consisting mainly of representatives of various public utility companies, waited upon the federal government in Ottawa on Jan. 11 and urged that users of privately owned electrical energy in Quebec be given the same immunity from taxation on its cost as is enjoyed by the users of publicly owned energy in Ontario. Several of the spokesmen deplored the advantage that Ontario had over Quebec in attracting United States industries and capital, when Ontario could tell them that they would not have to pay a tax on their electricity, while in Quebec the handicap in this respect amounted to $3 a year for every consumer of electric power. The Minister of Finance, replying, dwelt on the difference in the cost of power between the two provinces and appeared disinclined to remit the tax.

"Counted-Room" Rate to Be Introduced at Schenectady.—The Public Service Commission of New York has approved a new rate schedule of the New York Power & Light Corporation for electric service supplied in the Schenectady district. This schedule, effective March 1, provides for residential service on the "counted-room" basis. The rate is to be 25 cents per counted room per month (minimum three counted rooms), plus 5½ cents per kilowatt-hour for the first 10 kw.-hr. per month per counted room and 3 cents for excess consumption per month. A basis is provided for the determination of counted rooms. A "delayed-payment" excess of 2 per cent—but not less than 25 cents—is allowed. The present rate for residence lighting is 10 cents for the first 30 kw.-hr. and descending steps to 5 cents for all over 2,000 kw.-hr.

Water-Power Resources of Molalla River Basin, Oregon.—At five proposed power sites in the Molalla River Basin, Oregon, the potential power will amount to 38,900 hp. for 50 per cent of the time and 13,000 hp. for 90 per cent of the time, if the flow shall be regulated by the construction of the Pelkey Reservoir, according to a report by R. O. Helland made in connection with the classification of public lands by the Geological Survey, Department of the Interior. The report proposes a dam 260 ft. high at the Pelley site, which would make available 2,960 hp. for 90 per cent of the time and 4,830 hp. for 50 per cent of the time at 70 per cent efficiency. If the height of the dam were increased to 310 ft., it would double the storage and potential power. As Molalla River is close to Portland, power developed in the basin could be transmitted to that city at a low cost.

# Recent Court Decisions

"Willful Failure" to Observe Safety Rules Means More than Negligence.—In Knoxville Power & Light Company vs. Barnes, an appeal from an award under the workmen's compensation act, the Supreme Court of Tennessee, commenting on the contention that a workman's injury had resulted from refusal to use safety appliances furnished by his employer, drew a destinction between "willful failure" to do so and negligence founded on a false idea. The case in question was one where a lineman did not don rubber gloves because he had been told certain electric lines had been killed. The court found him entitled to compensation under the law. (299 S.W. 772).*

Where There Is Failure to Prove Contributory Negligence, Errors in Instruction on Such Negligence Are Without Prejudice.—The suit of Young vs. Vallejo Electric Light & Power Company, reported in the Electrical World for Nov. 26 (page 1114), came before the Supreme Court of California on appeal. Finding for the plaintiff was affirmed. The argument was on the matter of contributory negligence and the trial judge's instructions on the point. The Supreme Court held that the question was removed from the jury's consideration by the failure of the defendant to show the existence of such negligence and that, this being so, any errors in the judge's charge were immaterial. The case arose because of the transmission of electricity over wires resting on the roof of the plaintiff's house. (262 Pac. 327).

New Jersey Commission's Division of Territory Upheld.—The New Jersey Supreme Court has upheld the State Board of Public Utility Commissioners in fixing the territorial boundary line in the borough of Spring Lake for the supply of electrical energy as between the Jersey Central Power & Light Company and the Eastern New Jersey Power Company. In December, 1926, the board ruled that the two companies should divide the electric business of Spring Lake (Electrical World, Jan. 15, 1927, page 170). Spring Lake and the Eastern New Jersey Power Company attacked the ruling, the borough claiming that the utility board was attempting to control lighting of its streets and the power company contending that its property was being taken without due process of law. The Supreme Court held that these were unwarranted asumptions.

Doctrine of Trespass—Nervous Injuries a Cause for Recovering Damages.—The Supreme Court of Vermont reversed a directed verdict for defendant in Humphrey vs. Twin State Gas & Electric Company. In this case a temporary transmission line belonging to the company sagged owing to the breaking of a tie wire and made contact with a wire fence. The plaintiff and a companion, while on a hunting trip, trespassed on land traversed by the fence and the plaintiff was injured and the other man killed because of contact with the fence. The Supreme Court of Vermont held: (1) that there was a prima facie case for the jury under the doctrine of *res ipsa loquitur* (the thing speaks for itself); (2) that the fact of trespass on a third party's land did not absolve the company from liability; (3) that evidence to the effect that plaintiff on regaining consciousness was affected by seeing his companion dead was admissible both as proving the intensity of the electric shock and as showing a cause contributing to the disturbance of plaintiff's nervous system; (4) that plaintiff was entitled to recover for both physical injuries and nervous injuries occasioned by defendant's negligence. (139 At. 440).

Casually Placing Hand on Electrical Apparatus Exposed on Street Not Contributory Negligence.—In Johnson vs. East Texas Public Service Company the cutting of a guy wire by a telephone company had caused a short circuit which charged a hook used by the defendant, a light and power company, to raise and lower a street lamp. This hook was fastened on a pole six feet above the ground. While talking with another man on the street the plaintiff casually brought his hand into contact with the hook or the chain attached to it and was knocked down and severely injured. The Court of Civil Appeals of Texas sustained a judgment for damages, holding the plaintiff not guilty of contributory negligence. It also agreed in absolving the telephone company of responsibility, since two weeks elapsed between its severance of the guy wire and the accident, thus making any negligence by the telephone company antecedent and remote. The absence of strain insulators and the fact that there was plenty of time for the defendant company to have discovered and remedied the dangerous condition were ground for the jury's finding. (300 S.W. 975.)

# Commission Rulings

Meter Readers Must Not Enter Premises Without Occupants' Permission.—Meter readers for public utility companies do not have a right to enter any home in Kansas without first notifying the owner or occupant. This was the ruling of the Kansas Public Service Commission in a written communication to the Mayor of Haddam, who complained that meter readers for an electric light company carried skeleton keys and used them to enter homes at any time they were making rounds. Patrons of the company complained of this practice, and it was alleged that a local manager maintained that the readers had the right to enter a home at any time and without notice. The commission directed that meter readers give notice of their presence and that they must not enter homes without permission.

Adequate Service Insisted On.—Orders requiring the Dakota Public Service Company to take steps immediately to improve electric service furnished by it at Hettinger and Reeder have been issued by the North Dakota Board of Railroad Commissioners following a hearing at which citizens of the two cities detailed incidents of alleged poor service. It is the duty of a public utility to provide itself with adequate facilities for furnishing efficient service, the board said, and the company was instructed to install a new generating unit as quickly as possible, to improve the distribution service and to make weekly reports to the commission showing progress.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

H. J. Woodard has been appointed auditor of the Georgia Power Company, succeeding F. A. Brine, who retired on account of ill health.

Thomas Ahearn, president of the Ottawa Light, Heat & Power Company, has been made a member of the Canadian Privy Council, a high political honor.

Perry T. Knight of Valdosta has been appointed a member of the Georgia Public Service Commission to succeed the late O. R. Bennett.

Walter H. Smith has resigned from the Westinghouse Electric & Manufacturing Company, where he was connected with the railway equipment division, to join the engineering staff of the Reading Company in connection with the electrification of the Reading Terminal at Philadelphia.

Lester Hooker, senior member of the Virginia State Corporation, was named chairman of that body on Feb. 1. On that date William Meade Fletcher was sworn in as a member, succeeding Berkley D. Adams, who had been chairman for the previous two years.

E. W. Sweezy has been named president and general manager of the Suburban Light & Power Company, Cleveland, recently purchased by New York men through a transaction negotiated by Love, Macomber & Company of New York. Mr. Sweezy was formerly identified with public utility properties in Alliance, Ohio.

Unit Rasin, for the past fifteen years district manager of the Westinghouse Lamp Company in Philadelphia, has resigned. Mr. Rasin is well known in electrical manufacturing circles in the Philadelphia district, his sales work for the Westinghouse company having brought him in close contact not only with the jobbers and dealers but also with the industrial plants in that territory.

E. A. Armstrong, formerly power engineer of the Public Service Company of Northern Illinois, has been appointed manager of power sales. A graduate of Michigan Agricultural College in electrical engineering, Mr. Armstrong became associated with the Public Service Company in 1920 in the capacity of power salesman. It was in 1924 that he was appointed power engineer.

Albert H. Manwaring, who recently retired after 46 years of service with the Philadelphia Electric Company, was the guest of honor at a luncheon given by his fellow employees at the Penn Athletic Club. Among those present were Walter H. Johnson, president; A. B. Huey, H. P. Liversidge and W. E. Long, vice-presidents; A. V. R. Coe, secretary, and H. C. Lucas, treasurer. A. R. Granger, vice-president of the Delaware County Electric Company, subsidiary of the Philadelphia Electric Company, acted as toastmaster and on behalf of Mr. Manwaring's fellow workers presented to him an electrically operated radio.

## *J. A. Hunnewell New President of Lowell Utility*

John A. Hunnewell, whose election as president of the Lowell (Mass.) Electric Light Corporation was recently announced, is one of the best known resident managers of the East in the Stone & Webster group. He was born 50 years ago at Scarboro, Me., was educated at Bates College and shortly after graduation entered the employ of Stone & Webster. In 1906 he was made manager of the Lowell company and has been prominently identified with the growth of this organization and to a large extent responsible for its prosperity and good public relations, besides taking an active part in civic affairs. His interest in employees has been expressed in many ways, perhaps the most prominent of which has been in the personal conductorship for some years of an unusually fine orchestra composed of members of the Lowell company's rank and file. He was recently made vice-president of the Lowell Gas Light Company, but with the acquisition of the electric company by the New England Power Association he resigned from this post and severed his connection with the Stone & Webster organization.

J. A. HUNNEWELL

W. R. G. Baker has been appointed managing engineer of the radio department of the General Electric Company to succeed Adam Stein, Jr., who has joined the executive staff of the Acoustics Products Company. Mr. Baker has been in the employ of the General Electric Company for eleven years and he has been connected with the company's radio development work since 1918. He accompanied David Sarnoff, vice-president and general manager of the Radio Corporation of America, to Europe in 1924 to investigate the progress which had been made both in England and on the Continent in all fields of radio. Mr. Baker is a member of the American Institute of Electrical Engineers, the Institute of Radio Engineers and the National Electrical Manufacturers' Association.

John J. Albright, Jr., formerly district manager of the Niagara, Lockport & Ontario Power Company, at Olean, has been transferred in a similar capacity to Syracuse.

O. W. Bennett, assistant treasurer for the Blackstone Valley Gas & Electric Company at Pawtucket, R. I., for the last four years, has been made assistant comptroller of the Puget Sound Power Company, Seattle. Mr. Bennett will be succeeded at Pawtucket by John W. Kelly, now assistant treasurer of the Baton Rouge (La.) Electric Company.

C. P. Billings, after nine years' service in various capacities with the West Penn System of Pittsburgh, has resigned and joined the staff of the Electric Bond & Share Company at New York. Mr. Billings had served as vice-president and general manager of the Wheeling Traction Company, vice-president of the West Penn Company and vice-president of the West Virginia Power & Transmission Company.

Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company, was made the recipient of the John Ericsson medal by the American Society of Swedish Engineers for his outstanding contributions to the field of electrical engineering. The presentation was made Feb. 11 at a dinner which marked the fortieth anniversary of the Swedish Engineers' Society. Dr. Alexanderson, who recently demonstrated his developments in radio television, made a short address in which he commended the General Electric Company for providing the facilities and laboratories which have made his research work possible.

Cyrus S. Eaton, chairman of the board of directors of the United Light & Power Company, was recently elected a director of the Sherwin-Williams Company. For some years Mr. Eaton has been a prominent figure in the electrical industry, having entered the public utility field in the United States in its early stages, though a Canadian by birth. While still in his twenties, he organized and financed public utility properties in Ohio, forming the Continental Gas & Electric Corporation, of which he soon became chairman. Making his headquarters in Cleveland, Ohio, he extended the field of operation of the Continental company until in 1925 it was merged with the United Light & Power Company. In addition to holding the chairmanship of the board of the United Light & Power Company.

Mr. Eaton is also on the directorate of several other utility companies and industrial organizations.

R. T. Porter, formerly district superintendent of the Alabama Power Company at Decatur, is now identified with the Georgia Power Company.

E. C. Sorby, commercial manager of the Wisconsin Power & Light Company, Beloit, Wis., for the past two years, has joined the George D. Roper Corporation, Rockford, Ill.

Wendall P. Holman of Monticello, N. Y., has been appointed educational director of the Rockland Light & Power Company, the Rockland Electric Company and the Pike County Light & Power Company.

George Bartholomew, formerly connected with the Niagara, Lockport & Ontario Power Company at Cuba, N. Y., has been transferred to Olean in the capacity of commercial manager.

M. E. Hall has left Lancaster, Wis., for Decorah, Iowa, where he takes charge of Interstate Power Company interests for a wide territory. His place at Lancaster is taken by Charles Meyers of Bloomington.

J. E. Gargrave has been appointed manager of the Otter Tail Power Company at Aneta, N. D.

Richard Van Horn, an electrical engineer of the General Electric Company at New Haven, Conn., has been appointed engineer of the United Illuminating Company at Bridgeport and will assume his new duties March 1.

P. H. Powers, manager of the Keystone division of the West Penn Power Company, Pittsburgh, has been appointed commercial manager, effective March 1, in which capacity he will have charge of all activities of the commercial department. H. F. Smiddy will on the same date become an assistant commercial manager. K. G. Fuller will succeed Mr. Powers as manager of the Keystone division about Feb. 15.

William G. Keay, formerly New England sales manager of the Eureka Vacuum Cleaner Company and more recently sales representative of the Premier Vacuum Cleaner Company in the same territory, has been appointed merchandising manager of the Associated Gas & Electric Company properties in New England, with headquarters at Cambridge, Mass.

Frederick W. Brierly, superintendent of the Bridgeport (Conn.) division of the United Illuminating Company for 36 years, has tendered his resignation, effective July 1, and will be succeeded by Walter A. Upham, at present assistant superintendent. Mr. Brierly plans a long vacation in California. He has been associated with the electrical industry for 50 years, going to Bridgeport from the Union Electric Company, Worcester. He designed the Steelpoint station at the foot of East Main Street, Bridgeport, which was put in operation last year, and substations at Bridgeport, Fairfield and Milford. Mr. Upham was with the Pennsylvania Edison Company at Easton, Pa., before going to Bridgeport and is a graduate of Norwich University.

## *M. DeMerit Named Assistant to President*

Merrill DeMerit, distribution manager of the West Penn Power Company since December, 1926, has been appointed assistant to the president of that company. Mr. DeMerit affiliated himself with the West Penn Power organization in 1922 and he served until 1926 in the capacity of distribution engineer. In the course of his engineering career he has always devoted special attention to distribution and the knowledge obtained he used in revamping the West Penn Power Company's distribution system.

Mr. DeMerit was connected with the distribution engineering department of the Detroit Edison Company before transferring his interests to Pittsburgh.

MERRILL DEMERIT

A graduate of the University of Wisconsin, he entered the General Electric Company test course and subsequently affiliated himself with the Wagner Electric Company, St. Louis, engaging in meter manufacturing and inspection. Mr. DeMerit is active in association work, being a member of the overhead systems committee of the National Electric Light Association and of the Pennsylvania Electrical Association.

Harold R. Waldron has been made district manager of the Niagara, Lockport & Ontario Power Company in the Chautauqua division; Joseph H. Milbyer, superintendent; J. A. Parker, assistant superintendent, and Frank W. Bullock, commercial manager.

S. H. Osterhoudt, formerly superintendent of the Associated Gas & Electric interests at Liberty, N. Y., has been transferred to the Harlem Valley territory as superintendent of the Brewster district.

John P. Hannon, who has been with the Connecticut Light & Power Company for 21 years, has been appointed manager of the Branford (Conn.) district. Mr. Hannon started as a meter reader in 1907 and obtained his technical education through night study. In 1921 he became head of the test department at Waterbury and soon after was engineer and assistant manager at New Britain, and later division engineer.

C. E. Stephens, Northeastern sales manager of the Westinghouse Electric & Manufacturing Company, has been elected president of the New York chapter of the company's Veteran Employees' Association. The association is composed of employees in all parts of the country who have been with the company twenty years or more.

Floyd F. McCammon, for the last eleven years manager of power sales of the Public Service Company of Colorado, Denver, has been appointed assistant general superintendent of the company, effective Feb. 1. Mr. McCammon, a bachelor of science in electrical engineering, has been associated with Public Service Company since his graduation from Colorado College in 1916. It was at that time that he entered the company as junior engineer. Later he served in the United States Navy as ensign in the engineering division, and upon his return to Denver in July, 1919, he again became associated with the company as general engineer. In August, 1920, he was appointed power sales engineer, which position he held until his recent promotion.

D. F. Miner has recently been appointed manager of the material and process engineering department of the Westinghouse Electric & Manufacturing Company. Mr. Miner was first employed by the company in 1919 as an assistant to the section engineer of the electrical section. Since 1920 he has served as section engineer of the experimental section of the material and process engineering department. Mr. Miner was born at Hazarville, Conn., in 1892 and is a graduate of Clark College, Worcester, Mass. He is a member of the American Institute of Electrical Engineers and has spoken before that body and other engineering groups on the subject of high-voltage tests, in which he has utilized voltages of 1,000,000.

Prof. J. A. Fleming, honorary member of the Institution of Electrical Engineers of Great Britain, has been selected by that society as the seventh recipient of the Faraday medal, which is awarded by the council of the institution not more frequently than once a year, either for notable scientific or industrial achievement in electrical engineering or for conspicuous services rendered to the advancement of electrical science, without restriction as regards nationality, country of residence or membership of the institution. Professor Fleming, who is well known as the inventor of an early radio tube, was professor of electrical engineering in the University of London from 1910 until his retirement in 1927 and has played a notable part in the development of a great many applications of electrical science.

# Financial and Statistical News

## Merger of New York Utilities Again Rumored Imminent

THE growth of banking influence in the utility field is expected to culminate shortly in the amalgamation of the public utilities of the New York area into the nation's second largest utility group. While official denial is given the rumor, the usual orgy of premature press reports insist that prolonged attempts to consolidate these properties are approaching fruition. It is beyond question that the stock market has been discounting some such merger for many months.

The properties that would naturally be involved are the Consolidated Gas System, Brooklyn Edison Company, Brooklyn Union Gas and Brooklyn Borough Gas Company. Rumor includes also the Long Island Lighting Company, Kings County Lighting Company and the Westchester County utilities. This group, in the aggregate, has assets of well over $1,000,000,000 and provides practically exclusive gas and electric service to an area including and extending well beyond the metropolitan area of Greater New York.

Recent acquisition by the Mellon interests of fairly large blocks of the stock of Consolidated Gas and Brooklyn Union Gas suggest that this powerful banking group will figure prominently in any agreement arrived at. It is rumored, moreover, that holdings of the Nicholas A. Brady group in Consolidated Gas and Brooklyn Edison have recently passed into the hands of interests affiliated with the Mellon and Morgan banking groups.

One feature of the suggested negotiations, details of which those interested naturally withhold until arrangements have been completed, is the logic of such a merger. The benefits of large scale consolidation in the utility field are amply demonstrated, and the fact that the proposed tie-up is of such enormous proportions follows inevitably from the fact that the area served is the world's largest metropolitan area. Furthermore, the trend in the New York area is certainly toward unified control of interborough affairs.

## Japanese Company Offers New Issue

First mortgage 6½ per cent gold bonds of the Nippon Electric Power Company, Ltd., were recently offered the investing public to the amount of $9,000,000, the price being 94 and interest, yielding more than 7 per cent. These bonds, dated Jan. 2, 1928, mature Jan. 1, 1953. The Nippon Electric Power Company is at present primarily a wholesaler of power, its principal customers being the Toho Electric Power Company; the Great Consolidated Electric Power Company; the Kyoto Electric Light Company; the Hokurliku Co-operative Electric Company, and the Osaka Municipal Electric Bureau.

## Customers Oversubscribe Stock Before Campaign

THE entire issue of 6 per cent preferred stock, series C, offered by the Rockville-Willimantic Lighting Company, Willimantic, Conn., to its customers, through its employees, was oversubscribed on Feb. 7, the day preceding that on which the company's customer-ownership campaign was officially scheduled to open.

The enthusiasm which was aroused among the employees at the educational and sales meetings which preceded the campaign and the gratifying response of the company's customers to the offering were responsible for the early oversubscription of the issue. The plan used in preparing for the campaign was furnished by P. H. Whiting & Company, Inc., New York, and representatives of that organization, in co-operation with the executives of the Rockford-Willimantic Lighting Company, conducted the educational and sales meetings and directed the employees' efforts in the early stages of the campaign.

## St. John River Power Increases Capital

Notice recently appeared in the government *Gazette* of the granting of supplementary letters patent, under the New Brunswick companies' act of 1916, to the St. John River Power Company, authorizing an increase in capitalization by the issue of $601,750 of preferred stock. The St. John River Power Company is a wholly owned subsidiary of the International Paper Company, formed for carrying on the hydro development at Grand Falls on the St. John River in New Brunswick.

GENERAL PUBLIC SERVICE INCREASES DIRECTORATE.—The following directors have been elected by the General Public Service Corporation, increasing the board membership from eleven to seventeen: Gordon H. Balch; C. E. Groesbeck, executive vice-president of the Electric Bond & Share Company; Edwin Gruhl, vice-president and general manager of the North American Company; Philip G. Mumford, president of the Commercial Solvents Corporation; Sigourney B. Olney, member of the law firm of Cullen & Dykman, and Thomas W. Streeter, chairman of the board of the Simms Petroleum Company.

## Cleveland Electric Net Up 10 Per Cent

An increased volume of business during 1927 allowed the Cleveland Electric Illuminating Company to show gross operating revenues for the year of $23,609,479, which is an increase of 7.1 per cent over 1926. Operating expenses were $12,257,458, a 4.7 per cent increase. This allowed for an advance of approximately 10 per cent in net operating revenues, which were $11,352,021 last year.

| | Twelve-Month Period Ended | |
|---|---|---|
| | Dec. 31, 1927 | Dec. 31, 1926 |
| Gross earnings............ | $23,609,479 | $22,048,267 |
| Operating expenses...... | 12,257,458 | 11,704,563 |
| Net operating revenues..... | 11,352,021 | 10,343,704 |
| Non-operating revenues.... | 540,411 | 490,185 |
| Gross income........... | $11,892,432 | $10,833,889 |
| Deductions | | |
| Interest................ | 2,360,286 | 1,766,993 |
| Taxes.................. | 3,006,000 | 2,739,000 |
| Amortization of discount on debt.............. | 90,872 | 88,948 |
| Sinking fund requirements | 242,875 | 242,874 |
| Total deductions........ | 5,700,034 | 4,837,817 |
| Net income............... | 6,192,398 | 5,996,072 |

The company's maximum load for the year 1927 was 293,731 kw., an increase of 2.3 per cent over the maximum load for 1926. The year's operation showed 1,174,676,925 kw.-hr. generated, which is a 5.1 per cent increase over 1926. The total number of consumers at the end of 1927 was 282,441, an increase of 3.6 per cent during the year. There were 158 new industrial and commercial consumers, each having a load in excess of 25 kw.

A statement of the company's earnings in comparison with those of 1926 is given in the accompanying table.

PUGET SOUND COMPANY TO ISSUE STOCK.—The Puget Sound Power & Light Company has filed with the Massachusetts Commissioner of Corporations a notice of the issuance of 20,000 shares of no par preferred stock. Payments on the shares are to be made as follows: 5,000 shares at not less than $91 a share, 5,000 shares at not less than $92 a share, 5,000 shares at not less than $93 a share and 5,000 shares 1,174,676,926 kw.-hr. generated, which

MONTREAL LIGHT REPORT SHOWS RECORD EARNINGS FIGURE. — Montreal Light, Heat & Power Consolidated continued to make new earnings records in 1927, according to the annual report recently issued. Despite a marked increase in fixed charges, net income was well maintained, while one of the outstanding features of the report was a $6,000,000 increase in working capital position. The profit and loss account shows gross revenue amounting to $20,314,902, the highest figure yet reported, as compared with $18,907,382 in 1926. Operating expenses were $7,280,697, as against $7,109,819; taxes, $1,186,707, compared with $1,213,038, and depreciation, $2,031,490, compared with $1,890,738, leaving net revenue $9,816,006, an increase of practically $1,200,000.

EDISON COMPANY TO EXCHANGE STOCK. — The Southern California Edison Company, which is planning to purchase 2,000 shares of the common stock of the Ojai Power Company of Ventura County, proposes to give six shares of its series C 5½ per cent preferred stock for each share of the Ojai company stock.

# Brooklyn Edison Net Income Shows 10 Per Cent Rise

WHILE the annual report of the Brooklyn Edison Company, just issued, shows an extremely gratifying growth over the previous year, this growth is not so great as was the 1926 increase over 1925. Gross revenue increased 9 per cent, against an increase of 15 for the previous year. Net revenue increased 9 per cent over 1926, while the 1926 increase over 1925 was 18 per cent and the balance transferred to surplus showed a 9 per cent increase over the previous year, against 20 per cent the year before. These reductions are more or less indicative of industry conditions. They are not due to any great expansion in operating costs, since expenses, including taxes, maintenance and retirements, increased but 9 per cent over 1926, against the 13 per cent increase of that year over 1925. The fact, however, must be taken into account that the company made a voluntary reduction in the maximum rate for service from 7½ cents to 7 cents per kilowatt-hour, which resulted in a saving of about $1,400,000 to consumers during the year. This was the second general reduction in rates that has occurred in two years, and the two reductions together effected a total saving of more than $2,500,000.

The position of the company's surplus account indicates the exceedingly strong financial standing which has been achieved. Last year $2,167,132 was transferred to surplus, making a net increase in surplus of $2,440,934. Even with this increase earnings on common stock amounted to well over $11 a share, approximately the same as the amount earned in 1926, but the capital stock of the company was increased during the year from 750,000 to 1,000,000 shares at $100 par.

The company continues to pay 8 per cent on the common stock. The shareholders were invited to subscribe to

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Feb. 14 | Low 1927 | High 1927 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, 4% com.—no par | k151 | 140½* | 163½* |
| Ala. Pwr., $7 com. pf.—no par | 114½ | 107 | 115 |
| Allis Chalmers Mfg., 6% com. | 122 | 115½* | 125* |
| Aluminum Co. of Amer., com. | 136 | 120* | 136* |
| Aluminum Co. of Amer., 6% pf. | 106½ | 105½* | 107½* |
| Amer. & Foreign Pwr., 7% pf.—no par | k107½ | 105½* | 108½* |
| Amer. & Foreign Pwr., com.—no par | 24½ | 22½* | 27½* |
| Amer. Bosch Magneto, com.—no par | 18½ | 17* | 22½* |
| Amer. Brown Boveri Elec.† | 17 | 14½* | 18* |
| Amer. Brown Boveri Elec., pf. $7 | 62½ | 55* | 63* |
| Amer. Gas & Elec., 6% pf.—no par | 107½ | 106½* | 109* |
| Amer. Gas & Elec., com. †—no par | 123½ | 117½* | 126½* |
| Amer. Lt. & Trac., 6% pf. | 118 | 115½* | 115¾* |
| Amer. Lt. & Trac., new com. | 181 | 170* | 191* |
| Amer. Pwr. & Lt., 6% pf. | 105¾ | 104¼* | 109¼* |
| Amer. Pwr. & Lt., com. †—no par | 66½ | 62½* | 69¾* |
| Amer. Pub. Serv., 7% pf. | a100 | 99* | 100* |
| Amer. Pub. Serv., com. † | k 70 | 65 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | 92 | 73 | 90 |
| Amer. Pub. Utilities, 7% pr. pf. | 97 | 88 | 97 |
| Amer. Pub. Utilities, com. | l 60 | 58 | 70 |
| Amer. States Sec., A | 5 | 2½ | 5½ |
| Amer. States Sec., B | 5½ | 2¾ | 5½ |
| Amer. Superpwr., 6% ptc. pf.—25 | 29½ | 28¾* | 29¾* |
| Amer. Superpwr., 6% 1st pf. | l102 | | |
| Amer. Superpwr., Class A†—no par | 41½ | 37* | 41¾* |
| Amer. Superpwr., Class B†—no par | 43 | 37½* | 43* |
| Amer. Wtr. Wks. & Elec., 6% pf. | 104½ | 101½* | 104½* |
| Amer. W. W. & E., com. new—no par | 58 | 54½* | 61* |
| Anaconda Copper, cap. $3 | 59 | 53½* | 59½* |
| Appalachian Electric Pwr., 7% pf. | 109 | 100 | 109 |
| Arkansas Pwr. & Lt., 7% pf. | 107½ | 101 | 108 |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf., $6—no par | 95 | 85 | 98 |
| Assoc. G. & E., Class A, 10—no par. | 47½ | 47½* | 51½* |
| BABCOCK & WILCOX, 7% com. | 121½ | 120* | 124½* |
| Binghamton L. H. & P., $6 pf. | 105 | 93 | 103½ |
| Birmingham Elec., pf., $7—no par | 109 | 105 | 111½ |
| Blackstone V. G. & E., 6% pf. | l107 | 105 | 110 |
| Blackstone Valley Gas & Elec., 10% com.—50 | 132 | 132* | 135½* |
| Blaw Knox, com. † | i 104½ | 91* | 105* |
| Brazilian Trac., Lt. & Pwr., $7 com. | f209½ | .... | ... |
| Brazilian Trac., Lt. & Pwr., com., new | f 53½ | .... | ... |
| Broad River Pwr., 7% pf. | 105½ | 97 | 105½* |
| Brooklyn Edison, 8% com. | 234½ | 206½* | 235½* |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26½ | .... | .... |
| Buffalo, Niagara & East. Pwr., com., $1.20—no par | l 35½ | .... | ... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | k 99 | 96 | 101½ |
| California Ry. & Pwr., 7% pf. | k135 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | l110½ | 109* | 110½* |
| Central & S. W. Util., $7 pf.—no par | a102½ | 99½* | 105½* |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a105 | 104½* | 108* |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 100 | 107 |
| Central Ill. Pub. Serv., $6 pf. | a 99 | 97½* | 98* |
| Central Ind. Pwr., 7% pf. | a 97½ | 95* | 97½* |
| Central Maine Pwr., 6% pf. | 95 | | |
| Central Maine Power, 7% | 107 | 102 | 110 |
| Central Pwr. & Lt., 7% pf. | 105 | 100½ | 105 |
| Central States Elec., 7% pf. | 106 | 104½* | 107½* |
| Century Elec., 6% com. | b141 | 140* | 145* |
| Chicago Fuse Mfg., com.—$2.50 no par | a 30 | 30* | 33½* |
| Cincinnati Gas & Elec., 5% com. | g 99 | 98½* | 100* |
| Cities Service, $6 pf.—no par | l 95½ | 87* | 94½* |
| Cities Service, pf. B—no par | l 9 | 8* | 8½* |
| Cities Service, pf. BB—no par | l 90 | 80½* | 86* |
| Cities Service, com.—20 | l55½ | 40½* | 58½* |
| Cities Service, Bks. Shrs.—10 | l 27½ | 22½* | 27* |
| Cities Service Pwr. & Lt., 7% pf. | 106 | 105½* | 106½* |
| Cities Service Pwr. & Lt., 6% pf. | 96½ | 95½* | 96½* |
| Cleveland Elec. Illg., 6% pf. | 114 | 108 | 114 |
| Cleveland Elec. Illg., 10% com. | 360 | 285 | 370 |
| Columbia Gas & Elec., 6% pf. | k107½ | 107½* | 110½* |
| Columbia G. & E., com., $5—no par | 93 | 89½* | 97½* |
| Columbus Elec. & Pwr., $2 com.—no par | m 65 | .... | .... |
| Columbus Elec. & Pwr., 7% pf. | 112 | .... | .... |
| Columbus Ry., Pwr. & Lt., 6% 1st pf. | 105 | 98½ | 108½ |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 107½ | 96 | 106 |
| Columbus Ry., P. & Lt. com.—no par | k105 | 75 | 110 |
| Commonwealth Edison, 8% com. | a180 | 165* | 189* |
| Commonwealth Pwr., 6% pf. | 103 | 102½* | 104½* |
| Commonw'th Pwr., $2, com.—no par | 66 | 62½* | 69* |
| Conn. Lt. & Pwr., 8% pf. | 121 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 112 | 119 |
| Cons. Gas of N. Y., pf. | 101½ | 101½* | 102½* |
| Cons. Gas of N. Y., com., $5—no par | 136½ | 119½* | 139½* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e112½ | 110½* | 113* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e110½ | 110½* | 113* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e110½ | 110½* | 115* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf. | e125½ | 125½* | 128½* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com., $3.00—no par | e 72 | 67½* | 72½* |
| Consolidated Pwr. & Lt., 7% pf. | 105 | 100 | 106 |
| Consumers Pwr., 6% pf. | 104 | 100 | 106 |
| Consumers Pwr., 6.6% pf. | 106½ | 103 | 107½ |
| Continental Gas & Elec., 7% pr. pf. | 107½ | 100 | 107½ |
| Cont'l G. & E., com., $4.40—no par | i230 | 210 | 265 |
| Crocker Wheeler, com.† | 30 | 23 | 38 |
| Crocker Wheeler, 7% pf. | 90 | 78 | 88 |
| DALLAS PWR. & LT., 7% pf. | 110½ | 107 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108 | 101 | 109 |
| Detroit Edison, 8% com. | 180½ | 166½* | 194½* |
| Dubilier Condenser, com.—no par | 3 | 2½* | 3½* |
| Duke Pwr., cap. | 135 | 135* | 145* |
| Duquesne Lt., 7% pf. | k116½ | 115½* | 116½* |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 102 | 112½ |
| Eastern New York Util., com. | k 65 | 70 | 75 |
| Eastern States Pwr., $7, com. | 13½ | 11½* | 15½* |
| Eastern States Pwr., pf. | 97 | 90 | 99 |
| East. Tex. Elec., 7% pf. | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d265 | 259 | 268 |
| El Paso Elec. 7% pf. | 110½ | 105 | 112½ |
| Elec. Bond & Share, 6% pf. | l109½ | 109½* | 111½* |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 91 | 76* | 80½* |
| Electric Household Util.† | a 14½ | 13½* | 15½* |
| Elec. Investors, 6% pf.—no par | 102 | 92 | 101 |
| Elec. Investors, com. †—no par | 43½ | 40½* | 45½* |
| Elec. Pwr. & Lt., ctfs. pf. | 107½ | 106½* | 108½* |
| Elec. Pwr. & Lt., ctfs., 40% pd. | k123 | 120½* | 123* |
| Elec. Pwr. & Lt., ctfs., com.—no par | 33½ | 28½* | 34½* |
| Elec. Refrig. cap.† | 14½ | 11½* | 14* |
| Elec. Ry. Securities, com.—no par | 6½ | | |
| Elec. St. Battery, com. $5.25—no par | 70½ | 69½* | 75½* |
| Elmira Wtr., Lt. & R. R., 7% pf. | k105 | 99 | 105½ |
| Empire Pwr., ptc.† | k 32½ | 32½* | 35½* |
| Engr. Pub. Serv., $7. pf.—no par | 108½ | 107* | 109* |
| Engr. Pub. Serv., com.—no par | 35 | 34* | 36½* |
| Eureka Vacuum Cleaner, com. $4 no par | 72 | 72* | 79* |
| FAIRBANKS MORSE, 7% pf. | k107 | 104* | 106½* |
| F.-M., com.—$3—no par | k 37½ | 32½* | 40½* |
| Federal Lt. & Trac., com. $1.40 | 51 | 42* | 55* |
| Federal Lt. & Trac., $6 pf.—no par | k 101 | 98* | 105* |
| Florida Pwr. & Lt., 7% pf. | 107½ | 104½* | 107½* |
| Ft. Worth Pwr. & Lt., 7% pf. | l113½ | 113* | 114½* |
| GALVESTON-HOUSTON ELEC., 6% pf. | 76 | 68 | 85 |
| Galveston-Houston Elec., com. | 32 | 26 | 32 |
| General Cable, Cl. A $1 no par | m57½ | 56½* | 80* |
| Gen. Elec. $3 com.—no par | 131 | 127½* | 138½* |
| Gen. Elec., special 6% | 11½ | 11½* | 11½* |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 37 | 35½* | 39½* |
| Gen. G. & E. (Del.) pf. A $8—no par | k125 | 123* | 126½* |
| Gen. G. & E. (Del.) pf. A $7—no par | k111½ | 108½* | 112½* |
| Gen. G. & E. (Del.) pf. B $7 | k106 | 105½* | 107* |
| Gen. Pub. Serv., $7 cum. pf.—no par | k110 | 102 | 112 |
| Gen. Pub. Serv., com., no par | k 18½ | 16½* | 20½* |
| Ga. Lt., Pwr. & Rys., com. | k 59 | 50 | 70 |
| Ga. Ry. & Pwr., 8% pf. | k125 | 119 | 125 |
| Ga. Ry. & Pwr., 7% pf. | k113 | 106 | 115 |
| Gt. Western Pwr., 7% pf. | h105 | | |
| IDAHO PWR., 7% pf. | 108½ | 103 | 110 |
| Ill. No. Utilities, 6% pf. | a 99 | 98* | 99* |
| Ill. Pwr. & Lt., 7% pf. | 104½ | 99 | 104 |
| Ingersoll Rand com. | 92½ | 91* | 94* |
| Int. Combus. Engr., com. $2—no par | 31½ | 19* | 55½* |
| Int. Combustion Engr., 7% pf. | k103½ | 104½* | 105½* |
| Int. Util., Class A—$3.50—no par | 47½ | 46* | 51½* |
| Int. Utilities, Class B—no par | [illegible] | [illegible] | [illegible] |
| Interstate Pwr., pf.—$7—no par | 100 | 93 | 100 |
| Interstate Pub. Serv., 7% pf. | 102 | 98 | 104 |
| Iowa Ry. & Lt., 7% pf. | k100 | 97 | 100 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | [illegible] | 97 | [illegible] |
| Johns Manville, com. †—no par | 124½ | 120* | [illegible] |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Feb. 11. lBid price Wednesday, Feb. 15. mLatest quotations available. †Dividend rate variable. *1928

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Feb. 14 | Low 1927 | High 1927 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | 115½ | 115* | 115¾* |
| Kansas Gas & Elec., 7% pf. | l109½ | 107* | 109* |
| Kentucky Hydro-Elec., 7% pf. | a104 | 102* | 104* |
| Kentucky Sec., 6% pf. | 92 | 83 | 90 |
| Kentucky Sec., 5% com. | 140 | 100 | 135 |
| Kentucky Utilities, 6% pf. | k101½ | 95 | 101½ |
| LACLEDE GAS LT., 12% com. | k230 | 200* | 260* |
| Lehigh Pwr. Sec., com.—no par | 25⅜ | 19¾* | 27¼* |
| Long Island Ltg., 7% pf. | 112 | 107 | 112½ |
| Long Island Ltg., com.†—no par | k170 | 139 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 108 | 98 | 105 |
| Louisville Gas & Elec., cl. A. $1.75 | 29⅜ | 28* | 29½* |
| MAN ELEC. SUPPLY, cap. $5—no par | 50½ | 50* | 54¼* |
| Manilla Elec., com.†—no par | k 43½ | 45¾* | 50* |
| Maytag Mfg., com. 50 no par, ex. div. | 32½ | 32½* | 34¼* |
| Memphis P. & L., pf. -$7- no par | k109¼ | 107 | 111 |
| Metropolitan Ed., pf.- $6—no par | 106½ | 93 | 106 |
| Metropolitan Ed., pf.—$7—no par | 109 | 104 | 110 |
| Metropolitan Ed., com. $5—no par | k145 | 60 | 72 |
| Middle West Utilities, 7% pf. | a124¼ | 116½* | 124½* |
| Middle West Util., 7% pr. lien | a128½ | 125¾* | 129¼* |
| Middle West Util., com. $6—no par | a132½ | 123¼* | 135* |
| Midland Utilities, pr. ln. 7% pf. | a105½ | 105* | 106¼* |
| Midland Utilities, 7% pf. A | a104¼ | 103* | 104¼* |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k 99 | 98 | 101⅜ |
| Minn. Pwr. & Lt., 7% pf. | l109 | 107* | 109* |
| Miss. River Pwr., 6% pf. | 108 | 94 | 108 |
| Miss. River Pwr., 3% com. | m 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k108 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | 106½ | 106¼* | 110* |
| Mohawk Hudson Pwr., com.—no par | 30½ | 29¼* | 31½* |
| Montana Pwr., 5% com. | 158¼ | 102¼* | 165⅜* |
| Montreal Pwr., 7½% com. | f 92½ | .... | .... |
| Mountain States Pwr., 7% pf. | k103 | 97 | 103 |
| Mountain States Pwr., com.† | 16 | | |
| NASSAU & SUFFOLK LTG., 7% pf. | 109 | 98 | 110 |
| National Carbon, 8% pf. | m138½ | 138* | 139* |
| National Elec. Pwr., A† | a 32 | 27½* | 32¼* |
| National Lt., Ht. & Pwr., com | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 110¼ | 108½* | 111* |
| National Pwr. & Lt., com.†—no par. ex div. | 25¼ | 21¾* | 27⅜* |
| National Pub. Serv., 7% pf. | 100 | 93 | 102 |
| National Pub. Serv., 7% ptc., pf. | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 26½ | 22* | 27¼* |
| National Pub. Serv., B com.—no par | 28½ | 24¾* | 30* |
| Nebraska Pwr., 7% pf., ex. div. | l110 | 110* | 111½* |
| Nevada-Calif Elec., com. | k 38 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | k 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k109 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | k108 | 95 | 100 |
| New Orleans Pub. Serv.—7% pf. | 108⅜ | 103 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | k103 | 101 | 104 |
| New York Power & Light 8% pf. | 114 | .... | .... |
| New York Power & Light, 7% pf. | 114½ | . | |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | k109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | k109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28⅜ | 28* | 28¼* |
| No. Amer., 6% pf.—50 | 54¼ | 53¼* | 54½* |
| No. Amer., com., no par | 61⅛ | 58⅛* | 62½* |
| No. Amer. Edison, $6 pf.—no par | 104¼ | 103⅜* | 105⅜* |
| No. Caro. Pub. Serv., pf.—$7—no par | 110 | 93 | 105 |
| Northeastern Pwr., com. | 20⅛ | 19⅜* | 23* |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com. no par | 22¾ | 18* | 24¼* |
| No. Ont. Lt. & Pwr., 6% pf. | k 98 | 98* | 98¼* |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | k109 | 108¼* | 109½* |
| No. States Pwr. (Del.), 8% com. | 134 | 123* | 136⅜* |
| No. Texas Elec., 6% pf. | 50 | 45 | 70 |
| No. Texas Elec., com. | 17½ | 5 | 36 |
| OHIO BRASS, com. B $4—no par. | 98 | 89* | 98⅜* |
| Ohio Brass, 6% pf. | k107 | 100 | 111 |
| Ohio Pwr., 6% pf | k106 | 96 | 106 |
| Ohio Pub. Serv., $6 pf. | 103 | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | 110½ | 103 | 111 |
| Ohio River Edison, 7% pf. | 109 | 103 | 109½ |
| Oklahoma Gas & Elec., 7% pf. | 111½ | .... | .... |
| PACIFIC Gas & ELEC., 6% pf. | 27¾ | 26¾* | 27¾* |
| Pacific Gas & Elec., 8% new com. | 48½ | 47¼* | 49⅜* |
| Pacific Pwr. & Lt., 7% pf. | l108¾ | 106* | 108½* |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 79½ | 77⅜* | 79¾* |
| Penn-Ohio Edison, 6% pf. no par | 94¾ | 94* | 96* |
| Penn-Ohio Edison, 7% pf. | 108⅜ | 107* | 109* |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l110¼ | 109½* | 110½* |
| Penn Wtr. & Pwr., $2.50 com., new | e 70½ | 68* | 72¾* |
| Phila. Co., 5% pf.—50 | k 45¼ | 46½* | 48¼* |
| Phila. Co., 6% pf.—50 | 52⅜ | 52* | 53* |
| Phila. Co., com.—50 | k150 | 149½* | 163* |
| Phila. Elec., 8% com.—25 | c 59 | 55½* | 58¾* |
| Portland Elec. Pwr., 7% pf. | 103½ | 97½ | 102½ |
| Portland Elec. Pwr., 6% pf. | 92 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 85 | 55 | 70 |
| Portland Elec. Pwr., com. | 50½ | 42¼* | 50½* |
| Potomac Elec. Power, pf. | k111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | k 60 | 28 | 60 |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | 108 | 99* | 103* |
| Pub. Serv. of N. J., 6% pf. | 106 | 103⅜* | 106¼* |
| Pub. Serv. of N. J., 7% pf. | k119 | 118* | 120¼* |
| Pub. Serv. of N. J., $2 com.—no par | 43⅜ | 41⅜* | 45* |
| Pub. Serv. of No. Ill., 6% pf. | a111 | 110½* | 113½* |
| Pub. Serv. of No. Ill., 7% pf. | a119 | .... | .... |
| P. S. of No. Ill., com. $8—no par | a168 | 159¼* | 180* |
| Pub. Serv. of No. Ill., $8 com. | a173 | 159⅜* | 180* |
| Pub. Serv. of Okla., 7% pr. ln. | k103 | 90 | 103 |
| Pub. Serv. Elec. & Gas, 6% pf | k109¼ | 109* | 110¼* |
| Puget Sound Pwr. & Lt., 7% pf. | k111 | 109¼* | 112* |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 98¼ | 92* | 98¼* |
| Puget Sound Pwr. & Lt., com. | 45 | 34⅛* | 46⅜* |
| RADIO CORPR. OF AMER., $3.50 pf—50 | k 96½ | 54½* | 57⅜* |
| Radio Corp. of Amer., com.—no par. | 95½ | 88⅜* | 104¾* |
| Rhode Island Public Service, pf. $2—no par | k 31¼ | 30⅜* | 31½* |
| Rochester Gas & Elec. 6% pf. D | k105½ | 101 | 103½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 7% pf. C | 105¾ | 101½ | 103½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | k111 | 105 | 112½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel Corp. | 6¾ | 4¼* | 7⅜* |
| Sierra Pacific Elec., 2% com. | 38¼ | 29* | 38¼* |
| Sioux City Gas & Elec., 7% pf. | 107 | 99 | 105½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l108¼ | | |
| Southeastern Pwr & Lt, ptc pf. | l 66 | | |
| Southeastern Pwr & Lt, com.—no par | 43 | 42* | 44⅞* |
| So. Calif. Edison, 8% pf. | k 45 | 36½ | 40 |
| So. Calif. Edison, 7% pf. | 28¼ | 28¼* | 28¾* |
| So. Calif. Edison, 6% pf | k 26½ | 25¼* | 27¼* |
| So. Calif. Edison, 8% com. | 46⅜ | 43½* | 47½* |
| Southern Cities Utilities, 7% pf. | k 75 | 67 | 90½ |
| Southwestern Lt & Pwr, A $3 | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 92 | 83 | 91½ |
| Southwestern Pwr. & Lt., 7% pf | k111 | 110* | 111⅜* |
| Standard Gas & Elec., 8% pf. | 66½ | 65* | 67⅛* |
| Standard Gas & Elec., 7% pr. pf. | 111 | 103 | 113 |
| Standard G. & E., com. $3.50 | 62⅜ | 57⅜* | 65* |
| Standard Power & Light, com. | 36⅛ | 29¾* | 37½* |
| Standard Pwr. & Lt., 7% pf. | k104 | 103⅜* | 105* |
| Staten Island Edison, pf.—$6—no par. | 102½ | 99 | 103 |
| Superheater, $6 com.—no par | 170 | 164* | 178* |
| Syracuse Lighting, 7% pf. | k110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 62 | 62* | 64* |
| Tenn. Elec. Pwr., 6% pf | 103 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf | 109½ | 103 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 15 | 20 | 30 |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | l113½ | 113½* | 115* |
| Tide Water Pwr., 8% pf. | 111½ | 105 | 111 |
| Timken Roller Bear., com.—$4 no par. | 123⅜ | 121⅛* | 134* |
| Toledo Edison, 7% pf. | 109 | 102* | 107* |
| Toledo Edison, 6% pf. | k103 | 95 | 105 |
| Toledo Edison, 6% com. | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf | k100 | 96 | 99 |
| UNITED GAS & ELEC., 6% pf. | 100½ | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c116⅛ | 111¼* | 117⅜* |
| United Lt. & Pwr., pf.—$4—no par | k 55 | 53* | 55* |
| United Lt. & Pwr., pf.—$6.50—no par | a 99 | .... | .... |
| United L. & P., com. A .48—no par. | a 16½ | 14* | 17¼* |
| United L. & P., com. B .48—no par. | k 18 | 19* | 20* |
| Utah Pwr. & Lt., 7% pf. | l 112 | 109½* | 111* |
| Utica Gas & Elec., 7% pf. | 103 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 100 | 93 | 100 |
| Utilities Pwr. & Lt., com. A $2 | 29½ | 28⅜* | 30⅜* |
| Utilities Pwr. & Lt., com. B $1—no par | 20¼ | 18½* | 21* |
| VERMONT HYDRO-ELEC., 7% pf. | k 98 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k111 | 105 | 110 |
| WAGNER ELEC., 7% pf. | b 99 | 96½* | 99¼* |
| Wagner Elec., com.—no par | b 39¼ | 37¼* | 40* |
| Washington Ry. & Elec., 5% com. | k480 | 180 | 475 |
| Washington Ry. & Elec., 7% pf. | 103 | .... | .... |
| Washington Wtr. Pwr., 8% com. | k228 | 136 | 182 |
| West Penn Elec., 7% pf. | 113 | 109¼* | 114¼* |
| West Penn Elec., Cl. A $7 | k110¼ | 106½* | 109¼* |
| West Penn Pwr., 7% pf. | 115½ | 114⅛* | 116¾* |
| West Penn Pwr., 6% pf. | 110 | 109¼* | 113* |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf | k103 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 103 | 96 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 98½ | 88⅜* | 100⅜* |
| Weston Elec. Instrument, Cl. A $2—no par | k 31 | 30¼* | 33* |
| Weston Elec. Instrument, com.—no par | k 13 | 12½* | 14½* |
| Wheeling Elec., 6% pf. | k104 | 95 | 104 |
| Worthington Pump, 7% pf. A | k 52½ | 46¼* | 55* |
| Worthington Pump, 6% B | k 47¾ | 41* | 49¼* |
| Worthington Pump, com. | k 28¼ | 28* | 34¼* |
| YALE & TOWNE com. $5—25 | 73 | 72½* | 75* |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington *k*Bid price Saturday, Feb. 11. *l*Bid price Wednesday, Feb. 15. *m*Latest quotations available. †Dividend rate variable. *1928

$15,000,000 par value, of the new stock and all of this amount was subscribed for and is being taken up.

### Steady Increase in Business

Owing to an aggressive business policy, the company has been able to increase the sale of current to a total last year of 754,635,691 kw.-hr., which is an increase of nearly 12 per cent over the previous year and an increase of approximately 70 per cent since 1923. It is anticipated that this will be greatly increased when the new Hudson Avenue generating station is ready for operation, some time next summer. This addition will bring the total capacity of the station up to 340,000 kw. and there are still three more units to be installed. As power is now generated at this station with less than 1 lb. of coal per kilowatt-hour the outlook for increased earnings is attractive, especially since operating costs are being exceedingly well regulated.

A study of these operating costs by items for the past year is illuminating: Taxes required 12.63 per cent of the total, or an amount of $4,700,000; wages took 25.7 per cent, coal 9.12 per cent and other operating expenses 11.21 per cent; interest and amortization costs were 6.8 per cent, dividends were 17.6 per cent, which figures out to 8 per cent on the capital stock outstanding at the time, and reserves and surplus amounted to 15.29 per cent. The balance of 1.4 per cent is going to the employees' profit-sharing plan. Taking the financial statement as a whole, there are few operating power and light companies in the country which show a stronger financial position and a more favorable future.

## New Capital Issues

First lien and collateral trust gold bonds, series A, of the Central Arkansas Public Service Corporation were offered to the public during the past week at 94½ and accrued interest, to yield about 5.45 per cent. This involved a total of $2,700,000. These bonds, dated Feb. 1, 1928, will mature Feb. 1, 1948.

The Alabama Power Company recently issued 20,000 shares of $5 cumulative preferred stock at $97.50 per share, the stock being fully paid and non-assessable.

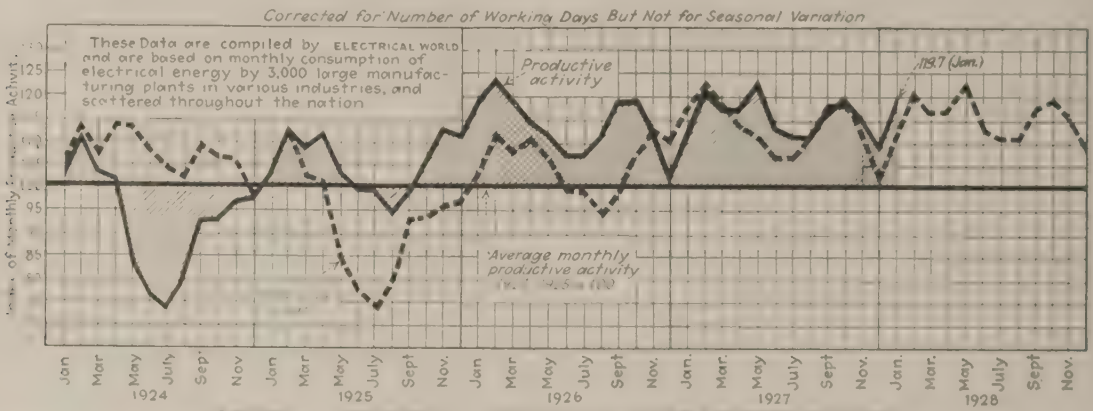
Weymouth Company to Issue Stock.—The Massachusetts Department of Public Utilities has approved the issue by the company at $30 a share of 3,338 shares of additional capital stock, par $25.

# 1928 Opens with Materially Increased Production

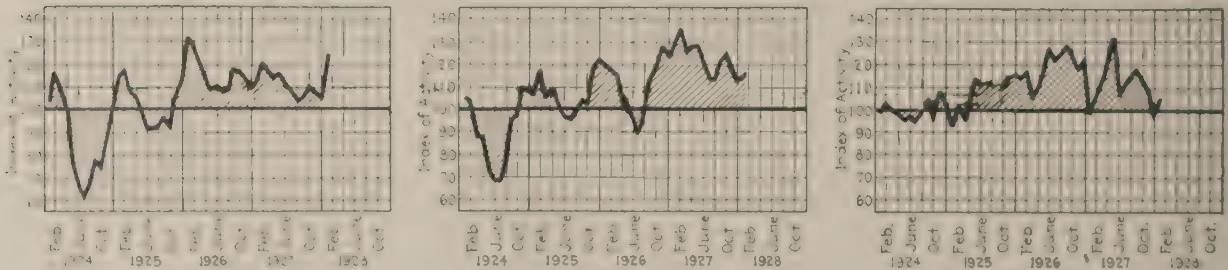
### More Than Normal Seasonal Increase in Productive Operations During January — Practically all Industrial Groups Reported Materially Increased Operations

THAT the general feeling of business and industrial optimism which seems to pervade practically every section of the nation is based upon a solid foundation is borne out by data just made available upon general industrial production during January as indicated by the consumption of electrical energy. Reports of energy consumption during January made to ELECTRICAL WORLD by some 3,000 large manufacturing companies indicate that the rate of industrial production during January was about 9 per cent over that witnessed during December, after correction is made for the number of working days in the two months. This is about the rate of increase reported for January, 1927, over December, 1926, but is materially greater than the increase in rate of general production witnessed during the same month in 1923, 1924 and 1925. It would appear, therefore, that the current January witnessed increased productive activities over December on a scale slightly greater than that which would normally be expected for the month. It also appears from the basic data that American industry as a whole enters 1928 on a slightly higher plane than at the opening of 1927, the current January rate of activity being about 7.4 per cent over that reported for January last year.

Only three of the nation's primary industrial groups—food and kindred products, lumber and its products and paper and pulp—reported a rate of productive operations during January under those of December. On the other hand, the following basic industries reported the indicated increased rate of operations over December: Chemicals and allied products 14 per cent, rolling mills and steel plants 18 per cent, ferrous and non-ferrous metal working plants 16 per cent, leather and its products 14 per cent, rubber and its products 25 per cent, stone clay and glass 6 per cent, textiles 4 per cent and the automobile industry, including the manufacture of equipment and replacement parts, 27 per cent. These increased rates of productive operations during January indicate that American industry in practically all its branches felt a materially upward impulse as the year opened. An upward trend of considerable proportions is to be expected at this season of the year, but the fact that the impulse was felt by a very large proportion of the industrial groups instead of being confined largely to a few groups is a significant fact, offering an excellent basis for prognosticating a continuance of our present industrial prosperity at least through the first half of 1928.



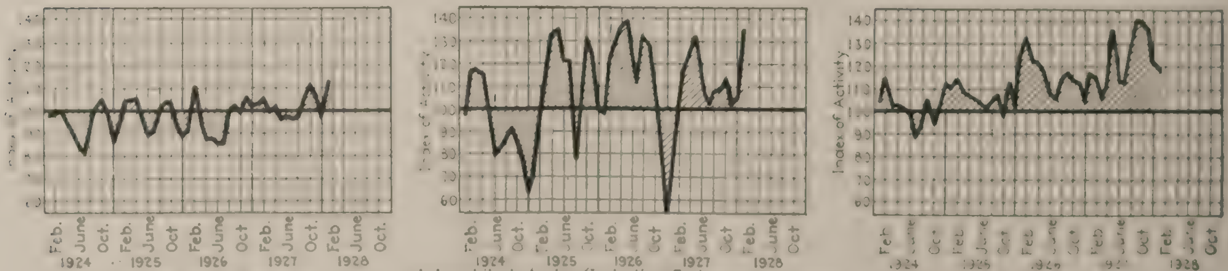
GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES



Metal Industries

Textiles

Stone, Clay, and Glass



Leather and its Products

Automobile Industry (Including Equipment and Parts)

Lumber and its Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

# Business News and Market Conditions

## Conference on Refrigerator Standardization

A general conference of manufacturers, dealers and consumers to consider the standardization of refrigerators will be held in New York in March under the auspices of the American Engineering Standards Committee. A preliminary meeting was recently held to consider requests for standardization received by the committee from the American Home Economics Association and the American Institute of Architects. It was the view of both these bodies that specifications and standards which would tend to bring about improvements in food-keeping performance and ice economy of household refrigerators should be developed on a national scale under the auspices of the American Engineering Standards Committee, with the possible establishment of carefully defined grades of refrigerators.

All representatives at the preliminary conference were agreed that work along standardization lines was necessary, and that it should be accompanied by education of consumers to the proper selection and use of refrigerators. It was pointed out that the economic questions involved are too important to be neglected; for example, an extra inch of efficient insulation in a refrigerator will pay dividends at the rate of 18 per cent on a box used only six months out of a year. Several organizations will be invited to name delegates if the conference decides to initiate the work. As part of its effort to consider the point of view of all groups before undertaking the work the committee invites comment and suggestions on this project from all those interested in domestic refrigeration.

SHIPMENTS OF DOMESTIC PUMPS AND WATER SYSTEMS

| | Water Systems, Electrically-Driven | | | | | |
|---|---|---|---|---|---|---|
| | | | Shallow-Well | | | |
| | Deep-Well (3-Hp. and Smaller) | | Under 500 Gal. per Hour | | 500 Gal. per Hour and Over | |
| Year and Month | Number of Units | Net Sale Price | Number of Units | Net Sale Price | Number of Units | Net Sale Price |
| 1926 | | | | | | |
| July | 1,076 | $117,670 | 5,937 | $435,669 | 413 | $47,015 |
| August | 1,283 | 133,895 | 5,667 | 409,467 | 288 | 33,834 |
| September | 1,352 | 121,625 | 5,118 | 374,300 | 346 | 29,915 |
| October | 1,019 | 100,834 | 5,474 | 385,976 | 298 | 24,927 |
| November | 865 | 87,285 | 4,578 | 313,264 | 239 | 19,629 |
| December | 854 | 69,865 | 3,524 | 256,028 | 270 | 24,265 |
| Total (year) | 10,738 | $1,073,575 | 59,247 | $4,407,277 | 3,591 | $404,249 |
| 1927 | | | | | | |
| January | 756 | $51,695 | 3,751 | $247,429 | 118 | $7,932 |
| February | 883 | 69,339 | 3,621 | 251,849 | 141 | 10,239 |
| March | 763 | 72,850 | 4,590 | 318,190 | 81 | 7,079 |
| April | 1,077 | 96,692 | 4,998 | 357,004 | 125 | 17,045 |
| May | 1,109 | 93,014 | 6,021 | 388,645 | 136 | 16,008 |
| June | 1,104 | 106,935 | 6,870 | 440,535 | 158 | 16,104 |
| July | 1,031 | 85,524 | 6,023 | 420,131 | 126 | 14,012 |
| August | 1,111 | *102,793 | *7,120 | 446,645 | 113 | 14,833 |
| September | 1,136 | 91,924 | 6,668 | 397,639 | 106 | 10,187 |
| October | 1,042 | 88,325 | 6,492 | 406,732 | 95 | 7,081 |
| November | 918 | 75,946 | 6,029 | 354,833 | 132 | 8,310 |
| December | 757 | 53,831 | 4,934 | 260,338 | 289 | 11,705 |
| Total (year) | 11,687 | $988,868 | 67,283 | $4,301,025 | 1,620 | $140,535 |

* Revised.

## Domestic Pumps and Water Systems

Shipments of domestic pumps and water systems as reported to the Department of Commerce by 32 manufacturers are shown in the table above. It presents a comparative statement of shipments for the last half of the year 1926 and shipments for all of the year 1927.

## *Imports of Electrical Apparatus Into United States by Commodity and by Country of Origin for the year 1927*

(Data furnished by the Bureau of Foreign and Domestic Commerce)

| Article | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|
| Carbon-filament incandescent electric lamps: | | | | |
| Miniature | $16,324 | $59,858 | $151,565 | $181,259 |
| Other lamps | 254,407 | 137,723 | 125,989 | 125,106 |
| Metal-filament incandescent electric lamps: | | | | |
| Miniature | 19,901 | 4,642 | 14,027 | 13,539 |
| Other lamps | 70,753 | 35,428 | 12,486 | 31,096 |
| Other electric lamps, including neon, etc | 1,375 | 6,440 | 911 | 2,073 |
| Generators | 210 | ....... | 6,728 | ....... |
| Transformers | ....... | 3,437 | ....... | ....... |
| Converters, double-current and motor-generators, dynamotors and other converting apparatus | 147 | ....... | 35 | ....... |
| Switches, circuit breakers, fuses, choke coils, reactors, sockets, plugs, etc. | 1,438 | 1,594 | 1,582 | 2,918 |
| Motors, stationary, railway, vehicle, automotive, and other | 6,104 | 2,218 | 468 | 1,016 |
| Electric fans and blowers | 32 | 26 | ....... | ....... |
| Table household, kitchen and hospital utensils and similar hollow or flat ware containing electrical heating element: | | | | |
| Electric flatirons | 17 | 143 | 101 | 6 |
| Iron or steel-enameled or glazed with vitreous glasses | 149 | 425 | 1,005 | 1,516 |
| Copper, brass, steel or other base metal | 1,416 | 456 | 300 | 3,650 |
| Industrial electric furnaces and ovens | ....... | 345 | 101 | ....... |
| Therapeutic apparatus and X-ray machines | 797 | 1,535 | 775 | 896 |
| Radio and wireless apparatus and parts | 10,198 | 119,688 | 115,469 | 110,696 |
| Telegraph apparatus | 2,226 | 58 | 2,125 | 631 |
| Telephone apparatus | 184 | 251 | ....... | 312 |
| Storage batteries and parts | 2,773 | 1,642 | 5,950 | 1,826 |
| Batteries other than storage | 106 | 5 | 155 | 598 |
| Electrical machinery and parts | 288,714 | 433,114 | 222,490 | 246,861 |
| Electric apparatus and parts | 19,192 | 51,209 | 32,005 | 60,164 |
| Total | $696,463 | $860,237 | $694,267 | $784,163 |

| Country | First Quarter | Second Quarter | Third Quarter | Fourth Quarter |
|---|---|---|---|---|
| Austria | $77,527 | $5,434 | $11,405 | $23,189 |
| Australia | 4 | ....... | ....... | 19 |
| Azores and Madeira Islands | ....... | ....... | 39 | ....... |
| Belgium | 1,218 | 303 | 35 | 43 |
| Brazil | 10 | 8 | 31 | 10 |
| British West Indies | 10 | ....... | ....... | ....... |
| Canada | 5,440 | 11,261 | 10,170 | 12,009 |
| Ceylon | 7,423 | ....... | ....... | ....... |
| China | 3,401 | ....... | 17 | 585 |
| Cuba | 256 | 3 | ....... | 5 |
| Czechoslovakia | 13,316 | 263 | 968 | 672 |
| Denmark | ....... | 228 | ....... | ....... |
| France | 12,013 | 18,982 | 5,781 | 13,757 |
| French Oceania | ....... | 90 | ....... | ....... |
| Germany | 187,790 | 195,050 | 226,864 | 234,741 |
| Hungary | 1,530 | ....... | ....... | ....... |
| Irish Free State | ....... | ....... | 4 | ....... |
| Italy | 562 | 1,300 | 844 | 1,996 |
| Japan | 105,848 | 153,895 | 207,342 | 235,115 |
| Mexico | 260 | ....... | ....... | 300 |
| Netherlands | 937 | 430 | 2,200 | 7,244 |
| Norway | ....... | 33 | ....... | ....... |
| Philippine Islands | ....... | ....... | 7 | ....... |
| Rumania | 4 | ....... | ....... | ....... |
| Spain | 120 | 58 | 124 | 194 |
| Sweden | 66,025 | 78,133 | 32,682 | 178,550 |
| Switzerland | 198,433 | 261,412 | 160,776 | 13,542 |
| United Kingdom | 14,336 | 133,354 | 34,978 | 62,192 |
| Total | $696,463 | $860,237 | $694,267 | $784,163 |

# Market Conditions

SALES in the New England district have decreased, motor business has dropped off and no equipment orders of special interest were reported. There is a marked upward trend in new building projects, with mercantile types predominant. Industrial inquiries in the Eastern market are better. The steel industry looms as an important consumer in the next 60 or 90 days. A steel company near Birmingham, Ala., placed an order for about $150,000 worth of equipment. No outstanding orders were placed in the Southeast, though the number of inquiries received was satisfactory. In the St. Louis district business is at a normal level. An oil refinery bought about $10,000 worth of motor apparatus, and a number of orders are being placed for line construction material. Industrial buying improved in the Middle West and utility companies continue to be busy with a large amount of construction work. On the Pacific Coast pole-line hardware sales are prominent, miscellaneous small telephone line jobs are reported in the Shasta and Diablo districts, and the Patterson irrigation project and the Turlock Irrigation District will soon be in the market for transmission line apparatus, pumps and motors.

## *Copper Steady with Tendency to Weaken—Lead Drops*

After ruling at 6½ cents for 2½ months the price of New York lead has been cut to 6.35 cents, tin continues its downward course, zinc has eased slightly, but copper prices are maintained with "primary" producers firm at 14⅛ cents Connecticut, despite shading on the part of custom smelters. Business has not been brisk in any of the metals, although the cut in lead stimulated some buying. The copper situation is much the same as it has been for a month or more, with a tendency to weaken. The tonnage sold is well below average.

NEW YORK METAL MARKET PRICES

| | Feb. 8, 1928 Cents per Pound | Feb. 15, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14.075 | 14-14⅛ |
| Lead, Am. S. & R. price | 6½ | 6.35 |
| Antimony .. | 11 | 11 |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots............ | 6 | 5.92½ |
| Tin, Straits.......... | 53 | 51¼ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price Feb. 15, 1928, 15⅞ cents.

Predictions made two or three months ago that lead prices would advance before they would decline have proved to have been uninspired, for on Friday, Feb. 10, the American Smelting & Refining Company cut its contract price from 6½ cents, New York, at which level it had held since Dec. 1, to 6.35 cents. Other producers met the cut, and in fact, on Tuesday or Wednesday it might have been possible to shade this price by five points or so. The St. Louis market has also weakened. Producers are frankly uneasy over the drop in London, which has been largely accountable for the decline on this side. United States producers are not burdened with excess stocks, but the market cannot stand an inflow of bullion lead from foreign sources which would have eventuated had not prices been reduced as they have. Buying of lead has been fairly active since the prices dropped, with all classes of consumers in the market to some extent, and early delivery generally in most demand. Consumers have been buying tin on the breaks and traders have been selling. Forward prices are slightly less than prompt, but the difference is hardly more than ½ cent.

## *Inquiries Good in Southeast—No Outstanding Orders*

No outstanding orders were placed in the Southeast, though the number of inquiries received was satisfactory. Central-station companies are slow in starting to buy under the new budgets, but it is expected that the movement will shortly improve. A power company in Tennessee ordered high-tension insulators amounting to $15,000, while a Georgia company ordered three 667-kva. transformers and $13,000 worth of distribution and small power transformers. There is a very satisfactory amount of substation equipment business in more or less immediate prospect. Line construction materials are active, one company ordering weatherproof wire amounting to $12,000 and creosoted pine poles totaling $6,400. Another order in this line was for insulators, cross-arms and hardware amounting to $5,300. In a flatiron campaign just closed one of the larger central-station companies sold 5,620 irons in ten days.

Buying on the part of municipalities is more active than for some time past and is ahead of that usually noted for this period of the year. "White-way" equipment is active, three towns in Georgia ordering to the extent of $4,000, $3,500 and $3,000, respectively. Another town in the same state ordered line construction materials amounting to $1,000.

Construction projects are as follows: The Alabama, Tennessee & Northern Railroad Corporation plans terminal and repair shops at Mobile, Ala., to cost $250,000. Libby, McNeill & Libby, U. S. Stock Yards, Chicago, Ill., plans a milk condensory at Tuscaloosa, Ala., to cost $200,000. The Columbus Electric & Power Company, Columbus, Ga., plans a one-story substation on Tenth Avenue, to cost $40,000. The United States Foil Company, Louisville, Ky., plans a plant addition to cost $350,000. S. R. Morgan & Company, Little Rock, Ark., plans an ice plant at Aberdeen, Miss., to cost $100,000. The Mississippi Power & Light Company plans lighting and power system at Hickory Flat, Miss. The Powell Knitting Company, Spartanburg, S. C., will soon take bids for a new mill to cost $100,000. The Community Electric Company and the Blue Ridge Talc Company, Henry, Va., plan to rebuild their plants destroyed by fire with loss of $215,000. The Hooker-Bassett Furniture Company, Martinsville, Va., plans a new factory to cost $150,000. The Stanley Milling Company, Stanley, Va., plans rebuilding the portion of its mill destroyed by fire with loss of $150,000. The Appalachian Electric Power Company plans a substation at Madison, W. Va. The Kentucky Power Company, Brooksville, Ky., and the Carolina Power & Light Company plan extensions in transmission lines. Miami, Fla., and Portsmouth, Va., plan ornamental lighting systems.

## *Business in St. Louis at Normal Level*

Business in the St. Louis district is at a normal level. An order for sixteen 25-hp. motors with control, metering equipment and transformers was placed by a large oil refinery company and amounted to $10,000. A switchboard for $1,800 and another for $1,100 were sold to power companies in the south and western part of the district. The demand for stock sizes of motors and transformers shows slight improvement. Several orders are being placed for line construction material.

Construction projects are as follows: The North Arkansas Power Company, Mountain Home, Ark., plans a light and power plant at Salem, Ark.; also, an ice plant. The Arkansas Power & Light Company plans a 110,000-volt transmission line from Pine Bluff to Camden, Ark. Hannibal, Mo., plans extensions in its municipal power plant to cost $150,000. Kennett, Mo., plans a municipal power station to cost $30,000. Sweetwater, Tex., and Oakdale, La., will install ornamental lighting systems. The Thompson Can Company, Dallas, Tex., plans a new plant to cost $100,000.

## *Sales Volume Decreases in New England District*

A slight sag in the sales volume is noted in the New England district. Motor sales dropped off and no equipment orders of special interest were reported. Central-station supplies are moving very slowly, some interest in cable, wire and hardware is recorded and emergency repair orders for work in southern Vermont are being received in limited number. The Gloucester Electric Company recently purchased new switch and control equipment for replacement purposes. A number of small lot transformer orders is expected, but activity as a whole is lessening. A manufacturer of electric furnaces reports an order for a special type continuous feed heater. Industrial plant lighting is active and a Salem manufacturing company is planning its adoption on a large scale. Electric range sales are encouraging in the Maine and Vermont districts. In the former 90 ranges were sold recently.

New England shows a marked upward trend in new building projects, mercantile types predominating. A number of factory additions and changes are being planned. An ice plant, costing about $100,000, will be erected in Brockton, the Carver Cotton Gin Company plans a plant addition, several shoe and industrial plants are planning for an increase in power load and the General Motors Corporation is considering an assembly plant at Stoughton, Mass.

### *Industrial Inquiries Better in Eastern Market*

Industrial plant inquiries in the Eastern district point to early improved sales. The steel industry looms as an important consumer in the next 60 to 90 days. The improved operations in this field are leading not only to advance inquiries but immediate commitments. A steel company near Birmingham, Ala., has placed an order for a turbine unit, condenser and switchboard, totaling about $150,000, with a large manufacturer; the American Steel & Wire Company, Cleveland, is expected to buy a heavy amount of equipment, with an appropriation of $5,000,000, for extensions and improvements in Eastern and Western mills during 1928; the Sheffield Steel Corporation, Kansas City, Mo., is another prospective purchaser, with a fund of about $2,500,000, for plant expansion, including a new combination bar and rod mill, and the Southern Ornamental Iron Works, Dallas, Tex., will soon buy equipment for a plant at Arlington, Tex., to cost more than $200,000. Business in smaller industrial equipment, including fractional-horsepower motors shows tendencies for marked betterment. A manufacturer of automatic ticket registers has placed a contract for 1,500 motors of 1/50-hp. rating, totaling about $14,000; a producer of electric-operated coin counters has ordered 50 motors of 1/20 hp. at $700, and a manufacturer of compressors has contracted for 125 motors, divided in 1-hp. and 2-hp. sizes, at a cost of $4,000.

In the Philadelphia district manufacturers are encouraged by the advancing quota of inquiries, with industrial apparatus for new enterprises forming the largest percentage. Ice and cold storage plants in this territory, including southern New Jersey, will soon buy considerable machinery. Textile mills are coming into the market for motors and control equipment, and leather plants are showing expansion for early requirements.

Construction projects include the following: The Fur Merchant's Cold Storage Company, New York, plans a ten-story cold storage plant addition to cost about $300,000. The Rochester Gas & Electric Corporation, Rochester, N. Y., plans extensions in transmission lines in Monroe and Ontario Counties. The Riley Milk & Ice Company, Pitman, N. J., plans an addition to its ice and cold storage plant to cost about $100,000. The Bureau of Supplies and Accounts, Washington, D. C., will receive bids until Feb. 28 for lighting and power cable for the Philadelphia, Pa., navy yard (Schedule 8487); also, until Feb. 21, for one Diesel engine, air compressor, etc., for the Charleston navy yard (Schedule 8497). The Pennsylvania Water & Power Company, Holtwood, Pa., will call for bids on the initial unit of a hydro-electric plant at Safe Harbor, Susquehanna River. The Eastern Shore Public Service Company, Salisbury, Md., has acquired properties in Talbot, Caroline and Queen Anne Counties and contemplates extensions in transmission lines. The General Supply Committee, Washington, is asking bids until March 2 for electrical supplies for 1928 (Class 6), and the Maryland Paper Mills, Inc., will soon begin work on the first unit of its plant at Glen Burnie, Md., to cost $175,000.

### *Industrial Buying Improves in Middle West*

Business in the Middle West continues to improve. So far the year has been up to reasonable expectations. Building operations in the Chicago suburban districts are increasing. Industrial activity is steadily improving. Utility companies continue to be busy with a large amount of construction work and a great deal more is contemplated. Maintenance purchasing is quite large. Jobbers' sales are steadily improving, although some irregularities are noticeable. Appliances are moving fairly well. A jobber placed an order for 1,000 vacuum cleaners.

Construction projects are as follows: The Central States Power & Light Corporation, Dubuque, Iowa, has acquired the system of the Gladwin Light & Power Company, Gladwin, Mich., and plans expansion. Emmetsburg, Iowa, plans the installation of a municipal power plant. The Iowa Railway & Light Company will improve its power plant at Nevada, Iowa, to cost $30,000. Mountain Lake, Minn., plans a municipal electric distributing system. Louis P. Wolff, Globe Building, St. Paul, Minn., engineer, plans a municipal power plant at Detroit Lakes, Minn., to cost $32,000. The Hinde & Dauch Paper Company, Sandusky, Ohio, plans a new mill at Sullivan, Ill., to cost $100,000. The Willys-Overland Company, Toledo, Ohio, plans an addition to its plant to cost $700,000. The Great Atlantic & Pacific Tea Company, Milwaukee, Wis., plans an electric-operated baking plant to cost $200,000. Stoughton, Wis., plans a municipal power plant to cost $30,000. The Detroit Edison Company plans a 120,000-volt steel tower transmission line from its Trenton Channel power plant to Detroit, Mich. The Iowa Railway & Light Company plans a transmission line from Boone to Roland, Iowa, and rebuilding of line from Maxwell to Collins, Iowa. The Northwest Public Service Company plans a transmission line at Columbus, Neb., and the Nebraska Power Company at Valley, Richfield, Neb. Langdon, N. D., and North Milwaukee, Wis., will install ornamental lighting systems.

### *Pole-Line Hardware Sales Prominent on Pacific Coast*

Pole-line hardware purchasing has been active on the Pacific Coast. The Pacific Gas & Electric Company and the San Joaquin Light & Power Company being in the market for one car each and the Great Western Power Company for two cars. The latter company also purchased one carload of guy wire. Another power company purchased one carload of 11,000-volt insulators valued at $8,000. Miscellaneous small telephone line jobs are reported in the Shasta and Diablo districts. The Patterson irrigation project will require a total of 1,650 hp. of pumps and motors. The Turlock Irrigation District is requesting bids for construction of 14 miles of transmission line.

The city of Oakland, Calif., is in the market for 12,000 ft. of dredging cable, a lime company needs $2,500 worth of wiring material and ten assorted motors from 25 hp. to 100 hp., a new state fair building in Sacramento needs about $2,000 worth of reflectors and wiring material. The city of Los Angeles has purchased $19,000 worth of street-lighting transformers. New construction includes an administration building for the Fabiola hospital in Oakland to cost $700,000, and a million-dollar addition to the Olympic Club in San Francisco.

Electric range sales in Seattle during January showed a considerable decrease over those of December. Smaller appliance and table-ware sales are on the increase. Several substation transformers were purchased by the Puget Sound Power & Light Company for the Baker River and Seattle plants, fifteen motors from 25 hp. down to a lumber mill in Tacoma and about 30 from 50 hp. down for miscellaneous mill and woodworking plants in the Puget Sound district. Some sales of small motors to dealers in Grays Harbor and in eastern Washington are reported, but the volume was below the average.

Construction projects are as follows: The Benbow Power Company, Benbow, Calif., plans a hydro-electric plant on the Eel River, to cost $200,000. The Southern California Edison Company plans a 120,000-volt transmission line from Saticoy to its substation at Castiac, Calif., to cost $400,000. Los Angeles, Calif., plans a two-story substation on South Figueroa Street to cost $105,000. The Pacific Coast Steel Company, San Francisco, plans an addition to its plant to cost $500,000. The Great Northern Utilities Company plans a power plant at Shelby, Mont., to cost $300,000. The Utah Woolen Mills Company, Salt Lake City, plans a new mill to cost $175,000. Burbank, Monrovia, San Leandro and Whittier, Calif., plan ornamental lighting systems.

# Activities of the Trade

## Servel Elects Directors

At a meeting of Servel, Inc., the following directors were elected: Nicholas F. Brady, George W. Davison, William H. McCurdy, Ernst Aurell, Murray H. Coggeshall, C. A. Dana, Richard E. Forrest, W. S. Gray, Jr., Richard C. Hunt, John Higgins, George P. Smith, M. G. B. Whelpley and Col. Frank E. Smith.

## Edison Lamp Works Plans Merchandising Campaign

The "Out-in-Front" campaign, the third of a series of semi-annual merchandising drives, will be made by the Edison Lamp Works of the General Electric Company during the month of March. The campaigns have the two-fold object of educating agents to modern merchandising methods as well as to increase the sale of lamps. Better window and counter displays are the aim summed up in the slogan adopted and by means of which the company will stimulate its 15,000 agents to a nation-wide drive.

## Electric Refrigeration Elects Three New Directors

The Electric Refrigeration Corporation of Detroit at a recent meeting elected three new directors, as follows: Jules S. Bache, head of J. S. Bache & Company; D. B. Lee, chairman of the Motor Products Corporation, Detroit, and Harlan T. Pierpont, Springfield, Mass. At the meeting plans were laid to change the name of the corporation to the Kelvinator Corporation.

## Westinghouse Veterans Hold First Annual Dinner

The first annual dinner of the New York chapter of the Veteran Employees' Association of the Westinghouse Electric & Manufacturing Company was held at the Pennsylvania Hotel on Wednesday evening. This association, which has a membership of over 3,500, is made up of employees all over the country who have twenty or more years of service to their credit with the Westinghouse organization. There are fifty-five employees with forty years of service to their credit in this association.

C. E. Stephens, Northeastern sales manager of the company, who is president of the New York chapter of the association, presided at the meeting. After outlining the plans for the coming year, Mr. Stephens introduced E. H. Sniffin, who acted as toastmaster. Mr. Sniffin in turn introduced Walter P. Holcombe, vice-president of the Brooklyn Edison Company, who spoke to those in the banquet hall on "Veterans' Service." Another speaker was John J. Jackson, general attorney of the Westinghouse company, whose subject was "The Acid Test." Until this year those eligible in the New York district to join the association were affiliated with the Pittsburgh chapter, but during the last year so many in the New York office have joined this association it was deemed necessary to establish a New York Chapter. At a recent meeting, sixty chapter members were present. Officers elected at that time were: W. J. Massey, vice-president; Carl L. W. Baotz, secretary; C. V. Holmes, treasurer, and Miss C. C. Bickel, C. C. Bawden, and F. M. Garretson, trustees.

## First Allis-Chalmers Unit Started at Conowingo

The first of the four 54,000-hp. turbines built by the Allis-Chalmers Manufacturing Company, Milwaukee, for the Conowingo development on the Susquehanna River has been started. The immense size of these turbines will be apparent from the fact that the steel runner, or rotating part of each machine, weighs 100 tons, and that the valve admitting water to each turbine is 27 ft. in diameter. The Conowingo development forms one line in the chain of the system of the Philadelphia Electric Company. The project, one of the largest hydro-electric developments in the world, represents an investment of $52,000,000.

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The W. R. Ostrander Electric Works, 911 Atlantic Avenue, Brooklyn, N. Y., has placed on the market a floor receptacle with a shallow box and a small diameter nozzle. It is designed for 250 volts, 10 amp.

The Central Flatiron Manufacturing Company, Johnson City, N. Y., announces the appointment of John W. Stiles & Son, Cleveland, as its representatives for the "Betsy Ross" line of electric appliances in Ohio, Indiana and Kentucky. The company also announces that the George W. Underhill Company, St. Louis, has been appointed representative in the states of Iowa, Nebraska, Oklahoma, Texas, Arkansas, Missouri and southern Illinois.

The McGill Manufacturing Company, Valparaiso, Ind., manufacturer of lamp guards, sockets, switches, etc., announces an improvement in its "Levolier," Cat. No. 61, fixture switch.

The Automatic Electric Heater Company, 1505 Race Street, Philadelphia, is offering a new line of water heaters equipped with a by-pass that will not allow any hot water to drip when house faucets become defective or are left partially closed.

The Steinmetz Heating Company, Inc., 30 Church Street, New York City, announces that it has been awarded a contract by the 963 Fifth Avenue Corporation, New York, for 60 flush-type wall insert electric heaters, "Globar" equipped, for use in the bathrooms of an apartment house.

The Benjamin Electric Manufacturing Company, 120 S. Sangamon Street, Chicago, has prepared a new reference wall chart which will enable the selection of the right type, size and catalog number of any Benjamin reflector or other industrial lighting equipment.

The American Electric Switch Corporation, Minerva, Ohio, announces the acquisition of the Nyelec Switchboard Company, 422 E. 53d Street, New York City. The Nyelec Switchboard Company will retain its New York office, factory and personnel and will operate as the Nyelec division of the American Electric Switch Corporation. The sales for the present will be handled by the American Electric Switch Corporation sales organization.

The Standard Electric Stove Company, Toledo, Ohio, announces that J. D. Behnke has been appointed district representative for western Missouri, Kansas, Oklahoma and southern Nebraska, with headquarters at Kansas City. Mr. Behnke formerly covered the same territory for the Commercial Electrical Supply Company of St. Louis.

The Bryant Electric Company, Bridgeport, Conn., has placed on the market its No. 782 expulsion type surface switch, built especially for inductive loads, for controlling three-phase alternating-current motors up to and including 2 hp. It is reversible triple-pole, with a rating of 20 amp., 250 volts or 10 amp., 600 volts.

The Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., announces the appointment of Leighton B. Underwood as district sales manager in Philadelphia. L. B. Underwood & Company, of which Mr. Underwood has been head, was a manufacturers' representative, and has carried the Trumbull-Vanderpoel line of safety switches for many years.

The Lincoln Electric Company, Cleveland, announces the appointment of A. M. MacFarland as a general sales and development engineer, who will devote his efforts to the development and special application of automatic carbon arc welding, with headquarters at Cleveland.

The Wagner Electric Corporation, St. Louis, announces the opening of a new branch sales office at 475 West Peachtree Street, N.E., Atlanta, Ga., to cover the states of Georgia, Alabama and Florida, until recently a part of the St. Louis sales territory. Roy F. Druschky, who has been with the company for sixteen years and until recently a salesman in the St. Louis territory, has been put in charge of the Atlanta branch office.

The Hoover Company, North Canton, Ohio, maker of Hoover electric cleaners, is placing on the market a floor polishing attachment for use in connection with its various models.

# New Equipment Available

## Instrument and Control Switches

A new type of switch used for connecting any instrument or group of instruments selectively into various circuits as may be required for metering, synchronizing or other switching functions has been placed on the market by the Westinghouse Electric & Manufacturing Company. These switches are of the rotary type and are especially adapted to mounting in small space.

The switches are made in six standard lengths. The many combinations required are assembled from a relatively small number of standard segments and insulating arc-resisting spacers. All switches are insulated for 600-volt service for alternating or direct current. The contacts will carry 10 amp. continuously and will open 5 amp. under normal conditions. These switches can be mounted 3 in. apart horizontally and 5¼ in. vertically between center lines.

## Automatic Time Switch

A motor-operated automatic time switch for controlling alternating-current circuits where the load is less than 10 amp., has been placed on the market by the General Electric Company. This device will be designated as the T-8 switch, and may be used for the control of show-window lighting, electric signs, protective lights, and many industrial applications where circuits are required to operate regularly during a certain portion of each day. Two arms, registering on the revolving dial of the switch can be set at half-hour intervals to control the making and breaking of the load circuit, the maximum time interval being 11½ hours. The time keeping element of the switch is a small disk-type synchronous motor having a consumption of 3 watts.

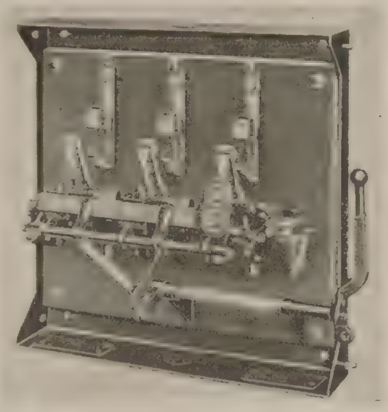
## Potheads

A new line of potheads has been added to the distribution products made by the Line Material Company, South Milwaukee, Wis. The potheads are so designed that any type may be assembled quickly from standard interchangeable parts. Owing to the type of design the company states that prompt delivery is insured on all orders. The potheads are made for indoor or outdoor service and for one, two, three or four conductors in any type such as side-entrance, flat-straight, 135-deg. angle, 90-deg. front entrance, tap-off type, bracket type, etc.

Secondary Rack.—A line of Peirce "Presteel" electro-welded secondary racks in both the heavy service and the light service types and which the manufacturer claims has greater strength per pound has been placed on the market by Hubbard & Company, Pittsburgh. In this line of racks there are no rivets, no pockets to hold moisture and no lapping of material to start rusting. The mounting holes on both the heavy service and light service racks have exactly the same spacing.

## Inclosed Circuit Breakers

A complete line of inclosed circuit breakers in capacities from 5 amp. to 800 amp. has been placed on the market by the Roller-Smith Company, 233 Broadway, New York City. The type ESF, shown in the illustration, is a free-handle breaker and the type ES, which is not of the free-handle type, has the handle projecting directly through a slot or slots, depending on the number of poles, in the front cover. These two types are for use on potentials up to 600 volts for direct or alternating-current service, are made with one, two, three, or four poles, with overload or undervoltage release or combinations and with instantaneous or time-limit trip. The type EF is made in capacities from 3 amp. to 100 amp. and is generally similar to the type ES except that the breaker itself is of the industrial type instead of the standard type. It does not have the fine finish of the ES line, but all parts are dipped and lacquered and they are built for hard use. They are for use on potentials up to 250 volts on direct or alternating current, are made for one, two, three or four-pole service, can be provided with overload or undervoltage release or combinations and have an instantaneous trip only.



TYPE ESF FREE-HANDLE CIRCUIT BREAKER WITH COVER REMOVED

With these circuit breakers the box can be installed first, if desired, and the breaker mounted at a later date. The box is so designed as to provide all safeguards against damage due to the explosion and liberation of gases that take place when a breaker opens under a heavy load. Changing a breaker can be easily accomplished.

## Centrifugal Air Compressors for Cupola Blowing

A cupola blowing equipment which it is claimed will greatly improve the efficiency of the melting operation has been developed by the General Electric Company. This equipment automatically insures the supply of a constant weight of air to the cupola, irrespective of atmospheric conditions and the resistance through the cupola. The new equipment will be manufactured with either hand or automatic control, and can be set to give the proper weight of oxygen to meet varying operating conditions. A meter indicates the volume of air flowing for standard conditions. Constant-speed motors are used with all sets, except when direct-current motors are required. As a result, the weight of air flowing into the cupola is not controlled by variable speed, but by opening and closing the blast gate.

## Hollow-Square Bus Support

A new line of bus-bar supports known as the modified hollow-square type and particularly adapted to heavy low-voltage bus construction has been developed by the Westinghouse Electric & Manufacturing Company. These supports consist of heat-treated aluminum alloy clamps which are insulated from the standard 1½-in. pipe of the mounting support by means of high-grade micarta tubes. The bus support is designed for 4-in. x ¼-in. bus bars and for a maximum of 4,000 volts alternating or direct current. The support may be adjusted to carry one or twelve bars so the bus may be tapered as feeders are tapped off or installation of additional bus copper to provide for an increasing load may be easily made.

Electric Mold Drying Unit.—An electric heating unit for drying large sand molds in brass, steel or iron foundries has been designed by the General Electric Company to obviate the attention required by the kerosene lamps, stoves or other fires usually employed. The device consists of a helicoil sheath-wire unit cast into iron. The terminals are protected by a cast-iron cap with an insulated hole in it, through which lead wires may be brought. The unit is designed to operate directly on the line voltage. It is rated 1,250 watts at either 110 volts or 220 volts. It has a shipping weight of approximately 10 lb., the over-all length is 21 in., length of heating surface, 18 in., width, 2¼ in., and thickness, 1 in.

Drum Switches.—Three new drum switches are announced by the General Electric Company for use with squirrel-cage and slip-ring motors. They have been designed particularly for the control of small cranes, hoists, machine tools, etc., but can be applied on any work where a small and inexpensive drum switch is desired for the control of the types of motors mentioned.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Jan. 31, 1928)

Reissue 16,865. Oil Refining Still and Method of Making the Same by Electric Welding; L. R. Smith, Milwaukee, Wis. App. filed Dec. 31, 1924.

1,657,452. Lightning Arrester; A. L. Atherton, Pittsburgh, Pa. App. filed Sept. 19, 1922. Multiple-gap type.

1,657,455. Trolley Base; L. F. Burnham, Pittsburgh, Pa. App. filed Nov. 5, 1925. Of the roller-bearing type for supporting current-collector members.

1,657,459. Circuit Closer for Electric Alarms; F. Davis, Brooklyn, N. Y. App. filed Nov. 15, 1924.

1,657,465. Electric Heating Unit; F. F. Forshee, Mansfield, Ohio. App. filed March 12, 1926.

1,657,479. Electric Heating Device; F. MacFarland, Wilkinsburg, Pa. App. filed Dec. 2, 1922. Flexible electric heater.

1,657,486. Switching Mechanism; W. M. Scott, Tredyffrin Township, Chester County, Pa. App. filed April 21, 1924.

1,657,492. Regulator System; C. A. Boddie, Wilkinsburg, Pa. App. filed Nov. 26, 1924. Actuated in accordance with a predetermined power factor of a supply circuit.

1,657,493: Testing Device and Method for Railway Traffic Controlling Apparatus; P. N. Bossart, Swissvale, Pa. App. filed July 13, 1926.

1,657,495. Mercury Arc Rectifier Starting Device; E. W. Breisch, Edgewood Park, Pa. App. filed Dec. 7, 1921.

1,657,507. Connecter; A. D. Keene, Pittsburgh, Pa. App. filed July 6, 1923. For electric resistance conductors.

1,657,513. Regulator System; W. E. Menzies, Irwin, Pa. App. filed June 14, 1923. For maintaining a number of machines at definite relative speeds that are variable at will.

1,657,521. Control System for Electric Ranges; V. G. Vaughan, Wilkinsburg, Pa. App. filed Nov. 5, 1923.

1,657,543. Primary Cell; R. B. Lynn, La Salle, N. Y. App. filed Feb. 9, 1926.

1,657,550. Method and Apparatus for Cooling Electrical Apparatus; G. W. Saathoff, South Orange, N. J. App. filed April 29, 1922.

1,657,581. Electrical Heating Apparatus for the Crucibles of Linotype Composing Machines; O. Mozzali, Treviglio, Italy. App. filed Oct. 23, 1922.

1,657,587. Electrical Pulse Generator; M. I. Pupin, Norfolk, Conn. App. filed Aug. 7, 1924.

1,657,617. Electric Clock Winding Mechanism; F. A. Feldkamp, Newark, N. J. App. filed Jan. 19, 1927.

1,657,638. Electrical Gas Igniting Device; E. L. Payne, Los Angeles, Calif. App. filed April 6, 1925.

1,657,643. Electric Heating Means; J. H. Reniers, Ben Avon, Pa. App. filed May 15, 1923. For stock such as rods, bars, wire, etc.

1,657,660. Electric Control for Sterilizers; F. Cedergren, Hammond, Ind. App. filed April 1, 1927.

1,657,671. Electric Furnace Terminal; F. A. Fitzgerald, Niagara Falls, N. Y. App. filed June 10, 1925.

1,657,677. Compensated Induction Motor; F. Kade, Kiel, Germany. App. filed March 26, 1924.

1,657,681. Safety Overload Device; I. E. McCabe, Chicago, Ill. App. filed Dec. 21, 1925. Thermostatic device.

1,657,688. Switching Mechanism; W. M. Scott, Tredyffrin Township, Chester Co., Pa. App. filed May 14, 1924.

1,657,714, 1,657,715. Switch Mechanism; T. E. Griffith and L. L. Dodds, Cleveland, Ohio. Apps. filed March 5, 1923. For use in elevator cars for breaking the operating circuit of the car upon the opening of the door of the elevator inclosure.

1,657,785. Electric Furnace; C. A. Calwell, Cleveland, Ohio. App. filed April 29, 1920. Of relatively high voltage.

1,657,794. Circuit Closer for Fluid-Level-Indicating Devices; M. S. Elton and G. E. Barnhart, Pasadena, Calif. App. filed Feb: 10, 1925.

1,657,799. Electrical Attachment Plug; L. Kellner, Chicago, Ill. App. filed Aug. 22, 1925.

1,657,808. Electric Heater; A. Steffen, Pittsburgh, Pa. App. filed Aug. 11, 1925. Wall heater.

1,657,855. Electrical Indicating Instrument and Control System Therefor; H. L. Decker, Toledo, Ohio. App. filed Oct. 7, 1925.

1,657,886. Direct Current Metering System; J. Harris, La Fayette, Ind. App. filed Jan. 24, 1925.

1,657,900. Closed Electric Machine; H. Richter, Behringersdorf, near Nuremberg, Germany. App. filed Nov. 7, 1925. Mine pump motor.

1,657,904. Electric Lighter; T. C. Russell, Chicago, Ill. App. filed Nov. 30, 1925.

1,657,910. Electrically-Operated Remote-Control Indicator; S. B. Allen, Framingham, and L. R. Sutherland, Boston, Mass. App. filed Sept. 11, 1922.

1,657,928. Ship Telegraph; W. R. Hornberger, Philadelphia, Pa. App. filed Aug. 27, 1921.

1,657,932. Electric Heater; P. Kukec, Chicago, Ill. App. filed July 12, 1927. Which may be installed in a boiler for generating steam.

1,657,933. Electrical Connecter; W. E. Lindsley, Brooklyn, N. Y. App. filed Feb. 15, 1927.,

1,657,948. Process in the Employment of Self-Baking Electrodes; J. Westly, Kristiansland, Norway. App. filed Jan. 5, 1925.

1,657,969. Electrical Cut-Off; E. W. Moon, Youngstown, N. Y. App. filed April 16, 1926.

1,657,970. Cone Coupling for Electrical Cables; E. Politi, Milan, Italy. App. filed Nov. 2, 1925.

1,658,010. Electric Switch; S. E. Skinner, New Britain, Conn. App. filed June 18, 1923. Switch having a plurality of terminals and means for electrically connecting the terminals in various combinations.

1,658,013. Mercury Switch; R. W. Armstrong and I. E. McCabe, Chicago, Ill. App. filed Dec. 16, 1922.

(Issued Feb. 7, 1928)

1,658,028. Armature Actuating Mechanism for Magnetos; P. Brown, Springfield, Mass. App. filed Jan. 28, 1928.

1,658,056. Electric Pressing or Forging Machine; G. H. Phelps, Warehouse Point, Conn. App. filed April 20, 1923.

1,658,071. 1,658,072. Electric Furnace; J L. Bernard, Beaver, Pa. Apps. filed Dec. 15, 1926. In which the tops or roofs may be removed for charging.

1,658,142. Electric Dry Battery; K. Stamm, Berlin-Dahlem, Germany. App. filed Feb. 9, 1925. In which the electrolyte is stored in a separate closed vessel of breakable material.

1,658,158. Device for Automatically Disconnecting Electric Circuits; O. Dreyer, Essen-on-the-Ruhr, Germany. App. filed July 4, 1925. In case of an overload.

1,658,160. Battery Terminal Clamp; C. Fisher, Chicago, Ill. App. filed March 24, 1927. For storage batteries.

1,658,194. Signal; R. S. Harter, West Nanticoke, Pa. App. filed March 24, 1924. For use at street crossings.

1,658,206. Lighting Fixture; G. Matthyssen, Inglewood, Calif. App. filed Oct. 22, 1925.

1,658,222. Electrocleaning; R. M. Burns, Brooklyn, N. Y. App. filed Feb. 10, 1925. Method of electro-cleaning metals.

1,658,237. Auxiliary Socket Connection; C. E. Godley, Detroit, Mich. App. filed Feb. 28, 1925. Means for affording a circuit connection from a wire terminal of a lamp socket or the like.

1,658,238. Compartmental Lamp; C. E. Godley, Detroit, Mich. App. filed Feb. 24, 1926. Means for partitioning the lamp casing, for supporting the lamp bulbs and for affording controlled circuit connections to the several bulbs.

1,658,242. Controller for Electric Motors; R. B. Hunter, Shorewood, Wis. App. filed July 6, 1926. For motor operated woodworking machines.

# New Trade Literature

LIGHTNING ARRESTERS. The Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, is distributing booklet No. 246, the second of a series of booklets describing the technical features of the crystal valve lighting arrester as they apply to modern lightning protection.

MOTORS.—Bulletin No. 202 issued by the Reliance Electric & Engineering Company, Cleveland, describes and illustrates the type T, heavy-duty Reliance motors for direct-current with ball and roller bearings. The bulletin is well illustrated and covers the advantage of ball and roller bearings in the motors.

BOILER.—The Edge Moor Iron Company, Edge Moor, Del., has issued catalog No. 65 describing the Edge Moor cross drum boiler and giving the principal facts concerning it. The catalog contains a description of the operation and performance of the boiler and also contains many photographs illustrating both the design and the construction. Included at the end of the catalog are the suggested rules for the care of power boilers embodied as section 7 of the A. S. M. E. boiler construction code.

WATER COOLING EQUIPMENT.—The Cooling Tower Company, Inc., 15 John Street, New York City, is distributing bulletin No. 278, entitled "Cooling Water in the Modern Power Plant."

RAILROAD TURNTABLES. — Bulletin GEA-890 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its alternating and direct-current railroad turntables.

CABLE AND OUTDOOR STATION EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-923, covering its impregnated paper-insulated cable. The company is also distributing bulletin GEA-856, describing and illustrating its type FA-1 disconnecting switches for outdoor station equipment.

VALVES.—Bulletin No. 89 issued by the Wellman-Seaver-Morgan Company, Cleveland, describes the Wellman "Supertest" gate and globe valves. Complete dimensional data on the various types are included.

CRANES. — The Whiting Corporation, Harvey, Ill., has issued bulletin No. 179, covering the operation and maintenance of Whiting electric cranes. Various illustrations show the construction of the different types of cranes.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Hamburg, Germany (No. 29,577), of dishwashing machines.

Purchase is desired in Dresden, Germany (No. 29,602), of heaters, space, industrial; and ventilating equipment.

Purchase and agency are desired in Rome, Italy (No. 29,519), for heating and cooking equipment.

An agency is desired in Vancouver, Canada (No. 29,521), for household appliances.

Purchase is desired in Hamburg, Germany (No. 29,577), of refrigerators and electric shoe-shining machines.

Purchase is desired in Seville, Spain (No. 29,605), of wiring devices and electrical installations.

Purchase and agency are desired in Turin, Italy (No. 29,530), for air compressors, all types.

Purchase is desired in Dresden, Germany (No. 29,602), of furnace control instruments.

An agency is desired in Sao Paulo, Brazil (No. 29,514), for pumps, centrifugal and turbine outfits and smaller water turbines.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## The South's Rapid Increase in Customers

LIKE every other measure of the growth in the use of electricity in the United States, the number of consumers has shown an uninterrupted increase since the beginning of incandescent lighting, about 45 years ago. The first recorded count on a national basis was that of the census of electric light and power companies in 1907, a quarter of a century after the erection of the first plant. The number reported for that date was 1,946,979. Five years later it had increased by 97 per cent; the number added during the half decade ended with 1912 lacked but a trifle of being equal to the entire clientele acquired during all previous years. From 1912 to 1917 there was another huge increase, far greater numerically than between 1907 and 1912, but the ratio was somewhat smaller; it mounted to 87 per cent. This condition has continued: each five-year period has shown a larger numerical but smaller percentage than the one before: from 1917 to 1922 it was 77 per cent, and from 1922 to 1927 it was 71 per cent. Thus, as the residential users, who constitute about four-fifths of the entire number, come to approach—and in some localities to exceed—the number of families, it is to be expected that the increase will occur in successively smaller steps, not only relatively but absolutely. This apparently is already happening; for the past two or three years the annual gains, as closely as they could be determined by a careful survey, have been growing smaller. This is not surprising in view of the circumstance that the residential customers are already 63 per cent as numerous as the families in the United States as a whole, and in certain regions greatly exceed that ratio.

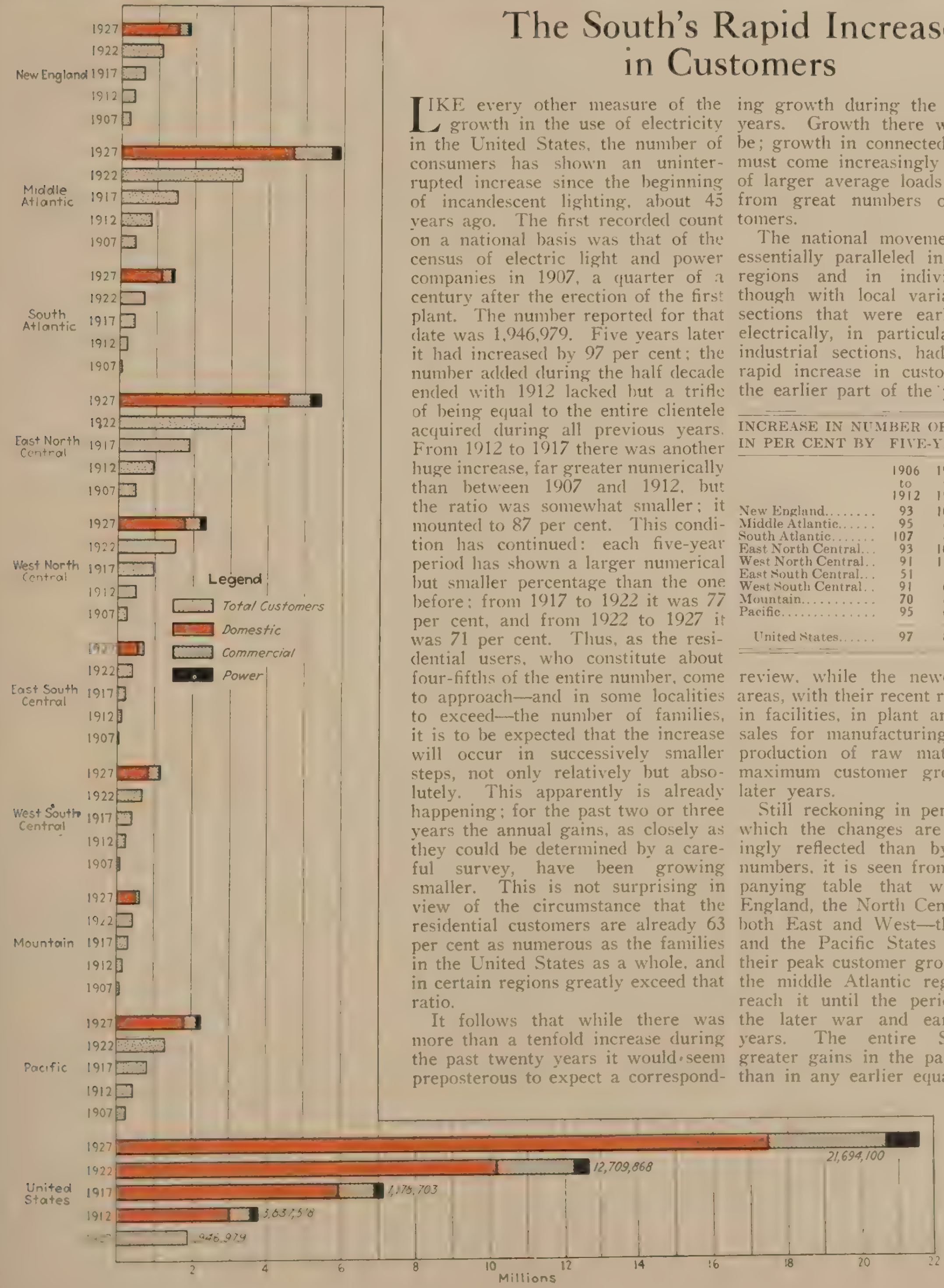
It follows that while there was more than a tenfold increase during the past twenty years it would seem preposterous to expect a corresponding growth during the next twenty years. Growth there will certainly be; growth in connected load, but it must come increasingly in the form of larger average loads rather than from great numbers of new customers.

The national movement has been essentially paralleled in the several regions and in individual states, though with local variations. The sections that were early developed electrically, in particular the older industrial sections, had their most rapid increase in customers during the earlier part of the period under review, while the newer industrial areas, with their recent rapid increase in facilities, in plant and in energy sales for manufacturing or for the production of raw materials, show maximum customer growth in the later years.

INCREASE IN NUMBER OF CUSTOMERS IN PER CENT BY FIVE-YEAR PERIODS

| | 1906 to 1912 | 1912 to 1917 | 1917 to 1922 | 1922 to 1927 |
|---|---|---|---|---|
| New England........ | 93 | 107 | 77 | 69 |
| Middle Atlantic...... | 95 | 85 | 112 | 83 |
| South Atlantic....... | 107 | 85 | 93 | 115 |
| East North Central... | 93 | 100 | 79 | 63 |
| West North Central.. | 91 | 119 | 58 | 43 |
| East South Central... | 51 | 72 | 90 | 91 |
| West South Central.. | 91 | 67 | 62 | 93 |
| Mountain........... | 70 | 85 | 32 | 37 |
| Pacific.............. | 95 | 61 | 71 | 67 |
| United States...... | 97 | 87 | 77 | 71 |

Still reckoning in percentages, by which the changes are more strikingly reflected than by the actual numbers, it is seen from the accompanying table that whereas New England, the North Central States—both East and West—the Mountain and the Pacific States had reached their peak customer growth by 1917, the middle Atlantic region did not reach it until the period including the later war and early post-war years. The entire South made greater gains in the past five years than in any earlier equal period.



*Customers by geographical divisions*

# 1927 Industrial Operations in the New England States 3 Per Cent Over 1926

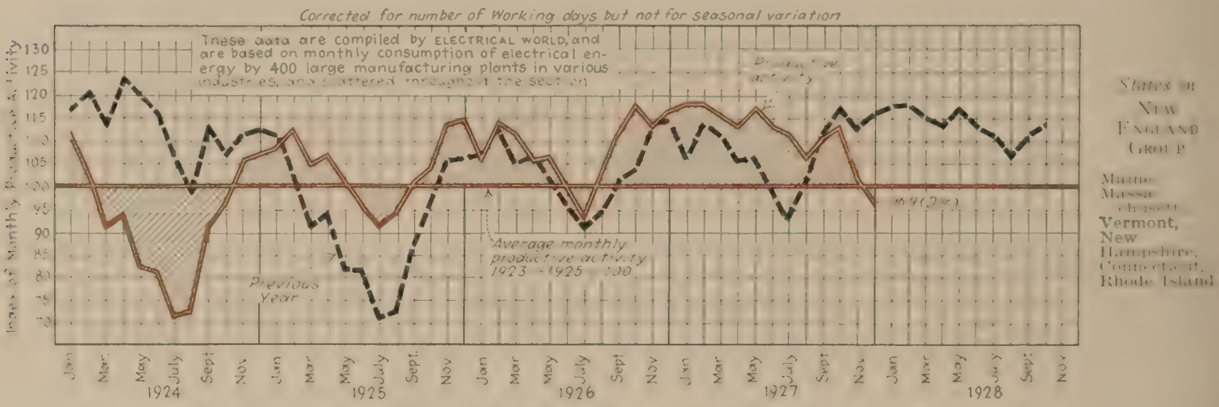
REPORTS on the consumption of electrical energy by the manufacturing plants operating in the New England States indicate this was one of the few sections of the nation witnessing increased general industrial operations during 1927 as a whole, with an average monthly rate 2.9 per cent over 1926. This favorable condition was largely due to continued high rates of activity of the textile mills during the first ten months, reaching the peak in July, when operations were about 20 per cent over those recorded during July, 1926. The year closed, however, with textile operations about 19 per cent under July and 22 per cent under December, 1926, which influence resulted in an index of general industry during December about 17 per cent under December, 1926.

Compared with 1926 only two of the primary industrial groups—textiles and paper and pulp—reported a higher monthly average and only one—metals—closed the year 1927 on a higher plane. So that while the average monthly operations of New England industry as a whole during 1927 were over those of 1926, conditions in many of the individual industries during a large portion of the year were far from satisfactory.

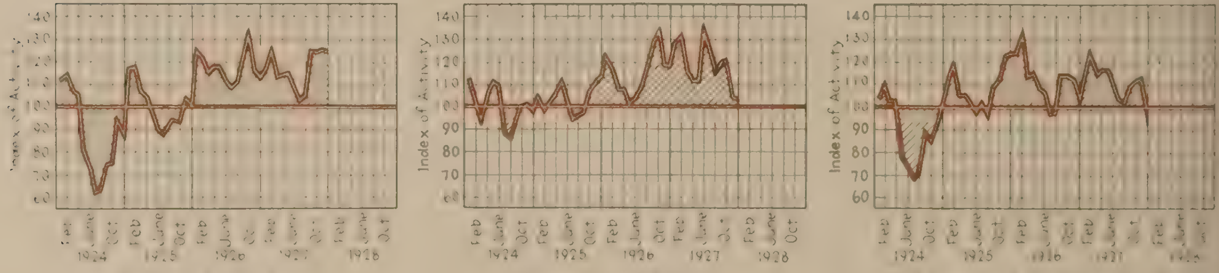
*Indexes of Productive Activity in the New England States*
(All Figures Adjusted for Number of Working Days)

| | Dec., 1927 | Nov., 1927 | Dec., 1926 | Average for Full Year 1927 | Average for Full Year 1926 |
|---|---|---|---|---|---|
| All industries | 96.9 | 101.2 | 116.0 | 111.0 | 107.8 |
| Chemical and allied products | 88.8 | 92.2 | 97.8 | 112.6 | 118.7 |
| Leather and its products | 87.8 | 98.0 | 93.7 | 95.0 | 96.0 |
| Lumber and its products | 87.0 | 114.5 | | | |
| Metal industries group | 124.2 | 125.3 | 113.0 | 117.2 | 117.8 |
| Paper and pulp | 100.9 | 102.1 | 118.2 | 117.8 | 115.[illegible] |
| Rubber and its products | 93.2 | 112.0 | 101.5 | 110.7 | 111.5 |
| Textiles | 94.2 | 99.0 | 120.6 | 112.4 | 107.4 |

ELECTRICAL WORLD *Barometer of Industrial Activity in the New England States*



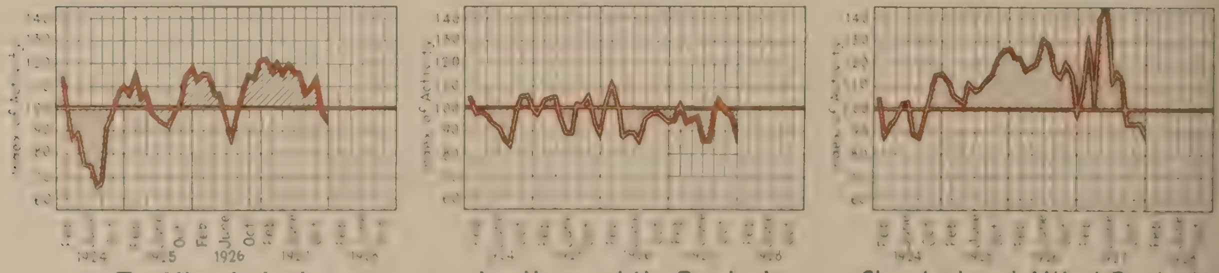
GENERAL INDUSTRIAL ACTIVITY IN THE NEW ENGLAND STATES



Metal Industries

Paper and Pulp

Rubber and its Products



Textiles Industry

Leather and its Products

Chemical and Allied Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NEW ENGLAND STATES

# Electrical World

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W. H. ONKEN, JR.
*Editor*

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## *Now for Defense and Vindication*

TO THE Federal Trade Commission has been given the task of investigating public utility and closely allied corporations. Senator Walsh's proposal for a senatorial inquiry has been denied and the industry spared the invective and calumny which the three-day debate in the Senate indicated would surely be heaped upon it had the original measure passed. Factual rather than sensational information ought, therefore, to be in order, and while the trade commission will be under pressure, the case against the utilities will, we have a right to expect, be conducted along judicial lines and not along the lines of prosecution. This outcome of the matter should be an occasion for congratulation but not for rejoicing, for the industry will be subjected to searching inquiry, and the desire of the commission to bring out all the facts will inevitably elicit much irrelevant, biased and misleading testimony which will be read by many who will not read that on the other side.

It is regrettable that passion instead of reason marked the debate in the Senate on the resolution and Senator George's amendment to it. Those who argued to place the investigation in the hands of the Federal Trade Commission were accused by inference of being bought by utility money; the trade commission itself was charged with incompetency and said to represent "big business" only, and as for the executives and others of the utility industries involved, they were all lobbyists. For three days the Senate debated without bringing out one constructive thought or any good reason, for that matter, why there should be an investigation at all. Senator Walsh presumably held back information, hoping at a proper time to startle the country. Others cluttered up the record with statistics on the comparative rates of municipal and privately owned generating stations, as though rates had anything to do with the question or even came within the purview and constitutional scope of the national government.

Obviously, from a utility angle the situation was anything but reassuring, and the Senate did well, in vindication of itself as well as in justice to the utilities, to turn the matter over to the Federal Trade Commission. There the complete story may be told—to a gathering, not partial to be sure, but at any rate to one not prejudiced —and the record can speak for itself. The utility companies of this country have made wonderful social and economic contributions—too great in fact to be ignored or lightly set aside. They are entitled to a fair hearing, and the submission of their case to the Federal Trade Commission would indicate that the Senate of the United States means that the utilities shall have it. When the case will end and what the final judgment is to be will be revealed in due season. The verdict should be one of exculpation and reassurance. No other outcome is thinkable if the case of the public utility companies is properly presented.

* * * *

## *High Lights of the A.I.E.E. Winter Convention*

GREATER interest even than usual was attracted to the winter convention of the American Institute of Electrical Engineers last week by the epochal joint radiotelephonic meeting with the British Institution and the presentation of both the Edison and the John Fritz medals. But even without these events the meeting would have ranked high among technical gatherings of recent years, and the Institute and the convention committee are to be congratulated upon it. No convention in the electrical industry has more value than this both to engineers who desire to be informed of current principles and practices and, in the case of some of the sessions, to men outside the fraternity, who can profit by the knowledge and force with which the engineers discuss many economic problems.

The meeting on interconnection was outstanding. The papers and discussions were good and many sound principles were stated, including words of caution about embarking upon schemes of interconnection without first making careful economic studies and hints that many interconnections cost more than they saved. Interconnection is a guarantee of service and is an insurance reserve which meets, for a minimum cost, the necessity for giving better electric service. But it costs money to improve service standards, and loose talking can be corrected if this fact is better understood. In the realm of lightning a good operating paper was presented by Philip Sporn, and Doctor Norinder gave hints of further technical progress. The instrument developed by Doctor Norinder apparently has many advantages for field surveys and, if used in this country, should bring out facts that will enable engineers to deal with insulation in tangible terms. Aside from some ideas of voltage magnitude, however, lightning still baffles the industry. Machinery and communication papers showed a steady advance in the art. The lecture of Doctor Swann and several scientific papers proved valuable and interesting. One of the encouraging trends was to find that engineers are attempting to discard the infinitesimal or mathematical method of analysis in favor of a basic work-and-energy approach to their problems. This means more complication, but the method deals with realities and not with assumptions made to satisfy the Maxwellian equations.

## *Two Coveted Medals Are Worthily Awarded*

BESTOWAL of the John Fritz medal upon General J. J. Carty of the American Telephone & Telegraph Company and of the Edison medal upon Dr. W. D. Coolidge of the research laboratory of the General Electric Company has met the hearty indorsement and approval of engineers and scientists everywhere. Few men have worked harder or longer in the service of electrical science than Carty and Coolidge, and although they labored in different fields, the first in telephony and the second in electrical research, both were worthy recipients of the great honor conferred on them.

As an original research worker and inventor Doctor Coolidge stands in the front rank of scientific men. While he has done magnificent work with the medical X-ray and high-voltage vacuum tube, he is probably best known to the world and to American electrical engineers in particular for his work on incandescent electric lamps with ductile-tungsten filaments. Nor is the Edison medal the only honor bestowed on him. Others besides the American Institute of Electrical Engineers have recognized his work. The Rumford medal was awarded him in 1914, and in 1926 he received the Howard N. Potts medal, and the Louis Edward Levy gold medal. Last year the Royal Society of London honored him with the Hughes medal and the American College of Radiology gave him a gold medal. Thus he is not a prophet without honor in his own country and in others.

Of the two medalists General Carty is the better known. As the organizer and head for many years of the great technical staff of the still greater American Telephone & Telegraph Company, General Carty has been responsible for the superior excellence of American telephone service. He is primarily an organizer, having inherited some of the stupendous ability of the late T. N. Vail, than whom telephony had no keener or greater leader. Honored by his own as well as by foreign governments, given doctor's degrees by nine colleges and universities, and possessing three medals in addition to that bearing the name of John Fritz, General Carty's standing in the world is firmly established. His work with the American Expeditionary Forces during the World War was of extraordinary value in organizing and maintaining the communication service that was such a vital factor in America's contribution to victory.

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## *Analysis of Disturbances Suggests Remedy*

ELIMINATION of transmission-line interruptions comes nearer to reality every time that an operating company makes a thorough study of its disturbances, analyzes the causes and endeavors through exchange of experience to prevent their recurrence or minimize their effects. A few such reports have been made public in the last year or so, notably those by Philip Sporn of the American Gas & Electric Company and J. G. Hemstreet of the Consumers Power Company.

When more companies overcome the fear that discussing interruptions will ruin their business and develop the courage to throw their experiences into a common melting pot, the day will be hastened when interruptions will not be considered so serious a problem. Such reports will help to confirm or disprove some of the ideas which have been developed, theoretically or in the laboratory. They will also bring forth factors that might otherwise be overlooked. In this field of investigation, as in others, the majority of companies should not expect to sit back and profit from the work of a few pioneers. To those who view the situation in perspective investigations behind closed doors usually result in retarded progress.

In the most recent report by Mr. Sporn (abstracted on page 411 of this issue) it is pointed out that experience has led to: (1) An extensive program of ground-wire installation with an increase in the number of such conductors at the terminals of lines to reduce the surge impedance from the last tower to the bus; (2) increased insulation of the line conductors except within a mile or so of the terminals, where the insulation is reduced to make certain that the insulating value of the station apparatus equals or exceeds the flashover value of the adjacent line insulation; (3) avoidance of tower extensions where feasible, or at least a net reduction in the average height of spans to minimize induced charges, and (4) more attention to arcing-protection arrangements, with a view to minimizing effects of conductor vibration on the protection assembly.

Conclusions from his former report have been confirmed, namely, that necessity exists for establishing a balance between tower height, span, lightning voltage, conductor spacing, insulators per string, insulation on terminal apparatus and clearances to ground; that lines of 44 kv. and over should have a ground wire unless the ground resistance is very high; that in no case should a ground wire be dismissed without consideration; that on high towers it is necessary to provide arc-protecting devices, and that lines should be so designed and relayed as to permit prompt disconnection in case of trouble.

Imagine the progress which could be achieved if more investigations of equal thoroughness were made and reported. For such studies adequate recording apparatus and means of checking the causes of any trouble are essential.

* * * *

## *Unshackle the Hands of the System Operator*

MANY valuable papers on technical and operating phases of interconnection have been presented by various authorities at various times and places. Probably not much new has been said on the subject in the last year. Nevertheless the symposium on energy interchange and the discussion which ensued at the winter convention of the A.I.E.E. last week deserve careful reading for several reasons. They stress the operating experiences, practices and problems, as distinguished from the technical phases, and thereby give attention to that side of the interconnection which if it be not successfully handled nullifies all plans and aspirations. They make available in one place the thoughts and experiences of more than a dozen authorities in the utility field. Better than one or two viewpoints, they enable any one to orient the relative importance of different problems.

By inference—but emphasis was needed—the fact was brought out that the most attractive paper plans for taking advantage of all species of diversity to minimize reserve capacity, stagger construction, provide emergency power and effect operating economies go for naught unless the operating man is able to cope with the various operating contingencies, contractual limitations, legal and political handicaps which at present arise on every hand. Charles L. Edgar apparently supported this view when he said, "Load dispatching is the heart of successful interconnection." With interconnection of financially independent systems there must be a give-and-take attitude in all relations, otherwise the aggregate benefits will not approach those possible under single management. W. E. Mitchell, P. M. Downing and H. B. Gear implied as much in their remarks. Proofs of this contention have become evident wherever interconnected systems have changed their attitude from that of self-interest to that of group interest.

When A. C. Marshall expressed a hope that interconnection agreements could be developed "that would not require joint interpretation by a Philadelphia lawyer and a Schenectady engineer," he voiced a widespread need for reform in interchange contracts. To this comment might be added the unwritten opinion of many load dispatchers—that most interconnection contracts are unworkable or at least serious deterrents to the realization of possible economies. Maintenance of service reliability on interconnected systems frequently operates against obtaining maximum economies, and for this reason further obstacles in the form of complicated or ironbound contracts should not be wedged into the already difficult task of system operators.

With the variety of interconnections which have been in operation for some time, there should be available experience which, if compiled, will give the answer to some operating problems still imperfectly handled. But the solution will not be forthcoming quickly unless engineers, operating men and executives individually present their problems and then jointly and frankly discuss their possible solution.

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## *Voices Across the Sea*

IN THE words of President Archibald Page of the Institution of Electrical Engineers at its joint meeting with the American Institute of Electrical Engineers on Feb. 16, during the winter convention of the latter, we are living in an age of "extraordinary progress." We are accustomed to this idea perhaps, but President Page could emphasize it with good reason on this occasion. Rarely has there been seen so vivid an example of the triumph of engineering skill and enterprise over the difficulties caused by our ignorance of nature's hidden secrets as was presented when at this meeting, by means of radio-telephonic communication, there were linked not only two continents, but two bodies of engineers in a joint meeting which offered freedom and easy means for mutual technical discussion.

O. B. Blackwell's lucid review of the essential elements in this latest triumph in the art of communication, made just before the transatlantic session, could not in its brief extent cover the multiplicity of examples of ingenuity and skill represented in the various special apparatus and combinations of electric circuit, any one of which could be held up for special admiration. But in such features as the use of long and of short waves to meet nature's changing conditions and the acoustic cutout for preventing interference between the sending and receiving stations on each side of the Atlantic, and in the economies in sending energy gained by single side-band transmission for the long waves and the special focus for a receiving antenna for the short waves, his description revealed a fine example of engineering research of the highest type.

Sir Oliver Lodge, speaking from London, pointed out as an essential element in all successful long-distance radio communication "nature's bounty" to man in confining the ether waves to a comparatively shallow envelope about the earth, rather than radiating them into space. Without this circumstance it is probable that this remarkable new means of interchange across the ocean would not be possible. It is not so long since electrical engineers assembled in a somewhat similar meeting to celebrate successful telephonic communication across our continent. What will be celebrated next? It is no great stretch of imagination—it is in fact a reasonably certain bet—that very soon men will not only hear one another in joint meeting across the Atlantic but will look into one another's faces as they speak.

When joint sessions of such widely separated gatherings are extensively feasible what a wonderful power will be available for removing the misunderstandings that now result in international friction and constantly tend to cause war!

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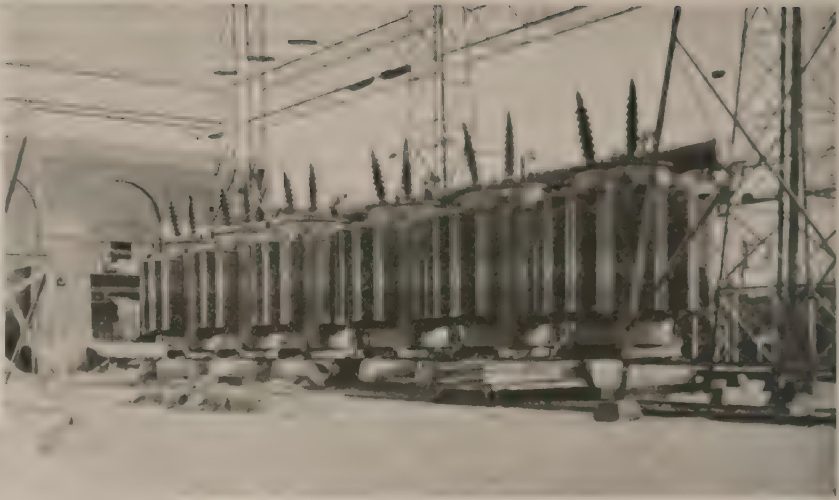
## *The Significance of the Harvard Advertising Award*

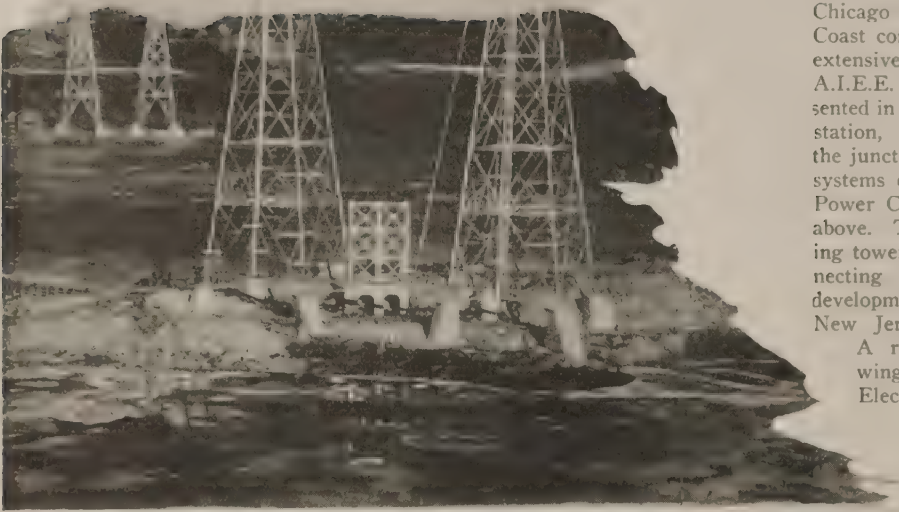
AWARD of the Harvard medal last week to James H. McGraw, publisher of the ELECTRICAL WORLD, "for distinguished contemporary service to advertising" should be of more than passing interest to electrical men. True, the electrical industry has never ranked among the larger employers of advertising, as a glance at the popular magazines of the day will attest. The romantic records of advertising have been written for the most part in terms of those commodities that have battled their way into the public fancy through spirited competitive selling, while electricity has prospered so far largely by the inherent appeal of this new service that has offered man so many obvious benefits not otherwise obtainable.

But electrical men are passing now into a new era in which their minds will more and more turn to the arts of marketing, among which that printed salesmanship called advertising is so important. Fortunate it is that so much knowledge has been amassed in the advertising experience of other fields within the last two decades. With its period of growth by the accumulation of customers drawing to a close, the electrical industry now enters the marketplace to joust for a larger share of the consumer's dollar. In the modern practices of advertising it will find a sturdy shield and a well-tried lance ready to hand.

Mr. McGraw has been a pioneer in the development of the art of advertising in the electrical industry from the time that he acquired the ELECTRICAL WORLD, back in 1899. The industry then consisted of an unrelated and scattered group of small shops, factories and power houses. His fourteen publications have been a progressive force in many industries. They have worked for the elimination of unethical and uneconomic practices. By the study of industry's buying habits and the effective forms of marketing organization needed for industrial products they have done much to clarify industry's own appreciation of the requirements of industrial marketing, as contrasted with the development of sales to the private consumer. It was for his leadership in this creative service that the Harvard medal was awarded to Mr. McGraw.

# *Interconnection—A Major Topic at Institute Convention*





EXPERIENCES with energy interchange in the Southeast, in Pennsylvania-New Jersey, in the Chicago district and on the Pacific Coast constituted the subject of an extensive symposium before the A.I.E.E. last week and are presented in this issue. East Point substation, near Atlanta, serving as the junction point for tie-lines from systems contiguous to the Georgia Power Company, is shown in part above. To the left are river-crossing towers for the 220-kv. lines connecting Conowingo hydro-electric development with the Pennsylvania-New Jersey interconnection loop. A recent view of the Conowingo plant of the Philadelphia Electric Company is below.

# A·I·E·E· Winter Convention

## *in New York*

MEASURED by attendance, the communication session of the winter convention of the American Institute of Electrical Engineers, held in New York City, Feb. 13-17, was the most popular, due undoubtedly to the joint session with the British Institution of Electrical Engineers conducted by means of transatlantic radio telephony.

From a purely technical point of view, however, the symposium on interconnection experiences really commanded the most attention, so that very lengthy excerpts from the papers are presented on pages 403 to 409, while the high points of the discussion may be found on page 396. The interest at other sessions centered chiefly around dielectric and lightning studies, automatic and supervisory control, automatic synchronizing and improvements in turbo-generators. Abstracts of all the papers are presented in this issue, as are also the major points developed in the ensuing discussions.

The ceremony at which the Edison and John Fritz medals were presented to Dr. W. D. Coolidge and Gen. J. J. Carty respectively and the customary dinner dance at the Astor constituted two of the formal occasions.

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## Control, Protective Equipment and Substations

### *Protection of Supervisory Control Lines Against Overvoltage*

Edward Beck, Westinghouse Electric & Manufacturing Company.

Supervisory control lines used in the remote or automatic control of electric plants are subject to overvoltages dangerous to insulation and to operators. These overvoltages may be caused by lightning, crosses with the power lines, or induction from them. Cables with grounded sheaths are immune to disturbances caused by lightning or other electrostatic induction, and are more or less safe from crosses. However, the ordinary cable is still subject to high voltages by electromagnetic induction when a fault occurs on the power line in which it is included.

Even if apparatus locations are protected, high voltages may occur along the line and cause cable failure unless the cable is protected at intervals. Discharge currents of the order of 50 amp. for two seconds can be handled by a spark gap inclosed in argon under less than atmospheric pressure. Specially made cables will shield the line against extraneous disturbances.

### *Vacuum-Tube Synchronizing Equipment*

T. A. E. Belt and N. Hoard, General Electric Company.

Potential from high-voltage circuits is obtained by means of capacitance transformers. This potential is applied to the grid circuit of vacuum-tube amplifiers, the output from which drives a rotating type of synchronoscope. Thus the vacuum-tube synchronizing equipment makes unnecessary costly high-voltage transformers, which have been almost universally used for synchronizing in the past. The capacitance transformer does not affect the electrical characteristics or functioning of the high-voltage bushing in which it is mounted. The ratio is constant under changes in weather conditions. The ratio of the capacitance transformer is not affected by voltage change of the system; it changes with decrease in shunt resistance, but is negligible with a decrease in resistance down to 300,000 ohms. The normal leakage resistance of the capacitance transformer is approximately 100 megohms, and therefore the ratio, which is 0.05 per cent at 50 cycles and 0.04 per cent at 70 cycles, may be considered independent of frequency. The phase-angle shift changes slightly with change in frequency, being 2.75 deg. at 60 cycles, 2.4 deg. at 70 cycles and 3.3 deg. at 50 cycles with a 600,000-ohm shunt resistance.

### *Automatic Control of Edison Systems*

O. J. Rotty, Union Electric Light & Power Company, and E. L. Hough, General Electric Company

The St. Charles Street substation of the Union Electric Light & Power Company has been operating fully automatic for somewhat over a year very successfully. In practically every case of system disturbance the automatic control appeared to function correctly. In one case particularly, when the Keokuk transmission circuits were completely disabled by a tornado and the load thus released was suddenly thrown on the steam plants, this control gear operated admirably over a wide range of frequency and alternating-current voltage and through severe direct-current load fluctuations until the system was again stabilized. At the time of the disastrous tornado of Sept. 29, 1927, none of the machines at St. Charles Street even dropped its load, although the a.-c. system was subjected to many severe short circuits and grounds. Increasingly complicated operations will be controlled automatically with still greater reliability in the future, according to the authors.

### *Lightning Experience*

Philip Sporn, American Gas & Electric Company.

Performance of different sections of 132-kv. line reduced to a common basis, changes in tower design, work done to reduce lightning troubles at stations and efficacy of ground wire are related by the author. An extensive excerpt will be found on page 411.

### *Use of Condenser-Type Bushing in Synchronizing*

E. E. Spracklen, Ohio Public Service Company; D. E. Marshall and P. O. Langguth, Westinghouse Electric & Manufacturing Company.

Describes apparatus recently developed for utilizing the charging current of a condenser bushing in operating a synchroscope. Operating data are given covering different conditions of frequency, voltage, etc. The voltage characteristic is practically a straight line regardless of burden. Phase-angle error is practically constant with variation in line voltage. Practically constant ratio is obtained for a given frequency. The more resistive secondary burdens flatten out the voltage-frequency performance. The power factor of the burden appears to have little effect on voltage performance, however power-factor change affects the frequency-voltage characteristic. The phase-angle variation with temperature change is negligible. The voltage variation amounts to 2½ per cent for a burden of 15-volt-amp. at 50 and 60 cycles. Although considerable distortion is obtained in the capacity circuits, the reactor smooths out all variations and produces a very good wave form in the secondary current through the burden. The burden voltage drops with change of frequency above and below rating, the change being greatest for the heavier burdens. When two condenser-bushing potential devices are used for synchronizing the phase-angle error with change in frequency is about 2½ deg. for departures from rating of 7½ cycles.

JUDGING by the amount of discussion at this session the interest was about equally divided between protection of supervisory control circuits, lightning experience and new substitutes for the customary synchroscope coupling. Considering automatic control of Edison systems in St. Louis, Herman Bany contended that removing the batteries there indicates that automatic switching gives sufficient service reliability.

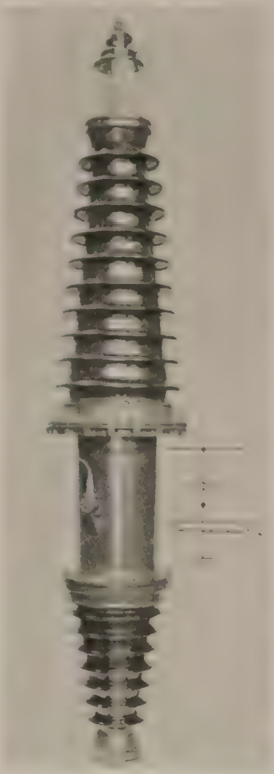
H. L. Wallau reported that automatic selection of buses is being employed with the synchronous converters in the latest Edison substations of Cleveland, but that no serious disturbance has occurred to test their functioning.

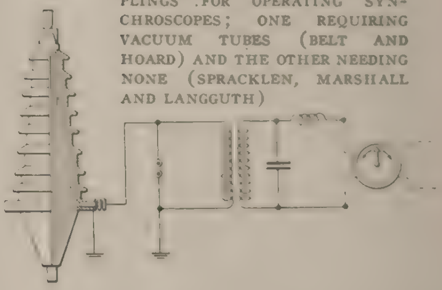
Opening the discussion on supervisory control protection, V. Boyd referred to an installation in Ontario of two control cables paralleling 44-kv. lines about 3 miles in which effective protection has been afforded by grounding each supervisory conductor through the primary of a transformer the secondary of which is connected to a supervisory equipment.

Chester Lichtenberg, pointing out that the success of supervisory control is predicated on continuous availability, declared that insulating transformers must be used when direct-current impulse and holding-coil currents are used on supervisory conductors paralleling high-tension lines. Choke coils will check electromagnetic disturbances and lightning arresters must be self-restoring. Power lines using carrier current for supervisory control have been protected on the Chicago South Shore Railroad by using pellet-type arresters, high-tension fuses and drainage coils.

C. Antoniono warned against the danger of power lines coming in contact with the lead sheath of supervisory cables, saying that the reliability of supervisory control is even more important than that of communication. A supervisory control line on the Chicago, North Shore & Milwaukee Railroad composed of both cable and aerial conductors and paralleling both 2,300 and 132,000-volt lines is protected by periodically spaced lightning arresters on the exposed sections, at each end of the cable, and by fuses in each circuit. Lightning has been found to cause most of the troubles experienced.

Alfred Herz declared that pilot-wire systems must also be protected against lightning. Mr. Beck, the author of a paper, closed by emphasizing the need of making ground resistance as low as economical.





TWO TYPES OF BUSHING COUPLINGS FOR OPERATING SYNCHROSCOPES; ONE REQUIRING VACUUM TUBES (BELT AND HOARD) AND THE OTHER NEEDING NONE (SPRACKLEN, MARSHALL AND LANGGUTH)

W. A. Kates declared that reputed effectiveness of arc-protecting devices is often minimized by the fact that there has not been sufficient segregation of the supporting data to make the conclusions convincing. Too infrequently are data collected on frequency and intensity of electrical storms and the basis for determining causes of outages is often superficial.

A. O. Austin submitted a discussion of some length, commenting chiefly on the value of ground wires. He also emphasized that performances of lines cannot be compared on a simple unit basis without taking into account clearances, intensity of storms, etc. Ground wires, he declared, reduce the stored potential in the protected conductors 30 to 40 per cent, so that the effect of a disturbance may spread farther beyond its sources than in the case where the stored potential is of great enough magnitude to dissipate itself rapidly through corona loss. Curves were presented indicating the relation between induced voltage and distances from disturbances with and without ground wires.

H. B. Vincent expressed the opinion that it would be interesting to hear how well arc-protecting devices guard insulators during surges; disturbances may never interrupt service and still damage porcelain.

Closing the discussion on lightning experiences, Mr. Sporn advised that the U. S. Weather Bureau has discontinued recording the frequency of lightning storms because it has found that new records merely corroborate what years of collected data have indicated. Consequently, utility operators can learn much about lightning in their territories by examining past lightning records of the bureau. In determining the causes of outages, the speaker pointed out that logs of interruptions are checked against relay records before deciding whether the cause of interruption was as indicated. Klydonograph records have indicated that no insulators designed for 1,100,000 volts flashover will break down as low as 400,000 volts even with oscillatory wave fronts such as suggested by Mr. Austin. Some grounding points on lines have been omitted with very satisfactory results, although the omissions were made for economy and not for the reasons suggested by Mr. Austin.

PORTION OF LOADING SEQUENCE CHART FOR ST. CHARLES STREET SUBSTATION (ROTTY AND HOUGH)

| Load on Machine (Amp. at 250 Volts) No. 8 | No. 12 | No. 11 | No. 7 | Total Load on Station | Operating condition |
|---|---|---|---|---|---|
| 1000 | 0 | 0 | 0 | 1,000 | **Minimum load** |
| | | | | | Load increases |
| 8400 | 0 | 0 | 0 | 8,400 | No. 8 gives signal to start No. 12 |
| 7000 | 1400 | 0 | 0 | 8,400 | After No. 12 is on |
| | | | | | Load increases |
| 7000 | 6300 | 0 | 0 | 13,300 | Before No. 12 recalibrates No. 8 |
| 9000 | 4300 | 0 | 0 | 13,300 | After No. 12 recalibrates No. 8 |
| 9000 | 6800 | 0 | 0 | 15,800 | No. 12 gives signal to start No. 11 |
| | | | | | *Etc. up to* |
| 9000 | 7200 | 7200 | 7400 | 30,080 | **Maximum load** |

| Load on Machine (amp. at 250 Volts) No. 8 | No. 12 | No. 11 | No. 7 | Total Load on Station | Operating condition |
|---|---|---|---|---|---|
| 9000 | 7200 | 7200 | 7400 | 30,800 | **Maximum load** |
| | | | | | Load decreases |
| 9000 | 7200 | 3000 | 7400 | 26,000 | Before No. 11 decalibrates No. 12 |
| 9000 | 5200 | 5000 | 7400 | 26,600 | After No. 11 decalibrates No. 12 |
| | | | | | Load decreases |
| 9000 | 5200 | 1000 | 7400 | 22,600 | No. 11 gives signal to shut down No. 7 |
| 9000 | 7200 | 5400 | 1000 | 22,600 | No. 7 reduces load, preparatory to timing off |
| 9000 | 7200 | 6400 | 0 | 22,600 | After No. 7 is off |
| | | | | | *Etc. down to* |
| 1000 | 0 | 0 | 0 | 1,000 | **Minimum load** |

Grading rings on 132-kva. insulators have not been found to increase their flashover value, but arc-protection devices have greatly avoided burning and breaking of the porcelain.

Because of the lateness of the hour very little opportunity was afforded for discussions on the new synchronizing equipment. E. D. W. Eby announced that the vacuum-tube synchronizing device is being compared with the ordinary synchroscope on a 110-kv. system to ascertain the relative accuracies.

Mr. Lund reported that the Metropolitan Edison Company has had very good experience with vacuum-tube synchronizing, even when the capacitance transformer bushing flashed over due to lightning. The apparatus is rather complicated but very reliable, he commented.

Mr. Langguth suggested four general uses for the new condenser type bushing: Synchroscope, frequency meters, voltmeters and relaying.

Mr. Marshall pointed out that a synchroscope can be connected with this bushing and operated without any intervening apparatus except a transformer, reactance, capacitance and a spark gap.

## Electrophysics and Dielectrics

### *Surge Impulse Breakdown of Air*

J. J. Torok, Westinghouse Electric & Manufacturing Company

Describes a phenomenon used to study the development of high-voltage sparkover. It has been found that if a voltage which is more than sufficient to cause breadown of a sphere-gap is applied and then very quickly reduced to a low value luminous streamers are produced instead of the usual intense spark. These streamers, which represent the intermediate stage between the initiation of and actual flashover can be recorded on a photographic plate by the use of a quartz lens. The effect on time lag of flashover, with special reference to the state of ionization of the gas previous to flashover, is also discussed. This method of "suppressed discharge" has also been used to determine the electrostatic field around insulators and between electrodes of various shapes.

### *Approximate Solution for Highly Oscillatory Networks*

E. A. Guillemin, Massachusetts Institute of Technology

The general solution for the slightly damped network is expressed in terms of the undamped solution by means of series expansions. The first part of the paper gives a method for evaluating the complex roots of the determinantal equation, and the second part shows how the expansions of the first part may be correlated with the Heaviside formula to form the complete approximate solution. An example illustrates the application to a simple network.

### *Boltzmann-Hopkinson Superposition Applied to Dielectrics*

F. D. Murnaghan, John Hopkins University

This paper shows that the principle of superposition is a necessary consequence of Maxwell's theory. It goes somewhat further and shows that the principle is valid for any theory which leads to a system of linear differential equations with constant coefficients.

### *Influence of Internal Vacua and Ionization on Cable Life*

Alexander Smouroff and Leo Mashkileison, Electrochemical Institute of Leningrad, Russia

Preliminary results of research show that internal vacua of the order of 350-400 mm. of mercury may appear in a cable under the influence of temperature changes and ionization of air, noticeably lowering the life of the cable. To prevent the dangerous effect of internal vacua the following recommendations are made: (a) Use of chemically stable compounds; (b) arrangement of ducts within the cable to maintain atmospheric pressure; (c) pumping of dry air through ducts in cable to maintain a pressure higher than atmosphere; (d) filling a cable with transformer oil under pressure to compensate volume changes of air in cable.

### *The Earth's Electric Charge*

W. F. G. Swann, Director of Bartol Research Foundation, Franklin Institute.

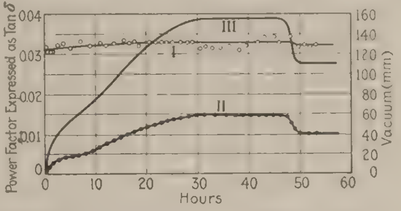
A new theory to account for the earth's magnetic charge was offered in this lecture. It was suggested that a slow death of positive electricity might be taking place on earth, leaving an excess of negative electricity to cause the earth's electrical charge under the influence of rotation. This idea may be incorporated in a consistent scheme of electrodynamics and at the same time provide an explanation of the earth's magnetic field. The theory suggests a possible origin for the known magnetic field for sun spots, and according to one interpretation, the velocity of matter in the sun spots need be no greater than about 80 km. per second in order to provide for the magnetic activity which they exhibit. It appears that the replenishment of the earth's charge could be accounted for satisfactorily by supposing that each cubic centimeter of the atmosphere supplies three electrons per cubic centimeter per second, and that these electrons are of such speed that they can travel a distance of 9 m. in air without absorption.

SUPPLEMENTING Mr. Torok's paper, C. L. Fortescue explained that the streamers in the sphere gap were due to molecular dissociation of the air. He mentioned that all severe lightning discharges may be considered to be of the negative-cloud type.

J. Slepian added that the slowness of ions returning to the cathode, in the case of sphere-gap discharge, constitutes a fundamental difficulty in applying the Townsend theory and that the single passage of the initiatory electron is sufficient to cause breakdown, the trail being highly conducting.

F. W. Peek, Jr., concluded, as a result of early investigations, that time lag is not a constant, but depends upon the rate of voltage rise and that sparkover voltage is different for lightning, needle-point and sphere-gap conditions. He reported that lightning surges always cascade over insulator strings, while 60-cycle impulses may or may not do so, the latter being automatically dissipated by the corona due to gradual application of potential. Horn gaps are not considered to increase spark-over voltages, although arcing rings may do so.

Considering the paper on cable life, William Del Mar suggested that the ability of a cable to absorb large quantities of oil from reservoir joints is possibly a heat-cycle action in which the expanding oil deforms the sheath but on cooling leaves voids, which are gradually filled by capillary action from the reservoir supply. The cables used by Smouroff and Mashkileison were judged to have been low-life specimens, differing considerably from American materials.



CHANGE OF VACUUM AND POWER FACTOR AS RESULT OF PROLONGED LIFE TEST (SMOUROFF AND MASHKILEISON)

(I) Power factor; (II) observed vacua; (III) vacua corrected for parasitical volumes.

C. L. Dawes cited four experimental parameters to be considered: Voltage, frequency, thickness of air space, and pressure. He declared that it is incorrect to "assume the loss angle of the dielectric proper (without air) to have a constant value and neglect the small variations of cable capacity with increase of voltage."

ELECTROSTATIC FIELD AS MODIFIED BY ELLIPTICAL RINGS (TOROK)

W. F. Davidson pointed out that the arrangement used by the authors for the test terminal permits the cable to pick up stray charges and possibly influences the results.

E. H. Salter suggested that the quality of cable used by the authors was apparently inferior to standard American products, judging from the results obtained. He also added that forcing air into and out of the cable specimens produces misleading effects, as in installed cables the quantity of air is unvarying, although the pressure changes with the heat cycles.

L. H. Conlin observed that the flat characteristics obtained in the prolonged life test were due in part to the air path produced in connecting the manometer and that the indicated results were caused by the using up of the oxygen content. Chemically stable compounds are necessary, declared the speaker, only to resist oxidation. The use of transformer oil was discounted for cable impregnation, as light oil, due to low reservoir pressures and rapid losses, will not prevent void formation even at short distances from the joint.

E. S. Lee contended that pressures in cables above atmospheric were conducive to long life, while those below atmospheric have the opposite effect, according to power-factor curves.

R. J. Wiseman added that full saturation is desirable and suggested alternate high and low pressure reservoir joints so that air can be forced to low pressure points and to maintain saturation.

Commenting upon Prof. Murnaghan's paper, V. Bush declared that the principle of superposition depends upon the validity of the assumption that each increment has the same fundamental characteristics.

E. R. Le Ghait stated that a close study of apparent contradictions in the theorem may lead to new light on the materials involved.

O. G. Marti showed that the principle of superposition does not hold unless the linear relation between time and quantities is not exceeded.

J. Slepian felt that undue prominence has been given to Maxwell's theorem of dielectrics and that if small enough voltages are used the quantities will appear to be linear. Dr. Slepian added that many a memoir on the mathematics of physics is vacuous of physics and, so far as the principle is concerned, expressed extreme skepticism on the value of the principle of superposition for obtaining further knowledge regarding dielectrics.

V. Karapetoff, the chairman, added that the situation was "macrocosmomorphic"; that is, built like the big world —in which the viewpoint of finding the unknown in terms of the familiarly surrounding is evidenced.

## Interconnection and Power Development

*Progress and Problems of Interconnection in Southeastern States*

W. E. Mitchell, Georgia Power Company.

*Interconnection and Power Development in Chicago District*

H. B. Gear, Commonwealth Edison Company.

*Conowingo and Philadelphia, with Reference to Interconnection*

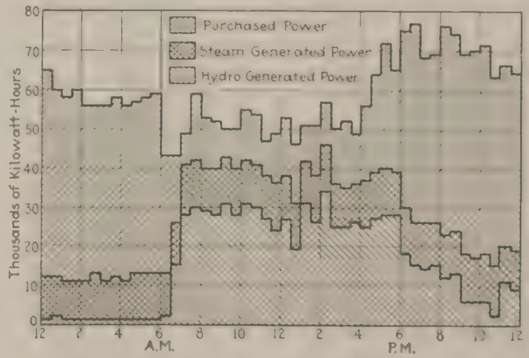
The late W. C. L. Eglin, Philadelphia Electric Company.

*Aspects of Pacific Coast Interconnections*

P. M. Downing, Pacific Gas & Electric Company.

EXPERIENCES with interconnection in the Middle Atlantic States, Southeast, Chicago district and Pacific Coast were ably presented by the authors indicated above, whose papers are abstracted quite extensively on page 403 of this issue. To make the discussion still more embracive of the subject as well as of the talent in the electrical field, nine well-known men in the utility field were called upon.

Charles L. Edgar contended that load dispatching is the heart of successful interconnected operation. Executive as well as engineering problems must be solved. Interruptions from lightning and switch or insulator failure are to be expected until more study is given to minimizing the disturbances caused thereby. Spectacular interconnections like the Chicago-Boston-Pensacola tie are merely demonstrations of the feasibility of parallel operation and possibility of exchanging energy between adjacent systems. But many tie lines have inadequate capacity for great transfer of power. Electrical interconnection, like the Lincoln Highway, merely permits transport between adjacent cities or territories and is not intended primarily for through transport.



INTERCONNECTION IN THE SOUTHEAST PERMITS MOST FLEXIBLE COMBINATIONS OF STEAM, HYDRO AND PURCHASED POWER (MITCHELL)

A. C. Marshall pointed out that the chief benefits of interconnection come from diversity of various kinds: Diversity of daily and annual load, generator capacity, latitude and longitude, construction programs, population, habits of living, industry, etc. Therefore it is impossible to imagine two systems which have identical characteristics, so the value of interconnection is widespread. Executives are chiefly interested in interchange agreements that will not require a Philadelphia lawyer and a Schenectady engineer to interpret.

James Lyman reported that sixteen years experience with interconnection in the Middle West had shown that voltages which were once considered adequate had to be increased to as high as 132 kv. A map of the 66 to 140-kv. lines in the Great Lakes region tells an entirely different story than a map of all the lines. Plots of 132-kv. line characteristics show that power factor influences decidedly the kilowatt-miles that can be transmitted. Ground wires and insulator shielding rings have been found to reduce interruptions considerably. Tie lines rated at 132 kv. and 50 to 60,000 kva. per circuit have been found adequate for the Middle West. Among the possible advantages of interconnection recited were: Availability of power to markets, favorable location of plants, load factor due to diversity, necessity of less generating capacity and reserve, increased reliability, staggered construction, normal and emergency exchanges of power.

Financing of interconnection is no kindergarten problem, declared Farley Osgood. Large investments are needed years in advance of the full income expected. Most rugged construction is essential to reliability of interconnection service and avoidance of duplicated expense. He cautioned his audience to design tie lines for high voltages initially so that they will not have to be scrapped for higher voltages. Rotary condensers were recommended on the customers' premises and favorable rates were urged to encourage their purchase by customers. Elimination of solid ties was suggested as a means of avoiding severe interruptions. High-voltage cable is greatly needed in congested territories. Every possible recording device which will enable studying experiences under abnormal conditions are desirable, as infallible data constitute the only guide to proper procedure. "Let no argument remove any appropriation therefor from the budget," he urged.

Interstate transmission involves legal and political aspects, declared E. C. Stone, that every engineer should recognize if he is to develop interconnection unhindered. The chief trouble lies in the inability of laymen to distinguish electric services from other utility services, largely because the kilowatt-hour cannot be traced in its course. While only 9 per cent of the energy generated crosses state boundaries, hindrance of interstate transmission will curtail its use by utilities to the detriment of the public.

L. W. W. Morrow corroborated the 9 per cent figure for interstate transmission and pointed out that 26 per cent of that transmission involves no change in ownership and that 16 per cent is interchange energy as compared with regular supply. The leading states in export and import of power have unusually large power plants and markets respectively. There is no reason to expect as great a growth in interstate transmission as in total energy growth.

All large water powers will soon be developed, declared W. S. Lee, who contended that markets should be served from the nearest power sources for economy. To fulfill their obligations to the public utilities will build water power where available and intersperse steam plants. Interconnection was favored only as a means of shortening transmission distances and not to carry large blocks of power long distances.

Loose-linkage interconnection, explained C. F. Hirshfeld, is to permit a system to separate readily when in trouble and to allow the parts to operate independently. Such a system remains intact under controllable or easily cleared troubles, but the portion in which uncontrollable trouble occurs is isolated and must shift for itself. Loose-linked systems comprise a collection of service areas, each of which must become self-sustaining instantly when trouble arises, but which operate in parallel normally. Reserve is necessary to make each area self-sustainable, but each area does not carry its own load independently normally. The boundaries of the service areas and interconnections are not fixed, but are shiftable to permit separation in an emergency with the least disturbance. Plants so connected can be operated for the best combined thermal economy, but some efficiency is sacrificed as the price of service protection. Such operation requires a higher degree of engineering and operating skill than solid-tie systems, it was contended.

F. A. Allner contended that there are advantages in interconnection even if two systems have identical characteristics, which is difficult to imagine. Benefits come from saving reserve capacity, ability to stagger construction and emergency exchanges of power. Hydro units can be synchronized quicker than steam, advised the speaker.

# Electrical Machinery

## *Reactances of Synchronous Machines*

R. H. **Park and** B. L. **Robertson**, General Electric Company

Part I treats those factors which are important to application or operating engineers and to designers. Synchronous, transient and phase-sequence reactances are defined and their methods of test outlined. A table is included which gives the numerical range of reactances for the various types of synchronous machines. Part II discusses the theoretical considerations, such as the effect of external reactance on negative phase-sequence reactance. Transient reactance is shown to be the difference between synchronous reactance and the ratio of the mutual reactance between armature and field and the total field reactance. Calculations are included to show that the short-circuit and open-circuit time constants are related to each other in a simple manner.

## *Synchronous Machines—IV*

R. E. **Doherty and** C. A. **Nickle**, General Electric Company

Four basic concepts underly the theory presented: (1) Characterization of the machine by four reactance coefficients, two corresponding to the main pole axis, i.e., direct axis, and two to the interpolar axis, i.e., quadrature axis; (2) resolution of flux and m.m.f. waves traveling with respect to the rotor into stationary, pulsating components in line with the direct and quadrature axes; (3) that the variable component of armature inductance varies between the direct axis value and the quadrature axis value as a second harmonic function of the electrical space angle. Each quantity in equations is expressed as a decimal fraction of "normal" value.

Expressions are derived for the short-circuit currents in the armature and field, for voltage induced in the open phase, and for voltages across external reactances in the armature and field circuits. The short circuit currents are expressed as the sum of two series, one of odd, the other of even harmonics, in which the magnitudes of the harmonics in ascending order are in geometric ratio. It is shown that although voltage induced in the open phase during single-phase short circuit may be fifteen or twenty times normal in a laminated, cylindrical rotor machine without amortisseur circuits, it may be only two to four times normal in a salient-pole machine. An amortisseur winding greatly reduces it in either case.

## *Calculation of Armature Reactance of Synchronous Machines*

P. L. **Alger**, General Electric Company.

The author presents new and simplified formulas for the armature reactance of synchronous machines and compares the results obtained with tests on 100 machines of various types. The new formulas are characterized by unusual expressions for the end leakage and for the air gap or differential leakage reactances. Formulas for zero phase-sequence reactances are given. The definitions of armature leakage and armature reaction reactances used are those proposed by Doherty and Nickle in 1926. As a result the leakage reactance has a much smaller value than has heretofore been assigned to it, thus requiring a rather fundamental revision of the ordinary conceptions of the flux densities existing in the various parts of a loaded synchronous machine.

## *The Thermal Volume Meter*

C. J. **Fechheimer** and G. W. **Penney**, Westinghouse Electric & Manufacturing Company.

A development of the original device of Professor Thomas. The principle involved is that of raising the temperature of a gas by means of an electrical heater, the change in temperature being accurately measured either by means of a thermopile or resistance thermometers connected in a wheatstone bridge network. The thermocouple method is offered as being preferable to resistance thermometers and most of the consideration is devoted to that type of construction. A sufficient number of thermocouples is required to give a good reading of the potentiometer with a comparatively low temperature rise of the gas, and also to obtain a good average of the gas temperature. The details of construction, the equations for calculating the volumes of gas and the possible sources of error are included.

THE three papers regarding synchronous machines constituted a unit and were presented as such. F. D. Newbury, chairman, in discussing the contributions, mentioned the increase in the number of known reactances for which allowance must be made, from the original two of earlier days of design work to an essential seven and generally accepted thirty-one.

A. E. Kennelly suggested that it was highly important that the useful concepts regarding reactance and other synchronous machine factors which were included in the various papers be clearly tabulated and classified so that in speaking of the reactances of synchronous machines it may be mutually understood just which ones are involved. The suggestion to express the figures in unit values rather than in per cent terms received particular approval.

As a result of investigations conducted with salient-pole and cylindrical-rotor machines J. J. Linebaugh derived curves, both theoretically and experimentally, which check very closely. The effect of salient-pole and amortisseur windings was indicated by voltage and current curves.

B. A. Behrend praised the work of the investigators who had made their determinations with such mathematical preciseness, but suggested that it is sometimes wise to compromise with knowledge to secure simplicity. The futility of accuracy in design greater than that which can be imparted in construction was suggested as a consideration not to be overlooked.

R. Treat pointed out that the growth of knowledge regarding synchronous machines requires continually diminishing numbers of empirical constants and factors. Complications are reduced by a realization of the comparative unimportance of certain factors. The work of the authors was foreseen as a basis for determining with considerable reliability the effect of synchronous machines upon oil circuit breakers, relay operation and the general stability of systems to which they are connected.

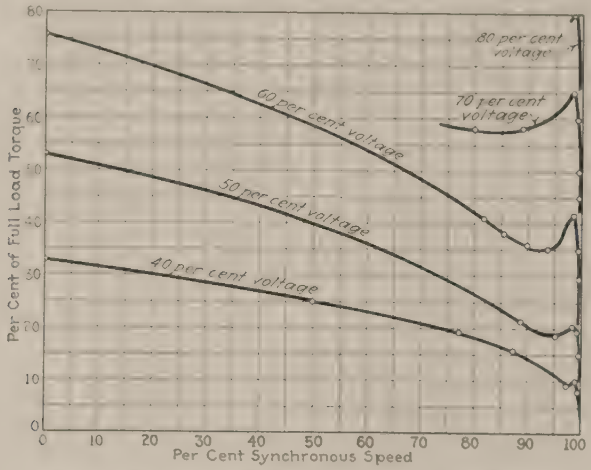
W. V. Lyon contended that the mathematical side of the question had not been overstressed and that the papers afforded a steppingstone to a more complete solution of the general problem involved in the use of synchronous machines. It was also his contention that the phrase "transient reactance" is a misnomer, as reactance depends upon frequency.

W. F. Dawson expressed the opinion that the assumption of sinusoidal wave form made in preparing the surge-curve envelope leads to errors, as great as 25 per cent in some cases. These errors often lead to the specification of larger oil circuit breakers and equipment than necessary. He suggested that r.m.s. values of the wave shape be employed.

H. H. Spencer suggested the possibility of using superposition in preparing these curves and computing circuits.

A. A. Bennett objected to the analyzing of functions in Mr. Alger's paper, contending that it is unreasonable to resolve into components vectors which do not reasonably exist as such in a machine.

In closing the discussion Mr. Doherty defended the inclusion of details in the determinations, but agreed that it is permissible to neglect certain factors if it can be demonstrated that they are comparatively insignificant. The thirty-one reactances considered in the paper reduce to only seven in actual practice, it was pointed out. Mr. Park reported that detailed treatment of three-phase phenomena is not available now, but may be in the future. He also concurred with Mr. Dawson's comment regarding the sinusoidal wave forms.



TORQUE SPEED CHARACTERISTICS OF TWO-POLE SYNCHRONOUS MOTOR AT VARIOUS VOLTAGES (MCLENEGAN AND SUMMERS)

Considering the thermal volume meter, W. F. Dawson stated that this device has proved almost indispensable for the investigation of significant conditions involved in turbo-alternators and similar classes of electrical machines. By employing resistance coils instead of thermocouple instruments measurement within one-tenth of 1 deg. can be obtained.

Mr. Fechheimer advised that he had conducted his original measurements with resistance thermometers, but not with the stream-line device mentioned by Mr. Dawson, although this expedient may have certain advantages. However, an accuracy of one-tenth of 1 deg., when total variations of only 2 deg. are to be measured, was not considered satisfactory by the speaker. The use of a number of thermocouples, as described in the paper, was suggested as a satisfactory solution of the temperature recording difficulty.

## Electrical Machinery

(SECOND SESSION)

### *Effect of Transient Conditions on Compound Motors*

L. R. LUDWIG, Westinghouse Electric & Manufacturing Company.

When a direct-current compound motor is started the rise of current in the series field induces a counter potential in the shunt field and the current may reach several times normal value in a negative direction. This produces the effect of differential compounding and causes the starting torque to be materially reduced. Where the motor is continually started and stopped the effect may be so serious as to dictate the choice of another type of motor. In case the compound motor is disconnected from the line while running and reconnected with no external resistance, the delay in establishing a flux, due to the damping action of the shunt field, may permit excessive currents to flow. A study of such transients leads to means by which they may be minimized and suggests methods for predetermining motor behavior.

### *Design and Application of Two-Pole Synchronous Motors*

D. W. MCLENEGAN and IVAN H. SUMMERS, General Electric Company.

The synchronous characteristics of the two-pole motors are similar to those of lower speed salient-pole machines. In sizes smaller than 800 to 100 hp. at 3,600 revolutions per minute the synchronous motor is hardly competitive with the squirrel-cage or the slip-ring motor unless the need of power factor improvement justifies a considerably higher first cost. The two-pole synchronous motors now in service are used to drive centrifugal gas boosters or centrifugal air compressors in connection with sewage disposal or copper refining processes. Since the two-pole synchronous motors are of large ratings and necessarily have low reactance, it is important to design the control equipment to start and accelerate the motor with the lowest possible inrush. In general, if a synchronous motor falls more than a few per cent below synchronous speed, due to momentary voltage drop, it will not resynchronize upon return of voltage. However, if the direct-current excitation can be removed and the oil-circuit breaker in the armature circuit remains closed the motor can resynchronize provided the squirrel-cage torque at subsynchronous speeds just below synchronous is sufficient to carry the load.

### *Heat Losses in the Conductors of a Direct-Current Armature*

W. V. LYON, E. WAYNE and M. L. HENDERSON, Massachusetts Institute of Technology

The armature copper loss in a direct-current generator is not correctly computed by squaring the armature current and multiplying by the measured armature resistance between brushes, because the disturbance produced by the commutation persists throughout the cycle, so the current is not uniformly distributed over the cross-section of the conductor. To find the extra losses the vector method of analysis is employed, assuming that the time variation of the coil current is trapezoidal and computing the losses for each harmonic component as previously described by W. V. Lyon and I. H. Summers. Where several coils are side by side, as is usual in a d.-c. armature, the average extra loss is computed as if the coils that are side by side were connected in parallel and carried the vector sum of the currents in these coils.

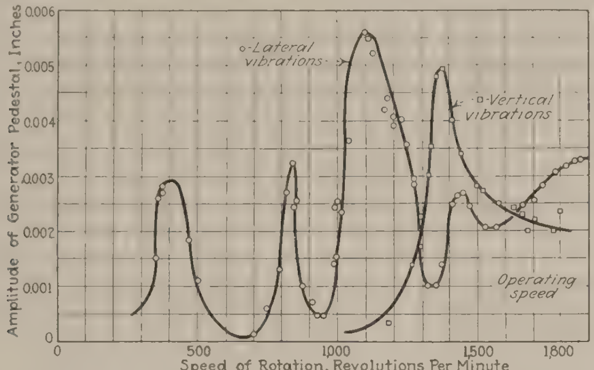
### *Improvements in Turbine Generators*

S. L. HENDERSON and C. R. SODERBERG, Westinghouse Electric & Manufacturing Company.

Both electrical and mechanical improvements are covered. Multiple radial distribution has diminished the ventilation problem of large units. Provisions for hydrogen cooling are being made. Eddy currents are being avoided by coil and strand transposition. Swelling and wrinkling of mica-folium is being avoided by a new bond and semi-conducting corona shields are proving effective for coil insulation. Generator voltages as high as 22,000 are being used. Stators are being built of steel almost equivalent electrically to that used in transformers. Non-magnetic material is avoiding trouble with coil-retaining rings and finger plates. No indications of instability have been observed with 0.8 to unity short-circuit ratios. Structural steel skeleton frames have revolutionized stator construction and built-up plate rotors and one-piece rotor forgings have simplified rotor construction. With a multiplicity of resonance frequencies or critical speeds the problem is to design machines so they will operate in the valleys of resonance curves.

DISCUSSION at the second session devoted to electrical machinery centered chiefly around recent improvements in turbine generators. W. J. Foster advised the audience that two plants have already selected a generator voltage of 22,000. Referring to the swelling of mica-folium, he pointed out that there are better bonding materials than shellac when high temperature must be withstood. To prevent corona deterioration, insulated metallic sheathing has been tried out, but it was not permanent. A sheath is needed which adheres closely to the insulation and does not deteriorate electrically or chemically. Hydrogen cooling benefits rotors more than stators.

Stress charts developed twenty years ago were displayed by B. A. Behrend, who referred to the failure of the old Niagara generators and concluded that the construction employed and not the calculations were at fault. Plate-type rotors are favored by the speaker, who claims that forging a hole in a rotor reduces the strength in a critical direction.



RESONANCE OCCURS AT SEVERAL SPEEDS—UNIT MUST BE DESIGNED TO OPERATE AT INTERMEDIATE VALUES (HENDERSON AND SODERBERG)

Solid rotors were recommended by M. D. Ross for large synchronous motors so that they may be made self-starting, the same as smaller machines. The number of starts which can be made depends on the heat storage capacity of the rotor. Salient-pole motors will pull into synchronism without excitation. The speaker expressed the hope that better knowledge of the characteristics of two-pole synchronous motors would open their field of application.

Two discussions from abroad were presented, one by Edouard Roth and the other by A. B. Fields. The former declared that skeleton-frame generators have doubtful value in England. Leakage slots give great stability without increasing short-circuit ratio appreciably. Heating of end plates can be avoided by using non-magnetic metal. Thin mica and a small percentage of bond avoid swelling of mica-folium, declared the author of this discussion, who referred to a French machine for producing homogeneous insulation. Solid steel forgings are being used for rotors as large as 75,000 kva. Mr. Fields suggested more consideration of water and oil cooling of rotors.

A new type of steel was mentioned by W. J. Merton for retaining rings and poles. He referred to the improved physical characteristics which can be obtained by heat treating rotor forgings or subjecting them to high-frequency magnetization.

R. W. Owens, referring to the operating requirements of centrifugal gas compressors, emphasized that they must operate at 10,000 to 20,000 r.p.m. The starting requirements are low, as motors require only 30 to 40 per cent full voltage to start. For this reason he recommended solid rotors to obtain the starting effect.

R. B. Williamson contended that ventilization is no longer a limit to machine size and that laminated conductors have overcome the eddy-current bugbear. The real limit to size is shipping weight (approximately 200,000 lb.), so rotors constitute the limiting factor. Great difficulty is experienced in securing sound castings free from hair cracks. To avoid these the forgings should be made from freshly poured billets. Coil-retaining rings are almost limited to alloy steel and this is usually brittle. Attempting to utilize metals with a higher tensile strength than 85,000 lb. per square inch was not favored by the speaker. Overheating of end rings and development of flaws may result from single-phase operation. To prevent starting of hair cracks it was suggested that end rings be machined.

S. L. Henderson reported that the permanence of the corona shields mentioned in his paper has been tested. No tooth failures have been experienced in five years with silicon-steel stators.

C. R. Soderberg advised that the only way to improve the character of carbon steel is to heat treat it. The stresses caused by forging a hole in a rotor are not objectionable if kept within control. Solid disks do not have sufficient advantage over disks with a hole to warrant substitution, in the speaker's opinion. Great improvement in materials available is shown by micro-photographs. Unexpected faults in materials are more responsible for troubles than miscalculations. This speaker also contended that it is not wise to increase the tensile strength at the expense of ductility.

The remaining discussion at this session was less extensive and referred to the other three papers. I. H. Summers expressed favor for squirrel-cage windings over solid rotor construction for starting effect because the characteristics are controllable. Furthermore, the pull-in torque close to synchronism is high. D. W. McLenegan agreed that reactance starters are ideal when the impedance of the motor increases rapidly, but are not desirable for two-pole synchronous motors. In the control apparatus described in his paper the auto-transformer circuit is not interrupted, so the in-rush current is limited.

R. F. Franklin cautioned that an attempt to reduce excess direct-current armature losses may harm commutation and said that there are conflicting operating requirements where flux is considered.

B. A. Behrend briefly reviewed the literature available on eddy-current losses and expressed the hope that a complete study of the subject would be made some time. He criticised the A.I.E.E. publications committee for failure to print some scientific papers which have been given great attention abroad.

## Communication

### *Transatlantic Telephony—The Operating Problem*

K. W. Waterson, American Telephone & Telegraph Company.

The economic features of rates, service, company policy and personnel for transatlantic telephone communication and statistics on the anticipated value to subscribers are given by the author. The uniformity of charge bases and the methods by which the operating divisions of the American and European systems co-operate are outlined. Calls average seven a day, are about evenly divided between hemispheres of origin and, with the exception of some 5 per cent, are carried on in English.

### *Certain Topics of Telegraph Transmission Theory*

H. B. Nyquist, American Telephone & Telegraph Company.

Solutions have been derived previously for lines with simple terminal conditions, but, according to the author, it has long been recognized that the extension of the same methods to the more complicated terminal problems leads to great difficulties. This problem has been attacked from the alternative standpoint of steady-state characteristics. This method has the advantage that it does not complicate the calculations materially. The criteria for distortionless transmission are expressed in terms of the steady-state characteristics. The minimum frequency range required for transmission at a given speed of signaling is considered. A comparison of single side-band and double side-band transmission for carrier telegraphy is presented.

### *Loudspeakers of High Efficiency and Load Capacity*

C. R. Hanna, Westinghouse Electric & Manufacturing Company.

Elements considered in the design of high-quality air-column loudspeakers with moving coil drivers are enumerated and described. Efficiency and maximum output capacity are calculated. The methods which may be used for providing sound volume greater than that possible with a single loudspeaker are described. The author has proceeded upon the basis that the moving-coil driver offers the most suitable means for the transformation of electrical energy into mechanical energy in loud-speaking equipment. It is also his acceptance that the exponential type of horn offers the most suitable device for mechanical-acoustical energy transformation. A horn with a low rate of expansion and a large mouth has been used in this work. A device employing three elements with individual horns has been developed, not to increase tone quality, but to secure an increased volume.

### *Transatlantic Telephony—The Technical Problem*

L. B. Blackwell, American Telephone & Telegraph Company.

An outline of the design and construction problems involved in the present transatlantic telephone communication facilities. The equipment in North America and on the other side of the Atlantic and the fundamental considerations which influenced the specification of the diversified devices used are mentioned. Single sideband carrier transmission is used in this work and through the necessary arrangement of switching devices the circuits are energized only during speech transmission resulting in reduced energy of consumption and interference. Separate paths are used for east and west-bound communication. While long waves are used as standard, the short-wave circuit from England to the United States is reserved for emergency use. The advantages derived through proper selection of geographical placement of stations and of minor refinements are reflected in the conservation of transmitted energy throughout the telephone system.

FOLLOWING the presentation of the papers of Messrs. Blackwell and Waterson, a joint session of the American Institute of Electrical Engineers and the Institution of Electrical Engineers (England) was conducted by means of the transatlantic telephone facilities. Archibald Page acted as joint chairman. Speakers included Bancroft Gherardi, John J. Carty, F. B. Jewett and H. P. Charlesworth in America, Archibald Page, T. F. Purves, Sir Oliver Lodge and Colonel Lee in England. President Gherardi spoke of this occasion as but a further step in bringing widely separated groups together. President Page paid tribute to the work of American telephone engineers through whose work this development became possible. The joint meeting was mentioned by Colonel Purves as but another proof of the "internationalism of engineering" In seconding a resolution of satisfaction over the consummation of this event, proposed by General Carty, Sir Oliver Lodge expressed the hope that "no word of hostility be ever spoken between the English-speaking peoples."

In discussing Mr. Hanna's paper on high-efficiency and high load-capacity loud speakers, H. Fletcher commended the determination of efficiency by two additional methods as well as by calculations and mentioned that while Mr. Hanna's device produced approximately 40 per cent over-all efficiency, several commercially available designs could be said to attain 50 per cent. The derivation of the experimental response curve shown in the paper was a matter of inquiry, as was the use of the equation for diaphragm thickness which gave values nearly twice those thought necessary by Mr. Fletcher for the purpose of avoiding resonant vibrations.

A. E. Kennelly suggested the use of electric circuit terms in the new "acoustical" circuit work in order to simplify the nomenclature for investigation and study in the latter field. Acoustic impedance and ohms were specific recommendations.

The diaphragm-thickness formula was reported by Mr. Hanna in his closing remarks to represent the values indicated as desirable according to the result of his experience.

## Arc Welding

### *The Stability of the Arc Welding*

P. Alexander, General Electric Company.

The stability of the iron welding arc is influenced by a number of factors, such as the nature and the aerodynamic state of the surrounding atmosphere, the strength and distribution of the magnetic field, the composition of the electrode, the nature and the amount of gases occluded in the electrode, etc. The cooling of the electrode and the arc core has the preponderant influence on the stability of the arc. If the vapors of alkaline earths or alkali metals be present in the space between the electrodes, striking and maintaining of the arc would be much easier than in air. It requires much greater voltage to strike an arc with water-cooled electrodes than with electrodes allowed to become incandescent.

### *Welding and Manufacturing of Large Electrical Apparatus*

A. P. Wood, General Electric Company

The present tendency is to produce large electrical machinery from welded steel plates, thereby practically eliminating the pattern shop and foundry. By making these large structures of fabricated plates, no expensive patterns are required. Valuable pattern storage space can be used for other manufacturing purposes. Foundry space is reduced and the substitution of welded forms for castings results in a great saving of time and eliminates the possibility of a defective casting due to cores shifting, blowholes, cold shots and pouring gates, which require time to burn and machine off. The work of the machine shop is reduced to a minimum, as the plates arc-welded together have approximately the finished dimensions, whereas a casting requires excessive machining.

### *Effects of Surface Materials on Metallic Arc-Welding Electrodes*

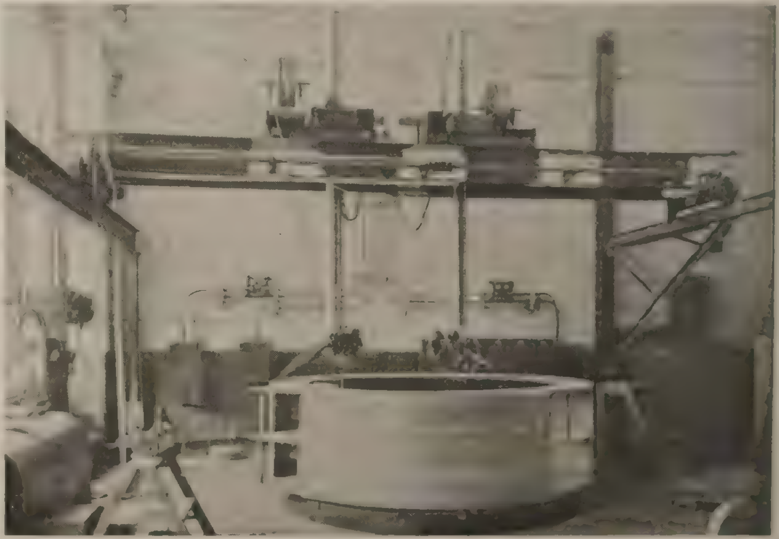
J. B. Green, Fusion Welding Corporation.

Surface materials have a significant influence on the brittleness or ductility of weld metal and can be used to control the type of arc developed They also affect the heating of electrodes and may be employed to control the operating characteristics of the electrode and the resultant weld properties. Among operating characteristics might be mentioned stability and rate of melting. Among the weld properties are included freedom from blowholes and tensile strength. Other practical applications of a comprehensive knowledge of surface materials are cited in this paper, which also deals with the fundamental theory of arc heat distribution, arc vapor resistance and similar characteristics modified by the presence of surface materials.

### *Arc-Welded Structures and Bridges*

A. M. Candy, Westinghouse Electric & Manufacturing Company

The advantages ascribed to arc welding follow: (1) The weight of materials required in a member or structure can be reduced by as much as 18 per cent; (2) no material is removed from members for welded connections such as rivet holes for riveted construction; (3) the weight of connecting material in some cases can be reduced 50 to 90 per cent; (4) absolute



STATOR-FRAME AUTOMATIC WELDER FOR FRAMES UP TO 14 FT. DIAMETER (WOOD) fixation of one member to another can be readily obtained; (6) greater rigidity can be obtained in a structure; (7) overlapping members can be completely sealed by weld metal, thereby excluding moisture, preventing corrosion and making a structure easier to paint; (8) changes in or additions to structure can be made with a great saving in both time and expense; (9) more pleasing designs and in some cases designs impossible by other processes can be produced; (10) the welding process is practically noiseless.

TO ILLUSTRATE the character of arc phenomena and influence of welding materials Mr. Green presented a series of lantern slides and a slow-motion picture film secured by the use of infra-red sensitive negatives. Replying to questions by C. Siebenmorgen, J. C. Lincoln, A. P. Wood and A. M. Candy, Mr. Green explained that the electrodes were $\frac{3}{16}$-in. diameter, the currents about 125-150 amp. and that the different length paths assumed by the arcs were probably due to the relative and absolute resistances of the core and sheath characteristics. Hand welding was used in making the study, a constant potential source with large excess of ballast resistance being utilized. Flux is used in gas welding to dissolve the oxide, while for electric arc welding its purpose is to improve the arc-heat distribution. In his opinion arc and gas welding, in so far as quality of work is concerned, are interchangeably satisfactory.

An explanation of the fundamental idea of the atomic welding process was offered by Elihu Thomson in connection with Mr. Alexander's paper. Dr. Thomson pointed out that the concept of dissociation means that a molecule in absorbing energy under welding conditions is broken up into its atomic components, which reassociate with a release of energy.

In response to an inquiry by E. Herzog regarding the use of atomic ionizing-potentials, Mr. Alexander indicated that molecular values are unnecessary except for gases, as other materials listed do not exist in gaseous form except in the atomic state. He advised that ionizing-potentials referred to in his paper involve the energy that an electron should accumulate to energize a neutral atom. Replying to an inquiry by R. J. Kehl regarding a practical application of hydrogen shielded arc, Mr. Alexander reported that it is not sufficient merely to establish the fundamental principles involved in such a process, since the technique of handling must be advanced to a usable state.

A question of whether atomic welding could produce oxide-free welds was answered in the affirmative by the author, who also added that the resistance to corrosion of atomic-hydrogen welds had not as yet been fully established, but that higher corrosion-resistance values are anticipated.

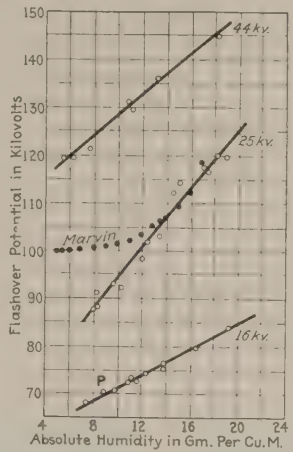
J. C. Lincoln demonstrated an electric torch in which two-thirds of the heat of the electric arc appeared in the flame. Herman Lamb and Dr. Thomson added data regarding similar devices known to them some years ago.

# Miscellaneous

## *Effect of Humidity on Dry Flashover of Insulators*

J. T. LITTLETON, JR., and W. W. SHAVER, Corning Glass Works

Humidity affects considerably the flashover voltages of porcelain and Pyrex insulators, the potential rising as the humidity is increased. This characteristic is a surface effect which varies with the absolute water content of the surrounding atmosphere. A decrease in flashover potential was noted at humidities above 90 per cent, but is believed to be due to condensation on the insulator surface, which could be avoided by having the insulator at the proper temperature. The curve slopes for porcelain insulators are slightly steeper than those for Pyrex insulators having approximately the same flashover potential. This may be accounted for by the high chemical resistivity surface of Pyrex insulators. A No. 441 Pyrex insulator at 760-mm. pressure and 35 deg. C. temperature would flash over at 128 kv. with a 10 per cent relative humidity and at 193 kv. with a 90 per cent relative humidity. Moreover, the apparent straight line relation between flashover potential and absolute humidity makes it possible to adopt a correction factor for the humidity effect on a given insulator and to catalog the dry flashover potential at a standard humidity as well as at a standard temperature and pressure.



VARIATION OF FLASHOVER POTENTIAL WITH HUMIDITY (LITTLETON AND SHAVER)

The curves apply to porcelain insulators, but very similar curves apply to Pyrex insulators.

## *Cathode Oscillograph in Study of Line Surges*

HAROLD NORINDER, Swedish State Power Organization

Investigations were reported covering the value of lightning arresters and other apparatus for protecting lines and equipment against surges, the fundamental nature of surges and the relation between natural lightning and laboratory lightning. The klydonograph was found to fail in many desirable requisites and serially modified. Specially constructed cathode-ray oscillographs were used. It was found particularly desirable to measure short-time intervals of the order of $10^{-6}$ to $10^{-8}$ seconds and to secure records of transients at exceedingly brief intervals during long periods of phenomena absence. The instrument employed should be of such relatively simple nature that it can be used by station mechanics or most operators, and the instrument should be in the recording position at all times. These requirements are met by the modified Dufour oscillograph.

## *The Saturation Permeameter*

S. L. GOKHALE, General Electric Company

A device for speedy and accurate measurement of the limiting value of intrinsic induction of magnetic material. The permeameter is of the bar-yoke type, capable of producing a magnetizing force of 4,500 gausses without excessive heating. A coil compensates automatically for the spatial flux inclosed by the potential coil, so that the ballistic deflections indicate the saturation value without any further computation or correction. The permeameter is suitable for all magnetic materials except cobalt and permanent magnet steels and will measure $B$ or $\beta$ with $H$ as low as 200 gausses.

## *Compressed Powdered Permalloy—Manufacture and Properties*

W. J. SHACKELTON, Bell Telephone Laboratories, and I. G. BARBER, Western Electric Company.

The manufacture of magnetic cores of compressed permalloy powder and the electrophysical and magnetic properties, including permeability, core loss and modulation, are treated. The permalloy considered contains approximately 80 per cent of nickel. The technical problems involved in powdering the permalloy and in insulating the powder so that subsequent high-pressure forming and high-temperature heat-treating operations may be applied are related. The processes are said to be adaptable to economical large-scale production and at the same time to be controllable so as to insure a highly uniform product. Loading coils made with this magnetic material approximate one-fifth to one-third the size of former coils with no sacrifice in quality and with appreciable improvement in transmission efficiency, inductance stability and modulation.

RESPONDING to a question regarding his saturation permeameter, Mr. Gokhale explained that the method of clamping the specimen or degree of contact is not of primary importance in test work with this device and that the temperature rise during operation does not exceed 2.5 deg. C.

Mr. Shackelton pointed out that the use of permalloy-dust in place of iron-dust loading coils greatly reduces space requirements for manhole and duct-system installations and facilitates line design and construction.

B. Gherardi mentioned that the loading coil constituted not an incidental but an essential part of modern telephony, 3,000,000 being in use in this country, approximately one for every six telephone instruments, and that these devices are being added to the lines at the rate of 6,700,000 yearly.

In response to an inquiry from the floor, Mr. Barber, who read the joint paper, replied that so far as he knew no attempt had been made to apply permalloy to other than telephone fields, due, he felt, to the relatively low permeability.

Discussing the paper on flashover potentials of insulators, E. D. Eby suggested that a correction factor is needed for rating and specifying different type insulators. While impulse flashovers are considered unaffected by wet or dry conditions, tests have shown that at 40 to 100 per cent relative humidity and 180 to 225-kv. crest voltages the highest flashovers occurred at 95 to 100 per cent relative humidity. The values did not go below those for wet flashovers on the specimens. Sustained periodic tests over several years indicated humidity and flashover voltages to be a maximum in August and a minimum during the month of January.

C. L. Clarke submitted the determinations of P. Woog with flashovers on glass cylinders as an explanation of the observed effect of increased flashover values with high humidity and suggested that it is not an air dielectric effect but a surface effect of the insulator that is involved.

C. F. Harding corroborated the statements regarding increases in flashover voltages with higher humidity values. Professor Harding pointed out the folly of referring insulator test data, secured under 60-cycle conditions, to a sphere-gap basis as flashover tests upon sphere gaps are not affected by humidity. Errors of 14 to 15 per cent may be involved in such comparisons.

Referring to Mr. Norinder's lecture, D. W. Roper reported that as a result of the dismantling of many pole-type distribution transformers rendered useless by lighting, scars had been found in all cases on only the secondary windings. Twenty to thirty such burnouts occur annually on the lines of the Commonwealth Edison Company. Although 300 to 400 domestic meters are connected to such secondaries no meter burn-outs are found. House services are carried through iron pipe, which is believed to protect the consumer's end of the circuits. In fifteen or twenty cases the wires have shorted to the pipe, but investigation indicated the presence of standing water in the pipe due to faulty erection practices. The possibility of protecting the transformer end of the service by the use of a ground pipe is being undertaken by means of cathode-ray oscillograph equipment.

K. B. McEachron mentioned the difficulty of automatically starting recording processes so they will respond quickly after a disturbance starts and suggested the use of a hot, instead of a cold, cathode ray oscillograph. The transient may be delayed slightly by passage through a cable section of known characteristics so that the surge reaches the oscillograph after the latter has attained full operating condition.

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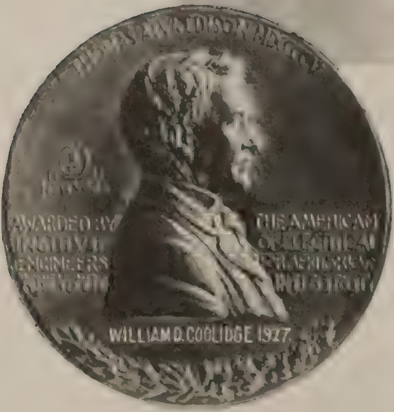
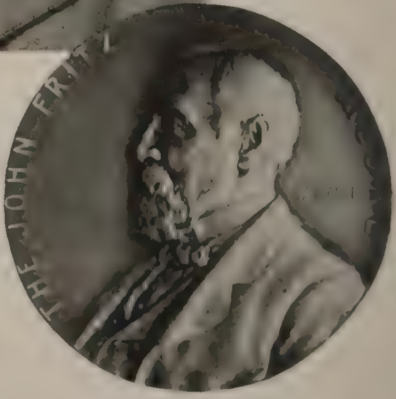
# *Edison and John Fritz Medals Awarded*

WILLIAM
DAVID
COOLIDGE

JOHN
JOSEPH
CARTY



PRESENTED
AT THE
WINTER CONVENTION
OF THE
AMERICAN INSTITUTE
OF ELECTRICAL ENGINEERS
FEB. 15, 1928



*"The Gold Medal has been awarded to* ***William D. Coolidge*** *for his contributions to the incandescent electric lighting and the X-ray arts by the American Institute of Electrical Engineers."*

*"The Medal for the year 1928 has been awarded to John Joseph Carty for pioneer achievement in telephone engineering and in the development of scientific research in the telephone art."*

# *Symposium on*
# Energy Interchange

Experiences in Pennsylvania-New Jersey, Southeast, Chicago district and Pacific Coast interconnections related before A.I.E.E. convention

THE past four years has witnessed additional and higher capacity interconnections. Individual system operation has been improved, as has co-ordination between systems. More use is being made of interchange facilities. More careful forecasts of load growth and system planning are being conducted. Advantage is being taken of the lower costs of larger units and particularly of the efficiency of the modern steam-generating plants. Long-distance transmission is growing more reliable. But there are still many problems unsolved or only partially solved.

Load dispatching becomes more difficult and complicated with the growth of systems. Relaying continues to require much study. The division of load between parallel circuits, the control of wattless current, system stability and more reliable oil circuit breakers are problems worthy of the best engineering brains in the industry. As hydro-electric stations decrease in size, more automatic ones will be constructed to keep down the cost per kilowatt-hour. The future will probably see still larger steam plants with larger units located at the mine mouths, when water is available there, and others as near to large load centers as available condensing water will permit. These will, in turn, bring up the problems of still heavier trunk transmission lines. The last word has not yet been said regarding lightning protection. Improvement in communication circuits also offers a fertile field for study.

The foregoing statements, made by W. E. Mitchell, Georgia Power Company, and applied to the Southeastern section of the United States, indicate almost without exception the situation all over the country.

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## Accomplishments in the Southeastern States

By W. E. Mitchell
*Georgia Power Company*

TREMENDOUS strides have been made in the last few years to increase the capacity of the interconnecting links between different systems, to develop water power distant from the power market and to construct mine-mouth or other strategically located high-capacity steam plants, and to connect them with the great load centers by means of high-capacity networks. By co-ordinating various operating companies under holding companies, the benefits of massed capital, massed resources and unified control have been realized. Interconnection, group management, low-cost steam generation and long-distance transmission have come as a logical succession of natural economic steps.

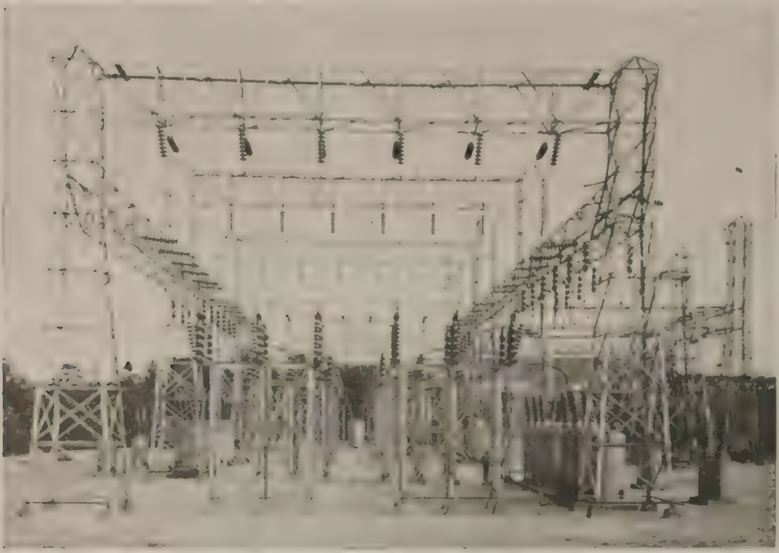
Interconnection between independent systems is, first of all, a measure of protection in emergencies. But it cannot be a complete success unless the executives and operating forces of the respective companies realize it is a give-and-take proposition and have mutual regard for each other's obligation to the public.

To stimulate the needed mutual interest the companies that are involved in the Southeastern interconnections have jointly formed an operating committee which meets about eight times a year and compares operating data, load, rainfall, storage reservoir conditions and problems of mutual interest. The resultant better understanding of each other's systems and their points of strength or weakness has facilitated the prompt handling of emergency power exchanges and improved operating economies.

Unquestionably great benefits can be derived from interconnections between independent companies or systems, but it is practically impossible for such companies to have a unified development program. If the companies are under the same financial, engineering and management control, then genuine system planning on a large scale will be practicable and the most economical plants and tie lines can be built first, because only the results for the group as a whole need be considered.

For successful parallel operation and to secure the proper load division between interconnected generating stations and systems, it is essential that the frequency be very closely controlled. This has been facilitated by the installation of master clocks at the larger generating stations and use of extremely accurate frequency recorders at load-dispatching centers. The system supplying the bulk of the power regulates the frequency. Special attention has been given to the adjustment of governors at all generating stations, so they will respond as uniformly as possible and enable each station to carry its share of load fluctuations.

Voltage control grows more important and more complicated as larger systems are tied together and as additional interconnections are made. To minimize this problem synchronous condensers with a total rating of 130,000 kva. are used on the Southeastern Power & Light Company's system, being controlled by automatic voltage regulators. During the wet season, when steam units are not required for supplying power, generators are disconnected and operated as synchronous condensers. During peak-load hours, and when not required for supplying power, the hydro-electric units are used for power-factor correction. Naturally such units are not as beneficial as synchronous condensers at load centers. However, they are generally at opposite ends of the system from the steam plants, so they serve to correct voltage.


EAST POINT SUBSTATION, CONNECTING GEORGIA AND ALABAMA SYSTEMS

It has not yet been found necessary to install regulating transformers in tie lines to govern the division of load and wattless current, but it is very likely that this or some other method will be required as the number of ties between the systems increases. With the increasing amount of load carried over the lines the problem of system stability has been encountered. Simultaneous readings of load, power factor, voltage, etc., have been found of considerable assistance in the system operation. In order to analyze troubles and provide remedies, permanent recording equipment, such as the Hall recorders, or oscillographs, are now being installed at strategic points on the system.

A great need exists for a system of relaying which, while selective, will instantly disconnect a faulty circuit. At present ordinary induction type overload relays are being used on single-circuit lines, a short time setting being provided to secure selective operation. In a few instances the settings of these relays have been such as to hold a short circuit on the system long enough to affect the system stability, and in one or two cases has resulted in rather serious interruptions. On the double-circuit tower lines balanced relays are functioning very satisfactorily. However, during lightning storms both circuits on the tower lines are frequently interrupted simultaneously.

The construction of some 154-kv. lines built recently brings out forcibly the economy of unified control. The lines considered permit the postponing of the construction of additional power plants by one company until those under way by other companies under the same control are loaded up.

As the systems grow larger interconnection between those under one management makes for greater operating efficiency, as full advantage can be taken of diversity of time, rainfall and seasonal load. Less benefits could be derived from these factors with ties between independent companies. With the large storage reservoirs practically no water goes to waste during the summer season. If one section has a heavy rain and another none the tie lines permit sale of the surplus at such a price that the company that has had no rain can afford to buy power and store its own water.

Run-of-river plants which formerly wasted water all night long because they had little or no storage now generate more kilowatt-hours because they are linked with a comprehensive system. By jointly studying the hydrographs of all rivers in the territory for the last 25 years and considering wet, dry, average and medium periods it is now possible to forecast available water fairly accurately a year in advance.

Operating and maintenance practice has also improved with the exchange of operating data and ideas, resulting in reduced maintenance expense and more efficient condition of equipment. Co-ordinated development and operation of plants has made it possible to develop more kilowatts of capacity per dollar of investment and to produce more kilowatt-hours at a lower cost than would be practical under independent management.

The improvement in steam-generating efficiencies, plant costs, the reliability of the large steam units and the varying character of Southern streams is making utility engineers in the South realize that a greater and greater proportion of power will be produced by steam in the future.

During 1927, as in 1925, the value of interconnection was emphatically demonstrated to the Southeast. Enabled by co-ordination of the systems and the tie lines water was conserved in the Burton storage all during the spring and drawn out in the late fall, when most needed. Under independent operation the tendency would have been to have taken a chance on getting summer rains (which never came), and so to have drawn upon the stored water that when the final pinch came there would have been none left. Then industries would have been forced to curtail because the tie lines could carry no more and the hydro plants would have been greatly reduced in capacity by lack of water.

Other striking examples of the benefits of interconnection were afforded the same year. A large cotton mill in Georgia had a failure in its isolated plant. Within 24 hours from the time notice was received the power company had picked up more than 3,000 hp. of the mill's load and within 72 hours the entire 10,000 hp.

Again when the flow of the Savannah River dropped nearly as low as in 1925, a local plant near Augusta was inadequate to carry its load for several months and 15,000 to 20,000 kw. was supplied over the interconnecting 110-kv. line.

Another example of the greater use of available resources: Company A had available 25,000 kw. of transmission capacity but no surplus generating capacity. It was interconnected on one side of its system with Company B, which had surplus power, and on the other side with Company C, which was short of power. Transmission facilities were leased from Company A, power purchased from Company B, and Company C's needs completely cared for.

The effect of interconnection on steam-generating plants is illustrated by consideration of one in Alabama. Whereas eleven years ago the first large unit installed at Gorgas was 25,000 kva., and the plant was built purely as a reserve steam plant to operate at from 10 to 25 per cent annual load factor, the new plant will be a base-load plant operating on a 50 per cent annual load factor at first and probably ultimately on a 70 per cent load factor. Another interesting fact is that while the new plant will be 50 per cent more efficient than the old, its cost per kilowatt will be but little, if any, higher; such is the effect of larger units. Again, units of 66,667 kva., which are used in the new plant, would not be the proper size were there not ample reliable tie lines between Alabama and Georgia so that such a unit would be available to both companies.

Transmission lines still constitute the weakest link in the chain between generating station and customer. After fifteen to twenty years' experience Southern operators feel sure that ground wires are justified on important lines. The new 154-kv. lines being built in Alabama and Georgia are being overinsulated, but the equipment is not. For its protection, a weak link will be put in the lines near the substations by leaving off two or three of the insulator disks. On the Southeastern Power & Light Company's system we feel that in the more important stations lightning arresters should be installed. Annual buzz-stick testing is favored for eliminating defective insulators and lines are patrolled after every interruption.

With the growth and interconnection of systems the necessity of uninterrupted communication circuits has grown in importance. Important stations and load-dispatching centers are usually coupled by several private land-line circuits as well as by Bell system lines. Extensive use has been made of the carrier-current telephone system with exceptionally good results. It is being used regularly for load dispatching over 1,000 miles of transmission lines.

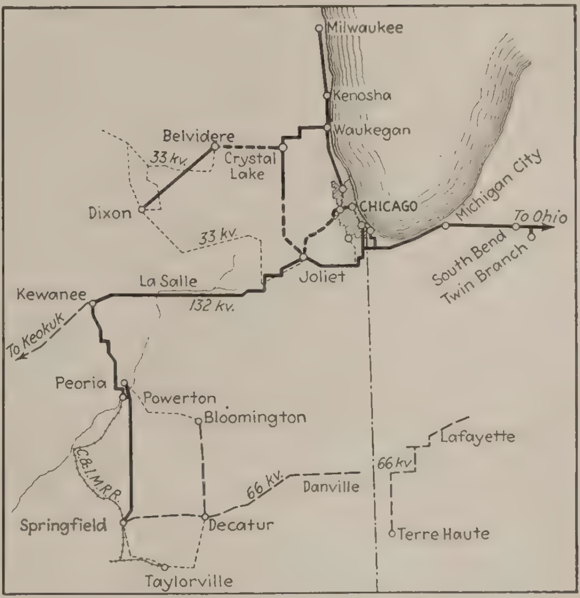
Oil circuit breakers continue to be one of the most important factors affecting satisfactory long-distance transmission and system interconnection. Here again the increase in capacity of transmission lines and the concentration of power necessitate ever-increasing capacity in the oil circuit breaker. Today short circuits of 1,000,000 kva. are possible in the Birmingham district. We believe we shall continue to give best service by operating with so-called solid ties as compared to the loose-link method, limiting short circuits by opening the ties at certain predetermined points. Later we shall probably add 110-kv. reactors through which no current flows normally.

# Interchange Arrangements in Chicago District

By H. B. Gear
*Commonwealth Edison Company*

MAXIMUM use of reserve generating capacity and low-cost energy is facilitated in the Chicago district by the provisions of a three-party energy-interchange agreement. This pools reserve capacity and permits the flow of energy to neighboring zones whenever the load in the immediate zone permits or when the energy so transferred costs less than that produced in the neighboring zone.

The difference between the total capacity in the pool and the coincident maximum load of the three systems is taken as the group reserve, until a higher maximum has been established or additional capacity put into service.



AT POWERTON, CLOSE TO THE COAL FIELDS, A BASE-LOAD GENERATING STATION IS BEING CONSTRUCTED

The percentage of group reserve is taken as the standard and any company having a reserve percentage higher than the group percentage is compensated for the carrying charges on its excess station capacity by the other company or companies whose percentage of reserve is less than that of the group. This permits the smaller companies to install larger units than would be possible if only the requirements of their individual systems were to be met, and thus gives them capacity for future growth at a lower investment cost, with higher operating efficiency.

Operation on this basis is not accomplished at the expense of the larger companies, except temporarily, as they are able to draw upon the excess capacity thus created and so defer, for a year or more, additions to their own plants.

Power-station construction for the entire district is co-ordinated through a committee of two representatives from each company. It studies load increases in the various zones and recommends to the executives the size and location of units to be added from year to year. The recommendations are made about two years in advance of the dates when the units are to come into service.

Reporting to this committee is a sub-committee of load dispatchers, which meets weekly to arrange operating schedules for the transfer of energy from the more efficient stations to other zones during off-peak periods, to co-ordinate removal of turbines for overhauling purposes and, in emergencies, to confer by telephone and arrange relief where it may be required.

The conditions which existed during one of the summer months of 1927 illustrate the way in which the energy-interchange agreement is accomplishing the result contemplated by the parties thereto:

SYSTEM CONDITIONS DURING A SUMMER MONTH IN 1927

| Company | A | B | C | Total Kilowatts |
|---|---|---|---|---|
| System maximum....... | 864,300 | 139,800 | 44,700 | 1,041,000 |
| Reserve capacity, kw.... | 101,245 | 97,980 | 2,075 | 201,300 |
| Reserve quota (19 per cent) | 165,875 | 26,240 | 8,585 | 201,300 |
| Excess and *deficiencies.. | *64,630 | 71,740 | *6,510 | ........ |

Company "A" paid Company "B" for 64,630 kw. of reserve capacity and Company "C" paid Company "B" for 6,510 kw. of reserve capacity. Thus Company "B" was reimbursed for an excess of 71,740 kw. in its reserve capacity. During the same month Company "A" delivered to Company "B" 9,135,000 kw.-hr., Company "B" delivered to Company "A" (in other zones) 16,936,000 kw.-hr. and Company "A" delivered to Company "C" 9,172,000 kw.-hr. Of the total of 35,243,000 kw.-hr. thus transferred, about 19,000,000 kw.-hr. were delivered during off-peak, resulting in a fuel saving of about $19,000 in that month.

Normally the three systems are operated in parallel with each other and with the Twin Branch station at South Bend most of the time. Parallel operation with the Milwaukee system is not normal, as this line is maintained, primarily, as a reserve connection for use in emergencies. Interconnections with companies west and south of the Chicago district are also operated, for the most part, as reserve connections and are paralleled only as operating conditions require it. These lines are of small capacity and are not suitable for other than local reserve service.

The interconnection of power stations by lines of relatively large capacity has resulted as follows:

(a) The size of generating units is increased, while the total capacity and reserve for a district is decreased.

(b) The investment per kilowatt of capacity in generating stations and the total investment are decreased.

(c) The consumption of fuel is reduced by ability to give the more economical units the "base load" of an entire district.

(d) The reliability of service is enhanced by increased availability of the capacity and reserve in generating units during emergencies and routine operating work, such as overhauling and repairing equipment.

Some problems require solution before an interconnected group may realize the advantages sought. These problems relate, chiefly, to the ability to control the division of energy between neighboring stations and to make delivery continuously when occasion requires. Experience thus far in the Chicago district indicates that these problems lie outside of the generating equipment almost entirely and relate to the size, voltage, length and other characteristics of the interconnecting lines.

When line capacity is high and lengths are short in proportion to the voltage of transmission the transfer of energy between stations is readily accomplished by governor control of the generating units. When lines are relatively long and have a capacity which is approached by the normal surges of synchronizing energy, which flow between the two sources of power, there is instability of operation, and lack of continuity is likely to result.

The presence of several successive transformations in a tie line has the effect of increasing its impedance and is, thus, equivalent to an increase in length. More than two transformations (one each way) are to be avoided in such lines, if possible.

With long lines or lines in which the direction of flow of energy is at different times in opposite directions it is often necessary that means of voltage control be provided. These are required to permit the receiving station to operate its bus at a voltage level suited to the requirements of the circuits supplying energy within its own area of distribution. In such situations transformers with tap changers, adjustable under load, are finding useful application.

At the higher voltages the use of synchronous condensers for voltage control are often found desirable through the ability to regulate the power factor of the system secured thereby.

# Pennsylvania-New Jersey Interconnection

By the Late W. C. L. Eglin
*Philadelphia Electric Company*

INTERCONNECTION ranges from ties of very small capacity between outlying points of adjoining or interpenetrating systems, which if utilized to the utmost could not materially affect the operating economies of the system taken as a whole, up to trunk lines connecting principal centers of load and generation, involving a comprehensive mutual program with large investment and promising commensurate return. To the latter class belongs the interconnection between the Philadelphia Electric Company, the Pennsylvania Power & Light Company and the Public Service Electric & Gas Company, the first step of which is now practically ready for operation. It is the purpose of the three companies by this interconnection so to co-ordinate their construction and operation programs as to result in a maximum saving of investment and operating expense. The studies made preliminary to the final agreement indicate that the present contemplated construction, namely, a complete 220-kv. ring between the systems with suitable facilities for connecting each system to the ring, will, when carefully operated, utilize to the best advantage all of the diversity occurring between the system loads for the coming ten years.

Each company will design and construct the lines lying within its own operating territory, although all three have agreed upon the climatic loading conditions and the general basis of design.

The principal saving in this case results from load diversity, in that the peak load of the combined systems is smaller than the sum of the individual peaks. By pooling the reserve capacities which the companies maintain they are able to dispense with a certain portion of this reserve without loss of reliability. Staggering of construction among the companies will make the installation of two or three generating units adequate in any particular year, where four or five might be required if the three systems operated independently. Distribution of the combined load so that the more efficient stations will carry the base load and the less efficient the peak loads will be a source of considerable saving in operating expenses. The furnishing of emergency power in excess of normal reserve requirements when this is available in the other companies results in no actual money saving, but does improve reliability of operation.

*Load Diversity*—In this interconnection the principal portion of the load diversity is due to the difference in the shape of the individual daily load curves on any selected day during the peak period of the combined systems. Further contributions are made by the difference in the season of annual peak and by the noncoincidence of those accidental high days which cause weekly or monthly peaks on the individual system. For example, the daily peak of the Pennsylvania Power & Light Company is in the morning throughout the year, with the afternoon load slightly lower and the evening load materially reduced. The annual peak load occurs in October. The load curves of the Public Service Electric & Gas Company and the Philadelphia Electric Company are quite similar, both having large evening loads throughout the year, and in particular a high peak near 5 p.m. throughout the winter months. The yearly maximum load of both usually occurs in December.

*Reserve Diversity*—The experience of the three individual systems with calls upon their own reserve generating capacity indicates that these are relatively infrequent and no loss in reliability is expected under the assumption that the interconnecting companies will not all require their share of the total reserve diversity simultaneously.

*Substation connecting Conowingo and Philadelphia System with Pennsylvania Power & Light and Public Service Electric & Gas Companies*

Plymouth Meeting substation, which will be the junction point for the 220-kv. lines from Conowingo, the 220-kv. loop connecting the three companies and the 66-kv. lines to Philadelphia will be equipped with three 30,000-kva. synchronous condensers initially. Self-cooled 220/66/13.3-kv., 100,000-kva. transformer banks equipped for ratio changing (15 per cent range) under load are installed. Air-jet radiator cooling will increase their rating to 130,000 kva. The condensers are connected to the 13.3-kv. tertiary windings and are equipped with extra high-speed excitation. Many unusual features of design are involved.

*Economic Distribution of Combined System Load*—In a single system of steam-generating stations, especially when serving a compact territory, the proper apportionment of load among stations seldom offers serious difficulties. It is usually found economical, as the system grows, to build up one station at a time from initial to ultimate capacity rather than to have two or more under way simultaneously. Thus each station in its operating performance reflects current practice during its design and construction period, and the cost margin between stations is sufficient to render the correct distribution of load obvious. Transmission limitations and minimum loading requirements of stations may enforce departures from this ideal distribution. In the case of a system of wide area and low concentration of load it may prove more economical to establish two or more centers of supply, and increase them in capacity according to the requirements of their districts, rather than to provide the transmission facilities required to permit all the growth to take place at one station.

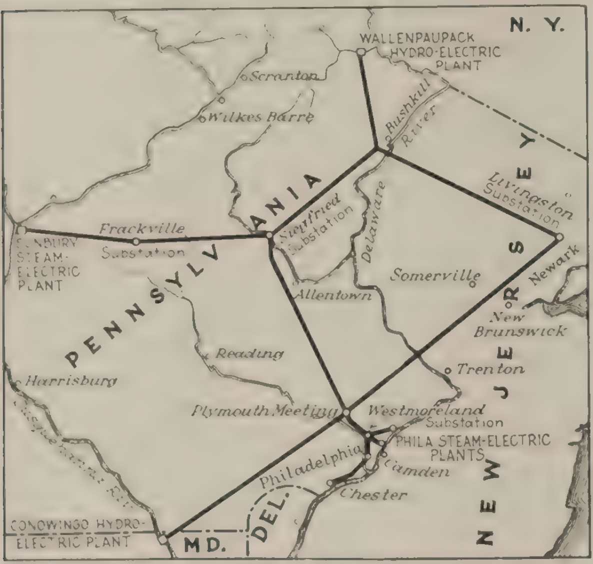
No matter to which class the systems concerned belong, the interconnection of two or more systems which have grown up entirely independent, and which are therefore likely to include stations of approximately equal operating performance, offers many delicate problems of load apportionment.

*Load Dispatching*—The interconnection headquarters for general administration and load dispatching is to be established at Siegfried. It will be advised of the expected outputs from the various hydro plants of the system as far in advance as estimates can reasonably be made, and will plan the operation of the steam stations to carry most economically the remaining load. The preliminary studies of the interconnection project have demonstrated conclusively that an opportunity for large savings exists, but only the most alert and skilled load dispatching will realize all of the possible benefits.

Relay protection on the 220-kv. lines consists essentially of special type C Z relays and directional, ground-current relays. Transformer banks and condensers have the usual differential protection. The 66-kv. lines are also protected by C Z and ground-current relays.

The 220-kv. oil circuit breakers have an interrupting capacity rating of 2,500,000 kva. and the 66-kv. line breakers a rating of 2,000,000 kva.

The Conowingo and interconnection projects have many favorable reactions upon each other. One of these is the common use of facilities for connecting the 220-kw. lines with the Philadelphia Electric Company's existing transmission system. The cost of Plymouth Meeting substation and of Westmoreland substation (66-kv. tie between Plymouth Meeting substation and Philadelphia), for either the Conowingo project or the interconnection separately would have been considerably greater than the proportionate share of the actual combined construction cost. Furthermore, a high-capacity, initial installation was imperative at Conowingo on account of the size of the dam. This precluded independent operation and building up of local load or transmission to existing load centers with provision of expensive steam-generating reserve for use in the low-flow periods.



THREE LARGE SYSTEMS POOL THEIR SERVICE FACILITIES THROUGH THE MEDIUM OF THIS LOOP

That the project has now become economically justified is because the Philadelphia Electric Company system load is large enough to absorb nearly the entire output of the plant at all times, while operation in connection with the existing steam stations in Philadelphia, utilizing Conowingo station as the base of the load in high flows and on the peak in low, makes relay steam capacity unnecessary.

The output of the Conowingo project can be completely absorbed earlier with the interconnection, since the minimum combined load of the three systems is well above the full load capacity of Conowingo station. Likewise, Conowingo's value in replacement of steam-generating capacity at all times of the year is greater with the interconnection.

# Pacific Coast Observations

By P. M. Downing
*Pacific Gas & Electric Company*

THERE are many instances where two or more independent systems are operating very successfully under interconnection agreements, but to obtain maximum benefits, control and management should be unified.

Although there are many arguments in favor of interconnection, the extent to which power systems can be advantageously interconnected has certain limitations beyond which there is no advantage in going. In the light of present knowledge the advantages of interconnection are regional in character and limited to a radius of 300 to 400 miles.

Interconnection between various sources of electric generation and distribution on the Pacific Coast was the inevitable result of environment and economic pressure. Along the route of these transmission lines, running from the hydro plants on the western slope of the mountains to the larger cities along or near the coast, were many small towns and agricultural communities supplied with power from isolated plants. Eventually most of these plants with the distributing systems became a part of a larger and more extensive network. When it is considered that the agricultural business is the least remunerative of any that is served, it will be apparent that the rural communities have benefited greatly by the fortunate fact that nature placed them between the source of power supply and the principal markets.

It is still desirable, if best operating results are to be obtained, to maintain a ratio between hydro and steam capacities that will place the base load on hydro and peak and emergency loads on steam. The ideal relationship depends upon such elements as load factor, relative capital costs of steam and hydro installations, cost of fuel, etc.

From the standpoint of continuity of service, steam plants play a less important part today than they did a few years ago. For example, the Pacific Gas & Electric Company, with a peak load of 439,568 kw. and an energy output of 2,380,000,000 kw.-hr., produced less than 0.9 per cent of it by steam. Several factors have contributed toward bringing about this change. In the first place, as the number of hydro plants feeding into an interconnected network is increased, temporary cessation of operation of one or more generating stations whose output represents a comparatively small percentage of the total has but little effect on the general service of the system as a whole. A similar situation obtains in the case of transmission lines. However, a much more important factor in improving service, in so far as transmission is concerned, is due to the better quality and design of insulators that are now available and the better and more substantial physical construction used.

Some of the chief factors that must be given consideration in the operation of interconnected systems are:

## *Important Benefits from Interconnection*

1. Greater reliability of service and increased economies. In cases of a shortage of power due to accidents to equipment, other similar devices on the interconnected system can supply the shortage until repairs are made or other units put into service. Under normal conditions, the more efficient units can be operated, the less efficient being held in reserve and operated only in emergencies.

2. Increased diversity, thus reducing the power requirements of the combined systems and, by improving the load factor, reducing the capital investment in plant facilities.

3. Common use of reserve or spare capacity, further reducing the capital investment in plant.

4. In cases where the network is supplied with power from both steam and hydro sources, the hydro stations can be operated continuously at full load when water is available, thus making a maximum beneficial use of water power and a minimum use of steam. On a smaller system there would be much less opportunity of doing so.

5. General availability of power over large areas, thus making it possible for factories to locate where raw material, labor, market conditions, etc., are most favorable. This is particularly important as it permits manufacturing plants to locate in smaller towns and agricultural areas and use labor normally employed during certain seasons only. In this way interconnection becomes an active force in the decentralization of population. P. M. DOWNING,

Vice-president Pacific Gas & Electric Company.

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1. Dependable communication.
2. Centralized authority and control over operations.
3. Location and isolation of trouble.
4. Voltage regulation and control over the entire network.
5. Frequency control.

When trouble occurs on the power circuits the inductive disturbances are generally sufficient to make communication circuits on the same or closely adjacent structures inoperative when they are most needed. Much more dependable communication can be had over circuits independent of and located a sufficient distance from the power line to be out of range of inductive interferences. Recent developments in carrier-current equipment give promise of providing a cheaper and more dependable means of communication.

The success attending the operation of large interconnected networks is due in very large measure to the fact that authority and control over the details of operation are centralized in the load dispatcher. Among the more important responsibilities of this position is allocation of load among the generating stations, substations and lines in such a way that there is maximum use of the more efficient plants or equipment, conservation of water or fuel and readiness to meet any operating emergency. Under normal operations, these conditions can be met without any great difficulty, but once the regular operating routine is upset by storms, breakdowns, water shortage or otherwise, the resourcefulness of the load dispatcher may be taxed to the limit.

Where generating stations and switching centers are separated by several hundred miles there is always the liability of partial or complete failure of the communication circuits. To dispatch orders under this condition increased accuracy and saving of time have been effected by use of code numbers indicating prearranged instructions.

Localization and isolation of trouble have been greatly facilitated by substitution of relay-control for manual operation of switches.

As an interconnected network grows and the amount of power delivered into it increases, the necessity of having dependable switches becomes of increasing importance. The construction of high-voltage switches has been materially improved during recent years, but there has been practically no change in the general design. Failure to keep pace with the development of other facilities used in connection with the production and transmission of high voltages has made them the weakest link in a power system.

Thus far the vacuum type switch has given more promise of relief than any other that has been proposed. Laboratory tests have shown that there is practically no deterioration or damage to the contacts after opening a 15,000-volt circuit carrying 120 amp. more than 500 times. If this type of switch can be developed to a point where it can be used on a commercial basis there is every reason to believe that it will rapidly supersede the present oil type.

Condenser installations can be fully justified not only as a most satisfactory means of improving voltage regulation but they also have a tremendous economic value in that, by improving the power factor, the amount of power that can be carried over a given line is materially increased.

Frequently control on an interconnected system is a comparatively simple matter. Irrespective of the number, size or location of generating stations one station does the governing. Ordinarily the station near the load center, where a sufficient governing margin can be maintained at minimum cost, is selected. Where a hydro plant does the governing it is desirable that one having sufficient forebay capacity to supply the varying drafts necessary to meet load fluctuations be selected. Where the network is supplied from both hydro and steam sources, especially where the latter is operated as a standby or reserve source of power supply, there is but little, if any, economy in governing with steam. Maximum economy will be obtained by loading all hydro plants except the one doing the governing, thus reducing the steam load to a minimum and keeping only enough boilers hot to pick up the predetermined amount of load that is to be thus protected against interruptions in case trouble should occur.

To prevent seesawing of load between different plants the governors on the governing plant are adjusted sensitive enough to operate on a minimum variation in speed. Those on the other plants are adjusted to operate only on the wider variations that would occur if and when for any reason they might become separated from the governing station.

On a reasonably large interconnected network of lines, carrying a highly diversified load, the instantaneous variation in load, or what is ordinarily called the governing margin, is comparatively small. In fact, it is not at all unusual during short water periods to reduce this to practically zero and follow the gradual variations in load by hand control. On the system of the Pacific Gas & Electric Company, with a peak of almost 440,000 kw.-hr. supplied to an area larger than any other interconnected network in the West, the normal governing margin is between 1,000 and 2,000 kw.

## System Voltage Control

By C. P. Hubbard

*System Operator Detroit Edison Company, Detroit, Mich.*

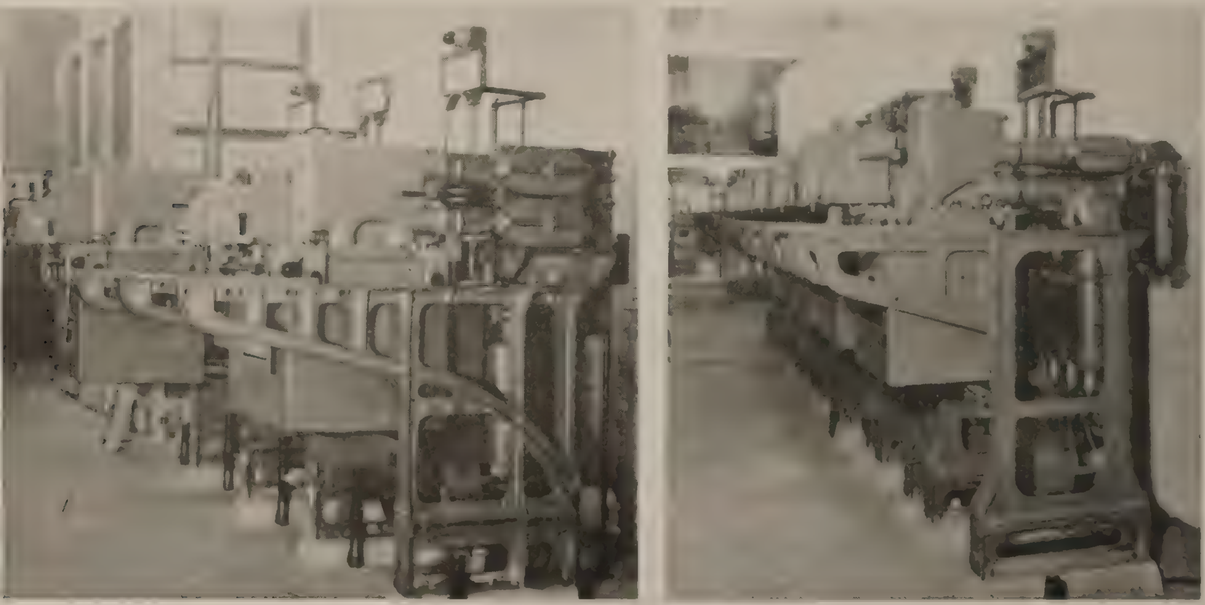
CONTROL of voltage on the Detroit Edison system from the generator busbars to customers' outlets is the direct responsibility of one man in the engineering division of the electrical operating department. Load conditions are not permitted to affect the voltages; that is to say, over- or under-voltage is not allowed at times of light or heavy system load. Except for a slight variation, caused by shifting wattless current from one plant to another, the generating-plant voltages are carried practically constant throughout the 24 hours of the day. Generator voltage is not regulated to compensate for system conditions caused by changes in load. The voltage schedules in the various elements of the system are maintained by tap chargers at switching stations and by synchronous condensers at the ends of long transmission lines. It should be observed that these synchronous condensers are more for voltage control than power-factor correction. The synchronous condensers are not operated at scheduled loads, but are controlled by the local station operator in accordance with voltage conditions at the particular point. The operator increases or decreases load on the condenser, or even removes the unit from the line or replaces it on the line entirely as the local voltage conditions warrant.

System voltages are checked both by voltage charts and by periodical testing. Bus voltages at generating stations are taken every half hour. Bus voltages at large switching stations are watched carefully and any deviation from normal is reported to the system operator at once. At attended substations a complete set of voltage and load readings are taken on three days each week, at 10 o'clock in the morning and during the evening peak load. These regular readings are supplemented with voltmeter charts taken at unattended points on the system.

It is the duty of the man in charge of voltage control to determine which taps are to be used on regulating transformers at the switching stations and to determine when these taps shall be changed by reason of changes in load. The usual range of the taps is in steps of 2½ per cent to 10 per cent above and below normal. The voltage on the transmission lines is kept as nearly constant as possible. Distribution voltage regulation is accomplished by regulators installed either on individual lines or on transformers feeding distribution buses. It is intended that these regulators shall care for all distribution voltage conditions and no attempt is made to regulate these conditions by changes of the transmission line voltage.

## Iron-Clad Equipment Saves Space in New Substation

REYROLLE switchgear is used throughout the new East 172d Street substation of the New York Edison Company. Energy is received at 13,200 volts, three-phase, and transmitted at the same potential to outgoing feeders, which in turn supply distribution transformers feeding low-voltage networks at strategic centers. Each incoming feeder is equipped with 330-kva. induction-voltage regulators and supplies three smaller distribution feeders.



SWITCHGEAR USED FOR INCOMING AND OUTGOING FEEDERS IS OF IRONCLAD TYPE

# Lightning Experience*

### Performance of different sections of 132-kv. line reduced to a common basis. Changes in tower design. Work done to reduce lightning troubles at stations. Efficacy of ground wire

By Philip Sporn
*Electrical Engineer American Gas & Electric Company*

WHEN a line goes out of service it is the business of the operating man to get it into service with as little delay as possible and afterward try to determine, if possible, what has happened. When the excitement of the emergency has passed this often results in a lack of evidence that will withstand critical analysis or give any real information as to what has happened such as would be of real benefit to future design. Keeping this in mind it is easier to understand why some of the records presented are in some respects incomplete. Examining the accompanying table it will be noted that the largest number of lightning outages occurred on the Twin Branch-Lima line. This line was in service for the full year and has a length of 128½ miles. Based on 100 miles of circuit, however, it is not at all out of line and checks up with similar performance on the Lima-Fostoria line and on the Philo-Crooksville line. On the basis of 100 line-miles the largest number of interruptions occurred on the Glen-Lyn-Roanoke line, but this figure is of course subject to the weakness that the line was in service for six months only, and there is no way of checking up whether the ratio employed for figuring the yearly number of interruptions was correct for the entire year.

## Where Greatest Interruptions Occurred

Of the lines that were in service for an entire year the largest number of interruptions per 100 miles of line was sustained by the Logan-Turner line. This is a line that has no ground wires and, in addition, passes through especially rugged country. The length of the insulator string on this line is particularly short (see tabulated values) being, in fact, shorter than that of any other line with the exception of the Windsor-Canton line. Expressed in circuit-miles, however, the record is rather good. In such cases involving a double-circuit line, however, the method of dividing the total number of interruptions by two and calling that the interruptions per circuit is questionable. It raises the question whether such a result can be compared with the number of flashovers on a single-circuit line.

To amplify: Consider the two top wires of a double-circuit tower line with both circuits subject to the same potential gradient. Upon the occurrence of a lightning discharge, chance will usually determine which one of the two circuits is to flash over first. This assumes, of course, that their arrangement is perfectly symmetrical and that they constitute the same phase wire in their respective circuits. A flashover having occurred on one of them, the question arises whether that flashover does not reduce the energy in the surface sufficiently to lower the head of the wave to such an extent that the second wire will not flash over. The fact that among all the double-circuit lines the maximum number of instances in which both circuits flashed over on any one line was only four against a total number of flashovers of twenty would certainly tend to indicate that some such explanation may be the correct one.

The Roanoke-Reusens line is third in the number of interruptions per 100 miles of line, but the figure for a whole year was again obtained by a ratio and is open to the same objection as the figures for the Glen Lyn-Roanoke lines. The Philo-Canton and the Windsor-Canton lines, in spite of the fact that the Philo-Canton line generally is exposed to more severe storms than the Windsor-Canton line, have practically the same record for the year 1926, when reduced to a 100-mile basis One of these lines, namely, the Windsor-Canton line, has two ground wires and is considerably lower than the Philo-Canton line, which has only one ground wire. The record during 1926 would seem to show that from the standpoint of reliability the Philo-Canton line, even though it has only one ground wire, has been put on a plane of reliability equal to that of the Windsor-Canton line. From the data gathered on the Glen-Lyn-Reusens line and Roanoke-Reusens line in 1926 it would seem that the ground wire on these lines was not so effective as it was on the other lines. The ground wire construction being in general the same on all of the lines, a possible explanation for the large number of flashovers may lie in the fact that the tower resistance over the lines as a whole is rather high.

## Apparent But Not Actual Immunity

An interesting line in the series is the Logan-Sprigg line. This line, of wood-pole construction, was originally built for 88,000 volts and was operated for a period of about five years at 44,000 volts. At the end of this time additional insulation was added and the line was cut over to 132,000-volt operation. The majority of the structures are two-pole A frames with ungrounded steel crossarms. The insulation is unusually liberal. For a while, when the line was first placed in operation, the operating records seemed to indicate an almost lightning-proof line, but detailed investigation has shown that this was not quite so. Considering the shortness of the line, namely 21 miles, the record is not particularly good, although again the record is open to the criticism that a full year's data were not available.

Only in one case has a line been out of service due to

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*Excerpts from paper presented before A.I.E.E. at midwinter convention on Feb. 17.*

## Operating Record and Some Characteristics of 132-Kv. Lines—(American Gas & Electric Company)

| Line designation | Glen Lyn Roanoke | Glen Lyn Switchback | Lima Fostoria | Lima Twin Branch | Logan Sprigg | Philo Canton | Philo Crooksville | Philo Turner | Roanoke Danville | Roanoke Reusens | Rutland So. Point | Saltville Kingsport | Switchback Logan | Switchback Saltville | Turner Logan | Tw. Branch So. Bend | Windsor Canton | So. Bend New Carlisle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Outages (one circuit only) Due to lightning—1926 | 16 | .... | 9 | 23 | 3 | 13 | 3 | 11 | 0 | 13 | 3 | .... | .... | .... | 16 | 0 | 9 | 0† |
| Circuit outages due to lightning—1926 | 20 | .... | 9 | 23 | 3 | 15 | 3 | 11 | 0 | 13 | 3 | .... | .... | .... | 18 | 0 | 11 | 0† |
| Circuit outages per 100 miles of line per year—1926 | 48* | .... | 19.8 | 17.9 | 31* | 20.5 | 19.5 | 10.6* | 0 | 36.6* | 6.3* | .... | .... | .... | 44.8 | 0 | 20 | 0† |
| Circuit outages per 100 miles of circuit per year—1926 | 24* | .... | 19.8 | 17.9 | 31* | 10.3 | 19.5 | 10.6* | 0 | 36.6* | 6.3* | .... | .... | .... | 22.4 | 0 | 10 | 0† |
| Length of line—(miles) | 65.0 | 30.0 | 45.6 | 128.5 | 21.0 | 73.0 | 15.4 | 118.7 | 65.0 | 43.0 | 50.3 | 56.0 | 50.0 | 46.0 | 40.2 | 4.9 | 55.0 | 17.7 |
| Number of circuits | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 1 |
| Number of ground wires | 1 | 1 | 1 | 1 | None | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  1 | None | 1 | 2 | 1 |
| Date ground wire installed | 6/13/26 | 8/13/27 | 5/15/26 | 6/7/26 | None | 5/6/26 | 4/9/26 | 4/22/26 | 9/16/26 | 5/5/26 | 3/15/26 | 8/25/27 | .... | 10/16/27 | None | 6/8/26 | 9/–/17 | 6/24/26 |
| Line configuration (horizontal-vertical) | V | V | V | V | H | V | V | V | V | V | V | V | V | V | V | V | V | V |
| Protection—Rings and horns | No | Yes | No | Yes | No | Yes | No | No | No | Yes | No | Yes | Yes | Yes | Yes | Yes | No | No |
| Protection—Horns line side | Some | .... | Some | .... | .... | .... | .... | Yes | Some | .... | .... | .... | .... | .... | .... | .... | Some | Some |
| Protection—Horns ground side | Some | Yes | Some | Yes | .... | Yes | .... | .... | Some | Yes | .... | Yes | Yes | Yes | Yes | Yes | Few | Some |
| Nature of terrain | Rolling to mountainous | Very mountainous | Very flat | Very flat | Very mountainous | Rolling | Rolling | Rolling to mountainous | Rolling | Rolling | Rolling | Rolling to mountainous | Very mountainous | Mountainous | Very mountainous | Very flat | Rolling | Flat |
| Length of suspension insulator string (inches) top | 52.25 | 56.38 | 57.0 | 57.5 | 64.4 | 52.25 | 57.0 | 57.0 | 56.38 | 57.0 | 57.0 | 51.3 | 51.3 | 51.3 | 47.5 | 57.5 | 47.5 | 57.5 |
| Middle | 52.25 | 56.38 | 57.0 | 57.5 | 64.4 | 52.25 | 57.0 | 57.0 | 56.38 | 57.0 | 57.0 | 51.3 | 51.3 | 51.3 | 47.5 | 57.5 | 47.5 | 57.5 |
| Bottom | 47.50 | 51.3 | 47.5 | 51.75 | 64.4 | 47.50 | 47.5 | 47.5 | 51.3 | 47.5 | 47.5 | 51.3 | 51.3 | 51.3 | 47.5 | 51.75 | 47.5 | 51.75 |
| Height of standard tower (ground to top crossarm) (ft.) | 90 | 92 | 90 | 90 | 35–40 | 90 | 90 | 90 | 92 | 90 | 90 | 90¼ | 92 | 90¼ | 90-45(c) | 90 | 74 | 90 |
| Conductor spacing (vertical) (ft.) Top—Middle | 13 | 15 | 13 | 13 | .... | 13 | 13 | 13 | 15 | 13 | 13 | 13¼ | 15 | 13¼ | 13 | 13 | 12 | 13 |
| Middle—Bottom | 13 | 15 | 13 | 13 | .... | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 13 |
| Clearance—Line to tower (normal position)—Top | 6.0 | 6.5 | 5.75 | 5.75 | 7.0(a) | 6.0 | 5.75 | 5.75 | 5.0 | 5.75 | 5.75 | 5.0 | 7.0 | 5.0 | 5.0 | 5.75 | 5.25 | 5.75 |
| At suspension strings (ft.)—Middle | 6.5 | 6.5 | 6.25 | 6.25 | 5.0 | 6.5 | 6.25 | 6.25 | 6.5 | 6.25 | 6.25 | 6.75 | 7.0 | 6.75 | 7.25 | 6.25 | 9.0 | 6.25 |
| Bottom | 7.5 | 10.0 | 7.5 | 7.5 | 7.0(a) | 7.5 | 7.5 | 7.5 | 9.75 | 7.5 | 7.5 | 9.0 | 10.0 | 9.0 | 7.5 | 7.5 | 7.75 | 7.5 |
| Clearance—Line to tower—(45 deg. position)—Top | 4.8 | 5.0 | 5.0 | 5.0 | 3.25(b) | 4.8 | 5.0 | 5.0 | 4.8 | 5.0 | 5.0 | 4.0 | 4.0 | 4.0 | 3.75 | 5.0 | 3.25 | 5.0 |
| At suspension strings (ft.)—Middle | 4.8 | 5.0 | 5.0 | 5.0 | .... | 4.8 | 5.0 | 5.0 | 4.8 | 5.0 | 5.0 | 4.0 | 4.0 | 4.0 | 3.75 | 5.0 | 3.25 | 5.0 |
| Bottom | 3.75 | 4.0 | 3.75 | 3.75 | 3.25(b) | 3.75 | 3.75 | 3.75 | 4.0 | 3.75 | 3.75 | 4.0 | 4.0 | 4.0 | 3.75 | 3.75 | 3.25 | 3.75 |

(a) Side cond. to pole. (b) To wood pole. 4.0 deg. to crossarm. (c) "E" towers. * Corrected for one calendar year. † Record incomplete.

lightning trouble on it for a period in excess of the time necessary to close the line back in service. The one case referred to occurred on May 18 on the Windsor-Canton line, where both circuits tripped automatically due to the breaking of two line wires. It is interesting to note that this occurred on a line that had been very conservatively designed from the standpoint of height above ground, but, on the other hand, it had practically no arcing protection. This again substantiates the point that in designing a line both preventive and remedial measures must be considered. Lowering a line, for example, will undoubtedly reduce the lightning voltage which may be induced on the line. Installing a ground wire will do the same thing. Both these measures are preventive. The purpose of the arcing protective devices, on the other hand, are decidedly remedial.

In every case during 1927 construction ground wire was brought into the station structure and, where the station structure design allowed, the number of ground wires brought into the station structure was made larger than the number on the line itself, all with the idea of reducing as much as possible the surge impedance of that portion of the system running from the last tower to the bus.

To limit definitely the amount of overvoltage that can be brought into the station apparatus a reduction in the insulating value on the first mile or so of the line coming into the station was made, all with the idea of making certain that the lightning strength of the apparatus connected to the bus was equal to, or greater than, the lightning flashover of the insulator string on the first mile of line.

Where the country did not absolutely demand it, the use of tower extensions has been kept at a minimum so as to keep the effective height of the line at a predetermined level, that level being determined, of course, by the tower design itself. In cases where the topography of the country permitted, the tension to which the conductor was pulled up was considerably reduced, resulting in a greater sag and a closer adherence of the conductor to the contour of the earth, with, of course, a net reduction of the average height of span above earth.

More attention was paid to the mechanical aspect of the arcing protection arrangements with a view to minimizing the effects of conductor vibration on the protection assembly itself.

Previously it was pointed out that unless a line was very low, generally steel tower structures, carrying power conductors of 44,000 volts and over, should be designed and installed with a ground wire. It is now believed that careful consideration should be given to the question of whether or not two ground wires would not in some cases be justifiable, with, of course, particular attention to the location of the ground wires as regards the main conductors. The experience with lines without ground wires, and particularly the experience obtained during 1926 on the Logan-Sprigg and Turner-Logan lines, would seem to prove definitely that it is very hazardous and extremely unwise to try to operate a line of the type under discussion without a ground wire. The limit to the voltage which can be picked up on an insulator string being the flashover of the string plus its supporting structure to ground, the likelihood of picking up voltages close to that limit will naturally be much greater without a ground wire than with it. This has been borne out by some of the 1927 experiences with klydonographs.

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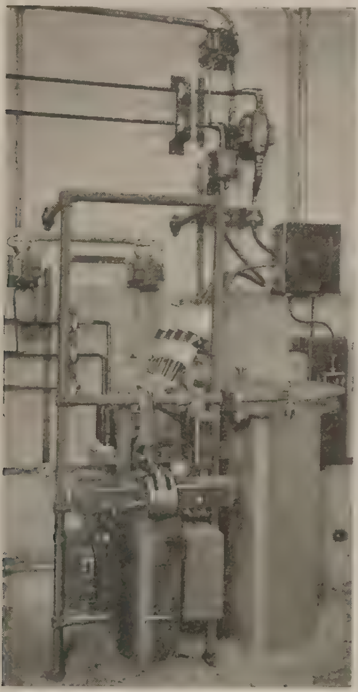
# Switch and Transformer Oil Testing

### Semi-automatic control of testing equipment expedites work. Chart record shows breakdown potential

By J. B. Wallace

*Detroit Edison Company, Detroit, Mich.*



SEMI-AUTOMATIC VOLTAGE CONTROL EQUIPMENT FOR OIL TESTS

THE STANDARD A.S.T.M. method of determining the dielectric strength of transformer and switch oils specifies (1) a definite settling time of five minutes for the sample in the test cup before applying potential; (2) a definite settling time of one minute between four succeeding trials, and (3) a constant rate of potential increase of 3,000 volts per second up to breakdown. Automatic recording of the breakdown kilovolts, while not specified, is also desirable to eliminate errors in observation of the swinging pointer on the voltmeter. To meet these requirements equipment has been developed for use in the high-voltage test laboratory of the Detroit Edison Company. Alternating current for general high-voltage testing is supplied by a motor-driven alternator with direct-connected exciter; the output voltage of this alternator is adjusted by a motor-driven main field rheostat with limit switches and can be varied between zero and 3,750 volts. The output of this alternator energizes the primary winding of the high-voltage test transformer, which is rated at 50 kva. with a ratio of 2,300/100,000 volts. A standard oil-circuit breaker connects the alternator output to the test transformer. This circuit breaker is operated by a G.E. type MK-1 reclosing mechanism actuated by a single-phase repulsion induction motor and fly-ball weights. This mechanism has been equipped with two potential trip coils, one of which is arranged for manual trip, remotely controlled, and the other is operated by a current relay in the secondary of a current transformer in the bus run between circuit breaker and test transformer.

BENCHBOARD FOR CONTROL OF DIELECTRIC TESTS OF OIL

The timing cycle is controlled by a Westinghouse periodic reclosing relay, which is a d.c. motor-operated drum type relay, arranged to control four circuits. Control energy is furnished by a 2$\frac{1}{4}$-kw., 125-volt d.c. generator which is a.c. motor-driven. Energy for indicating lamps, alarm circuits, etc., is taken at 115 volts a.c. from a 1-kva., 230/115-volt auto-transformer across one phase of the a.c. supply to the motor-driven control generator. Operating controls and indicating instruments are concentrated on a benchboard control desk inside the test inclosure, while the timing and set-up relays are mounted on a wall panel immediately adjacent.

An Esterline-Angus recording voltmeter was rebuilt, with a spark recorder substituted for the usual inking tube. The pointer is of wood, with a vertical metal pin at the recording end and a metal segment just above and extending along the travel of the pointer. A spark coil, mounted in the case, is connected through a small transformer to the current trip relay contacts, and this arrangement causes a spark to jump, at the moment of breakdown, from the metal segment to the pointer pin and through the chart to the chart table, thus marking the breakdown voltage with a small puncture in the chart. A small solenoid, actuated through the contacts of the circuit breaker closing relay, advances the chart one space between successive trials. The chart table has been made wider to facilitate writing oil sample identifications on the record, and the pointer is separated from the writing space by a heavy curved glass barrier. The entire recording assembly is mounted in a movable desk equipped with rubber roller casters and a three-circuit, six-conductor, flexible cable from the recording instrument is arranged to plug the three circuits simultaneously into the proper terminals of a six-point jack on the benchboard. The oil-test cup used with this equipment is an adaptation of the standard Westinghouse cup provided for use in dielectric breakdown tests of oil.

The indicating and alarm circuits are energized and control generator voltage is adjusted to a point at which the main field rheostat motor will raise the test voltage at a rate of 3,000 volts per second. This point has been predetermined.

The alternator is started and brought up to speed with voltage at zero. The oil-test cup is cleaned, dried, rinsed and sample poured in. The timer motor circuit is closed at the benchboard and the timer started manually. After 4½ minutes elapsed time a set-up relay establishes the closing circuit up to the timer contacts. After five minutes the timer closes the circuit and stops, the main circuit breaker closes also, closing the auxiliary switch and starting main field rheostat motor in "raise" direction. The voltage increases at 3,000 volts per second to oil breakdown. At breakdown the current-trip relay closes one circuit to the recording voltmeter spark coil and one circuit to the trip coil.

The main breaker opens, opening the "voltage-raise" auxiliary switch and closing the "voltage-lower" auxiliary switch and timer-motor circuit. The main field rheostat returns to zero, while the timer runs one-half minute to the set-up point. One minute after the first oil breakdown the main breaker closes and the second run-up to breakdown is made. This cycle is repeated for a total of five breakdowns. After the fifth breakdown the main field rheostat returns to zero, the timer closes an alarm bell circuit for five seconds and the timer-motor circuit opens through a timer-drum contact. It cannot again be closed until the timer drum is manually rotated to the starting position.

The testing cycle is repeated twice and the mean of the averages of the three series of five trials each taken as the dielectric strength of the oil under test in the standard gap used. Using this equipment, the standard A.S.T.M. oil test can be completed on a given oil sample in about 40 minutes and requires less than one quart of oil.

# Reducing Distribution Losses

NINTH ARTICLE

## *Graphic Ammeter Tests*

By J. B. Moorhouse
*Electric Distribution Engineer Central Illinois Public Service Company, Springfield, Ill.*

LOAD-CHECKING graphic ammeters are mounted in two-compartment steel boxes similar to those used for voltmeters and illustrated in a previous article of this series. A receptacle must be provided for a lamp or heater unit inside the steel box in order to keep the clocks warm during cold weather. A 25-watt lamp gives off sufficient heat if the door of the box fits properly.

In checking distribution transformer loads on either the primary or secondary side a current transformer must be used. A check on the secondary side is preferable in that: (a) Service need not be interrupted while connecting instruments; (b) connection of instruments on secondary voltage is less hazardous; (c) the current balance on the two legs of the transformer can be obtained.

All graphic ammeters on the market today operate at a relatively high load. To insure accuracy of results special solid core current transformers are used by the Central Illinois Public Service Company. Compensation, correct for use with Westinghouse type "U" graphic ammeters, is provided for by removing secondary turns of the winding. Variable ratio primary is provided by tapping the primary winding. In order to check all sizes of distribution transformers from 3 kw. to 37½ kw. ratios of 200, 100, 50 and 25.5 amp. are most convenient. These ratios, being in even multiples of five, are readily applied to the 0-5 amp. scale of the chart.

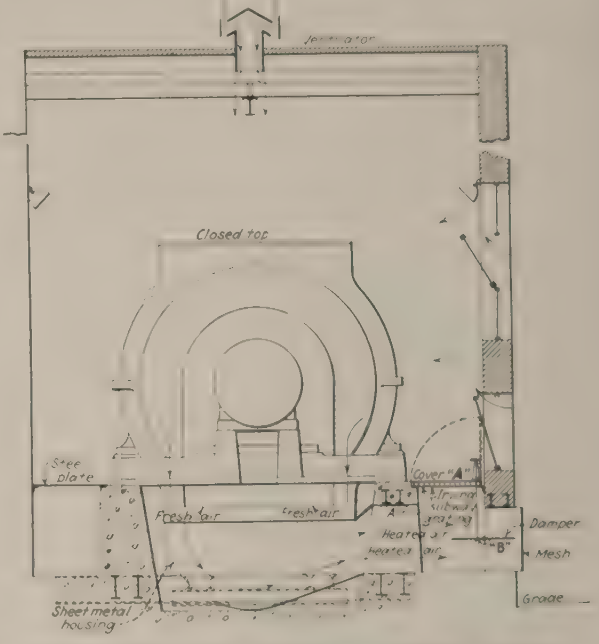
# Securing Clean Air for Synchronous Condenser

### Low intake velocities and selected entrance points reduce air impurities in machine ventilation

By H. W. Herrlich
*Electrical Design Engineer Utica Gas & Electric Company*

DUE to local conditions, a closed, circulating, air-cooling system could not be used in the installation of a 15,000-kva., 13.2 kv. synchronous condenser at the Washington Street station of the Utica Gas & Electric Company.

The proximity of the station to a water gas plant and to a large boiler plant compelled the greatest caution in the drawing in of free air, as a considerable deposit of fine cinders covered the ground for a great distance. It was therefore decided to draw in the required amount of air for cooling with the least velocity. This could quite readily be accomplished through the roof ventilators, windows and doors. Normally, the air is discharged through a screened opening on the side of the building, as indicated in the sketch, but during cold weather the butterfly damper, *B*, is closed, the cover plates, *A*, lifted, and the heated air enters the room. Almost all of the switching equipment is located in the same room with the condenser and is kept practically free from deposit of cinders. The condenser has been in constant use since the spring of 1923 and has shown at the annual inspections of the plant that there is practically no abrasive action on the coils and a very small deposit of cinders and dust.



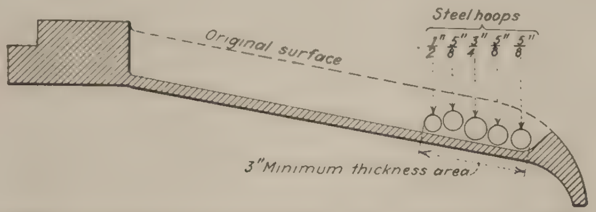
COOLING SYSTEM AVOIDS ENTRANCE OF EXTRANEOUS MATERIAL

The air ducts are free from goosenecks, short bends and other obstructions, permitting the condenser to carry considerable overload, without exceeding the guaranteed temperature rise.

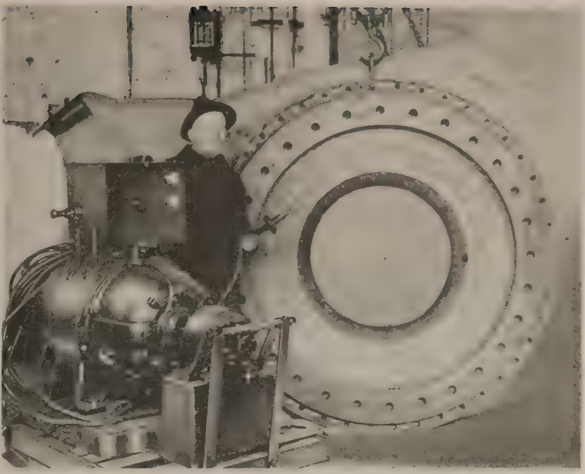
# Electric Welding Saves Waterwheel Casing

A SERVICE interruption of three months, the investment of about $1,000 in a new casing and loss of power during a high-water period were saved recently in a New England generating plant by electric welding, at an expense not exceeding $175, applied to a leaky hydraulic turbine. Describing this job before the Affiliated Technical Societies of Boston, C. W. Babcock, sales engineer Boston office Westinghouse Electric & Manufacturing Company, stated that the wheel in question ran under about 150 ft. of head and had been patched from time to time until leaks through the casing forced a shut-down. The wheel manufacturer quoted three months' delivery and a price of about $1,000 on a new casing, but the company could not wait for this. It was decided to try arc welding as a last resort.

During years of operation the outboard and thrust bearing had worn gradually, and the runner moved laterally until it touched the casing and wore away a section about 10 in. wide and 1 in. deep entirely around it. In one place the casing was worn through and in other spots it was from $\frac{1}{16}$ in., or less, to $\frac{1}{4}$ in. thick. A patch had been placed over the weakest parts. Owing to the extreme thinness of the iron near the inside radius of the worn section it was impossible to weld or deposit metal on the casing itself. The arc would have burned through as fast as established. This space was, therefore, bridged by a series of steel rings welded together and to the casing, and the remainder of the area welded in, as indicated in the drawing.



SECTION OF CAST-IRON WATERWHEEL CASING, ELECTRICALLY WELDED



CASING AFTER WELDING AND PORTABLE WELDER USED

In handling this work a $\frac{5}{8}$-in. ring was welded to the neck of the casing. A second hoop of this size was placed outside the first and welded to it across the top. A third hoop, $\frac{3}{4}$ in. in diameter, was then put in place and welded to the second. A fifth ring $\frac{1}{2}$ in. in diameter, was then placed at a distance from the third that the fourth hoop, $\frac{5}{8}$-in. diameter would be raised up from the cast-iron when finally put in place. The fifth hoop was welded to the casting on the outer side. This was done to prevent the fifth ring from pulling or shrinking from the cast-iron, as it might have done if first welded to the fourth. The fourth hoop was then dropped into place and welded to the third and fifth rings. A small piece was cut out of each ring before welding, to allow for expansion, and the gap filled in later. These gaps were staggered. This made a strong bridge over the thin section and the entire remaining area was welded in without great difficulty.

While welding directly on the cast-iron, the welder ran a bead of only 1 or 2 in. at a time in one spot, and a helper immediately peened this with a hammer to strengthen it and avoid porosity. The first layer of welding to the cast-iron was done with a special grade of welding wire for cast-iron, succeeding layers being put on with ordinary steel welding wire. After welding, the high spots were ground off with a portable wheel, the reinforcing patch outside the casing being left in place,

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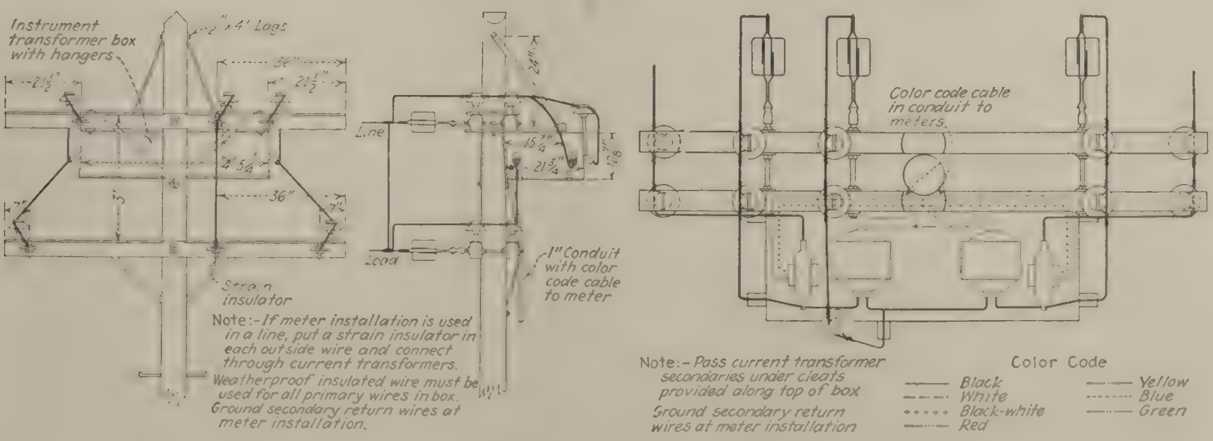
# Three-Phase Pole-Top Instrument Transformer Box Installation



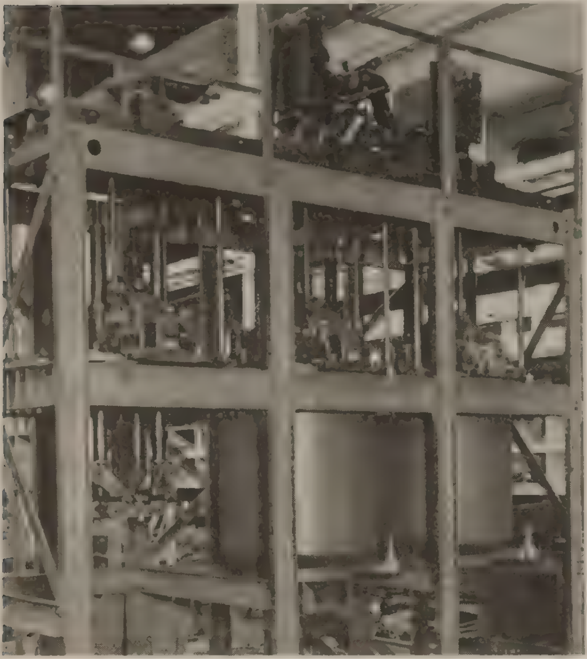
Note:—If meter installation is used in a line, put a strain insulator in each outside wire and connect through current transformers. Weatherproof insulated wire must be used for all primary wires in box. Ground secondary return wires at meter installation.

Note:—Pass current transformer secondaries under cleats provided along top of box. Ground secondary return wires at meter installation

*Standards of West Penn System*

as there was no object in removing it. The job was done in one week by a welder and helper. About 250 lb. of welding wire was used. A Westinghouse 200-amp. single-operator arc welder of the motor-generator type was employed, and about 300 kw.-hr. were consumed.

## Mechanical Strength a Feature of 2,500,000-Kva. Circuit Breaker



NO PORCELAIN is used in the construction of a new type high capacity breaker now being built by the Westinghouse Electric & Manufacturing Company, as this material is considered to be inadequate to meet the mechanical stresses that may occur. The manufacturer believes that this type of equipment, which is supplied for 15,000- and 220,000-volt service, will meet any system capacity needs for some years to come.

# Letters from Our Readers

### *Designing Plants in Economic Units*

*To the Editor of the* ELECTRICAL WORLD:

Alfred Iddles has employed the logical method* in attempting the solution for the most economical set of proportions. He first divides the plant into sections, each of which may, by itself, be treated as an economic unit.

The first economic unit is the steam-generating plant. Having determined which of the sets of conditions investigated is most economical for the steam-generating plant, he next, for the resulting operating conditions, finds which of the sets of conditions investigated is most economical for the power-generating section of the equipment. The latter section of the plant is thus the second economic unit.

In general, it may be stated that there is a set of proportions for any structure which will prove most economical. The discovery of this particular set of proportions is predicated, first, on ascertainment of the economic units into which the structure or system may be broken up. An economic unit is a part of the system such that the variations considered have little or no influence on the cost of operation in the part of the plant extraneous to the unit under consideration. Thus it is implied in the method of analysis here outlined that variations of proportions in the steam-generating plant will not materially influence the cost of operation in the power generating plant, and vice versa.

The economic factor is that expression which in general terms expresses in some way the cost of operation of the economic unit. It includes terms whose magnitudes are fixed when the physical proportions and load conditions are fixed and whose value changes when any one of these conditions is altered.

Curves plotted between axes, one of which is the economic factor value and the other some physical proportion of the unit, may be called the economic characteristic and show at a glance what is involved economically when the proportions of the unit are altered.

Usually such curves may be arranged to show maximum or minimum values at the best set of proportions, depending upon whether the economic factor is set up to express a saving in money or total cost of operation.

Mr. Iddles has chosen, for the sake of simplicity, to fix the surfaces in the economizer and air preheater. His conclusions, then, regarding whether or not economizer and, or, air preheater surfaces should be installed, apply strictly only to the amounts of surface in question. There may be and probably are smaller extents of both types of surface which would prove economical in use, even though the interpretation placed on the results is that in some instances economizers and, or, air preheaters are not economical. The reader might well be referred here to a recent paper by Mr. Van Deventer entitled "Economics of Air Preheater Applications," A.S.M.E. national fuels meeting.

The economic factor as set up by Mr. Iddles is thus restricted in certain proportions and represents directly differences in operating costs for the several sets of conditions chosen, and the only conclusion justifiable is that some one of these sets of conditions is more economical than another. But to say that because, for instance, Case I is more economical than Case II air preheaters are not justified is obviously a generalization based on insufficient information. All that may be said is that as much air preheater surface as is included in Case II is not justifiable. The conclusions stated under (2) on page 194 are thus subject to the above criticism.

Perhaps the same type of criticism may apply to conclusion (3) on page 194, as in view of our experience with both pulverized fuel and stoker fired boilers it is difficult to believe that it is generally true that it will take nine-dollar coal to justify the use of a pulverized coal system of the bin type. If this is so, then there is still the unit system, which, although mentioned by the author, has not been brought into the discussion. Obviously, the high fixed charge and maintenance account which handicaps the bin type system in this analysis would have to be greatly reduced for the unit system.

PROF. W. J. WOHLENBERG.
Yale University.

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*"*Economy of High Efficiency in Medium-Sized Power Stations,*" ELECTRICAL WORLD, *page 189, Jan. 28, 1928.*

# Digest of Electrical Literature

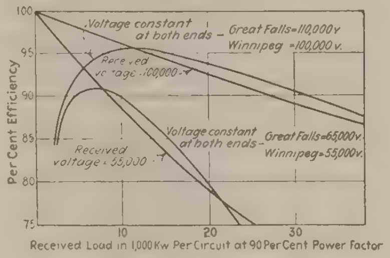
## *Generation, Control, Switching and Protection*

*The Klingenberg Power Station, Berlin.*—This station has a present capacity of 270,000 kw. and renders the city of Berlin independent of outside electrical sources. The various features of the station, including the method of receiving the coal, and steam and electric generating data and features are given. Steam is generated at 514 lb. per square inch and 797 deg. F. The boiler drums and superheater-tube suspension offer unusual features. All the combustion air is preheated to 302 deg. F., a portion of it being extracted and mixed with cold air for use in the primary air-fuel mixture. The remainder is drawn by suction into the combustion chamber. The generating equipment consists of three sets, each having an output at a continuous rating of 100,000 kva. Each set consists of a main machine of 80,000 kw. capacity and an auxiliary machine with an output of 10,000 **kw**. The turbines operate at 478 lb. per square inch and 752 deg. F. Each consists of a triple-expansion cross-connected turbine with twin low-pressure portions and drives two generators of equal output. The two parts of each turbine are arranged parallel and alongside one another, each set being placed one behind the other along the longitudinal axis of the turbine room. Control is obtained from a main control room, where an instrument indicating the conditions on the steam and electrical sides allow a close supervision of all operations. Transformers raise the generator voltage of 6,000 to 30,000 volts and are connected directly to the 30,000-volt bus bars for subsequent distribution. — *Engineering (England)*, Jan. 13, 1928.

## *Transmission, Substations and Distribution*

*The Grounding of a Long-Distance Transmission Line Compensated Through Petersen Earth Coils.*—Takashi Ohtsuki. — The author has endeavored to cover the subject of the grounding of long-distance transmission lines, and the general equations of a transmission line grounded at any point on the line with any treatment of its neutrals have been derived with consideration for all distributed line-constants so that an accurate tuning condition of the earth coils may be obtained. The electrical conditions resulting from the accidental grounding of a line are theoretically investigated for various probable causes so that the number and location of earth coils on a transmission line for the most favorable results are covered. It is stated that for practical purposes it is generally sufficient to take into account only the total line capacitance in order to determine the necessary compensating value of the earth coil on the comparatively short line, but that when the line to be compensated is longer it is increasingly important for the accurate tuning of the earth coils to be considered in connection with the line inductance. Formulas for the three-phase transmission line are derived and comparison with those for a single-phase system with general tuning conditions of the earth coils permits the establishment of an expression for symmetrical $n$-phase, $n$-line system. The effect of the third harmonic electromotive force acting on the system is discussed with relation to the treatment of the neutral point.—No. 14, *Selected Papers from the Journal of the Institute of Electrical Engineers of Japan.*

*110-Kv. Great Falls-Winnipeg Line.*—L. M. Hovey.—The new transmission line of the Manitoba Power Company is described in this article in connection with the design features involved and the considerations which influence their determination. Two-circuit steel-tower transmission lines are used with some unusually high structures and with long spans. Steel-reinforced aluminum conductors have been utilized in this installation. The features of the synchronous condenser operation and of the river crossing cables are developed. The methods of calculating performance of lines are given and the computed variation of efficiency with the received loads under potentials of 55,000 and 100,000 volts are also given.—*Electrical News (Canada)*, Jan. 15, 1928.



EFFICIENCY LOAD CURVES FOR TRANSMISSION LINES

*Series A.C. Transmission.* — Henry M. Sayers.—A discussion of the possibilities of the distribution of alternating-current electrical energy in certain areas by means of a constant current primary-ring main circuit with variable current secondary or load circuits. A definite scheme is offered for the practical application of this idea. The growing demand for electricity supply in rural areas is said to be satisfied economically by the plan outlined by the author, who also offers as an example a solution for a specific distribution problem to which his plan might be applied.—*Electrical Review (England)*, Jan. 13, 1928.

## *Units, Measurements and Instruments*

*Cathode-Ray Tube for General Alternating-Current Measurements.*—Mrs. Z. Tscherdanzev. — With the aid of a Brownian tube and a few properly dimensioned deflection coils most of the conventional a.-c. measurements can be readily performed with a high degree of accuracy. This little known and utilized fact is described in this paper. Current, voltage, frequency and power-factor measurements require but few accessories and a simple calibration. If higher harmonics are to be evaluated a basic sinusoidal wave must be available, which can best be derived from a small magneto-motoric induction machine. The Brownian tube can also be used to show to large audiences the characteristics of synchronous machines, commutator machines and other electrical machines and apparatus. It is claimed that for school or lecture purposes this method of measuring and demonstration is less expensive than the commonly employed double or triple element oscillograph.—*Elektrotechnik und Maschinenbau*, Jan. 15, 1928.

*The Hall High-Speed Recorder.*—E. M. Tingley.—A new form of oscillograph for recording fault currents and their voltage-disturbing effects in electric power systems is described. Representative records are analyzed and further applications of the instrument are suggested. Tests were conducted in connection with the operations of a large power company, and, in the opinion of the author, the high-speed recorder proved its value for such work. The recorders have been found to be useful for oil circuit-breaker tests and for measuring effects of test currents upon the system. The long time scale allows the starting of the instrument by telephone orders and consequently involves no lost intervals such as occur with other methods. Both generator and substation voltage disturbances may be accurately measured with the instrument.—*Journal American Institute of Electrical Engineers*, January, 1928.

## *Heat Applications and Material Handling*

*Electric Home Cooking.*—F. Marti. —The author investigated the status of electric home cooking in a number of European countries with the object of further stimulating its application in Switzerland. Of the 750,000 Swiss homes, one-half cook with gas and 100,000 have electric stoves. Full electrification would require annually 600,000,000 kw.-hr., which could be taken care of by the new hydro plant at Ryburg alone. Statistical data which have been collected by the author indicate that 1 kw.-hr. is required per person per day when meals are cooked electrically with the customary type of hot-plate stoves. The resulting load is exceedingly irregular, calling for three short daily demands, with the highest and sharpest peak near noon. A much more desirable load character could be secured for the central station by a more general use of the heat-accumulating type of stove, the heating element of which remains connected for sixteen hours per day, transmitting its heat to a well-lagged heavy metal block. Several constructions of such stoves are described, in particular Scandinavian types, of which excellent performance records are available, Comparing the current consumption of a hot plate and an accumulating type of stove, the latter requires about 17 per cent more energy, but since long periods of heating fall into off-peak periods with a lower rate, the total kilowatt-hour expenditure is less. A large number of practical statistical data are given from cooking experiences in several European countries. —*Bulletin de l'Association Suisse des Electriciens*, January, 1928.

*A New Electric Welding Set.*—C. H. S. Tupholme.—The apparatus consists of what the designers call a compensated rotating transformer capable of giving 60 or 30 volts alternating current with a drooping characteristic similar to that of the direct-current welding generators. Although employing alternating current, it is possible to weld at 30 volts with a current of 200 amp. In this equipment the rotary transformer acts as a static transformer while the motor is stationary, but as soon as the latter starts the primary winding rotates inside of the secondary, inducing a current, the frequency of which varies with the speed of rotation. It is possible to synchronize the single-phase pulsations in the welding circuit with that of the current in each of the supply lines, whatever the number of phases. The rotary also acts as a generator and can be constructed to give a wave form which will produce perfect conditions for efficient arc manipulation.—*Electrical Review (England)*, Jan. 20, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*The Short Wave Limit of Vacuum-Tube Oscillators.* — C. R. Englund. — An investigation of the short-wave limit of vacuum-tube oscillators of the normal type where regeneration builds up oscillation in a resonant circuit indicates that the physical limits for ordinary commercial tubes lie between 3.5 and 1.5 m., depending on the type of tube used. By means of a special tube a wave length of 1.05 m. was obtained. No frequency control was left at this wave length. With a small power tube, deviating but slightly from ordinary vacuum construction, it was possible to operate at 3.5 m., with adequate frequency control, and it is concluded that the 3.5-5-m. range is available for technical purposes. The apparatus utilized in the measurement of wave lengths and the methods used in computing capacity and inductance under the conditions of this test are included. —*Reprint B-278 Bell Telephone Laboratories, Inc.*

## *Electrophysics, Electrochemistry and Batteries*

*Chromium Plating.*—S. Wernick.—The fundamental considerations involved in the somewhat recent development of chromium plating are reviewed by the author. Statements regarding the wear-resisting surface offered by this metal and the technical problems which must be solved in its application to other metals are offered in connection with a consideration of the chemical and physical properties of the material. The process of deposition and the apparatus required for satisfactory results are reviewed. It is stated that chromium cannot be suitably cast into anodes for use in the electrolyte and that even were this possible a serious drawback would be involved in the rapid rate of dissolution of the anode as compared with the deposition of metal at the cathode, rendering the proceeding impractical. The factors which require the use of lead anodes are reviewed. It is stated by the author that the actual cost of chromium plating may be considered to vary from less than twice to five times the cost of nickel plating, depending upon the facilities available and the general organization of the plating shop.—*Electrical Review (England)*, Jan. 13, 1928.

*Electro-Thermic Saw.*—O. Neiss.—A circular saw for cutting heavy structural steel sections quickly and cleanly is the subject of this article. Experiments carried out by the author showed promising results if a low-voltage but high-intensity current is passed between the blade of a circular saw and the metal to be cut. The arc formed at the cut liquefies the metal and hastens the cutting speed very materially. The first saws built used the secondary of a transformer to provide about 16 volts and 5,000 amp. It was found, however, that such a saw has many disadvantages, such as short life of the blade, a poor power factor and a very irregular load demand. Conditions could be improved only if direct current could be used for the cutting. An ingenious and entirely novel machine design was therefore dedeveloped by the author, combining the saw with a unipolar type of dynamo into one unit. The cylindrically enlarged saw arbor serves as the unipolar inductor, with excitation coils placed around it and the hub of the saw blade. Several sets of brushes collect the current from the arbor. An effective voltage of about 10 at 4,000 amp. is available at the cut. The saw is driven by a 2,000-r.p.m. motor. The blade has a diameter from 30 to 60 in. A 12-in. I-beam can be cut in twenty seconds, requiring only 0.28 kw.-hr.—*Elektrotechnische Zeitschrift*, Jan. 19, 1928.

*Electric Storage Batteries.* — E. C. McKinnon.—The author offers a general review of the subject of electric storage batteries as applied to generating and substation work. A description is included of a portable instrument which may be inserted in the water used for electrolyte make-up purposes for instantaneous determination of its suitability for such use. This device consists essentially of two platinum electrodes so arranged that when they are immersed in water containing a definite percentage of chlorine a specific current will pass under the pressure of a standard potential. Calibration has been so arranged that suitable make-up water will cause very small deflections to be recorded upon the scale, while unsuitable material will be given a high reading. Various procedures suggested for insuring satisfactory operation and long life of storage batteries are suggested by the author as a result of a review of contemporary British practices which are indicated as having given satisfactory results. — *Electrical Review (England)*, Jan. 13, 1928.

## *Miscellaneous*

*The Dvorkovitz Carbonization System.* — The recent tendency in low-temperature carbonization processes to exceed 500 deg. C., rather than to fall below it, produces a great amount of cracking of the oil vapors in the carbonizing effects. A practical difficulty has entered the situation in that the charge tends to become cemented together by its plastic constituents before the oils have been sufficiently removed. This caking impedes both the penetration of heat into the mass and the escape of oil vapors before they are cracked and with some coal and retorts may hold the charge in the retort and interrupt the progress of the operation. An experimental unit has been installed to enable an exact investigation to be made from coal used in commercial carbonization processes. — *Engineering (England)*, Jan. 20, 1928.

*Control of Cable Impregnation.*—P. Junius.—What seems to be a much more reliable control of impregnation is described. The principle of the new treatment is that when the raw cable is placed in the tank its conductors are connected to an airtight multi-outlet plug in the vacuum tank cover. During the entire drying process continual electric records can be made of the condition of the cable within the tank. Since the dielectric loss of raw paper is 1.8 to 2.6, while that of oil-impregnated cable paper is 3.4 to 4.3, the process of impregnation can be controlled by continuous measurements with an a.-c. bridge method. In addition, impregnation increases the capacity of the cable, so that capacity measurements can be made to check further the proper treatment of the cable and to determine the point beyond which the quality of the cable can no longer be improved by the application of impregnating materials.—*Elektrotechnische ueitschrift*, Jan. 12, 1928.

# News of the Industry

## Trade Commission for Thorough Inquiry

### Invokes Its Own Powers to Make Legality of Investigation Beyond Question—Joint Committee Offers Its Aid—Muscle Shoals Now Unfinished Business

By Paul Wooton
*Washington Correspondent of* Electrical World

IMMEDIATELY upon the passage by the Senate of the Walsh resolution, as amended by Senator George, the Federal Trade Commission began its preparations for the handling of the work. It is very evident that the commission has been put on its mettle by the charges made in the Senate, and a very thoroughgoing job is in prospect.

In view of doubts expressed on the floor of the Senate as to the power of the commission to comply with all features of the resolution, the commission has invoked its own powers to initiate investigations in order to remove any doubt as to its authority to investigate at the behest of a single branch of Congress. It was pointed out that the commission has the right to initiate an investigation covering every phase of the inquiry ordered by the Senate. Immediately on receiving official notice that the resolution had been approved the commission adopted the following resolution:

> Whereas the Senate of the United States has by a resolution agreed to on Feb. 15, 1928, directed the Federal Trade Commission to make an inquiry into certain practices and conditions relating to specified classes of public utility corporations and corporations connected therewith, now, therefore, be it
>
> Resolved, that an inquiry shall be undertaken immediately by the commission in strict and full compliance with the terms of the said resolution, and that in the prosecution of said inquiry the commission shall rely on and employ the powers conferred on it to make investigations at the direction of either house of Congress, and any and all powers conferred upon it by law to conduct inquiries on its own initiative or otherwise, and any other powers legally available to it, whether contained in its organic act or elsewhere, which may conduce to a diligent and complete performance of the ends and purposes set forth in said resolution.

As this is written, the commission has not decided upon the exact method which will be followed in the conduct of this investigation. Usually such work is assigned to the economic branch of the commission, but occasionally investigations are assigned to a member of the commission who takes immediate charge and keeps in constant touch with the progress of the work. It is not improbable that this procedure will be followed in this case.

J. T. Newcomb, counsel of the Joint Committee of National Utility Associations, in charge of its Washington office, made a formal appearance before the commission on Feb. 20. He called the attention of the commission to the fact that one of the principal purposes of the joint committee is to make available officially to the government information, studies, engineering data, operating experience or other data relating to the utilities which may be useful to any government agency. He stated that he had been instructed formally to tender the services of the joint committee in connection with this inquiry. He assured the commissioners that the committee will do all in its power to assist in making the investigation a thorough one.

Secretary Tydings of Maryland, one of those who voted to intrust the public utility investigation to the Federal Trade Commission, has served notice by letter to Chairman Humphrey that if the commission fails to make a "complete, searching, fair and non-political probe," he will introduce a bill to abolish it as a "useless million-dollar-a-year expense" to the taxpayer.

### Norris Bill Unfinished Business

The Senate on Feb. 20 made the Norris Muscle Shoals resolution the unfinished business before that body. This probably indicates an early vote on the proposal to lease the power developed at the Wilson Dam and to use the proceeds for the experimental production of fertilizer. Objection to the Norris resolution is entertained by some members of the Senate on the ground that it opens the way for the entry of the government into the electric power and fertilizer businesses.

Senator Sackett of Kentucky has offered a substitute resolution which provides more specifically for the promotion of the use of concentrated fertilizers on the nation's farms. His resolution also carries the item to which objection is made, authorizing the Secretary of War to construct transmission lines. The Sackett substitute eliminates the government operation feature of the power plants, but makes no provision for the equitable distribution of the power. After the energy is developed the Norris bill provides for its equitable distribution. The Sackett substitute provides for a fifteen-year lease as compared with the ten-year maximum in the Norris proposal.

Another substitute for the Norris proposal has been introduced by Senator Tyson of Tennessee. He proposes to lease the power generating properties for a period of twenty-five years, but in the event that the Secretary of War is unable to secure a satisfactory lease within a reasonable time, he is required to operate the power plant and contract for the sale of power. Upon reasonable notice, however, the lease may be canceled after the expiration of ten years. Both the Tyson and Sackett proposals provide for the encouragement of the use of concentrated fertilizers.

Consideration of Boulder Dam legislation is proceeding in executive session before the irrigation and reclamation committee of the Senate. The bill is now being read for amendments and progress is reported to be slow. There has been no change in the position of the House committee.

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## Chicago Company Adopts Optional Room Rate

*Commonwealth Edison Figures that a Substantial Saving to 91½ per Cent of Its Residential Customers will Result from Change*

ON FEB. 15 the Commonwealth Edison Company of Chicago filed with the Illinois Commerce Commission a new tariff of residential rates which the company figures will save customers $1,300,000 a year on the basis of consumption in 1927. The new schedule, which is to be optional and is based on counted rooms, will apply to meter readings taken on and after April 1. It will impose a charge of 7 cents per kilowatt-hour for the first 3 kw.-hr. per room per month, 5 cents for the next 3 kw.-hr. per room per month and 3 cents for energy in excess of 6 kw.-hr. per room per month. The present rate is 8 cents per kilowatt-hour for the first 30 hours' use per month of the maximum demand, 5 cents for the next 30 kw.-hr. and 3 cents for any excess over 60 hours' use.

Since 91½ per cent of all residential users of electricity in Chicago live in homes of from three to seven rooms, the monthly bills of that percentage will, the company estimates, be reduced, assuming the same amount of use; but any dissatisfied customer will be at liberty to revert to the former schedule. The last previous reduction in Commonwealth Edison rates—the thirteenth—was in August, 1923. In 1927 the average residential electric bill was $2.29 a month, and the average rate paid by residential customers for electric service was, the company says, 5½ cents per kilowatt-hour.

# Economic Aspects of Power Production

## Midwest Power Conference Combines Engineering and Commercial Consideration of Generation and Utilization—President Glenn Frank's Prophecy

BROADER economic aspects of the relation between the production and utilization of power by industry and business held the stage at the third annual Midwest Power Conference, on Feb. 14 to 18, at the Hotel Stevens, Chicago, where nearly one thousand utility and industrial engineers and executives assembled.

Speaking at the opening session, Dr. Glenn Frank, president of the University of Wisconsin, portrayed the part that power promises to play in the future of our civilization. He pointed out that a machine civilization in which power can be taken to the worker is radically different from a machine civilization in which the worker must go to the power. Among several other important things, it means that even the mass production of goods and machines can be carried on in a decentralized industry, whereas a civilization in which the worker must go to the power means that mass production cannot be carried on save in a centralized industry. Once the cheap transmission of power decentralizes industry as it is now doing, most of the ugly social problems created by industrial centralization in congested cities will disappear automatically.

In his opening address Major Rufus W. Putnam, chairman of the conference, predicted that Illinois, Indiana, Wisconsin and Michigan will add eight million to their present population of seventeen million in another thirty years. He outlined the effect of increased population and industrial activity upon the use of power and pointed to the major transmission systems of the utility companies in the Great Lakes region which are being extended to meet these requirements.

Power's accomplishment in the factory and home was the topic of discussion at Tuesday afternoon's general session, when W. A. Durgin, director public relations Commonwealth Edison Company, gave an illustrated address.

Picturing electricity as the great burden bearer of mankind, R. Burke Corcoran, manager of the Electric Association, Chicago, pointed to the fact that $930,000,000 has been invested by the public of Chicago in electric wiring, appliances and equipment to promote human comfort, convenience and happiness.

On Wednesday the conference was given over largely to discussion of power problems, their relation to flood control and development of national and international waterways. Construction of reservoirs as a means of flood control was declared by two speakers to be in most cases economically unsound and physically inadequate. These speakers were General Edgar Jadwin, chief of engineers, U. S. A., and Daniel W. Mead, Madison, Wis., who analyzed in detail the work accomplished by such projects in Minnesota and Wisconsin.

Irrigation, flood control and possibilities of power development on the Colorado River were discussed by Colonel William Kelly, Buffalo, who compared the proposed Boulder Dam project with what he considered less costly and equally satisfactory methods of accomplishing the same end. Major G. E. Edgerton, chief engineer of the Federal Power Commission, said that while, on the whole, the present status of hydro-electric development is, perhaps, satisfactory, it can scarcely be described as gratifying. Navigation and projected power development on the St. Lawrence River were discussed by E. A. Forward, consulting engineer, Montreal.

H. A. Hageman, chief hydraulic engineer with Stone & Webster, Boston, described increased efficiency in hydraulic power equipment.

At the annual banquet on Wednesday evening Rufus C. Dawes spoke on "Engineering Phases of International Finance," with particular reference to international credits.

### Economics of Power Stations

Alex Dow, president Detroit Edison Company, speaking in his characteristic style on capital costs with relation to economy of central stations, urged upon engineers that in the design of power plants there be a careful balance of efficiency against total cost. Mr. Dow pointed out that in striving for high thermal efficiencies sight is sometimes lost of the fact that the cost of obtaining the last few per cent of increased efficiency may far outweigh the benefits derived.

Discussing operating experience with high-pressure and high-temperature steam, George A. Orrok, New York Edison Company, described a number of high-pressure installations in operation. Experience showed no serious difficulties in the way of operating plants up to pressures of at least 2,000 lb. per square inch and that the operation of superheaters raising steam temperatures to 850 deg. F. with ordinary steel superheater tubes was commercially practicable, but the most economical pressure and temperature for any given case have yet to be determined.

"Trend and Development in Steam Generation" was discussed in a paper by Thomas E. Murray, New York. Large installations and operation at higher production rates are the order of the day, he said, and it is now possible to obtain boiler production rates of more than 1,000 per cent in continuous operation. At present plans are being made for boilers having a capacity of 800,000 lb. of steam per hour, and this may be increased to 1,000,000 lb.

Methods and developments in power transmission were topics of discussion at a luncheon symposium on Thursday, at which H. W. Eales, H. M. Byllesby & Company, stressed the precautions which utility companies are taking to insure reliability of electric service to industrial plants and the communities supplied by the power companies' overhead transmission lines. Power transmission by high-voltage cables, methods of supplying power to industrial plants by cable circuits and use of ring circuits were discussed by H. B. Gear, Commonwealth Edison Company. Developments in power-transmission systems were outlined by A. C. Montieth, Westinghouse Electric & Manufacturing Company, and some of the causes of failures in impregnated insulated lead-sheathed cables were analyzed by W. S. Clark, General Electric.

Fuel and combustion economies of power stations were the topics of Friday morning's sesions, at which papers were presented by T. A. Peebles, Hagan Corporation, Pittsburgh; J. F. Shadgen, Smoot Engineering Company, New York; Edward Brown, Allis-Chalmers Company, Milwaukee, and Dr. S. W. Parr and F. C. Straub, University of Illinois.

Speaking on "The Engineer's Part in Business" at a luncheon meeting of the American Society of Mechanical Engineers on Friday, W. S. Hovey, president Fairbanks, Morse & Company, emphasized the need for the commercially minded engineer.

Coincident with the conference, the third annual Chicago Power Show, with 275 leading manufacturers of power and electrical machinery exhibiting, was held at the Coliseum under the auspices of the Midwest Engineering and Power Exposition.

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# Electric Heating Load and the Central Stations

At a meeting of the electric furnace section of the National Electrical Manufacturers' Association held in Detroit, Feb. 21, organization of the section was completed and plans were made looking to improvement of trade practices and more intensive development of the market. In discussing the extent of available business it was contended that the central-station companies, the principal beneficiaries from having the electric heating load connected to their lines, have so far failed to put forth the amount of engineering and sales effort that the value of this class of business seems to warrant. In order to present a better and more complete picture of the amount of electric heating load that is being added and as a guide to the extent of the business the furnace manufacturers have agreed to collect statistics giving the number of furnaces, total kilowatts and value in dollars of sales in units up to 100 kw. and of 100 kw. and over. This information is to be collected and published monthly.

# Harvard Medal Awarded to J. H. McGraw

## Publisher of "Electrical World" Honored for His Distinguished Services to Advertising—He Discusses the Part of Advertising in Building American Industry

TO JAMES H. McGRAW, president of the McGraw-Hill Publishing Company, last week was awarded the gold medal "for distinguished contemporary service to advertising," given under the Harvard Advertising Award, "because of his lifelong service in the upbuilding of higher standards in advertising in the business press of the country and his pioneering work in the recognition of advertising relations to marketing." The presentation was made at a dinner on Friday night in Boston under the auspices of the Graduate School of Business Administration of Harvard University. This is one of the four awards established by Edward Bok as an expression of the conviction that advertising, wisely utilized, is a great economic power to broaden markets and decrease the cost of distributing goods, but, if unscientifically employed, is wasteful to the community. Mr. McGraw is the third person to be honored with this medal.

In accepting the medal Mr. McGraw discussed some of the broader aspects of the part which advertising is playing in the development of American industry and the maintenance of prosperity, with particular reference to present business conditions. He said in part:

"At present the volume of trade is large. But competition is throttling and profits in some quarters are declining. Some industries are despairing of customers. Has advertising, now so generally used, proved ineffective in maintaining full prosperity? Advertising has won its spurs in the economical movement of distinctive goods, with resultant public gain. Is it not the greater field of staples or 'near staples' to which advertising must now be more widely applied, both in the industrial and consumer fields? And may not we here find a tonic for the price competition malady, thus aiding to restore complete industrial health?

"In considering the broader as well as the more effective use of advertising, it may well be questioned whether any product, however staple at first sight it may appear, is without elements of distinction. A product is endowed with the qualities of its makers, and no organization is entirely devoid of personality. The very fact of survival in a competitive market is proof that there is distinctiveness in product or service. There are a hundred respects in which firms differ from each other. All these affect the willingness of the buyer to take one manufacturer's product rather than another's, even though the products appear to be similar. We must increase our knowledge of how to sense these elements of distinctiveness in this great field of the staple product. Then we shall open up new vistas of advertising effort. Then we shall transfer many products from the miasma of excessive price competition to the high free air of competition in quality and service. Then we shall trade up, rather than down. And business will be the healthier for it.

"It is apparent that the very planning of advertising causes a most searching examination of products, to determine the distinctive elements. If, perchance, there be no market distinction, then, at the very least, advertising may guarantee a continuance of quality. The market position of certain brands of flour, bread, soap, cement, brass, industrial belting—the prosperity attending their makers—is eloquent testimony of advertising's effectiveness in the staple field. It has endowed run-of-product with a special character, and, through the guarantee of sustained quality, advertising has made specialties within staples.

JAMES H. McGRAW

"True, advertising does not confer full immunity from price considerations and consequent narrow profits and halting markets, but it does shift the competition to bases of quality and use. It puts the battle on the seller's rather than the buyer's ground, but at the same time it proves a boon to the buyer because of insistence on quality. The slogan 'Quality is remembered long after price is forgotten,' already accepted as a principle by industrial consumers, suggests distinct social advantages to consumers at large. Why, then, has not advertising been more completely adopted by business? Why is there today some mistrust of advertising and often lack of will to invoke its power to help correct the current business situation?

"Advertising failures have resulted less from lapses in advertising technique than from advertising misapplied. Advertising cannot create qualities. Advertising cannot give market standing to a product where market value does not exist. It is sheer folly to assume that a product will take on compelling qualities if only they be claimed in advertising. Advertising can express, develop and amplify what is already present. It can stimulate the seed of product or service personality to growth and vigor. It cannot create the seed. Advertising is a challenge to soundness. It drags an institution into the limelight. It exposes it to examination and to criticism of its claims. For businesses with productions that match the needs of the times advertising is a beneficent instrument; for those with products that have no rightful market claim advertising is either corrective or fatal. And to soundness of product or service there must be added soundness of marketing method, if advertising is to be an effective instrument of prosperity.

"Distribution costs are being subpœnaed before the court of public opinion, and too often advertising has had to bear the unjust odium of marketing's shortcomings. The logical markets may have been wrongly appraised. Distribution was attempted under conditions that made the cost prohibitive. Difference in buying habits, according to fields or industries, has been overlooked. Appeals to buyers have not been valid. Distribution channels have not been effectively organized. The sales force has been inadequate, ineffective or mishandled. Yet of advertising is expected the impossible delivery of economical distribution. It is to the credit of many advertising men that they have been among the leaders in the adoption of modern marketing methods and that, in large number, they are competent counselors on marketing plans.

"We can look with great hope on advertising's promise for the maintenance of prosperity. Advertising has an important rôle in widening the profit margin in both industrial and consumer transactions. It removes products from unhealthy price competition as fast as it can unearth distinctiveness in products and organizations. It reduces production costs by insistence, in the planning of campaigns, on conformity of goods to needs and on standardization and simplification. It reduces distribution costs by challenging unsound marketing programs. Proved to be an effective instrument in marketing specialties, advertising is now entering the even larger arena where staples are battling before a price-obsessed public. It offers new weapons of quality and service in business' struggle with meager profits. Proved the stimulant of new public wants, advertising holds out enticing incentive to ever-faster introduction of new products."

## Federal Court Restrains the Cambridge Rate Order

Judge Lowell of the United States District Court issued a restraining order on Monday of this week against the Massachusetts Department of Public Utilities in regard to enforcing its recent decision reducing the maximum price per kilowatt-hour from 8 cents to 5½ cents on the system of the Cambridge Electric Light Company. The company has filed a petition for a temporary injunction which will be before the court for hearing in about a week. Press reports current in Boston last week to the effect that the company had decided to accept the commission's finding were denied as without foundation by Frank H. Golding, general manager of the New England Gas & Electric Association, upon inquiry by the ELECTRICAL WORLD as to their authenticity.

## Governor Smith's Water-Power Bill Again Up

Governor Smith's bill to set up a Water Power Authority in New York State to "conserve and control" its water-power resources and provide for the submission of a comprehensive plan to the Legislature was once more introduced at Albany last week. Senator Downing called for a "popular uprising" to bring about passage of the bill and the Governor will probably write a special message in its support. There seems, however, little doubt that, as before, the bill will get nowhere against a hostile legislative body.

## Consumers Power-Detroit Edison Interconnection a Fact

On Thursday of this week throwing a switch at Jackson, Mich., tied in the high-tension systems of the Consumers Power Company and the Detroit Edison Company. The interconnecting link, work on which was begun a year ago, will operate at 132 kv. From a new substation of the Detroit Edison Company near Ypsilanti, which contains three 15,000-kva. transformers, a steel-tower transmission line carrying a three-phase copper circuit runs 42 miles to a joint substation at Cement City, south of Jackson. A like transmission line, 18 miles long, runs from a new Consumers Power substation north of Jackson, containing three 10,000-kva. transformers, to the joint station at Cement City. It is proposed later on to add a second circuit of like capacity.

The Consumers Power Company, which serves central, western and some eastern counties in Michigan, has a total rated capacity of about 283,000 kw. The Detroit Edison Company has about 644,000 kw. in the industrial southeastern section of the state. The interconnection will enable either company to call on the other to the extent of 37,500 kw. No formal ceremony took place on Thursday, but Alfred C. Marshall, vice-president and general manager of the Detroit Edison Company, and Charles W. Tippy, vice-president and general manager of the Consumers Power Company, met at noon at the substation north of Jackson and joined in the throwing of the switch.

## Maryland Commission's Ban on Sale Upset

Remanding to the Public Service Commission of Maryland for further procedure the application of the Electric Public Utilities Company for permission to purchase four small power plants in the western part of that state, the Court of Appeals declared last week that it was not within the discretion of the commission to refuse such permission unless it was proved that the change in ownership would be detrimental to the public interest. This decree upset the decision of the Baltimore City Circuit Court (see ELECTRICAL WORLD for July 23, 1927, page 182). In remanding the application the court expressed no opinion as to its merits.

The small companies concerned are the Home Electric Company of Lonaconing, the Emmitsburg Electric Company, the Antietam Electric Light & Power Company and the Midland Electric Light Company.

## Key in Fort Myers Starts Up Lights in Bellingham

Completing what is probably the longest remote-control circuit ever attempted in the United States, Thomas A. Edison, at Fort Myers, Fla., on the evening of Feb. 11, his eighty-first birthday, closed a key which actuated the switch controlling the new lighting system for the business district of Bellingham, Wash. This circuit, extending from Fort Myers to Bellingham via Washington, New York, Buffalo, Detroit, Chicago, Fargo, Butte, Spokane and Seattle, measured approximately 5,700 miles and had been set aside for the occasion by the Western Union Telegraph Company along with a second standby circuit following a different route.

## Iowa Power Conference Hears of Gain in Rural Service

A continued tendency toward consolidation, a higher standard of construction for transmission lines and an encouraging attitude by the industry toward solution of rural electrification problems were outstanding features last year in the light and power industry in Iowa, according to Joe Carmichael, director of the Iowa Committee on Public Utility Information, who spoke at the second annual power conference last week at the University of Iowa, Iowa City, at which a hundred engineers and power experts gathered.

Utilization of Iowa coal in industrial power development was discussed by J. E. Everson, general superintendent of the Sioux City Gas & Electric Company. "Pulverized-coal firing puts Iowa coal, admittedly of a lower quality, on a par with any coal so far as physical results are concerned," he said.

Sidney L. Miller of the Iowa College of Commerce dwelt on the social benefit to be derived from the development of electricity because of its decentralizing influence on industry.

## Purchases and Mergers

*Portland Electric Power Plans to Buy Northwestern Electric — Holding Company Formed in Providence to Buy Utilities*

ANNOUNCEMENT was made on Feb. 18 by Franklin T. Griffith, president of the Portland Electric Power Company, and Guy W. Talbot, president of the Northwestern Electric Company, that the Portland Electric Power Company would purchase the competing Northwestern company and make a material rate reduction, provided that the deal is sanctioned by the people of Portland at a special election which will be held in April at the expense of the two power companies. Operating economies estimated at approximately $300,000 a year resulting from the consolidation will be passed on in their entirety directly to the customers in the form of reduced rates applicable first to the domestic customer and secondly to the other classes of business.

The franchise of the Northwestern Electric Company, which expires in 1937, contains a clause prohibiting the sale of the property to a competing company without the consent of the City Council. The companies have suggested that the Council submit to the voters an ordinance permitting the consolidation. Promised domestic rate reductions will be made public before the people are asked to vote on the merger. The Northwestern Electric Company, purchased by the American Power & Light Company from the Fleischhacker interests in 1926, is valued at $23,000,000, and E. W. Clark & Company of Philadelphia now hold the controlling interest in the Portland Electric Power Company property, valued at $81,000,000. The joint properties have a combined steam and hydro generating capacity of 232,000 hp. and approximately a hundred and forty thousand customers.

The recent formation of a four-million-dollar holding company, the New England Water, Light & Power Company, to acquire public utility properties in different parts of New England, was announced last week at Providence by Arthur B. Lisle, former vice-president and general manager of the Narragansett Electric Lighting Company, who is heading the new firm, which will have headquarters in the Rhode Island capital. The companies so far acquired are mainly water companies, but the Central Connecticut Power & Light Company, East Hampton, Conn., is included.

Proposed operation of the Charlemont (Mass.) Electric Light & Power Company as a municipal plant by the town of Charlemont was defeated by a vote of 70 to 55 at the annual town meeting recently.

The Foshay interests in Vermont are to take over the Nichols company, operating in Barton.

The Low Power & Light Corporation has made application to the New York Public Service Commission to lease to the village of Tupper Lake the power plants in Colton and Piercefield, and the village of Tupper Lake has asked for authority to do a general business in Colton, Piercefield and Altamont.

Public hearings on the application of the Potomac-Edison Power Company to absorb four smaller companies in western Maryland were to be held Feb. 24 by the Maryland Public Service Commission. Little opposition was expected, if any. The four companies to be absorbed are the Ridgeley Light & Power Company, the Piedmont Electric Light & Power Company, the Potomac Light & Power Company and the Clearspring Electric Light & Power Company.

Cortland, Ohio, plans to sell its municipal lighting system to the Ohio Public Service Company, and preliminary legislation has been passed by the Council.

Authority has been granted by the Illinois Commerce Commission to the Illinois Power & Light Corporation to purchase the Orvil Light, Power & Water Company at Hartsburg for $26,150. The commission denied permission to purchase the Arenzville Light & Power Company, Prather & Hill Electric Company and Elkhart Electric Light Company.

The Illinois Power & Light Corporation has applied to the Illinois Commerce Commission for authority to acquire the Secor Light & Power Company.

Petition to purchase the Dillsboro (Ind.) Electric Company for $23,500 has been filed with the Indiana Public Service Commission by the Interstate Public Service Company.

The City Council of Onida, S. D., has called a special election for Feb. 28 to vote upon selling the municipal lighting plant to the Northern Power & Light Company, of Mobridge, S. D., for $22,600.

In answer to the Northern States Power Company, which wished to buy the city-owned electric plant at Moorhead, Minn., the Council says the system is not for sale.

The Minnesota Hydro-Electric Company, operating in the northern part of Minnesota, has been sold to the Northwestern Utilities Company of Minneapolis. The purchased company has been combined with four others owned by the Northwestern Utilities in Minnesota and Wisconsin.

The Northern States Power Company is negotiating with the Lakefield (Minn.) Town Council for purchase of its municipal electric plant.

Because officials of the city of Stafford, Kan., fear that rates of the municipally owned electric plant would have to be raised if a sister city, Sylvia, sells its distribution system to the United Power & Light Corporation, Stafford has entered objections with the State Public Service Commission. It is understood that the company desires to acquire the right to serve both towns.

Negotiations have been completed by the Central Kansas Power Company, with headquarters at Hays, for the purchase of the municipal electric light and power plant at Atwood, Kan., it is announced by Ross Beach, manager of the power company.

College View, Neb., a suburb of Lincoln, has defeated a proposal to sell its light and power plant to the Iowa-Nebraska Light & Power Company. The vote was 513 to 366.

The Western Light & Power Company of Salina, Kan., is reported to have offered $200,000 for the municipal lighting plant of Caldwell, in that state.

The Oklahoma Power & Water Company, newly incorporated in Delaware, has received authority from the Corporation Commission of Oklahoma to take over the Sand Springs Light & Power Company, the Sand Springs Home (supplying electricity), the Bigheart Light & Power Company, the Cimarron Light & Power Company and the Eastern Oklahoma Light & Power Company. Cities affected by the change are Sand Springs, Sperry, Skiatook and seventeen others.

Permission to merge the Kansas City Power Securities Corporation with the Continental Gas & Electric Company is being sought from the Missouri Public Service Commission. The Power Securities Company is the local holding company for the Kansas City Power & Light Company. The Continental Gas & Electric owns the common stock of the Power Securities.

Application has been filed with the Missouri Public Service Commission by the National Utilities Company, with headquarters at Brookfield, Mo., for authorization to purchase the Kirksville Gas, Heating & Electric Company and the Brookfield Gas, Electric & Heating Company.

Sale of the Rockport (Mo.) Light & Power Company by W. F. Marshall and O. W. Clifton to a new corporation to bear the same name has been authorized.

Purchase of the electric distribution system of Chula, Mo., by the Missouri Public Service Company is announced.

Sale of the city light plant at Benton, Ark., to the Couch interests will probably be an issue in the April city election.

The Arkansas Power & Light Company has purchased the lighting plant of Yellville, Ark., supplying power and light to Yellville and Summit.

Announcement is made by the Oklahoma Gas & Electric Company that the city of Drummond has voted to sell its municipally operated distribution system to that company.

The Carolina Power & Light Company, Raleigh, N. C., has bought the South Carolina Power & Light Company, serving Kingstree, Manning, Lake City and other places in South Carolina.

The East Coast Utilities Corporation, owned by Chicago interests, has in recent months acquired small plants in Waverly, Irvington, Kilmarnock, White Stone, Colonial Beach and other towns in eastern Virginia. The company is building a small generating plant at Port Richmond, near West Point, to furnish light and power to West Point, Saluda, Urbanna and other points in that section.

The Stuart (Va.) Light & Power Company has been sold to J. F. Reynolds and J. F. Reynolds, Jr.

A movement is on foot to sell the municipal electric light plant at Athens, Ala., to the Alabama Power Company.

Reports are current in Austin, Tex., that that city is considering the sale of its light and power plant to the Texas-Louisiana Power Company of Fort Worth.

A resolution for the sale of the municipal lighting plant to the Florida Public Service Company for $82,000 has passed the Mount Dora (Fla.) City Council.

A unification agreement has been signed by the Capital Traction Company, the Washington Railway & Electric Company and Harley P. Wilson, the owner of 21,237 shares of the stock of the Washington Rapid Transit Company, by which a new company, to be known as the Capital Transit Company, will be formed to operate the street railways and bus lines which the three companies are now operating in the District of Columbia and nearby regions. The plan must be approved by the Public Service Commission and by Congress. The street-railway business of the Washington Railway & Electric Company will be taken over, but the power business of the company will be continued as a separate entity, with the agreement that power is to be furnished the new company at reasonable rates.

Seeking to relieve the complications of the corporate set-up of its subsidiaries, the Consolidated Gas, Electric Light & Power Company of Baltimore has just filed with the Maryland Public Service Commission an application to acquire the properties and assets of the concerns in entirety. These subsidiaries are twelve in number. They include the Mount Washington Electric Light & Power Company and the Patapsco Electric & Manufacturing Company of Delaware.

Announcement has been made of the acquisition by the Canadian Hydro-Electric Corporation, a subsidiary of the International Paper Company, of the properties and assets of the Ottawa & Hull Power Company and its subsidiary, the Ottawa River Power Company, which serve the cities of Ottawa and Hull. This means that almost entire control has been obtained by the International Paper interests of all power developments in the Ottawa and Gatineau districts. The Power Corporation of Canada held the majority of the shares of the Ottawa & Hull Power Company.

## Kinston, N. C., and Municipal Ownership in That State

As previously reported, several bids for the Kinston (N. C.) municipal plant of approximately three times its cost have put that community of 12,000 souls on the electrical map and aroused intense interest among its inhabitants. (Electrical World, Feb. 18, page 370.) The matter will furnish the chief issue in the next municipal election. Backers of the proposal accepted by the City Council to sell the plant to the Carolina Gas & Electric Company for $1,271,000 will have to fight to bring a majority of the voters to their viewpoint. There is strong opposition, despite the fact that Robert A. Blackwood, head of the company, lives at Kinston and that the company has its headquarters there. One element of the voters believes that the still higher Gregory-Livingston bid should have been accepted. Another element opposes a sale to any group. Still others would have new bids called for or have the property turned over to the Carolina Power & Light Company. Though the Carolina's offer was considerably lower than the others, that company had a large following which believed it would "do more for Kinston" than either of the others.

City officials at Greenville, Washington, New Bern and other towns in the eastern half of the state that have municipal plants are watching the Kinston situation, and the outcome will be influential in strengthening or weakening the opposition that has been manifested in North Carolina towns to disposing of their plants to private companies.

# Oppose Plan of Regulation by Contract

*Massachusetts Utility Companies Assail Commission Bill Now Before Legislative Committee — Professor Cabot Defends Reproduction Cost as Rate Base*

A BATTLE royal between the Massachusetts Department of Public Utilities and the light and power companies represented in the Massachusetts Gas and Electric Association began last week at Boston over the regulating commission's bill providing for legislation under which companies would be penalized by non-consent to regulation by agreement along the lines reviewed in the ELECTRICAL WORLD for Dec. 17 (page 1265). At the opening of an all-day hearing before the legislative committee on power and light, Chairman H. C. Attwill of the Massachusetts commission set forth the board's bill as an opportunity for electric and gas companies to readjust their capital and carry on their future business under a regulative contract with the state which would safeguard their securities and insure protection of consumers against exploitation either by local managements or by outside controlling groups. He excoriated the policy of resisting rate reductions ordered by the commission, as in the case of the Worcester Electric Light Company, and declared that unless regulation of privately managed utilities is assured, municipal ownership will follow.

For the power companies, Sheldon E. Wardwell took the ground that the bill of the commission is revolutionary in character, threatening the stability of the industry by its new and untried expedients and by its requirement that companies accepting it abandon their right of appeal to the courts. He maintained that it would virtually wipe out the surpluses of many companies and cut down their proper rate bases, drying up the wells of fresh capital supply and stultifying the industry's development. The agreement proposes to furnish a fair return to the investor on his "desiccated" investment, but the future investor will not accept a risk where there is no constitutional protection. The promise to keep the stocks at par is ephemeral, the speaker declared, and in times of economic stress the financial burden would be transferred wholly from the investor to the rate payer.

Prof. Philip Cabot, head of the public utility courses of the Harvard Graduate School of Business Administration, analyzed the commission's bill from the economic standpoint and maintained that its objective—obtaining a necessary service for consumers at the lowest possible price — cannot be attained through this agency. He reasoned that the application of the bill would tend to create inflation in the long run, followed by increased rates at times when decreases are in order and increased severity of the business cycle. The rigid rate base chained to the dollar he held to be artificial and very dangerous.

Vigorous opposition to the bill was voiced at a second hearing by B. Loring Young on behalf of the Associated Industries of Massachusetts; F. W. Denis, vice-president Old Colony Trust Company, Boston; H. P. Gifford, president Savings Bank Association of Massachusetts and of the National Association of Mutual Savings Banks; Fitzhewey Smith, Massachusetts Bankers' Association, and Arthur W. Wood, investment banker, Boston.

Mr. Young contended that the business interests of the state are gravely concerned lest the bill impair the ability of the power companies to meet the expanding demands of industry for power. Other points made against the bill were its alleged unconstitutionality, the difficulty of maintaining stocks at or near par by commission action, the premium put on extravagance of management, liability of higher rates, and lack of provision for an emergency requiring drastic remedies. Chairman Attwill and Commissioner Wells defended the bill, urging that its opponents misinterpret its intent and exaggerate its effect on the stability of regulative practice in Massachusetts. The hearing was adjourned until this week for further rebuttals to be presented.

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# Two Recently Built Canadian Automatic Hydro Stations

STEADY increase in demand upon the Georgian Bay System of the Hydro-Electric Power Commission of Ontario has led to the recent completion of an automatic plant at Hanna Chute on the Muskoka River. This station, which is in a district lying north of the territory served from Niagara Falls, is operated by remote control from the South Falls generating station, half a mile below. The Hanna Chute station, built in a narrow rock gorge, is of pressed-brick construction and houses one vertical-type, three-phase, 60-cycle, 6,600-volt generator with a rated capacity of 1,400 kva. at 80 per cent power factor, operating at 225 r.p.m. The lubrication system is self-contained. No step-up transformers are provided at this plant, the station feeding direct to the South Falls station.

The exterior of the Alouette power plant of the British Columbia Electric Railway Company, shown on the right, has recently been finished. It is built on Stave Lake, 12 miles above the present Stave Lake plant, from which it will be automatically operated. Rated at 10,000 kva., the Alouette plant, which cost $2,300,000, will add almost 13,000 hp. to the present capacity of the company, and is therefore among the largest of its description. The Alouette chain of lakes lies at an elevation of 370 ft. above sea level, 25 miles east of Vancouver. They have a drainage area of 80 square miles with a dependable flow for power purposes of 700 cu.ft. per second, which is 90.2 per cent of the mean flow.

The development consisted of raising the lakes approximately 50 ft. by means of a semi-hydraulic earth-filled dam with separate concrete-lined spillway and an overflow weir and control crest gates set in the spillway at the north end of the dam. At the upstream end of the lake, which is 10 miles away from the dam, a 12-ft. by 16-ft. tunnel has been driven through the narrow ridge to Stave Lake, a distance of 3,500 ft. The water is discharged through this tunnel to the power plant at an average head of 132 ft., the flow and generation of 12,500 hp. being controlled at Stave Lake power plant.

## National Speakers Engaged for Tulsa Convention

The program of the tenth annual convention of the Oklahoma Utilities Association, to be held at Tulsa, March 13 to 15, will contain many national convention features, according to E. F. McKay, manager of the association. Among its features will be an illustrated review of the outstanding developments in electricity in 1927 by John D. Liston, General Electric Company; a discussion of relations between the newspapers and the utilities of Oklahoma by N. A. Nichols, secretary Oklahoma Editorial Association; a review of the year and a forecast of the future in public relations by J. F. Owens, vice-president Oklahoma Gas & Electric Company; an address on interstate phases of electric power development by H. S. Bennion, director of engineering, N.E.L.A., and a statement of progress toward elimination of drudgery in the home by Miss Eloise Davison of the headquarters N.E.L.A. staff. Representative Charles A. Eaton will speak at the banquet.

The Electrical Division program, March 13 and 14, will include: "Developing Power Load in the Oil Fields," O. A. Jennings, Oklahoma Gas & Electric Company; "Rural Electrification," Edwin Kurtz, chairman Oklahoma Farm Electrification Committee; "Refrigeration," R. W. Curran, Bartlesville Gas & Electric Company; "Rural-Line Construction Standards," L. H. Reagan, Southwestern Light & Power Company; "Developing the Small Industrial Load," S. I. McElhoes, Southwestern Light & Power Company; "Safety Methods and Accident Prevention," C. H. Meyer, Public Service Company of Oklahoma, and "Developments in Commercial Lighting," A. E. Warner, Oklahoma Gas & Electric Company.

## Applications Before Federal Power Commission

G. S. Howe of East Radford, Va., has applied to the Federal Power Commission for a preliminary permit covering a 12,000-hp. project on New River near East Radford. It is proposed to construct a dam 50 ft. high in New River which will create a reservoir extending up stream to Plum Creek, a distance of 12 miles.

The Board of Directors of State Institutions of Arizona has applied for a preliminary permit for a project on the Colorado River, the site being at Grand Wash Canyon, Mohave County. The project involves the regulation and storage of water for irrigation and power, which will be used for public utility purposes.

Anita M. Baldwin of Los Angeles has applied for a license to cover the replacing of a timber dam at an existing project on Taylor Creek in El Dorado County, Calif., with a concrete structure. The new dam is to be 10 ft. high and 450 ft. long. Only 150 hp. is involved.

# Briefer News

Progress on Oswego River Plant.—Nearly all construction work on the power plant of the Oswego River Power Corporation, at Dam 6 in the Oswego River, in New York State, is finished. Waterwheels have been set and electrical equipment is now being installed. The plant will go into operation early in the spring, it is thought.

Springfield (Mass.) Company Cuts Rates.—Directors of the United Electric Light Company, Springfield, Mass., last week voted to reduce rates from 7 cents to 6 cents a kilowatt-hour for domestic consumers using less than 200 hours a month and to 5 cents if more than 200 kw.-hr. is used. For refrigerators and ranges on a separate meter 4 cents will be the rate.

German Cloud-Advertising Machine Demonstrated. — An imported machine from the shops of Carl Zeiss, a German maker of photographic apparatus and lenses, is here shown on the roof of the Salmon Towers Building in New York. It is designed for casting advertisements on the clouds by means of a searchlamp shining through stenciled dies which rotate with a larger disk. The night must be cloudy to make the instrument of value, as the projected message must have a background to give it material form.

Los Angeles Gas & Electric Wants Ornamental Street-Lighting Business.—Making a determined effort to get a share of the rapidly increasing ornamental street-lighting business of Los Angeles, the Los Angeles Gas & Electric Corporation on Feb. 9 announced 25 per cent reduction in rates on electricity used for this purpose. The present rate, 4 cents a kilowatt-hour, will be cut to 3 cents, effective March 1. The company's engineers declare the new rate will allow an 8 per cent return on investment.

Cincinnati in Quandary Over Lighting Its New Boulevard.—Cincinnati is confronted with the probability that its new Central Parkway will be unlighted throughout the spring and summer. This has just been revealed by the definite announcement of the Rapid Transit Commission of the municipality that it was not authorized to do more than to construct the parkway. The commission has bought and installed light standards and traffic signals, but has no legal authority to contract for energy and maintenance. The parkway is the city's most important boulevard.

Virginia Electric & Power Takes Load of Marine Corps Post.—Quantico, Va., and the United States Marine Corps post there have been placed on the main transmission system of the Virginia Electric & Power Company, according to William E. Wood, president. The company has completed a 27-mile extension of its 66-kv. line from Fredericksburg to Quantico and the construction of a modern all-steel substation at the Quantico terminus. The Marine Corps post previously has been served by its own power plant.

A.I.E.E. Regional Meeting Programs.—For the regional meeting to be held at Baltimore on April 17-19 three technical sessions are planned on the subjects of insulation, the Gould Street station of the Consolidated Gas, Electric Light & Power Company and the Conowingo development of the Philadelphia Electric Company respectively. The proper application of relays and the instruments and methods used in determining it will be topics at the New Haven regional meeting, scheduled for May 9-11.

Improvement Program for Michigan's Capital.—Of the large sum appriated for extensions to be made this year to the Consumers Power Company's system in Michigan, more than a million dollars will be spent on improvements in the Lansing district, according to Clark R. Graves, district manager. Service will be extended to Howell and towns en route; a substation will be erected in Delhi township, about 3 miles south of Lansing, and the completion of transmission lines connecting Lansing with Jackson, Battle Creek, Flint, Owosso and Ann Arbor will insure uninterrupted service.

Syndicate Power Company and West Texas Objectors Reach Agreement.—As a result of settlement of the controversy between the Insull interests and the West Texas Chamber of Commerce over the appropriation of water rights on the Colorado River, the Syndicate Power Company will immediately start its program for the construction of a series of dams and hydro-electric plants on that stream, according to reports said to emanate from the power company. The initial expenditure will be $1,000,000 and may be made before the end of this year in the purchase of equipment. An ultimate expenditure of $25,000,000 is envisaged. The Syndicate Power Company holds permits to build six dams and hydro-electric plants in the Colorado River, two in Travis County and four in Burnet County. Under the terms of the agreement the

Syndicate Power Company agrees to surrender all but 580,000 acre-feet of water annually of its legal rights to 1,225,000 acre-feet of the Colorado River, together with the waiver from south Texas rice growers to water above the proposed Hamilton dam in Burnet and Llano Counties.

Another Eel River Plant Projected in California.—The Snow Mountain Water & Power Corporation has obtained a permit from the California Department of Public Works to appropriate 400 sec.-ft. and 214,813 acre-ft. per annum from the South Eel River in Lake County for power purposes. The corporation plans to develop about 22,000 hp. at an estimated cost of $3,200,000, in addition to the output of its present power plant, which is supplied by water from the South Fork of the Eel River.

Rice Growers Benefit from Industrial Electrification in Arkansas.—Coming reduction in rates for electric service to rice growers is announced by Frank M. Wilkes, general manager of the Arkansas Power & Light Company. The new rates will, it is expected, save between 15 and 30 per cent, depending upon the rainfall and the amount of energy used during the pumping season. The reduction was made possible by the steady increase in the industrial power business of the company due to the establishment in Arkansas of additional mills and substitution of electric service for other power by long-established industries. Many additional rice farmers are planning to avail themselves of electricity in their homes as well as on their fields.

Rochester's Gain from Added Water Power.—Installation of a 23,000-hp. hydro-electric unit at Station 5 in the Rochester Gas & Electric Corporation's Genesee River power development at Rochester has enabled the company to generate an additional 16,000,000 kw.-hr. from the river flow and resulted in a saving of 16,000 tons of coal since October, according to Thomas H. Yawger, superintendent of the company's electric department. The new unit has enabled the company to take advantage of the flow which ordinarily would have gone over the dam during the last three and one-half months. Repairs completed last week on the break in the State Barge Canal near Holley also gave the utility company the advantage of added water power.

Pacific Gas & Electric Rate Reductions Will Save Consumers $1,600,000 a Year.—Through the voluntary reduction of electric lighting rates to domestic and commercial consumers served by the Pacific Gas & Electric Company a saving of $1,600,000 on their yearly bills will be effected, the company says. New schedules are now being prepared, and the reduced rates are expected to go into effect in March. They will apply to the cities and towns of all P. G. & E. territory except that recently acquired through purchase of the properties of the Western States Gas & Electric Company and the Coast Valleys Electric Company. Under the new plan the minimum charge of 90 cents will be abolished, and in its place there will be a 5-cent kilowatt-hour rate plus a small service charge. To the small consumer this will mean a saving of approximately 10 per cent. The Great Western Power Company is also to reduce its rates, a total saving of about $500,000 being the estimate.

Construction of Stevens Point-Green Bay Line Begun.—Preliminary survey work on the new 110-kv. tie-in line from the Bayside steam plant of Wisconsin Public Service Corporation to the Wisconsin Valley Electric Company's lines at Stevens Point has been completed and construction begun. The line will enable the cities in the Wisconsin valley to get the benefit of the lower prices of coal brought to the Green Bay docks via the Great Lakes and in turn will enable Green Bay and other eastern Wisconsin cities to profit by the use of power from the hydro plants in the Wisconsin valley in times of high water.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

New England Central Station Association of Power Engineers—Engineers' Club, Boston, Feb. 29. T. D. Bond, C. H. Tenney & Co., Boston.

American Institute of Electrical Engineers—St. Louis regional meeting, March 7-9; Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11. F. L. Hutchinson, 33 West 39th St., New York.

Northwest Electric Light and Power Association — Engineering Section, Spokane, Wash., March 8 and 9. Berkeley Snow, 1208 Spalding Building, Portland, Ore.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Madison, Wis., March 17-18. W. Wilke, 4211 Elring Place, Milwaukee.

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N.E.L.A. — Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Electrochemical Society Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N.E.L.A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

First Rural Electric District Under New Nebraska Law Planned.—The directors of the Gering Valley (Neb.) Hydro-Electric Light and Power District have sold the $80,000 in bonds, subject to ratification by the voters on March 13, to a Denver house. The district, if established, will be the first under the new law intended to aid in rural electrification. It will serve sugar-beet growers owning 33,000 acres. The municipal plant at Gering, Wyo., which buys from the government reclamation dam at Guernsey, will supply the energy.

Canada May Set Up Electrical Testing Bureau.—The Dominion government is asking Parliament to sanction the creation of a Canadian Bureau of Standards, including the appointment of a director and the provision of facilities for the testing of electrical equipment and appliances of all kinds. Consent and co-operation of the provinces have already been obtained. Canadian and British manufacturers have made urgent representations to the government favoring such a bureau. Their products hitherto have been subject to the approval of United States laboratories in order to satisfy the fire underwriters.

For Improvement of New Orleans' Street Lighting.—Latest methods of street lighting in Chicago, New York, Detroit, Cleveland, Boston, Toledo, Milwaukee, Indianapolis, St. Louis and other Northern and Eastern cities have been studied by William T. Hall, commissioner of public utilities, New Orleans; Walter Dilzell, city electrician, and Frank Frost, general superintendent of the electric department, New Orleans Public Service, Inc. As the result of their tour Messrs. Hall and Dilzell will work out a new plan of street lighting for New Orleans. It is probable that this plan will include the installation of ornamental steel poles along Canal Street from the river to Claiborne Avenue, each pole carrying two 1,500-cp. lights with the poles 100 ft. apart. The present street-lighting contract will expire in April.

Tennessee Eastern Electric Seeks to Enjoin State Commission.—Involving issues of vital importance to the hydro-electric industry of the United States and to public utilities in general, the injunction suit of the Tennessee Eastern Electric Company against the Railroad and Public Utilities Commission of Tennessee has begun in the Chancery Court at Nashville. Flat denial of the legal right of the commission to exercise the power of control it claims over water-power development, or to impose a tax of one mill per kilowatt-hour produced, is made by the company, and even the authority of the Federal Power Commission is called into question in some of the issues. In its answer the Tennessee commission declares that the record of the company, in its dealings with the commission, has been one of "misrepresentation, duplicity, fraud and deceit." The commission demurs to the bill on fifteen separate grounds. The Holston River Power Company, named as a second defendant in the suit, likewise demurs to the bill and claims the petitioner is seeking to dam a navigable stream without obtaining federal permission. Decision was deferred by the court.

KANSAS ELECTRIC POWER CUTS RATES HEAVILY. — Voluntary rate reductions of 20 to 25 per cent for average domestic consumers throughout the territory served by the Kansas Electric Power Company, with headquarters at Lawrence, have been approved by the Kansas Public Service Commission. Such reductions, affecting 30 cities and towns, will go into effect in June. These decreases are probably the largest and most widespread to be made by one Kansas company for several years. The reductions have a bearing on the announced purpose of the state commission last fall to bring about a greater uniformity in electric rates in Kansas. At that time, acting on recommendations of John H. Fletcher, chief engineer for the commission, that body indicated that unless other electric companies voluntarily lowered rates to conform more closely to those of the Kansas Gas & Electric Company of Wichita, the commission would proceed to require a leveling of rates, and it has since then been taking steps to achieve that object. The Wichita concern has a uniform rate in all 64 towns in its territory, irrespective of size.

LATEST GEOLOGICAL SURVEY REPORT ON UMPQUA RIVER. — The Umpqua River basin in southwestern Oregon possesses huge potential power resources. They exceed those of any one of more than half of the states, according to a statement just issued by the Department of the Interior through the Geological Survey. There is, however, but one small developed site in the basin, on North Umpqua River near Roseburg, where a plant of 1,900 hp. has been built. A permit to investigate power sites at Rock Creek, Boundary, Toketee Falls and Lemolo Falls, on the North Umpqua River, and one on Clearwater River has been issued by the Federal Power Commission. Twenty-two power sites are proposed by the Geological Survey for the Umpqua and North Umpqua Rivers, fifteen power sites for the South Umpqua River and Fish Lake Creek and eleven power sites for tributaries. The total potential power of the Umpqua River basin without storage is 247,000 hp. for 90 per cent of the time and 584,000 hp. for 50 per cent. With storage these figures can be increased to 369,000 hp. and 561,000 hp. With unified operation the low figure could be increased to 400,000 hp., of which 350,000 hp. would be developed on the Umpqua and North Umpqua.

HIGH-TENSION LINE FROM FORT WAYNE, IND., TO MARION, MUNCIE AND KOKOMO.—A double-circuit 132-kv. transmission line will, it is announced, soon be built from Fort Wayne to Marion, Ind., a distance of 58 miles, by the Indiana General Service Company, at a cost of $2,500,000. At Marion the line will be divided, one double circuit going 28 miles to Muncie and the other extending 26 miles to Kokomo. At Marion a 20,000-kw. switching and stepdown substation will be built, while at Muncie there will be one of 35,000 kw. capacity. The company does not expect to shut down its plants in either city, O. M. Drischel, general manager at Marion, says. This line will join Muncie to the interconnected system of the American Gas & Electric Company.

## Recent Court Decisions

ORDINANCE REQUIRING OPERATORS OF MOTOR-DRIVEN MACHINES TO BE LICENSED AS STEAM ENGINEERS FOUND VOID.—A New York City ordinance adopted in 1921 requiring operatives on machines driven by electric power to pass examinations and be licensed as steam engineers was declared unconstitutional and void in a decision by the State Supreme Court rendered in injunction suits brought by the Ice Service Corporation and others, together with two employees representing workers in the several companies. It was contended that the operatives prior to the passage of the ordinance had efficiently operated machines driven by electricity, but, not being trained steam engineers, were barred from continuing such work, though it did not require engineering experience or training.

ORDER OF COMMISSION GOVERNING HEIGHT OF TRANSMISSION LINE APPLIED TO EXISTING AS WELL AS FUTURE LINES. —Howell vs. San Joaquin Light & Power Corporation was a suit to recover damages for the death of a man who raised a water pipe perpendicularly to clean it and was killed by its making contact with a line carrying voltages as high as 17,000 and having only about 19 ft. clearance over the farm land where the man was working. A finding for the plaintiff on the ground of negligence was sustained by the District Court of Appeals in California. The line had been originally erected at a height of 23 ft. but had sagged 4 ft. It had been erected previous to an order of the California Railroad Commission fixing 25 ft. as the proper minimum height for such lines, but the court held that this order, though it had no retroactive effect, applied to lines existing at the time it was made as well as to new lines, and that the company's failure to maintain the line in question at the ordered clearance was negligence *per se* and properly submitted to the jury, along with the question of contributory negligence by the deceased. (261 Pac. 1107.)*

## Commission Rulings

READY-TO-SERVE CHARGE BASED ON NUMBER OF ROOMS NOT DISCRIMINATORY. —The Public Service Commission of Pennsylvania dismissed a complaint brought against the Northern Pennsylvania Power Company based upon an alleged discrimination resulting from the fact that the company's tariff included a ready-to-serve charge computed according to the number of rooms served. The company showed that of the 2,058 residential or domestic consumers in the district to which this schedule applies, 1,099, or 53 per cent, would be benefited by taking service under it. Those who chose to do so could continue under the old schedule, receiving service as heretofore and having the option of changing to the other schedule should they so alter the manner of use to make the change advantageous to themselves.

"ROOM RATES" NOT APPLICABLE TO SMALL VILLAGE. — The North Dakota Board of Railroad Commissioners in fixing electric rates for the Farmers' Elevator Company, which operates an electric utility in connection with its elevator, said: "The schedule of rates now in effect, which is based upon the so-called 'room-rate' schedule, is not readily understood and, in our opinion, a more simple schedule would result in less conflict. While the room-rate schedule may be practicable in a city the size of Fargo, we doubt the wisdom of adopting such a schedule in a village with a population of 200. It is our recommendation that the Farmers' Elevator Company file with the commission within 30 days a rate schedule constructed upon a kilowatt-hour-per-month basis. . . . We will also require the company to install a system of accounting which will more clearly show the actual operating expenses of the electric utility as distinguished from the operations of the company as a whole."

'ROOM RATE" DEMAND CHARGES UPHELD.—A "room-rate" demand charge of an electric utility was said by the New Jersey Board of Public Utility Commissioners, in adjudicating a complaint listed as Sullivan vs. Rockland Electric Company, to be the result of an endeavor by the electric utility to measure the demand element in the cost of operation by some simple and easily understood rule and to distribute the cost of extra equipment used during peak demands equitably among such consumers as made the most use of such equipment. In dismissing a complaint against such a "room rate" it was said that in any revision of rate schedules, especially when such schedules effected a consolidation of two or more classes of service into one schedule, there may be some customers who suffer prejudice thereby, but that if this prejudice be not unreasonable and the greatest good is afforded to the greatest number, such prejudice should not stand in the way of an otherwise desirable form of rate schedule. In the particular instance before the commission the testimony indicated that only 24 customers would have higher bills, while upward of 4,000 would be benefited by composite reduction in charges approximating $20,000, and that costs were reasonably allocated. All customers taking lighting service alone would have decreased bills.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *J. B. Miller Thirty Years With Edison Company*

John B. Miller on Feb. 1 celebrated the completion of 30 years' service with the Southern California Edison Company. In 1898 Mr. Miller became associated with the Edison Electric Company, predecessor of the present organization, in the capacity of treasurer, which position he held until 1901, when he was elected president, the position which he has held continuously for the intervening 27 years. In 1896 Mr. Miller, then 27 years of age, visited Southern California for the first time and within two years had launched upon his life's work. His first task was to amalgamate several small power companies and to organize larger and more efficient operating units, the present Southern California Edison Company, operating in ten counties of southern and central California, being the result.

J. B. MILLER

In addition to being the directing officer of the Edison company Mr. Miller is president of the Landowners Company, president San Joaquin & Eastern Railroad Company, chairman of board Electrical Products Corporation, director Los Angeles First National Trust & Savings Bank, Pacific Mutual Life Insurance Company, Federal Telegraph Company of Delaware, Pacific Finance Corporation, Pacific Indemnity Company, Bellows Claude Neon Company, Detroit; Claude Neon Federal Company, Chicago; Claude Neon Lights, Inc., New York, and Diamond Electrical Manufacturing Company.

## *L. P. Sweatt Vice-President of Mississippi Company*

**L. P.** Sweatt, Jr., general manager of the Mississippi Power Company, Gulfport, Miss., since its organization, has been elected vice-president of that utility. At an early age Mr. Sweatt became interested in the public utility industry. For several years he was employed in the railroad branch of the business before entering the Alabama Polytechnic Institute at Auburn and he financed his technical education at that institution by acting as chief engineer of the power plant furnishing electricity to the college and city of Auburn.

Mr. Sweatt started with the Alabama Power Company in the capacity of a helper in substation maintenance, and step by step he has advanced, serving successively as foreman of substation construction, member of the commercial department, superintendent of the western division, manager of that division, manager of the eastern division and manager of the southern division. It was in 1925 that Mr. Sweatt assumed the duties of general manager of the Mississippi Power Company, which he will continue to carry on in addition to those pertaining to his new position.

E. C. **Brandt**, who has been connected with the Westinghouse Electric & Manufacturing Company since 1905, has been appointed assistant works manager of the East Pittsburgh works.

## *E. W. Dillard Receives New Appointment*

Edward W. Dillard has been appointed electrical engineer of the New England Power Company system, following eight years' service in the electrical engineering department of that organization. Mr. Dillard is a native of Alabama, was educated at the Alabama Polytechnic Institute and at one time was employed by the General Electric Company and then by the Alabama Power Company. He joined the staff of the New England Power Company at Worcester in 1916 as chief of tests, being in charge of all meter, relay, oil circuit breaker and telephone inspection and maintenance for two years. In 1919 he entered the department which he now heads, and for some time specialized in problems of relay operation and maintenance, acquiring a high reputation as a specialist in this field in the New England territory.

E. W. DILLARD

## *N. E. Funk Chief Engineer of Philadelphia Electric*

Nevin E. Funk, who has been assistant chief engineer of the Philadelphia Electric Company for the past year, has been appointed chief engineer of that company to succeed the late William C. L. Eglin. Mr. Funk affiliated himself with the Philadelphia utility nineteen years ago and during this period of service he has been closely identified with the planning and operations of the three large generating stations as well as with the huge hydro-electric plant now being constructed at Conowingo. A graduate of the Bloomsburg (Pa.) State Normal School and of Lehigh University, Mr. Funk entered upon his engineering career as an apprentice with the Westinghouse Electric & Manufacturing Company. Subsequently he was identified with the New York Central Railroad and later with the teaching staff of the Georgia School of Technology.

N. E. FUNK

He started with the Philadelphia Electric Company as assistant foreman in the station electrical construction department, occupying successively the positions of assistant superintendent, combustion engineer, superintendent of Schuylkill station, assistant operating engineer, operating engineer and assistant chief engineer.

Mr. Funk is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society for Testing Materials and other technical organizations, and has been active in the work of the prime movers committee of the National Electric Light Association.

**Austin D. Barney** has been elected general counsel of the Hartford Electric Light Company, Hartford, Conn., to succeed the late Judge William F. Heeney. Mr. Barney has been with the company as an attorney for several years and was assistant to Judge Heeney.

### *Stocks React Drastically*
### *Money Rates Firm*
### *Bond Prices Unaffected*

THE drastic downward readjustment through which the securities markets have passed within the last week brought several of the utilities down sharply, although as a group they were affected less than most of the other main groups. The average of a representative group of fifteen power and light common stocks reacted from 130 to 127, the former figure being the high point for these issues for all time. Brooklyn Edison lost eight points, to 226; Edison Electric Illuminating of Boston dropped eleven points, to 254; Pacific Gas & Electric is down twelve points, to 182; Montana Power reacted to 147 from a recent high of 165.

More attention, evidently, is being paid to money rates, in response to the action of the Federal Reserve banks. Rate increases were introduced by three of the reserve banks, Chicago, New York and Richmond. In the middle of February a 4 per cent rate was in effect in ten of the twelve reserve districts. Increases were made, apparently, in anticipation rather than as a result of increased demand for funds.

While it has had a radical effect on the stock markets, this general firming of money rates has had no apparent effect on the prices of higher grade bonds. The better class of power and light bonds are stated to be in just as keen demand as before these rate adjustments, although selling has been heavy in classes of bonds other than the utilities.

PHILADELPHIA ELECTRIC ELECTS NEW DIRECTORS.—At a recent meeting of the board of directors of the Philadelphia Electric Company Arthur W. Thompson, president of the United Gas Improvement Company; Samuel T. Bodine, chairman of the board of the United Gas Improvement Company, and William H. Taylor, formerly vice-president of the United Gas Improvement Company and now president of the Philadelphia Electric Company, were elected members of the board. These three new members are replacing Walter H. Johnson and A. V. R. Coe, resigned, and W. C. L. Eglin, deceased.

### American Superpower to Recapitalize

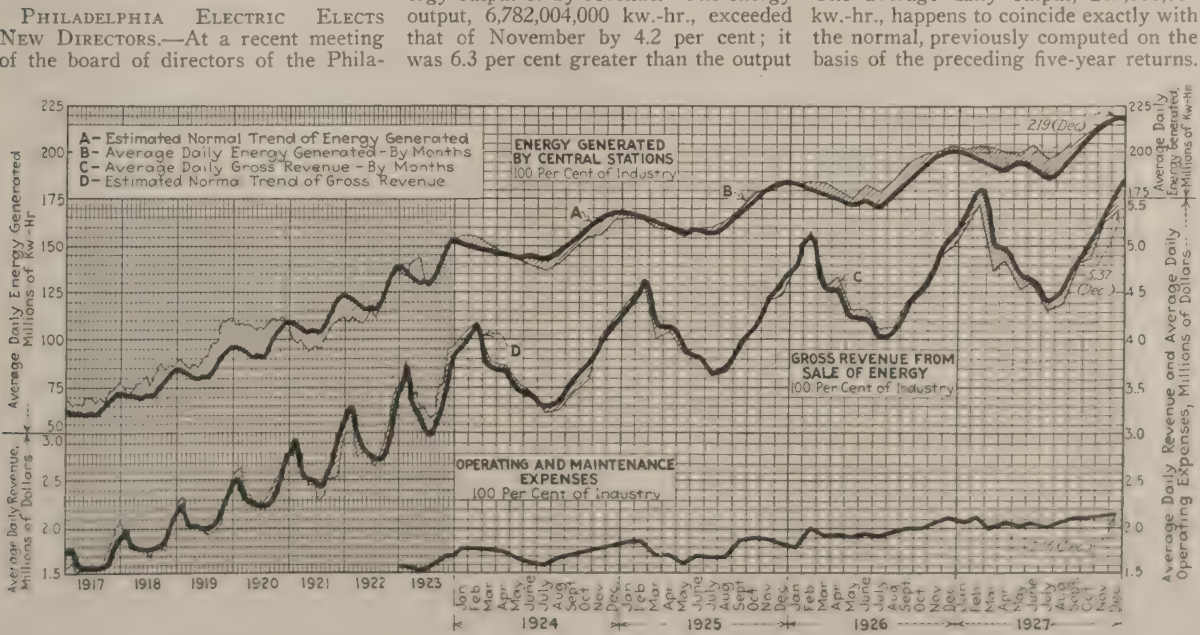
Revision of the capital structure of the American Superpower Corporation has been announced by President L. K. Thorne. The proposed plan calls for the immediate retirement of the outstanding participating preferred stock, the proceeds for which will be raised through the sale of additional class "A" common stock at $33 per share. This stock will be offered to all common stock holders, class A and class B, of record Feb. 20, 1928, on the basis of one share for each four shares held. In addition to the common stock the company has offered for sale 90,000 additional shares of first preferred stock, the proceeds of which will be used to finance certain large investments recently made by the corporation.

Stockholders also will be asked to approve the creation of a new class of preference stock (junior to the first preferred stock) cumulative as to dividends at the rate of $6 per share annually, and callable at $107.50 per share. If this proposal is approved the directors will distribute the stock to common stock holders on the basis of one share of new preference stock for each five shares of class A or class B common stock held. The additional common stock subscribed for at $33 per share on or before March 6 will receive its pro rata share of new preference stock.

## December Operations Greater Than Ever Before

### Revenue of $166,200,000 Exceeds Previous Peak—Energy Output, 6,782,000,000 Kw.-Hr., Also Breaks Records—Water Power Furnishes Nearly 40 Per Cent

NOTWITHSTANDING the slowing down of business activity in general toward the end of 1926, December operations in the electric light and power industry were greater than ever before, whether measured by energy output or by revenue. The energy output, 6,782,004,000 kw.-hr., exceeded that of November by 4.2 per cent; it was 6.3 per cent greater than the output of December, 1926. Both of these figures, while in harmony with the strong upward trend that has characterized the industry since its inception, are slightly below the usual seasonal and annual increase, respectively. The average daily output, 219,000,000 kw.-hr., happens to coincide exactly with the normal, previously computed on the basis of the preceding five-year returns.



## TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES

(100 Per Cent of the Industry)

| Month | Kw.-Hr. Generated Monthly * | | | Estimated Distribution of Energy Generated | | | | | | | | | | Energy Purchased by Public Utilities for Resale, Kw.-Hr. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total Energy Consumption by Central-Station Customers, Kw.-Hr. | | Energy Consumed for Lighting, Kw.-Hr. | | Energy Consumed for Power, Kw.-Hr. | | Energy Sold to Electric Railways, Kw.-Hr. | | Energy Used in Intra-company Business, Including Line Losses, Kw.-Hr. | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Sept.. | 6,268,814 | 5,825,852 | +7.6 | 5,158,814 | 4,701,852 | 1,274,000 | 1,188,000 | 3,373,814 | 3,009,852 | 511,000 | 504,000 | 1,110,000 | 1,124,000 | 1,299,000 | 1,225,000 |
| Oct | 6,577,566 | 6,174,959 | +6.5 | 5,413,566 | 4,982,959 | 1,372,000 | 1,262,000 | 3,485,566 | 3,172,959 | 556,000 | 548,000 | 1,164,000 | 1,192,000 | 1,290,000 | 1,240,000 |
| Nov.... | 6,507,024 | 6,063,784 | +7.3 | 5,355,024 | 4,989,784 | 1,400,000 | 1,310,000 | 3,396,024 | 3,128,784 | 559,000 | 551,000 | 1,152,000 | 1,074,000 | 1,269,000 | 1,200,000 |
| Dec... | 6,782,004 | 6,375,500 | +6.3 | 5,592,004 | 5,247,500 | 1,500,000 | 1,400,000 | 3,462,004 | 3,226,500 | 630,000 | 621,000 | 1,190,000 | 1,128,000 | 1,286,000 | 1,175,000 |

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only

The revenue, $166,200,000, exceeded the previous maximum of $162,000,000 attained in January, 1927. It was equivalent to a daily average of $5,370,000. This is but little less than the maximum ever recorded, which happened last February, when payments for a long month of heavy energy consumption were concentrated into a short one. The month's revenue exceeded that of December, 1926, by 7.3 per cent, and in accordance with the usual seasonal swing was 5.2 per cent higher than in the preceding month, but it fell about 5 per cent short of the estimated normal, based on former years.

This December departure downward from the computed normal is not new; it occurred both in 1925 and in 1926, whereas in some other years the variation was upward.

Operating expenses, which on the basis of returns received are estimated at $67,100,000 for the industry as a whole, were but 5.8 per cent higher than the year before, so that despite the moderate increase in gross revenue the net rose 8.4 per cent. In certain instances reports of operating expenses showed an actual reduction, suggesting a definite policy of retrenchment, but in general there is no evidence of drastic economies.

Of the total energy output 2,689,900,000 kw.-hr., or almost 40 per cent, came from water power. The increase of this item was 13.1 per cent, whereas the energy generated from fuel was only 2.3 per cent greater than in December, 1926. Thus, more than half the increment was borne by water power. Production of energy from fuel shows continued improvement in efficiency. The increased output was achieved with 2.6 per cent less coal and 21.1 per cent less fuel oil; the reduction far outweighs the 31.6 per cent increase in the consumption of natural gas. Oil consumption, while greater than in recent months, continues extremely low compared with previous years.

Regional analysis of the changes in energy output, compared with December, 1926, indicates an increase in New England of 1 per cent, in the Atlantic States of 6 per cent, the North Central 6, the South Central 10, and in the Western States of 4 per cent. The most rapid growth continues to be in the Southwest. Similarly the revenue rose, in New England 5.9 per cent, in the Atlantic States 6.0 per cent, North Central 9.7, South Central 9.7 and in the Western States 4.7 per cent.

The increasing use of energy for industrial purposes is apparently reflected in the gradual flattening of the output curve. During the past two years the seasonal fluctuations have been smaller than before. The winter peaks have checked quite closely with the values estimated in advance based on previous growth, but the summer sag has been very much smoothed out.

## TABLE II—OPERATING RATIO OF CENTRAL-STATION COMPANIES

| Month | Operating Ratio | | | | | |
|---|---|---|---|---|---|---|
| | Steam Plants | | Hydro Plants | | Combined Hydro and Steam Plants | |
| | 1927 | 1926 | 1927 | 1926 | 1927 | 1926 |
| Sept | 48.8 | 49.7 | 33.4 | 37.5 | 42.1 | 43.3 |
| Oct | 46.9 | 48.3 | 31.8 | 32.8 | 42.6 | 43.0 |
| Nov | 44.7 | 45.8 | 31.0 | 29.6 | 41.0 | 42.0 |
| Dec | 44.0 | 44.6 | 31.1 | 31.4 | 38.4 | 40.2 |

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Pacific Gas & Electric to Issue Bonds.—Permission has been granted by the Railroad Commission of California to the Pacific Gas & Electric

## TABLE III—CENTRAL-STATION FINANCIAL OPERATIONS FOR FOUR MONTHS IN THE UNITED STATES

(100 Per Cent of the Industry)

| Month | Total Gross Revenue from Sale of Energy† | | | Estimated Distribution of Gross Revenue | | | | | | | | Total Operating and Maintenance Expenses‡ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lighting Customers | | Power Customers | | Electric Railways | | Other Public Utilities | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Sept | $144,400 | $132,600 | +8.9 | $84,200 | $80,500 | $44,400 | $38,000 | $4,600 | $4,500 | $11,200 | $9,600 | $63,600 | $60,300 |
| Oct | 150,800 | 141,800 | +6.4 | 88,700 | 84,100 | 45,900 | 42,000 | 4,600 | 4,600 | 11,600 | 11,100 | 64,450 | 62,950 |
| Nov | 158,000 | 148,300 | +6.5 | 94,300 | 89,100 | 47,200 | 43,200 | 5,000 | 4,900 | 11,500 | 11,100 | 64,300 | 62,456 |
| Dec...... | 166,200 | 154,800 | +7.4 | 100,600 | 94,700 | 48,700 | 43,900 | 5,100 | 5,000 | 11,800 | 11,200 | 67,100 | 63,400 |

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

## TABLE IV—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL PLANTS IN THE UNITED STATES*

(100 Per Cent of the Industry)

| Month | Energy Generated | | | | | | Fuel Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hydro-Plants | | | Fuel Power Plants | | | Coal | | | Oil | | | Gas | | |
| | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Short Tons | 1926 Short Tons | Per Cent Increase | 1927 Barrels | 1926 Barrels | Per Cent Increase | 1927 Thousands of Cubic Feet | 1926 Thousands of Cubic Feet | Per Cent Increase |
| Sept ..... | 2,168,531 | 2,033,312 | + 6.7 | 4,100,283 | 3,792,540 | +8.1 | 3,242,546 | 3,114,535 | +4.1 | 478,816 | 883,913 | —45.9 | 6,474,756 | 4,816,955 | +34.4 |
| Oct ..... | 2,350,530 | 2,122,336 | +10.7 | 4,227,036 | 4,052,623 | +4.3 | 3,332,729 | 3,317,113 | +0.5 | 483,554 | 879,729 | —45.1 | 6,424,559 | 4,872,740 | +31.8 |
| Nov. ..... | 2,457,463 | 2,193,093 | +12.0 | 4,049,561 | 3,870,691 | +4.6 | 3,231,891 | 3,193,212 | +1.2 | 483,455 | 926,916 | —47.6 | 5,630,302 | 3,975,406 | +41.6 |
| Dec...... | 2,689,900 | 2,377,175 | +13.1 | 4,092,104 | 3,998,325 | +2.3 | 3,315,963 | 3,406,140 | —2.6 | 607,393 | 769,518 | —21.1 | 4,851,762 | 3,685,611 | +31.6 |

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

Company to issue and sell on or before June 1, 1928, at not less than 96 per cent of face value, plus accrued interest, $20,000,000 of first and refunding mortgage gold bonds, series "E," bearing interest at the rate of 4½ per cent per annum, and to use the proceeds to pay in part for the properties of Coast Valleys Gas & Electric Company and Western States Gas & Electric Company, and to refund outstanding bonds or notes of those companies.

## Electric Bond and Share to Change Set-up

At recent meetings of the boards of directors of the Electric Bond & Share Company and the Electric Bond & Share Securities Corporation it was determined to recommend to the stockholders of the two companies that the authorized shares of the capital stock of each of the corporations be increased. It is proposed to authorize an additional 1,000,000 shares of common and an additional 1,000,000 shares of preferred stock of Electric Bond & Share Company and to increase the authorized shares of common stock of the Securities Corporation from 1,802,870 to 4,000,000. Meetings have been called for March 5, 1928.

# Public Service of Northern Illinois Increases Net 15 Per Cent

Although Public Service Company of Northern Illinois did not show so great a growth in 1927 over 1926 as in 1926 over 1925, the progress made was almost as great. Gross revenue increased 11.8 per cent, as against 12.9 per cent the previous year. Operating costs were unusually well regulated, showing an increase of only 9.7 per cent, allowing for a 15.2 per cent expansion in net operating revenues during the period.

After all deductions gross income showed a growth of 13.9 per cent, against 14.5 per cent a year ago. The amount available for dividends in 1927 was $5,186,013, an increase of 5.9 per cent. Of this amount, $3,443,914 was distributed as dividends and $1,742,098 was added to surplus. It will be noted that rate reductions were made from time to time, and such reductions lowered the increase in operating revenues and the amount available for dividends on preferred and common stock for 1927 by about $685,000.

Total sales of electricity for the year, in kilowatt-hours, were 739,718,878 against 597,061,783 for 1926. Exclusive of sales to other electric companies, electric sales totaled 551,556,023, an increase of 13 per cent over 1926. The gain in total connected lighting load, over 1926, was 19 per cent. The total contracted power business for the year amounted to 55,250 hp., a gain of 21 per cent over 1926.

The financial set-up of the company was altered during the year by the issue of $10,000,000 in principal amount of 5 per cent debentures due August, 1932, and $750,000 of first lien and refunding 5 per cent mortgage bonds, series C, of 1966. Returns were used to purchase property and equipment, to acquire at par $4,245,000 of the first mortgage bonds of the Waukegan Generating Company and to refund certain of the company's own bonds. Furthermore, 3,500 shares of no-par common stock were sold to employees at an advantageous price.

Interest charges for the year were earned 2.4 times.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Monday Feb. 20 | Low 1927 | High 1927 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 73 | 72* | 81* |
| Ala. Pwr., $7 com. pf.—no par | 114¾ | 107 | 115 |
| Allis Chalmers Mfg., 6% com. | 117 | 115⅛* | 125* |
| Aluminum Co. of Amer., com. | k136 | 120* | 136* |
| Aluminum Co. of Amer., 6% pf | 106¾ | 105½* | 107¾* |
| Amer. & Foreign Pwr., 7% pf.—no par | 107 | 105½* | 108½* |
| Amer. & Foreign Pwr., com.—no par | 23¼ | 22¼* | 27⅞* |
| Amer. Bosch Magneto, com.—no par | 17¾ | 15⅛* | 22⅞* |
| Amer. Brown Boveri Elec.† | 16 | 14¼* | 18* |
| Amer. Brown Boveri Elec., pf. $7 | 56½ | 55* | 63* |
| Amer. Gas & Elec., 6% pf.—no par | 107 | 106¾* | 109* |
| Amer. Gas & Elec., com. †—no par | 121 | 117½* | 126⅞* |
| Amer. Lt. & Trac., 6% pf | 115 | 115½* | 115½* |
| Amer. Lt. & Trac., new com. | 182 | 170* | 191* |
| Amer. Pwr. & Lt., 6% pf | 105¾ | 104⅛* | 109¾* |
| Amer. Pwr. & Lt., com. †—no par | 65¼ | 62¼* | 69¼* |
| Amer. Pub. Serv., 7% pf. | k 99¾ | 99* | 100* |
| Amer. Pub. Serv., com. † | k 70 | 65 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | 90 | 73 | 90 |
| Amer. Pub. Utilities, 7% pr. pf. | 97½ | 88 | 97 |
| Amer. Pub. Utilities, com. | k 60 | 58 | 70 |
| Amer. States Sec., A | 5 | 2⅛ | 5½ |
| Amer. States Sec., B | 5¼ | 2⅛ | 5⅛ |
| Amer. Superpwr., 6% ptc pf.—25 | 30 | 28⅛* | 30* |
| Amer. Superpwr., 6% 1st pf | l 103 | .... | .. |
| Amer. Sup pwr., Class A†—no par, ex rts. | 40½ | 37* | 41⅛* |
| Amer. Sup'pwr., Class B†—no par, ex. rts. | 40½ | 37⅛* | 43* |
| Amer. Wtr. Wks. & Elec., 6% pf. | 105 | 101½* | 105* |
| Amer. W. W. & E., com. new—no par | 56¼ | 54¼* | 61* |
| Anaconda Copper cap. $3 | 55¼ | 53¾* | 59⅛* |
| Appalachian Electric Pwr., 7% pf. | 109 | 100 | 109 |
| Arkansas Pwr., & Lt. 7% pf. | 107½ | 101 | 108 |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 95 | 85 | 98 |
| Assoc. G. & E., Class A, 10—no par. | 47⅛ | 47⅛* | 51½* |
| BABCOCK & WILCOX, 7% com. | 120 | 120* | 124¾* |
| Binghamton L., H. & P., $6 pf. | 105½ | 93 | 103½ |
| Birmingham Elec., pf.—$7—no par. | 110 | 105 | 111½ |
| Blackstone Valley G. & E., 6% pf. | k107 | 103 | 110 |
| Blackstone Valley Gas & Elec., 10% com. 50. | k128 | 132* | 135⅛* |
| Blaw-Knox, com.† | i105 | 91* | 105* |
| Brazilian Trac., Lt. & Pwr., $7 com | f201 | ... | .. |
| Brazilian Trac., Lt. & Pwr., com., new | f 51½ | .... | .. |
| Broad River Pwr., 7% pf | 105¼ | 97 | 105½ |
| Brooklyn Edison, 8% com | 226⅛ | 206⅛* | 235⅛* |
| Buffalo, Niagara & East. Pwr., $1.60 pf—25 | l 26¼ | .... | .. |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 35¾ | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf | k 99 | 96 | 104½ |
| California Ry. & Pwr., 7% pf. | k135 | 125 | 150 |
| Carolina Pwr. & Lt., pf.—$7—no par | l110½ | 109* | 110½* |
| Central & S. W. Util., $7 pf.—no par | a102¾ | 99⅛* | 105½* |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a105 | 104½* | 105* |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 100 | 107* |
| Central Ill. Pub. Serv., $6 pf | a 99 | 97⅛* | 99* |
| Central Ind. Pwr., 7% pf | a 97 | 95* | 99½* |
| Central Maine Power, 6% pf | 95 | | |
| Central Maine Power, 7% | 107 | 102 | 110 |
| Central Pwr. & Lt., 7% pf. | 98 | 100½ | 105 |
| Central States Elec., 7% pf. | 105 | 104¼* | 107⅛* |
| Century Elec., 6% com | b145 | 140* | 145* |
| Chicago Fuse Mfg., com.—$2.50 no par | m 30 | 30* | 33¼* |
| Cincinnati Gas & Elec., 5% com. | g 97¼ | 97½* | 100* |
| Cities Service, $6 pf.—no par | l 95⅛ | 87* | 94⅛* |
| Cities Service, pf. B—no par | l 9 | 8* | 8⅜* |
| Cities Service, pf. BB—no par | l 90 | 80½* | 86* |
| Cities Service, com.—20 | l55⅛ | 40¼* | 58¾* |
| Cities Service, Bks. Shrs.—10 | l 27¼ | 22¾* | 27* |
| Cities Service Pwr. & Lt., 7% pf. | 106¾ | 105¼* | 106½* |
| Cities Service Pwr. & Lt., 6% pf. | 96½ | 95½* | 96⅞* |
| Cleveland Elec. Illg., 6% pf. | 114 | 108 | 114 |
| Cleveland Elec. Illg., 10% com. | 360 | 285 | 370 |
| Columbia Gas & Elec., 6% pf. | k108 | 107½* | 110⅛* |
| Columbia G. & E. com. $5—no par | 91½ | 89⅛* | 97⅛* |
| Columbus Elec. & Pwr., $2 com.—no par | k 70 | 66* | 71* |
| Columbus Elec. & Pwr., 7% pf. | 113 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. | 107½ | 98½ | 108½ |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 105½ | 96 | 106 |
| Columbus Ry., P. & Lt. com.—no par | 105 | 75 | 110 |
| Commonwealth Edison, 8% com. | a176 | 165* | 189* |
| Commonwealth Pwr., 6% pf | k103½ | 102⅛* | 104⅞* |
| Commonw'th Pwr., $2, com.—no par | 65 | 62¼* | 69* |
| Conn. Lt. & Pwr., 8% pf. | 119 | 119 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 116 | 112 | 119 |
| Cons. Gas of N. Y., pf. | 101½ | 101½* | 102½* |
| Cons. Gas of N. Y., com. $5—no par | 130¾ | 119⅛* | 139¾* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e112½ | 110⅛* | 113* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e110½ | 110½* | 113* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e110½ | 110½* | 115* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf | e125⅛ | 125¼* | 128½* |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par. | e 71¼ | 67¼* | 72¾* |
| Consolidated Pwr. & Lt., 7% pf. | 105 | 100 | 106 |
| Consumers Pwr., 6% pf. | 104½ | 100 | 106½ |
| Consumers Pwr., 6.6% pf | 106½ | 103 | 107½ |
| Continental Gas & Elec., 7% pr. pf. | 107 | 100 | 107½ |
| Contl. G. & E. com. $4.40—no par | k240 | 210 | 265 |
| Crocker Wheeler, com.† | 30 | 23 | 38 |
| Crocker Wheeler, 7% pf. | 90 | 78 | 88 |
| DALLAS PWR. & LT., 7% pf. | 110½ | 107 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108½ | 101 | 109½ |
| Detroit Edison, 8% com | 176 | 166½* | 194¾* |
| Dubilier Condenser, com.—no par | 3½ | 2¾* | 3¾* |
| Duke Pwr., cap | 135 | 135* | 145* |
| Duquesne Lt., 7% pf. | 116¼ | 115½* | 116¼* |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 102 | 112½ |
| Eastern New York Util. com | k 65 | 70 | 75 |
| Eastern States Pwr. $7, com | k 12 | 11¼* | 15¼* |
| Eastern States Pwr., pf | k 97 | 90 | 99 |
| East. Tex. Elec., 7% pf. | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d254 | 254* | 268* |
| El Paso Elec. 7% pf | 113 | 105 | 112½ |
| Elec. Bond & Share, 6% pf. | l110 | 109½* | 111¼* |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 86½ | 76* | 94¾* |
| Electric Household Util.† | a 14½ | 13¼* | 15⅛* |
| Elec. Investors, 6% pf.—no par. | 102 | 92 | 101 |
| Elec. Investors, com.†—no par | 41¾ | 40⅛* | 45¼* |
| Elec. Pwr. & Lt., ctfs. pf | 108¼ | 106⅛* | 108¾* |
| Elec. Pwr. & Lt., ctfs., 40% pd | k123¼ | 120¾* | 123* |
| Elec. Pwr. & Lt., ctfs., com.—no par | 33 | 28⅜* | 34½* |
| Elec. Refrig. cap † | 14 | 11⅛* | 15¾* |
| Elec. Ry. Securities, com.—no par | 6½ | .... | |
| Elec. St. Battery com. $5.25—no par | 69¾ | 69⅛* | 75¼* |
| Elmira Wtr., Lt. & R.R., 7% pf | k105 | 99 | 105½ |
| Empire Pwr., ptc † | 30 | 27¼* | 35⅛* |
| Engr. Pub. Serv. $7, pf.—no par | k109 | 107* | 109* |
| Engr. Pub. Serv., com.—no par | 34 | 33* | 35⅛* |
| Eureka Vacuum Cleaner, com. $4—no par | 70½ | 69½* | 79* |
| FAIRBANKS MORSE, 7% pf. | 105⅛ | 104* | 106½* |
| F.-M., com.—$3—no par | k 36 | 32¼* | 40¼* |
| Federal Lt. & Trac., com. $1.40 | 49½ | 42* | 55* |
| Federal Lt. & Trac., $6 pf.—no par | 102 | 98* | 105* |
| Florida Pwr. & Lt., 7% pf | 107 | 104⅛* | 107½* |
| Ft. Worth Pwr. & Lt., 7% pf. | l113½ | 113* | 114½* |
| GALVESTON-HOUSTON ELEC. 6% pf. | 77 | 68 | 85 |
| Galveston-Houston Elec., com. | 32 | 26 | 32 |
| General Cable, Cl. A | 61½ | 56* | 62½* |
| Gen. Elec. $3 com.—no par. | 127¾ | 125⅛* | 138¼* |
| Gen. Elec., special—6% | k 11½ | 11½* | 11⅛* |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 36⅛ | 35½* | 39⅛* |
| Gen. G. & E. (Del.) pf. A. $8—no par | 122½ | 122½* | 126⅛* |
| Gen. G. & E. (Del.) pf. A $7—no par | k112½ | 108¼* | 112½* |
| Gen. G. & E. (Del.) pf. B $7 | k107 | 105½* | 107* |
| Gen. Pub. Serv., $7 cum. pf., no par. | k120 | 115* | 120* |
| Gen. Pub. Serv., com., no par | 19 | 16⅛* | 20½* |
| Ga. Lt., Pwr. & Rys., com. | k 58 | 50 | 70 |
| Ga. Ry. & Pwr., 8% pf. | k125 | 119 | 125 |
| Ga. Ry. & Pwr., 7% pf. | k113½ | 106 | 115 |
| Gt. Western Pwr., 7% pf. | h105 | . | .... |
| IDAHO PWR., 7% pf. | 109 | 103 | 110 |
| Ill. No. Utilities, 6% pf | a 99½ | 98½* | 99½* |
| Ill. Pwr. & Lt., 7% pf. | 104½ | 99 | 104½ |
| Ingersoll Rand com | 90½ | 90¼* | 94* |
| Int. Combus. Engr., com. $2—no par | 47⅛ | 45¼ | 55⅛* |
| Int. Combustion Engr., 7% pf | k104 | 104* | 105½* |
| Int. Util., Class A—$3.50—no par | 45 | 45* | 51½* |
| Int. Utilities, Class B—no par | 7⅛ | 6¼* | *10½* |
| Interstate Pwr., pf.—$7—no par | 100½ | 93 | 100 |
| Interstate Pub. Serv., 7% pf. | 104 | 98 | 104 |
| Iowa Ry. & Lt., 7% pf. | k100 | 97 | 100 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 107¼ | 97¼ | 108 |
| Johns-Manville com.†—no par | 116 | 114* | 125 |
| Johns-Manville, 7% pf | 119½ | 119¼* | 120* |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Feb. 18. *l*Bid price Tuesday, Feb. 21. *m*Latest quotations available. †Dividend rate variable. *1928

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Monday Feb. 20 | Low 1927 | High 1927 |
|---|---|---|---|
| **KANSAS CITY PWR. & LT. pf. $7** | 111½ | 111½* | 111½* |
| Kansas Gas & Elec., 7% pf. | l109½ | 107* | 109* |
| Kentucky Hydro-Elec., 7% pf. | a104 | 102* | 104* |
| Kentucky Sec., 6% pf. | 92 | 83 | [illegible] |
| Kentucky Sec., 5% com. | 140 | 100 | 135 |
| Kentucky Utilities, 6% pf. | k101 | 95 | 101 |
| **LACLEDE GAS LT., 10% com.** | k230 | 200* | 260* |
| Lehigh Pwr. Sec., com.—no par | 25 | 19½* | 27½* |
| Long Island Ltg., 7% pf | 112½ | 110½* | 112* |
| Long Island Ltg., com.†—no par | k170 | 139 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 108 | 98 | 105 |
| Louisville Gas & Elec., cl. A. $1.75 | 29¾ | 28* | 29½* |
| **MAN. ELEC. SUPPLY, cap. $5—no par** | 51½ | 50* | 54½* |
| Manila Elec., com.†—no par | k 45 | 45½* | 50* |
| Maytag Mfg., com. 50—no par | 31 | 30½* | 34½* |
| Memphis P. & L., pf.—$7—no par | k109½ | 107 | 111 |
| Metropolitan Ed., pf.—$6—no par | 106½ | 93 | 106 |
| Metropolitan Ed., pf.—$7—no par | 109 | 104 | 110 |
| Metropolitan Ed., com. $5—no par | k140 | 60 | 72 |
| Middle West Utilities, 7% pf | a128 | 116½* | 124½* |
| Middle West Util., 7% pr. lien | a128 | 125½* | 129½* |
| Middle West Util., com. $6—no par | a130 | 123½* | 135* |
| Midland Utilities, pr. ln. 7% pf. | a106½ | 104* | 106½* |
| Midland Utilities, 7% pf. A | a104 | 103* | 104* |
| Milwaukee Elec. Ry. & Lt., 7% pf | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf | k 99 | 98 | 101½ |
| Miss. Pwr. & Lt., 7% pf | l109 | 107* | 109* |
| Miss. River Pwr., 6% pf. | 108 | 94 | 108 |
| Miss. River Pwr., 3% com. | m 62 | | |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k107 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | k104 | 106½* | 110* |
| Mohawk Hudson Pwr., com.—no par | 30 | 29* | 31½* |
| Montana Pwr., 5% com. | 148 | 102½* | 165½* |
| Montreal Pwr., 7½% com. | f 90½ | | |
| Mountain States Pwr., 7% pf. | k103 | 97 | 103 |
| Mountain States Pwr., com.† | 16½ | | |
| **NASSAU & SUFFOLK LTG., 7% pf.** | 109 | 98 | 110 |
| National Carbon, 8% pf. | a138½ | 138* | 139* |
| National Elec. Pwr., A† | a 30½ | 27½* | 32½* |
| National Lt., Ht. & Pwr., com. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 110 | 108½* | 111* |
| National Pwr. & Lt., com.†—no par. | 25½ | 21½* | 27½* |
| National Pub. Serv., 7% pf. | 102½ | 93 | 102 |
| National Pub. Serv., 7% ptc., pf. | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 25½ | 22* | 27½* |
| National Pub. Serv., B com.—no par | 27½ | 24½* | 30* |
| Nebraska Pwr., 7% pf. | l110 | 110* | 111½* |
| Nevada-Calif. Elec., com. | k 35 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | k 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k109 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | k108 | 95 | 100 |
| New Orleans Pub. Serv.—7% pf. | 108½ | 103 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | k103 | 101 | 104 |
| New York Power & Light 8% pf. | 114 | .... | ... |
| New York Power & Light, 7% pf. | 114½ | .... | ... |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | k109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | k109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | k 28½ | 28* | 28½* |
| No. Amer., 6% pf.—50 | 54½ | 53½* | 54½* |
| No. Amer., com., no par | 60½ | 58½* | 62½* |
| No. Amer. Edison, $6 pf.—no par | 103½ | 102½* | 105½* |
| No. Caro. Pub. Serv., pf.—$7—no par | 109 | 93 | 105 |
| Northeastern Pwr., com. | 20½ | 19½* | 23* |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 22½ | 18* | 24½* |
| No. Ont. Lt. & Pwr., 6% pf. | k 98 | 98* | 98½* |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | k108½ | 108½* | 109* |
| No. States Pwr. (Del.), 8% com. | 131½ | 123* | 136½* |
| No. Texas Elec., 6% pf | 58 | 45 | 70 |
| No. Texas Elec., com. | 18 | 5 | 36 |
| **OHIO BRASS, com. B $4—no par** | 97 | 89* | 98½* |
| Ohio Brass, 6% pf | k107 | 100 | 111 |
| Ohio Pwr., 6% pf | k106 | 96 | 106 |
| Ohio Pub. Serv., $6 pf | k102½ | 95 | 102 |
| Ohio Pub. Serv., 7% pf | 110½ | 103 | 111 |
| Ohio River Edison, 7% pf | 109½ | 103 | 109½ |
| Oklahoma Gas & Elec., 7% pf | 112 | | |
| **PACIFIC Gas & ELEC., 6% pf** | k 27 | 26½* | 27½* |
| Pacific Gas & Elec., 8% new com. | 45½ | 45½* | 49½* |
| Pacific Pwr. & Lt., 7% pf | l108½ | 106* | 108½* |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 79½ | 77½* | 79½* |
| Penn-Ohio Edison, 6% pf. no par | 93½ | 93½* | 96* |
| Penn-Ohio Edison, 7% pf. | 107 | 107* | 109* |
| Penn-Ohio Pwr. & Lt., 7% pf | 109½ | 99 | 110 |
| Penn Pwr. & Lt., $7—no par | l110½ | 109½* | 110½* |
| Penn Wtr. & Pwr., $2.50 com., new | e 70 | 68* | 72* |
| Phila. Co., 5% pf.—50 | k 45½ | 46½* | 48½* |
| Phila. Co., 6% pf.—50 | 52½ | 52* | 53* |
| Phila. Co., com.—50 | k150 | 149½* | 163* |
| Phila. Elec., 8% com.—25 | c 57½ | 55½* | 59* |
| Portland Elec. Pwr., 7% pf. | 103½ | 97½ | 102½ |
| Portland Elec. Pwr., 6% pf. | 94 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 85 | 55 | 70 |
| Portland Elec. Pwr., com. | 48 | 42½* | 50½* |
| Potomac Elec. Power, pf. | k111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | k 58 | 28 | 60 |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | l108 | 99* | 103* |
| Pub. Serv. of N. J., 6% pf. | k105½ | 103½* | 106½* |
| Pub. Serv. of N. J., 7% pf. | 119½ | 118* | 120½* |
| Pub. Serv. of N. J., $2 com.—no par | 42½ | 41½* | 45* |
| Pub. Serv. of No. Ill., 6% pf. | a110 | 110* | 110* |
| Pub. Serv. of No. Ill., 7% pf. | a119 | 119* | 121* |
| P. S. of No. Ill., com. $8—no par | a168½ | 159½* | 180* |
| Pub. Serv. of No. Ill., $8 com. | a169 | 159½* | 180* |
| Pub. Serv. of Okla., 7% pr. ln. | k105 | 90 | 103 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109½ | 109* | 110½* |
| Puget Sound Pwr. & Lt., 7% pf. | 110½ | 109* | 113* |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 98½ | 92* | 98½* |
| Puget Sound Pwr. & Lt., com. | 46½ | 34½* | 50* |
| **RADIO COPR. OF AMER., $3.50 pf.—50** | k 92½ | 87½* | 57½* |
| Radio Corp. of Amer., com.—no par. | 88½ | 85½* | 104½* |
| Rhode Island Public Service, pf. $2—no par | k 31½ | 30½* | 31½* |
| Rochester Gas & Elec. 6% pf. D. | k105½ | 101 | 103½ |
| Rochester Gas & Elec., 7% pf. B. | 107 | 105 | 107 |
| Rochester Gas & Elec., 7% pf. C. | 105 | 101½ | 103½ |
| **SAN JOAQUIN Lt. & Pwr., 7% pr. pf.** | k114 | 105 | 112½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | 6 | 4½* | 7½* |
| Sierra Pacific Elec., 2% com. | k 35 | 29* | 38½* |
| Sioux City Gas & Elec., 7% pf. | 107 | 99 | 105 |
| Southeastern Pwr. & Lt., pf.—$7 no par | l108½ | .... | |
| Southeastern Pwr. & Lt., ptc. pf. | l 66½ | .... | |
| Southeastern Pwr. & Lt., com.—no par | 43 | 41½* | 44½* |
| So. Calif. Edison, 8% pf. | 29 | 36½ | 29* |
| So. Calif. Edison, 7% pf. | k 28½ | 28½* | 28½* |
| So. Calif. Edison, 6% pf. | k 26½ | 25½* | 27½* |
| So. Calif. Edison, 8% com. | 45½ | 43½* | 47* |
| Southern Cities Utilities, 7% pf. | k 76 | 67 | 90 |
| Southwestern Lt. & Pwr., A $3. | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B. | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf | 92 | 83 | 91½ |
| Southwestern Pwr. & Lt., 7% pf | k110½ | 110* | 111½* |
| Standard Gas & Elec., 8% pf | 67½ | 65* | 67½* |
| Standard Gas & Elec., 7% pr. pf | 111 | 110½* | 111* |
| Standard G. & E., com. $3.50 | 60½ | 57½* | 65* |
| Standard Power & Light, com. | 36½ | 29½* | 37½* |
| Standard Pwr. & Lt., 7% pf | k104 | 103½* | 105* |
| Staten Island Edison, pf. $6—no par | 102½ | 99 | 103 |
| Superheater, $6 com.—no par | 170 | 164* | 178* |
| Syracuse Lighting, 7% pf | k110 | 103 | 111 |
| Syracuse Lighting, 8% pf | k117½ | 114 | 119 |
| **TAMPA ELEC., com. $2.** | k 62 | 62* | 64* |
| Tenn. Elec. Pwr., 6% pf | 103½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf | 110 | 103 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 10 | 20 | 30 |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | l113½ | 113½* | 115* |
| Tide Water Pwr., 8% pf. | 111½ | 105 | 111 |
| Timken Roller Bear., com.—$4 no par | 116 | 113½* | 134* |
| Toledo Edison, 7% pf. | l109 | 102* | 107* |
| Toledo Edison, 6% pf. | k103 | 95 | 105 |
| Toledo Edison, 6% com. | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | k100 | 96 | 99 |
| **UNITED GAS & ELEC., 6% pf.** | 98 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c113 | 111½* | 117½* |
| United Lt. & Pwr., pf.—$4—no par. | k 55 | 53* | 55½* |
| United Lt. & Pwr., pf.—$6.50—no par | a 99 | 95* | 100* |
| United L. & P., com. A .48—no par. | a 15½ | 14* | 17½* |
| United L. & P., com. B .48—no par. | m 18 | 19* | 20* |
| Utah Pwr. & Lt., 7% pf. | l 112 | 109½* | 111½* |
| Utica Gas & Elec., 7% pf. | 106 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 100 | 93 | 100 |
| Utilities Pwr. & Lt., com. A $2. | 29 | 28½* | 30½* |
| Utilities Pwr. & Lt., com. B $1—no par | 20½ | 18½* | 21* |
| **VERMONT HYDRO-ELEC., 7% pf** | k 98 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k111 | 105 | 110 |
| **WAGNER ELEC., 7% pf.** | b 99 | 96½* | 99½* |
| Wagner Elec., com.—no par | b 38½ | 37* | 40* |
| Washington Ry. & Elec., 5% com. | k480 | 180 | 475 |
| Washington Ry. & Elec., 7% pf. | 102½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | k228 | 136 | 182 |
| West Penn Elec., 7% pf | 113 | 109½* | 114½* |
| West Penn Elec., Cl. A $7. | k110½ | 106½* | 109½* |
| West Penn Pwr., 7% pf | 114½ | 114½* | 116½* |
| West Penn Pwr., 6% pf | 110 | 109½* | 113* |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf | k102 | 98 | 105 |
| Western States Gas & Elec., 7% pf | k102 | 96 | 106 |
| Western States Gas & Elec., com. | 38 | | |
| Westinghouse Elec. & Mfg., 8% com. 50 | 92½ | 88½* | 100½* |
| Weston Elec. Instrument, Cl. A $2—no par | k 33 | 30½* | 34* |
| Weston Elec. Instrument, com.—no par | k 12½ | 12½* | 14½* |
| Wheeling Elec., 6% pf | k104 | 95 | 104 |
| Worthington Pump, 7% pf. A | k 49 | 46½* | 55* |
| Worthington Pump, 6% B | k 45 | 41* | 49½* |
| Worthington Pump, com. | 28 | 28* | 34½* |
| **YALE & TOWNE com. $5—25.** | k 73½ | 72½* | 75* |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Feb. 18. *l*Bid price Tuesday, Feb. 21. *m*Latest quotations available. †Dividend rate variable. *1928

## Utility Offerings Total $32,000,000

New offerings by electric light and power companies during the week ended Feb. 23 amount to $31,637,500, three companies contributing to this total. The largest individual issue was offered by the National Public Service Corporation in the form of secured gold debentures, priced at 93½ and accrued interest to yield over 5.35 per cent, a piece of financing involving a sum of $20,000,000. These securities, dated Feb. 1, 1928, mature Feb. 1, 1978. Proceeds from their sale will be used for retiring the company's thirty-year 6½ per cent sinking fund collateral trust gold bonds now outstanding and for other corporate purposes. These secured gold debentures will be a direct obligation of the National Public Service Corporation.

The American Superpower Corporation, which has drawn up a plan for the revision of its capital structure, as announced elsewhere under "Financial and Statistical News," issued 90,000 shares of first preferred stock at $102.50 per share and accrued dividends, to yield 5.85 per cent. Proceeds will be used for the acquisition of additional interests in certain electric light and power companies and for other corporate purposes. This stock is cumulative as to dividends at the rate of $6 per share per annum.

With the purpose of refunding short-term loans outstanding the New England Public Service Company issued 25,000 shares of $6 dividend series preferred stock, the price being $96.50 per share and accrued dividends to yield over 6.20 per cent. Cumulative dividends are payable quarterly.

## California Edison Seeks Stock Authorization

Southern California Edison Company has made application to the Railroad Commission of the State of California for permission to issue some $6,000,000 of new common stock to be sold to shareholders at par $25 on the basis of one new share for each ten shares of common or original preferred stock held. The $6,000,000 stock issue is approximately 20 per cent of the estimated budget for construction and expansion for 1928. R. H. Ballard, vice-president, has announced that financing part of the budget each year through issue of rights to common stock holders will be a permanent feature. Hitherto it has been the practice of the company to give shareholders rights, but these were issued at no stated periods.

# Code to Recognize "Thin Wall Conduit"

## Mass of Detailed Agenda Prevented Final Action—Correlating Committee Appointed and Electrical Committee to Meet Again in Time to Offer 1928 Code in Fall

HARMONIOUS action toward the recognition of electrical metallic tubing, known to the trade as "thin wall conduit," in the code took place at the meeting of the electrical committee of the National Fire Protection Association last week. The report of the article 5 committee on thin wall conduit was presented by A. Penn Denton and a minority report was submitted by W. H. Blood. With the concurrence of Mr. Blood and Mr. Denton both reports were ignored and the committee discussed each principle separately. Out of the discussion the committee evolved eight points as given elsewhere on this page.

Owing to the heavy agenda covering a mass of detail the electrical committee was unable to discuss anything but the principles of the reports submitted. The usual attention was given to articles 1, 2, 3, 4, 6, 7, 8, 9 and 10. In order to have a 1928 code a motion was made by L. P. Dendel as follows:

> Because the field of National Electrical Code users, code administrators and other interests, including manufacturers, were promised by this electrical committee at our 1927 meeting that at the 1928 meeting of this committee a code would be produced taking into account the evident field needs, and, because of the absolute need that the code be correlated and be consistent and overlook no serious needs by mere failure to give them proper attention or by reason of no means provided prior to this meeting for correlation of article committee reports and, because our responsibility as code makers is seriously challenged if we cannot get out the necessary code revisions promptly to care for field needs and, because the National Electrical Code is expected by the field to give this needed guidance in the interest of economy and safety;
>
> It is therefore moved that a correlating committee be chosen at this time, subject to later additions to its personnel. That there be not less than seven members, one of whom shall be the chairman of the editorial committee. That any article committee chairman who desires may be a member. That there be a majority of inspector members, who shall be understood to be acting, not as individuals, but for and under advice of their constituent inspector associations and that all recognized industry associations be so represented. That the chairman of the correlating committee be selected by the main committee.
>
> The correlating committee is hereby instructed to co-operate with article committees to whom reports have been referred back for revisions so that such article committee work is completed within the next sixty days from today (Feb. 17, 1928), and so that the correlating committee may bring in a report by May 1, 1928. This correlating committee report to be distributed immediately to all members of this electrical committee, in order that this committee may meet and take formal action on a new 1928 code not later than July 1, 1928, thus making the complete new code available to the field by the early fall of 1928.

### Article 5 to Be Divided

The correlating committee was instructed to use generally the text of the 1925 code and to incorporate only what seemed to be necessary new ideas. A motion was passed instructing the editor of the code to divide article 5 into two, three or more chapters because its present size imposed too much of a burden on any one committee. The report of the committee on article 8 to have a new 0-15-amp. fuse cutout in which higher rating fuses could not be used was indorsed by the committee and the Underwriters Laboratories was instructed to work out a standard for such a fuse and report on it next year.

### Demand Factor for Feeders Adopted

The recommendation for a diversity factor, termed by the committee a demand factor, on mains and feeders was adopted in principle with some few changes in text covering principally its application to service conductors and modifications with respect to heating appliance loads. The method of estimating the demand factor will be provided in the code and depends on the diversity of load on the feed such that the maximum demand is less than the total connected load.

No action was taken on the grounding of portable appliances but A. R. Small was instructed to call a general meeting of all interested and to report the result to the committee. The electrical committee did not support the minority report of Mr. Blood regarding the use of the circuit wire for grounding in the case of non-metallic sheathed cable. The committee passed in principle rules regarding gas tube signs and X-ray apparatus which for the first time will appear in the code. The article 16 committee sponsored a table which will provide for special circuits in laundries, kitchens and bath rooms of residencies and provides for a 25-amp. circuit for plugging in 2,000-watt heaters. The correlating committee will develop specific rules to cover such special 25-amp. circuits and will present them at the proposed electrical committee meeting later in the year.

A resolution was presented by W. H. Blood at the end of the meeting calling for the appointment of a special committee to study the entire code making system and report upon six specific items and report to the electrical committee at the next annual meeting. The resolution presented by Mr. Blood is as follows:

> Whereas it is desirable that the National Electrical Code should continue to have the respect and confidence of the electrical industry, and at all times should be recognized as an American standard for universal acceptance, and,
>
> Whereas the present procedure in the revision of rules and especially in the consideration and adoption of new electrical devices and systems is slow, tortuous, productive of undesirable expense and tends toward commercial strife, and,
>
> Whereas for the benefit of the entire electrical industry and for the public at large these conditions should be corrected; therefore be it
>
> Resolved: That the chairman of the electrical committee appoint a special com-

### *Rules for Electrical Metallic Tubing*

Points set up by the electrical committee of the N.F.P.A. in regard to electrical metallic tubing known to the trade as "thin wall conduit."

1. To extend recognition to electrical metallic tubing of circular cross section.

2. To specify that when installed it will be readily identifiable as compared to standard conduit. The electrical committee has left it to the Underwriters Laboratories to specify the distinguishing features necessary for electrical metallic tubing.

3. That electrical metallic tubing shall have the same nominal inside diameter as standard conduit.

4. That only threadless fittings of approved design shall be used.

5. That trade sizes shall be ⅜ in. for under-plaster extensions only and ½ in., ¾ in., and 1 in.

6. Its use shall be limited to circuits using not larger than No 8 wire and carrying not over 35 amp. at voltages not exceeding 300 between conductors or 150 to ground.

7. To be installed as a complete system without wires continuous from fitting to fitting and the entire system firmly secured in place. It is not to be used in places where during installation and afterwards it may be subjected to severe mechanical injury. It shall not be imbedded in masonry, concrete or fill in buildings during their course of construction.

8. If of non-corrodible material it shall have a wall thickness and physical properties equivalent to the electrical metallic tubing being considered.

mittee to be known as the "committee on procedure" and that this committee consist of seven (7) members, the chairman of the electrical committee to be one and ex officio chairman of the committee on procedure and further that the committee consider and report upon the following matters:

1. The present membership of the electrical committee as to whether the proper organizations are represented best to secure an electrical code which may continue to be respected as national in principles and scope.
2. The size of the committee and members of representatives to which the various organizations should be entitled and whether other than representatives of national organizations should be included.
3. Methods for best considering changes in the code and additions to the code on their merits, regardless of other considerations.
4. The advisability of restricting voting privileges of those who are bound by commercial considerations.
5. Methods for improving present procedure which will simplify it and facilitate the adoption of new electrical devices and systems, retaining necessary safeguards, but making it possible for inventive genius promptly to be acknowledged and the public to be given the advantage of progress in the art without unnecessary delays.
6. The best and most practicable methods of co-ordinating the code, now and in the future, in order to make it a set of intelligent rules devoid of verbosity and textbook phraseology.
7. That a report of this committee be made at the next annual meeting of the electrical committee.

# 1927 Rate of Production Maintained

## January Activity in Electrical Manufacturing Plants on Level With January, 1927—Normal Trend Indicated for Next Few Months

THAT the electrical manufacturing plants of the nation are operating at approximately the same level as that reported at this time last year is indicated by reports received by ELECTRICAL WORLD on the monthly electrical energy consumption by a large portion of these plants. The rate of production of electrical equipment and supplies during January was about 0.6 per cent under December and 4.4 per cent under November, but was at exactly the same level as reported for January, 1927. A study of the operations in past years indicates that these monthly decreases in activity since October are normal, and that similar monthly decreases in the rate of activity may be expected in the industry until May or June, when the low point of monthly operations should be reached.

The index of activity in the electrical manufacturing industry, based upon consumption of electrical energy, stands at 124.7 for January, as compared with 125.4 for December and 124.8 for January, 1927. Comparative indexes of productive activity referred to the average activity for the period of 1923-25 as 100 and adjusted for number of working days are as follows:

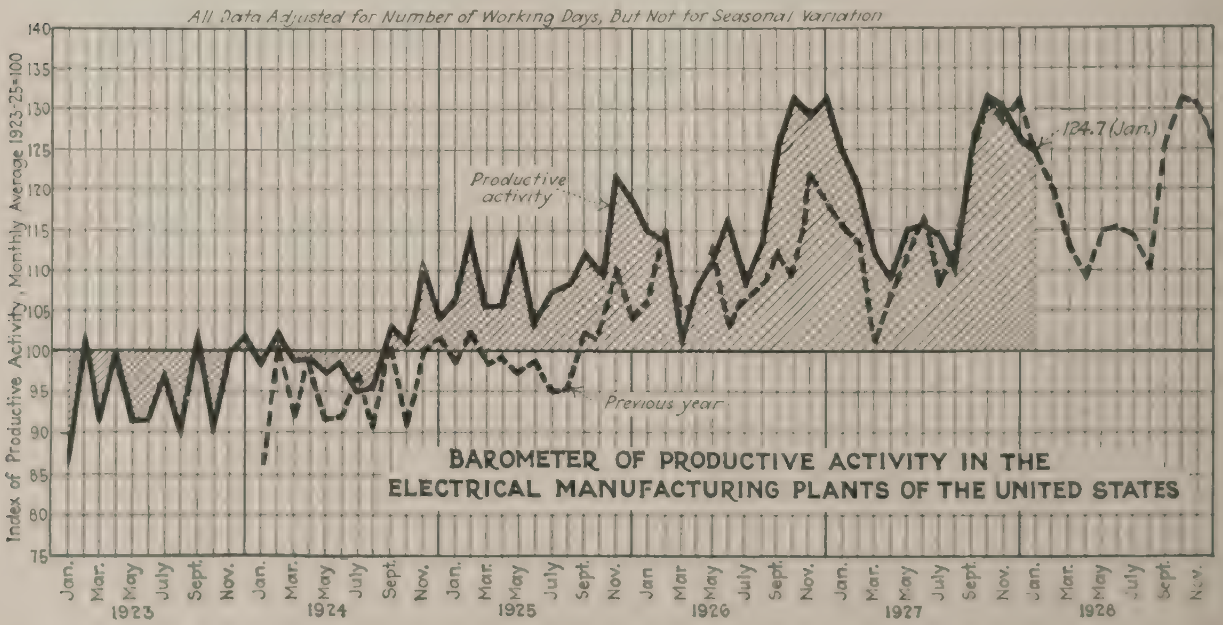
| | |
|---|---|
| January, 1928 | 124.7 |
| December, 1927 (revised) | 125.4 |
| November, 1927 | 130.4 |
| January, 1927 | 124.8 |
| January, 1926 | 115.0 |
| Average for full year, 1927 | 119.5 |
| Average for full year, 1926 | 116.6 |

Operations of American industry in general during January were about 9.2 per cent over those reported for December, an increase in the rate of operations being reported by all of the outstanding industrial groups except food, lumber and paper. An upward trend of considerable proportions is to be expected at this season of the year, but the fact that the impulse is felt by a very large proportion of the industrial groups instead of being confined to a few groups is a significant fact, offering an excellent basis for prognosticating a continuance of our present industrial prosperity, at least through the first half of 1928.

## Application of Industrial Trucks in Industry

A handbook entitled "Profitable Application of Electric Industrial Trucks and Tractors in Industry" has been published by the Society for Electrical Development as a co-operative measure of twenty manufacturers of electric industrial trucks and tractors, storage batteries and accessories who are engaged in a market development program. The book is of interest to plant managers, department heads, efficiency experts, or any who have to do directly or indirectly with material handling in and about the warehouse and industrial plant. The handbook contains 96 pages and 136 illustrations.

With a special chapter for each of sixteen major industries the book is based on a survey of 200 typical plan operations made by a member of the survey committee of the American Society of Mechanical Engineers. For each of the industries, the operating processes and the particular type of truck suited to individual jobs are described. An outline of operating costs, together with a tabulation of direct savings effected by employing this means of equipment, is given.



# Market Conditions

ENCOURAGING activity in the sale of central-station supplies is noted in the New England district. Railroad companies are planning increased purchases, small motor sales are a little below the normal trend, but are steady, and negotiations for heavy equipment have fallen off. In the Eastern district manufacturers are encouraged with current business and report that inquiries are maturing in better volume. A manufacturer of substation equipment states that his plant is running on a capacity schedule for current deliveries, and a company making water turbines reports that business is improving, with a decided increase in February as compared to January.

In the Southeast an order was placed by a central-station company in Alabama for $90,000 worth of power transformers. Purchases by industrial plants are slow but inquiries are good. Improvement in sales is noted in the St. Louis district. A power company in the southwestern part of the district purchased a fair amount of distribution equipment, and several good orders for line construction materials have been shipped. Utility companies are active in the Middle West and are preparing for large line extensions in the spring. On the Pacific Coast an order placed by the Michigan-California Lumber Company of Camino covered about $42,000 worth of equipment. Oil field activity was another feature of the week's business.

## *Central-Station Supplies Active in New England*

Encouraging activity is reported in the sales of central-station supplies with the demand for new service lines and expansions quite marked. Orders for pole-line supplies included a good volume of wire and hardware and poles. One order for four cars of line materials is noted; another group of orders called for five car loads of cross arms, hardware and wire. Railroad companies are planning for greater purchases than during the past year and to date sales show an encouraging increase. Weatherproof wire sales are active, switch and control equipment demand is steady, and a temporary slackening of outside work has slowed up contractors' needs.

Small motor sales are a little below the normal trend but are steady and reached over $35,000 last week. Negotiations for heavy equipment have fallen off, and transformer inquiries are quiet. An order for two 20-kw. baking ovens was reported. Industrial lighting projects are being considered in good volume with school-house plans numerous. The Malden Electric Company plans to erect a new service station at a cost of about $100,000. New building contracts placed last week show a marked increase over previous years. The Brockton Ice & Coal Company, Brockton, Mass., has filed plans for an ice plant to cost $100,000.

## *Utility Companies Active in Middle West*

A slight slowing up or reactive tendency was noticeable in the Middle West in some lines, while in others expansion is going on steadily. Considerable activity in the steel, automobile and railroad industries is evident and industrial plant buying generally is good. The various utility companies are busy preparing for large line extensions in the spring. Considerable purchasing of apparatus is under way and several interesting orders were placed, including auxiliary motor switchboard equipment complete with appurtenances, settings for one reheat and two standard B. & W. boilers, two oil circuit breaker units, steel inclosed outdoor type isolated phase 15-kv. switches, four heater drain pumps and appurtenances arranged for motor drive, structural steel and iron valued at $50,000 and Mazda lamps valued at $160,000. Maintenance purchasing is quite high with a good demand for poles and pole line hardware. Jobbers' sales are normal. The acceptance of the new gyrator type washing machine by the public has had a stimulating effect on washing machine sales, one jobber placing a single order for 1,000 machines.

Construction projects are as follows: Springfield, Ill., plans a substation to cost $60,000. The Interstate Power Company has authorized surveys for a hydro-electric plant near Decorah, Iowa. The Houghton County Electric Company plans power plant expansion at Houghton, Mich., and extensions in transmission lines to L'Anse and Baraga, Mich. Detroit Lakes, Minn., will receive bids March 5, for a 500-kva. generating unit (and alternate bids for a 625-kva. unit) with auxiliary equipment, including motor-driven ash hoist, for the municipal power plant. The Northwestern Utilities Corporation has purchased the Mapleton Electric Company, Mapleton, Minn. The Nebraska Power Company will rebuild its power line from Millard to Chalco, Neb., for operation at increased voltage. Cedar Falls, Iowa, plans a transmission line to points in Mount Vernon Township. The Iowa Public Service Company plans the purchase of the municipal lighting plant at Jolley, Iowa. Arlington, Neb., has secured permission to build a transmission line for commercial service. The Elkhorn Valley Power Company plans a transmission line from Clarkson to Creston, Neb.

## *Non-Ferrous Metal Markets Dull—Prices Stable*

Little activity prevails in the copper market and prices quoted by large producers are steady, although some interests are willing to sell for several points less. The lead market is dull. consumers evidently feeling that prices are uncertain and that plenty of lead is available. Orders are mainly for prompt shipment. The zinc market has declined slightly. Tin, after the largest price decline in several years, appears stable.

NEW YORK METAL MARKET PRICES

| | Feb. 15, 1928 Cents per Pound | Feb. 21, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14-14⅛ | 14 |
| Lead, Am. S. & R. price | 6.35 | 6¼ |
| Antimony............ | 11 | 10¾ |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots........... | 5.92½ | 5.80 |
| Tin, Straits........... | 51½ | 51.725 |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price Feb. 21, 1928, 15⅝ cents.

## *Large Transformer Order Placed in Alabama*

Purchases by industrial plants in the Southeast are slow, though inquiries are good, and activities in the central-station field are improving slightly. A central-station company in Alabama ordered power transformers totaling $90,000 and a South Carolina power company ordered similar equipment to the extent of $13,500. House-type meters are in brisk demand, the majority of individual orders averaging $1,500, though two orders received from Tennessee aggregated $8,000 and one from Georgia amounted to $2,500. In connection with the change of its direct-current system to alternating current, one company ordered $6,800 worth of elevator equipment in the past few days. Another interesting central-station order called for switching equipment amounting to $7,900. Two turbine inquiries are in hand, one for an industrial plant and the other for a small utility company.

One manufacturer reports the receipt of an order from Alabama for a mine locomotive costing approximately $9,000, and two industrial motor orders from the same state, one amounting to $6,000 and the other, $3,500. There is considerable activity in connection with prospective textile mills to be located in this territory and although definite announcements are not immediately forthcoming all or a large portion of this should materialize within a reasonable period.

Construction projects reported are as follows: The E-Z Opener Bag Company, Decatur, Ill., plans a paper mill at Tuscaloosa, Ala., to cost $3,000,000. The Columbus Electric & Power Company, Columbus, Ga., is having plans drawn by Stone & Webster, Inc., Boston, for a hydro-electric plant on the Chattahoochee River, to cost $7,000,000. The Columbus company also will build a substation near Cusseta Highway, to cost $50,000. The Carolina Gas & Electric Company has acquired the municipal lighting plant at Kinston, N. C. The Carolina Power & Light Company plans a substation at Sanford, N. C., to cost $70,000. The Savannah River Electric Company plans a hydro-electric development on the Savannah River, near Greenwood, S. C., to cost $20,000,000. The South Carolina Power Company plans the purchase of the municipal electric plant at Walterboro, S. C. The Peter Fox Sons Company, Chicago, plans an ice and cold storage plant at Nashville, Tenn., to cost $350,000. The East Coast Utilities Corporation, Richmond, Va., plans a power plant at Port Richmond, to cost $40,000. Milledgeville, Ga., has contracted with the Georgia Power Company for an ornamental lighting system, and Louisville, Ky., also is planning an ornamental lighting system in its parks.

## *Utility Orders Encourage Eastern District*

Manufacturers in the Eastern district are encouraged with current business and the improved immediate outlook for additional commitments. Inquiries are maturing in better volume. A central-station company in the New York territory has placed a fair-sized order for special switching equipment for substation service, and further business is anticipated from that quarter. Another power company has contracted for switching apparatus of the 6,600-volt type, both for indoor and outdoor service. A large manufacturer of substation equipment of this character reports a growing volume of business from a number of sources, with its plant running on a capacity schedule for current deliveries. High-voltage insulation apparatus is beginning to move at a better pace and several important orders have been placed in the New York market. A manufacturer of water turbines states that business is improving, with a decided increase this month as compared with January. A public utility in Vermont has contracted for a sizable unit, while a paper mill at Lee, Mass., also placed an order for a prime mover.

Industrial business holds rather uniform. Motor sales continue fair, with popular industrial sizes in demand from several branches of trade, including ice cream factories, metal-working shops, paper mills, leather plants and textile mills. Fractional-horsepower motor sales are active, and a leading manufacturer has secured an order for 160 1/20-hp. motors for a company in Brooklyn, to be used for electric office appliances. Electric fan business is showing fair promise for early spring.

Immediate construction activities include the following: Steel & Tubes, Inc., Brooklyn, plans a steel strip mill at its Elyria, Ohio, plant, to cost $1,000,000; Perth Amboy, N. J., plans an ornamental lighting system on Maple Street. The Public Service Electric & Gas Company will build a substation at Ridgewood, N. J. The John A. Roebling's Sons Company, Trenton, N. J., will build an addition to its wire and cable plant to cost $500,000. The Philadelphia Suburban-Counties Gas & Electric Company plans an addition to its plant on Barbadoes Island, Schuylkill River, near Norristown, Pa., and extensions in transmission lines. The Viscose Company plans an addition to its rayon mill at Lewistown, Pa., to cost $400,000. The Pennsylvania-Ohio Power & Light Company has secured permission from the United States Engineer, Pittsburgh, for a transmission line across the Ohio River, near Girard, Ohio. The White Company, Baltimore, Md., will build an addition to its paint factory to cost $100,000. C. Hoffberger & Company, Baltimore, will take bids at once, to be received about March 10, for an eleven-story cold storage and ice plant to cost $900,000. The Chief of Engineers, United States Army, Washington, D. C., will soon take bids for a 1,200-kw. Diesel engine-generating set, with auxiliaries and one station switchboard. The United States Engineer, Pittsburgh, Pa., will receive bids until March 9 for two hydraulic turbines (Circular 274).

## *Improvement in Sales Noted in St. Louis District*

A slight improvement in business is noted in the St. Louis district. Not many large contracts have been closed but several are being figured. One order was placed for a 150-kw. generator and a switchboard for $4,300. A lot of feeder voltage regulators, transformers and oil circuit breakers were bought by a power company in the southwestern part of the district at a total cost of $55,000. Several good orders for line construction materials have been shipped out and two contracts closed for conduit, wire and fittings for large office buildings.

Construction projects in the district are as follows: Sterling, Kan., will extend its municipal power plant. The Shreveport Producing & Refining Corporation, Shreveport, La., will enlarge its oil refinery at a cost of $250,000. The Liberty Textile Mills, Liberty, Mo., plans a new cotton mill to cost $100,000. The Board of Public Service, St. Louis, will receive bids March 13 for a complete street-lighting system in district A. The Southern Ice & Utilities Company plans an ice plant at Odessa, Tex., to cost $75,000. The West Texas Utilities Company plans a power and ice plant at Sonora, Tex., to cost $75,000. The Texas Gulf Power Company plans an 8,000-hp. power plant at Texas City, Tex., to cost $200,000. The Southwestern Gas & Electric Company plans a transmission line to Hatfield and Cove, Ark., and vicinity. The Arkansas Power & Light Company plans rebuilding its 66,000-volt transmission line from Pine Bluff to Camden, Ark., to operate at 110,000 volts, at a cost of $185,000. Independence, Kan.; Poplar Bluff, Mo.; El Reno, Bristow and Muskogee, Okla., and Ozona, and Sweetwater, Tex., plan the installation of lighting systems.

## *Lumber Company Order Placed on Pacific Coast*

The outstanding order on the Pacific Coast covered a power installation for the Michigan-California Lumber Company of Camino, consisting of assorted General Electric motors from 2½ to 225 hp., totaling $20,000 with accessories, a 750-kva. Allis-Chalmers turbine, valued at $18,000, and Westinghouse switchboard and control valued at $4,000. Oil field activity was another feature of the week's business. One manufacturer reports five different orders, totaling $20,000, from three companies and comprising six double-rated well motors, one arc-welding equipment and a large automatic panel. The city of Los Angeles purchased $63,092 worth of weather-proof wire and the Southern Pacific Railroad three carloads of iron wire. The latter company is in the market for approximately $20,000 worth of lead cable for its new Fresno classification yard and also plans to build a new tourist hotel near Phoenix, Ariz.

Other new construction projects reported include a $1,000,000 convent and school for Belmont, Calif., and a $2,500,000 apartment house and hotel for Pasadena. New street lighting prospects include Berkeley and Willows. Machinery orders include an order for 200 1/20-hp. motors for calculating machines, valued at $2,500; two circuit breakers at $4,000 for the Alameda substation; one special quadruple motor equipment for $6,000 for an Oakland traction company, and a miscellaneous assortment for the Truckee Carson irrigation project comprising 220 distribution transformers, 250 watt-hour meters, 1,000 line insulators, 1,200 strain insulators and six lightning arrester units having a total value of $35,000.

Construction projects are as follows: The Southern California Edison Company plans a substation at Yorba Linda, to cost $150,000. The United Verde Copper Company, Clarksdale, Ariz., will build an electric steel foundry to cost $100,000. The Snow Mountain Water & Power Corporation, San Francisco, has applied for permission to build a 21,680-hp. hydro-electric plant on the South Eel River, Lake County, to cost $3,200,000. The Coast Counties Gas & Electric Company, Santa Cruz, Calif., plans a substation at Watsonville to cost $35,000. The Red River Lumber Company, Westwood, Calif., plans a hydro-electric plant on Ash Creek, a tributary of Pitt River, Modoc County, to cost $250,000. The St. Helens Pulp & Paper Company, St. Helens, Ore., plans an addition to cost $100,000. The Columbia Valley Lumber Company, Bellingham, Wash., plans a new mill to cost $100,000. The Northwest Power & Light Company has applied for permission to build a hydro-electric plant in Rica Canyon, near Port Angeles, Wash., to cost $2,000,000. Nogales, Ariz., and Compton, Los Angeles, and Pittsburg, Calif., plan street lighting systems.

# Activities of the Trade

## Allis-Chalmers Announces Changes in Pittsburgh Works

Effective March 1, 1928, the Pittsburgh Transformer Company, purchased by the Allis-Chalmers Manufacturing Company last year, is to be taken over and operated as the Pittsburgh Transformer works of the Allis-Chalmers company. The manufacture of the Pittsburgh types of distribution and power transformers will be continued at the Pittsburgh works in sizes up to and including 5,000 kva. single phase, and 15,000 kva. three phase at 44,000 volts; up to and including 4,000 kva. single phase, and 12,000 kva. three phase at 66,000 volts, and also all transformers for electric furnace work. The larger sizes of transformers and those for higher voltages and all transformers regardless of size or voltage, equipped with built-in tap changers to operate under load, will be of the Allis-Chalmers type and will be built at the West Allis works.

The Allis-Chalmers company in its announcement says that it appreciates the business given the Pittsburgh Transformer Company during the past years and earnestly solicits continued patronage. The district offices of the Pittsburgh Transformer Company have been consolidated with and will be operated as a part of the Allis-Chalmers district office organization with offices in all principal cities. With a larger organization, increased facilities and advanced manufacturing methods, as well as its extended service organization, the Allis-Chalmers company states that it is in excellent position to serve the industry in its transformer requirements.

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The Hynes & Cox Electric Corporation, 406 North Pearl Street, Albany, manufacturer of "Red Crown" electric water heaters, has published a manual on electric water heating for salesmen. The manual has been compiled to enable salesmen to answer quickly and intelligently many of the questions which will be asked by prospects.

The Servel Sales, Inc., 51 East 42d Street, New York City, announces the appointment of John M. Bickel as manager of advertising and sales promotion. Mr. Bickel comes from the Magazine Repeating Razor Company, where he has been assistant general sales manager.

The Pacific Electric Manufacturing Company, 5815 Third Street, San Francisco, has opened offices in Seattle, Wash., at 516 Liggett Building, with Charles H. Cutter in charge.

The Belden Manufacturing Company, 2300 S. Western Avenue, Chicago, manufacturer of insulated wires and cables, has added to its cord department a new soft rubber plug for household appliances, office and store equipment, portable shop tools and other devices.

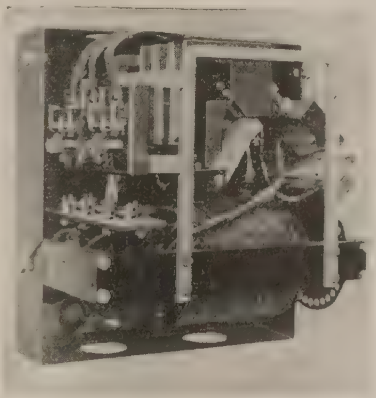
The Clifton Manufacturing Company, Boston, manufacturer of rubberized fabrics, announces that E. W. Kendall has been appointed manager of its electrical tape department in charge of all domestic and export tape sales effective March 1. For the last five years Mr. Kendall has been in the sales department of the Westinghouse Electric & Manufacturing Company. The Clifton company states that it will continue its constructive distribution policies through electrical jobbers.

The Lincoln Electric Company, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces the appointment of O. D. Fries as salesman in charge of consumer motor business in Detroit under the direction of J. M. Robinson, district manager.

# New Equipment Available

## Automatic Induction Starter

An automatic induction starter with two adjustable features has been announced by the Lincoln Electric Company, Cleveland. One of the adjustments is in the starting current and starting torque and is made by changing the position of the rotor in the regulator. This rotor is index mounted and the starting torque and starting current of the motor are increased by going to the higher numbers of the scale and decreased by going to the lower. The other adjustment is in the current at which the throw-over takes place. The throw-over is controlled by a retarding solenoid which is operated by the motor current. The pull of this solenoid can be adjusted by a simple lock rod arrangement carried on its plunger.



ADJUSTABLE STARTING CURRENT AND STARTING TORQUE ARE PROVIDED BY THIS AUTOMATIC INDUCTION STARTER

The manufacturer states that the starter can be mounted very easily. In mounting, the back cover is first secured to the wall. It is light and can be easily held and attached by one man. The back cover contains the conduit outlets. After the leads are drawn the switch may be set into the back cover and locked in position by a screw provided for that purpose. The conventional start and stop buttons are used in connection with the starter. If the front cover of the starter is removed the switch may be swung forward by the removal of the holding screw at the back. This brings the switch mechanism out where it is in a better position for observation. The barriers may also be moved upward out of the way. By the release of a screw on the control switch panel the contact carrying arm will drop back exposing all contacts for renewals or observation. The barriers completely inclose the contacts and six separate arc chimneys are provided to confine the arcs. The manufacturer states that with this barrier the switch can interrupt currents of ten times the rating without injury. The contacts in the switch are designed to give a wiping action. Overload protection is afforded by thermorelays and no-voltage protection by no-voltage release control.

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Metering Panelboards.—A metering panelboard of the loose-wire type, which the manufacturer claims will handle any metering problems that confront the builder, has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. Loose-wire connectionus replace the usual copper bus bars, directly lowering the price and speeding up installation. Four main types are being made. This panel is said to be particularly adapted to service in apartments and office buildings where frequent change of tenants makes meter changing an important item.

Automatic Dynamometer Control Panels.—A fully automatic control equipment for use with dynamometers in testing internal combustion engines has been placed on the market by the General Electric Company. The new control equipment consists of two panels, one a control panel and one a master panel. This arrangement permits mounting the master panel on the dynamometer base, providing complete control of the dynamometer at the point where the actual testing is being done. The automatic control panel, with its motor-operated rheostats and absorption resistor, is mounted at any suitable, remote place.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Jan. 3, 1928)

*1,654,949. Current-Regulating Arrangement for Rectifiers; P. M. Toulon, Paris, France. App. filed Dec. 21, 1923. To permit of regulating and continuously varying the rectified current.

(Issued Jan. 10, 1928)

*1,655,458. Gas-Burner Igniter; A. Dolfi, Yorkville, Ohio. App. filed May 4, 1927.

*1,655,689. Call Selector; L. L. Chauveau, Paris, France. App. filed Aug. 17, 1922. So arranged that the calling device is actuated only when the selector receives the predetermined group of signals for which it is adjusted.

(Issued Feb. 7, 1928)

1,658,254. Electrothermally Responsive Device; G. R. Radley, Milwaukee, Wis. App. filed Aug. 16, 1920. Susceptible to influence in accordance with both current and voltage variations.

1,658,259. Electric Rivet Heater; J. E. Sederholm, St. Paul, Minn. App. filed Dec. 8, 1924.

1,658,266. Suspending Device for Trolley Wires; F. A. Tice, Cincinnati, Ohio. App. filed Nov. 3, 1925.

1,658,315. Battery; E. B. Wheeler, New York, N. Y. App. filed June 22, 1927. Dry cell battery employing flat electrodes.

1,658,329. Protective System for Electric Circuits; P. W. Forsberg, Schenectady, N. Y. App. filed Nov. 3, 1925. For preventing the flow of currents of abnormal value in either direction in a circuit adapted to carry current in either direction.

1,658,334. Resistance Material; T. A. Holmgren, Stockholm, Sweden. App. filed Jan. 14, 1925. Electrically conductive in a cold state and usable at a high temperature. Consisting essentially of an intimate mixture of finely crushed silicon carbide and a refractory cementing medium, burnt until the cement has more or less sintered.

1,658,380. Electrical System; L. S. Keilholtz, Dayton, Ohio. App. filed July 11, 1919. Farm-lighting unit.

1,658,446. Bulb Adapter for Signal Lamps; L. C. Kuehner, St. Louis, Mo. App. filed June 28, 1926.

1,658,449. Fluid-Level Indicator for High-Pressure Vessels or Containers; S. Loffler, Berlin-Charlottenburg, Germany. App. filed July 10, 1925.

1,658,474. Cigar Lighter; M. T. Blier, Brooklyn, N. Y. App. filed June 8, 1927.

1,658,488. High-Frequency Alternator; M. Latour, Paris, France. (Granted under the provisions of the Act of March 3, 1921.) App. filed Sept. 1, 1921.

1,658,501. Electric Condenser; P. B. Vallé, New Haven, Conn. App. filed Nov. 14, 1925.

1,658,511. Switch; C. Bruynis, The Hague, Netherlands. App. filed Nov. 12, 1925. For switching 220-volt circuits and using a lower voltage for the operation of the switch.

1,658,522. Electrical Plug Connector; A. J. Frogue and J. I. Sloan, Kansas City, Mo. App. filed June 8, 1925. As used in automobile headlights.

1,658,568. Method and Apparatus for Maintaining Gaseous Conduction Discharges; D. McF. Moore, East Orange, N. J. App. filed July 22, 1922.

1,658,577. Regulator; C. H. Smoot, Maplewood, N. J. App. filed March 7, 1927. So constructed as to avoid hunting without loss of sensitiveness or power.

1,658,583. Electric Socket; B. D. Wells, Danbury, Conn. App. filed Sept. 10, 1923.

1,658,598, 1,658,599. Socket Construction; J. Hohl, Newark, N. J. Apps. filed April 22, 1921 and Nov. 21, 1922.

1,658,610. Safety Electric Fuse Igniter; N. M. Olevich, St. Clair, Pa. App. filed June 18, 1927.

1,658,615. Electric Oven Heater; H. O. Swoboda, Edgewood, Pa. App. filed Feb. 10, 1926.

1,658,618, 1,658,619, 1,658,620, 1,658,621. Liquid Flow Switch; W. W. Walker, East Orange, N. J. Apps. filed Aug. 26 and Oct. 1, 1924, May 26, 1925 and March 25, 1927. Mercury type.

1,658,635. Attachment Plug; F. P. Gates, West Hartford, Conn. App. filed Dec. 8, [illegible]

1,658,644. Control of Dynamo-Electric Machines; H. W. Liddiard, Rugby, England. App. filed Sept. 28, 1926. Connected in parallel and adapted to run at related speeds, as by being mechanically coupled together.

1,658,647. Alternating-Current Rectifier; L. B. Miller, Lynn, Mass. App. filed April 14, 1927.

1,658,651. Electric Furnace; R. B. Prindle, Schenectady, N. Y. App. filed Dec. 29, 1926. Means for sealing a furnace receptacle around an electrical conductor passing through the wall thereof.

1,658,660. Signaling System; O. C. Traver, Schenectady, N. Y. App. filed March 30, 1927. Wherein two members are related in synchronism in remotely situated transmitting and receiving stations.

1,658,662. Alternating-Current Commutator-Motor Regulating Apparatus; W. Welsch, Niederschonhausen, Germany. App. filed Sept. 25, 1926.

1,658,664. Variable-Ratio Transformer; F. F. Brand, Pittsfield, Mass. App. filed July 6, 1927.

1,658,677. Brush for Dynamo-Electric Machines; M. R. Hanna, Erie, Pa. App. filed July 18, 1927. Having a soft tip and a hard portion at approximately the top half.

1,658,692. Electric Heater; J. L. Schroyer, Oak Park, Ill. App. filed Dec. 9, 1924.

1,658,695. Circuit-Controlling Device; O. C. Traver, Schenectady, N. Y. App. filed Jan. 12, 1924. For controlling a circuit a plurality of times in succession at predetermined intervals.

1,658,699. Pressure-Difference Measuring Instrument; M. Weiss, Berlin-Friedenau, Germany. App. filed March 6, 1925.

1,658,703. Electric-Current Collector; G. W. Bower, Schenectady, N. Y. App. filed Nov. 27, 1925.

1,658,704. Protection of Electric Systems; M. D. Camhy, Berlin, Germany. App. filed March 11, 1926.

1,658,707. Signaling Device for Motion-Picture Machines; A. Costa, Donora, Pa. App. filed Oct. 31, 1923.

1,658,746. Lightning Arrester; C. P. Steinmetz, Schenectady, N. Y. App. filed Sept. 27, 1921. Formed of a plurality of discharge gaps arranged in series, each of the gaps being inclosed by a wall which separates the discharge electrodes of the gap.

1,658,752. Cable Terminal for Storage Batteries; W. F. Wilford, Fort Benton, Mont. App. filed Dec. 8, 1926.

1,658,787. Compression Rheostat; A. M. Levy, New York, N. Y. App. filed June 4, 1919.

1,658,788. Electrical Resistance Apparatus; A. M. Levy, New York, N. Y. App. filed Sept. 21, 1920. Of the compression type.

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*Omitted from previous listings of patents as they were received from the Patent Office too late to be included in numerical order.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Pilsen, Czechoslovakia (No. 29,634), for advertising signs, household electric appliances, electric flash buttons and lighting appliances.

Purchase is desired in Warsaw, Poland (No. 29,660), of storage batteries.

A sole agency is desired in Florence, Italy (No. 29,633), for apparatus for electrical treatments and electric toilet equipment.

A sole agency is desired in Oslo, Norway (No. 29,662), for storage batteries.

Purchase or agency is desired in Dresden, Germany (No. 29,678), for ice cream cabinets, drink mixers, and restaurant-type toasters.

An agency is desired in Toronto, Canada (No. 29,631), for electrical power equipment.

An agency is desired in Barcelona, Spain (No. 29,668), for storage batteries.

An agency is desired in Strasbourg, France (No. 29,650), for radio sets and parts.

An agency is desired in Tientsin, China (No. 29,711), for electric refrigerating units.

An agency is desired in Rome, Italy (No. 29,632), for X-ray, related ultra-violet apparatus, and appliances for electric treatment.

Purchase is desired in Comayaguela, Honduras (No. 29,709), of Diesel or semi-Diesel crude oil motor and centrifugal pumps.

# New Trade Literature

DRUM CONTROLLERS.—Bulletin GEA-887 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its CR3110 drum controllers for series and compound wound motors used on crane hoists and for similar applications.

COLD MOLDED PRODUCTS—"Come Adventuring" is the title of booklet R-1 issued by the Cutler-Hammer Manufacturing Company, Milwaukee, in which it gives complete information on the C-H cold molded "Thermoplax," what it is, and the uses to which it can be put. It also contains photographic examples showing where small metal inserts, trademarks, depressions and projections have been incorporated in parts of various shapes and sizes at the time of molding.

AIRPORT LIGHTING EQUIPMENT.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletin No. 2108, describing and illustrating its various types of airport lighting equipment including revolving beacons, landing field illuminating units, boundary, obstacle and marker lights, hangar roof lighting and interior illumination units, etc.

BRACKETS and RECEPTACLES.—A pamphlet No. A1127 issued by the Bryant Electric Company, 1421 State Street, Bridgeport, Conn., covers the Bryant "Alabax" line of porcelain brackets and receptacles for all kinds of installations.

LIGHTING EQUIPMENT.—The Edwin F. Guth Company, St. Louis, is distributing its architectural catalog No. 19 describing and illustrating its different types of artistic lighting fixtures. A number of illustrations show the actual application of some of the units described. Several photographs show how Guth fixtures are made.

INDUCTION MOTORS.—Bulletin No. 1143 issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes and illustrates its normal torque, type ARX, line-start induction motors with sleeve or roller bearings.

CLUTCH.—The L. G. S. spring clutch is described and illustrated in a bulletin issued by the L. G. S. Manufacturing Company, Indianapolis, Ind. The bulletin shows varied installations and suggests many practical applications. The three different types of clutch made, the ratchet type, the manual type and the centrifugal type are each illustrated and described.

THREADLESS FITTINGS.—The Erie Malleable Iron Company, Erie, Pa., is distributing its catalog of "Kondu" threadless fittings for 1928. Many additions to the line are offered in this new catalog. A number of illustrations show the application of "Kondu" fittings to various jobs.

STOKERS.—The Detroit Stoker Company, General Motors Building, Detroit, has issued a bulletin which describes and illustrates the Detroit underfeed stoker. The bulletin covers in detail such points as the design and construction, ash discharge, how low maintenance cost is insured, etc. A number of installations are illustrated and described and a series of drawings show the proper application of the stoker to all styles of settings. The company also is distributing a bulletin covering the Detroit self-contained uni-stoker.

LIGHTING DATA.—The Edison Lamp Works of General Electric Company, Harrison, N. J., is distributing bulletins LD 107B and LD 137B entitled "The Mazda Lamp in Projection Service," and "Lighting the Home." A number of illustrations showing installations are included.

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## *Forestalling Criticism*

THOSE holding companies whose skirts are clean with regard to the factors which the Federal Trade Commission has been authorized to investigate owe it to themselves and to the industry to make the facts known. If there are others whose record is less creditable, it is to be hoped that the investigation may disclose all of the facts—that such cases may be isolated by the commission, lest the industry as a whole be charged with the shortcomings of the few. In the case of the former, voluntary submission of the data on the subjects of inquiry, through financial statements, the press or other media, will aid the commission in its work and will forestall inconvenience to the companies. It is easier to avoid criticism than to eliminate its consequences.

To illustrate what is meant, one of the holding companies, the Engineers' Public Service Company, intentionally or otherwise, points out in its report that "earnings are derived solely from interest and dividends on securities owned and from incidental interest on the surplus funds." Evidently there are no exorbitant engineering and management fees. Disposing of the possible charge of "pyramiding," the report presents a tabular statement showing that the parent company owns nearly 100 per cent of the common stock of all of its subsidiaries. Furthermore, the purpose behind the formation of this holding company, and the value to the security holders of the system as a whole, are carefully discussed. Similar instances could be presented from the financial statements of other companies.

These are only a few of the points that will be investigated. There are others that could be cleared up in advance by a frank statement.

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## *Economic Triumph of the Steam-Electric Station*

ALTHOUGH the electric light and power industry realizes in a general way the increasing efficiency that attends its operations, few know intimately the exact measure of that efficiency. The Department of the Interior, however, through the Geological Survey, has for years gathered statistics on the production of electricity and the consumption of fuel by public utility plants, and it is from this government source, in a report dealing with the production of electricity in public utility stations, that the following commendation emanates:

"The improvement in the average utilization of fuels that has been brought about by improvements in plant designs and operation during the last few years continued in 1927. The operators of public utility power plants performed the remarkable feat of generating about two and one-half billion more kilowatt-hours of electricity by the use of fuel in 1927 than in 1926 by the consumption of about 150,000 tons of fuel less than was used in 1926."

Now, this is not an exceptional case. The industry has shown continuous improvement in the use of coal for years. In 1921 it consumed 31,585,000 short tons of coal and produced 26,000,000,000 kilowatt-hours. Last year it produced 50,000,000,000 kilowatt-hours of electrical energy from 41,713,000 short tons of coal. Some of the energy was produced from oil and gas, but the ratio holds. It is significant that in 1919, when 24,000,000,000 kilowatt-hours was generated from fuel, 35,000,000 short tons of coal, 11,000,000 barrels of oil and 21,000,000,000 cubic feet of gas were consumed, whereas in 1927, with more than double the output of electrical energy, 41,000,000 tons of coal, 6,000,000 barrels of oil and 63,000,000,000 cubic feet of gas were employed. That is 6,000,000 tons of coal more, 5,000,000 barrels of oil less and 42,000,000,000 additional cubic feet of gas.

This is a fine tribute to the engineering excellence of public utility enterprises. It indicates why rates are being reduced and reveals also why steam-station production is increasing at a faster rate than hydro production and why interest in water-power development is not so great as it was. Of course, increased efficiency is not always attainable without additional cost, but that is another story. The tale as it stands suffices to show what a conserver of natural resources the electrical industry is, and when translated into social service the accomplishment is almost unbelievable. Yet the facts cannot be denied.

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## *Electrical Engineers and the Span of Life*

BEFORE 1928 was six weeks old the American electrical fraternity was called upon to mourn the passing of two of its distinguished engineers—Elmer E. F. Creighton of the General Electric Company and William C. L. Eglin of the Philadelphia Electric Company. Mr. Creighton was 55. Mr. Eglin was 57. Their failure to attain the 70 years that by scriptural prescription every mortal thinks of as the lowest limit of his sojourn on earth suggests a comparison of their ages with those of other widely known American electrical engineers who have died so recently that their memories are still green.

A reference to the longer obituary articles in the ELECTRICAL WORLD's files for 1923-1927 shows ten written to commemorate either engineers or company executives with a broad engineering background. Of these the only man coming within hailing point of 70 was John A. Britton, who died at 68. Carl Hering was 66, Henry M. Byllesby 65 and Schuyler S. Wheeler 63. Benjamin G. Lamme reached three score. Of the others Charles P. Steinmetz and Louis Bell were 58, Ernest F. Nichols 55, John L. Harper 51 and Milan R. Bump 44. The twelve men occupied divergent fields. Britton, Byllesby and Wheeler were respectively heads of an operating, a holding and a manufacturing company; Hering and Bell were consulting engineers;

Lamme, Steinmetz and Creighton were in the employ of great manufacturing companies; Nichols was a physicist, for most of his life a technician and educator rather than a practitioner; Eglin and Harper were chief engineers of power companies, and Bump was a holding-company engineer-executive. But they were alike in that they all died too soon—their careers cut short in the full tide of achievement and probably before thought of retirement had entered the mind of any one of them.

Is there not something a little disquieting in their comparatively short lives, averaging 58 years? A more inclusive list of eminent members of the fraternity recently departed, taking in men like Joseph B. McCall, 56, and Guy E. Tripp, 62, would probably raise the average very little, if at all—though it is true that Charles R. Huntley reached 73 and Charles A. Coffin 81. Does this lack of longevity point the old moral of overwork and neglect of health and, therefore, fall in the category of preventable—though, alas! too seldom prevented—disasters? Or is electrical engineering one of those callings where to win great success all save a few must reconcile themselves to shortened life? Fortunately for the dissipation of gloomy thoughts, there are still living among us men high up in this profession who have passed three score and ten and a few of whom tread hard on the heels of the youthful veteran of Menlo Park, now headed for 90.

* * * *

## *Executive Indifference a Barrier to Selling*

IN SO FAR as the power industry is concerned, the biggest immediate problem in market development is not what can be done with the public, but what can be done with the executive. How can he be interested in commercial policy? How can he be brought into intimate touch with sales problems and sales plans?

No matter what we think, the public is not vitally interested in things electrical at this moment. The ordinary family feels that it must have electric light. It is standard for the modern home. The other uses of electricity are looked upon as appealing but not essential. Otherwise ten million wired homes would not be today without vacuum cleaners, for example, while seven million have them—to approximate the figure. Otherwise more than 3 per cent of wired homes would use electric ranges. But all that can be corrected by selling. For the same commercial enterprise that has popularized the phonograph, the radio, the camera and the automobile will popularize electrical appliances in the same homes. The kind of selling that has put over the good roads idea will put over good street lighting. The kind of marketing that has established the cash register and the time clock in universal use will build a universal market for electrical equipment in the store and in the factory.

When it comes to selling to the executives of the power industry themselves the idea that market building must be organized today on this broad scale and bulwarked with real leadership and financing, the task is harder. For these executives almost to a man are thinking as engineers, as operators, as financiers. They are not interested in commercial policy. They feel no enthusiasm for selling. They see the romance in a turbine, but not in a merchandising campaign, a load-building program. And that, to a very large extent, is what's the matter with the commercial end of the power industry. If the building of the market were receiving the high executive support—the planning, the direction and the leadership—that goes into the building of the transmission system and the development of the financial structure, the electrical industry would have as proud a record for its selling as for its technical achievements. And, after all, it is through selling that the true public service comes, for it is selling that introduces the uses of electricity into the lives and the work of the people.

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## *Price Courage as a Responsibility*

PRICE cutting is under very active discussion at the moment. There are two viewpoints. The purchasing agent is charged with taking unfair advantage of the manufacturer in this buyers' market and doing injury to the industry by beating down price levels and demoralizing values. The manufacturer is criticised for voluntary and precipitate price cutting impelled by eagerness for orders. Not all purchasing agents are indicated, of course, and not all manufacturers. But there is evidence enough to make the picture a distressing one, despite a vigorous defense by the buyer, that this is just the good old battle between the forces of supply and demand.

It is interesting to note, however, that there is one feature of the argument in which both sides are in accord. Manufacturers as well as purchasers agree that the power of "yes or no" lies in the hands of the seller. His ability to use it depends upon his courage. And there is no substitute for courage. But price courage is largely a matter of organization. For the most courageous salesman is apt to be the one who has the most courageous boss. And the company with the strongest price policy is usually headed by an executive who in a pinching market would rather sacrifice volume and loss in idle capacity than cut prices and compromise the principle that goods should not be sold at a loss. It is easy to talk about price courage. It is hard to battle in the marketplace. But price cutting is contagious. It is infectious. The manufacturer cannot escape his responsibility both to protect himself and to defend the economic soundness of values. There cannot be too much discussion on this point.

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## *Interpret the Facts*

UNDER stress of acute competition for industrial heating business, power sales engineers sometimes hesitate to make public the kilowatt-hour requirements of particular processes per unit of product, fearing that the data will be seized upon by representatives of gas or oil-burning apparatus and used against electricity in economic comparisons. On a B.t.u. basis electricity may not in certain cases show economies over combustible fuels, but its advantages in other ways may suffice to win the decision from the intelligent purchaser. The only safe way to meet this condition is to bring out the facts and to evaluate them as applied to each case in hand. Gas or oil may hold the trump cards in one case, electricity in another, and an all-around analysis of the costs and benefits of the different competitive methods is essential to a sound determination of what to use. An open-minded purchaser will allow certain points in favor of the quality repetition, improved working conditions, accurate control and flexibility of electric heating if the sales engineer knows how to present these claims. Many times the scales have turned toward electricity in negotiations where a bare fuel comparison showed lower outlays for other agencies, because of these real, if at times intangible, advantages. Excessive caution defeats its own ends in this field as in many others.

## *Insulation at a Price*

SERVICE standards are very high in the electrical industry, and often the cost of maintaining these high standards is enormous. The whole problem of system insulation is now largely a matter of fixing standards of service in terms of the cost of insulation. Much talk about ground wires, arcing rings, protection of terminal apparatus and other elements of utility systems deals with the necessity of spending money for insulation.

On transmission lines agreement is now had that ground wires are splendid assets to service continuity if properly installed and if low-resistance grounds are permanent along the lines. But they cost money. Whether to use arcing rings or a larger number of insulator units is also largely a matter of dollars. For example, a string of fifteen suspension units with arcing rings is about equivalent to eighteen suspension units without arcing rings under impact tests. To determine which to use involves a balance of the first costs of insulators, arcing rings and relays and an evaluation of the fact that possibly more insulators must be replaced and more maintenance will be required if no arcing rings are used. The relative erecting costs must also be considered. No general statement should be made and no experience on any one system can be taken as proof that the same experience will be had in other localities. After the balance sheet is made judgment based on local conditions and service standards must award the decision.

Then, again, if a line is made immune from flashover, it becomes necessary to protect the terminal station equipments. Added equipment insulation, caging of lines for some distance from the station, use of fused horn gaps, graded line insulation, arresters, special relay installations and many other methods may be used individually or in combination. What to do is largely a matter of service standards and costs to obtain these standards.

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## *Improvements in Turbo-Generators and Speculations Upon Them*

SUCH a record of improvements as that presented by S. L. Henderson and C. R. Soderberg at the winter convention of the A.I.E.E. indicates that designers and manufacturers of turbo-generators at least are giving sympathetic consideration to the major requirements of users and seem to have the solution of problems well in hand despite the rapid increases in rating demanded. Ventilation no longer appears to be a limitation, and hydrogen cooling may become an actuality if the units now designed therefor are so operated. Coil insulation is being so made and protected against corona that coils designed for 22,000-volt operation have withstood momentary tests of 160,000 volts. Objections to the use of silicon-steel laminations have been circumvented so that core losses have been reduced considerably. Short-circuit ratios are being held to values that avoid instability of operation. Use of structural-steel frameworks is simplifying the shipping of large units, but the weight of rotors is still a limiting factor.

If the attention being given to centrifugal, bending, longitudinal and torque stresses in the turbo-units under operating conditions is any indication of the study being devoted to vibration problems in turbine blades, it may be hoped that even these elements will give very infrequent trouble. Studies of resonance frequencies indicate that there may be more than one critical speed, that flexibility of bearings has an influence, and that the problem is now to design units so that under normal variations their speed will remain within the valleys of resonance curves.

Speculation regarding some problems suggests possible value in the investigation of such subjects as: (1) the feasibility of annealed vitreous coil insulation; (2) semi-conducting slot liners that can be maintained in close contact with the insulation to prevent corona; (3) circulation of water, oil or a refrigerant through piping threading the stator laminations for increased cooling effect; (4) space economy, improved vacuum and capital saving of refrigerant-cooled condensers, and (5) the relationship between the natural vibration of turbine blades and the product of the r.p.m. and number of stationary vanes in the corresponding diaphragms.

Now that a generator voltage of 22,000 is considered quite conservative, possibly more users will take advantage of the economies in circuit breakers, switches, bus-bars, etc., made possible by utilizing higher generator voltages. As pointed out by Mr. Henderson, it is not desirable to call for a high short-circuit ratio, because it will limit the rating of a given-size generator and increase the cost per kilowatt.

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## *When Will the Electrical Industry Talk to Its Public?*

"ADVERTISING is the principal means whereby business talks to its public." That is about as accurate a definition of advertising as has been made. The electric power industry of this country should adopt this means of talking plainly to its public. It has tried whispering in back rooms; it has tried speech making from platforms; it has tried many methods of propaganda; it has done some advertising in fits and starts. It has never, as an industry, tried plain, honest, continuous, forthright advertising—such as has won and held popular attention and interest for certain other products and industries.

The central-station companies are "due" to try advertising in this way as a means of talking to the public. They will make a terrible mess of it at first, no doubt, but they are too intelligent to do it badly for long. They will buy straight-in-line advertising brains. They will hire the educated pencils of keen-visioned copy men, the deft fingers and vivid palettes of capable commercial artists, the finely balanced skill of expert typographers. Advertising, they will find, is no harder to produce than electrical energy. They will make a success of it. The unsettled and unsettling question is—when?

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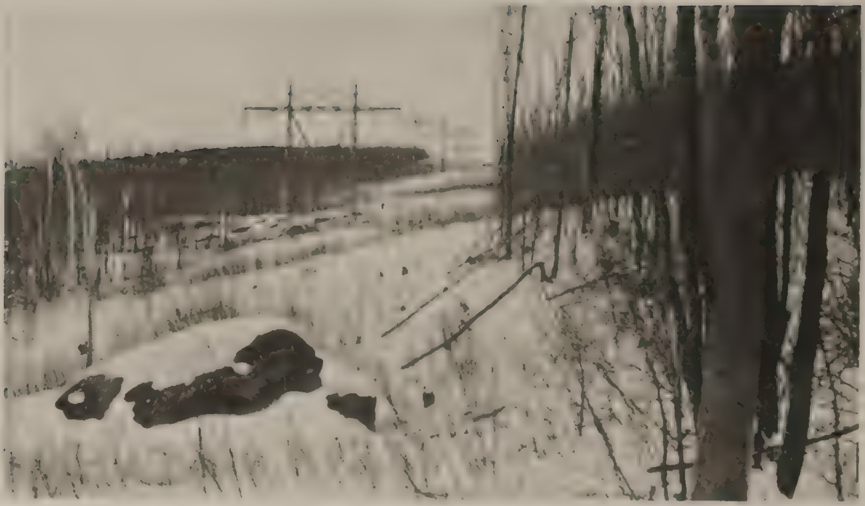
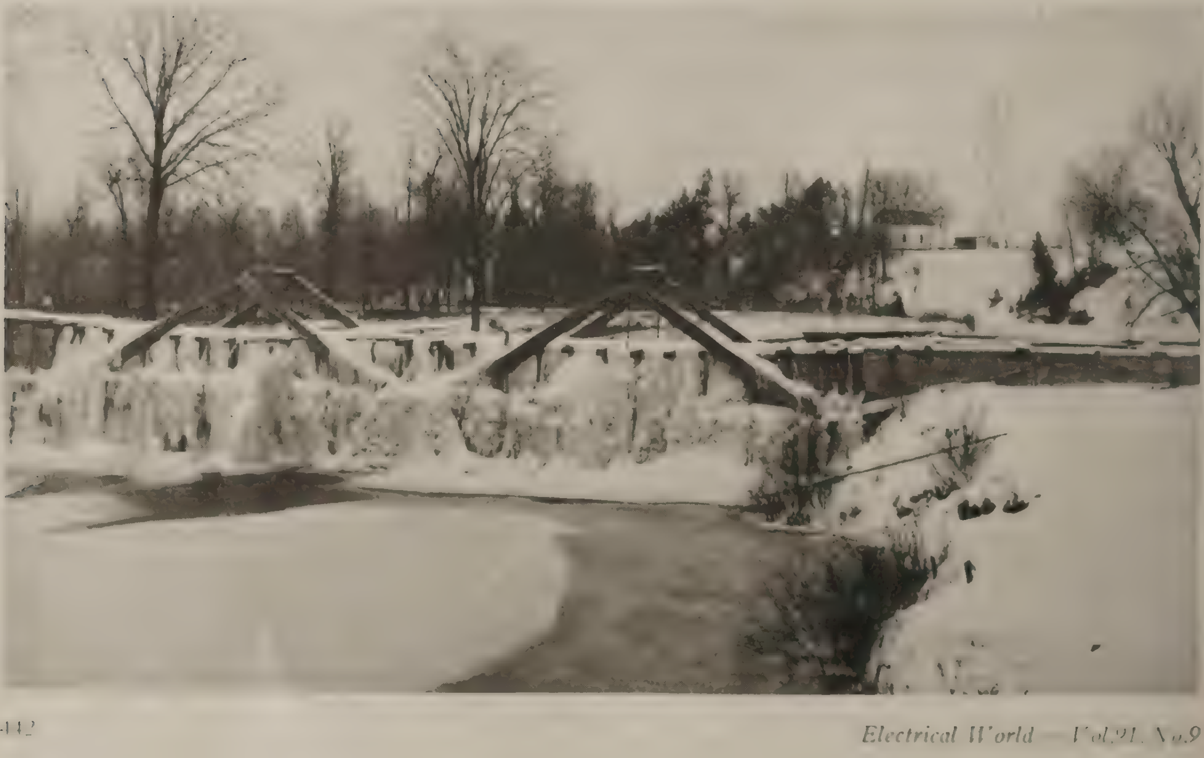
## *Vertical Distribution a Possibility*

IN THE skyscraper areas of large cities it may be economical and convenient to institute vertical distribution of electricity. The number of floors and the load per floor makes the cost of copper and of regulation a very large item when low-voltage distribution from street levels is used. In future developments high-tension cables set in concrete rising from the bottom to the top of the tall buildings may be used. Feeders at the top and bottom of the buildings could be used, and at each floor a transformer station could be located for service applications. For some areas such a plan would seem well worth study by the industry.



# Fighting Winter With Strategy

LOW towers and short spans are used by the New England Power Company for its 66-kv. line at the summit of Florida Mountain on the Mohawk Trail, to gain shelter from storms. The 120-kv. line of the Rochester Gas & Electric Company at Yates Crossing, near Rochester, N. Y., rises high above the winter-bound levels.



# Tests of Arrester Grounds

Emphasize necessity of initially and periodically measuring resistance of ground electrodes. The effects of multiple grounds, spacing, soil conditions and treating soil with various salts. Permanency and corrosive test methods

By Edward Beck

*Supply Engineer Westinghouse Electric & Manufacturing Company*

LIGHTNING arresters cannot reduce transient voltages to a value that will not harm protected apparatus if hampered by high ground resistance. The degree to which ground resistance interferes with the performance of an arrester is apparent from one of the accompanying curves relating to a 3,000-volt auto-valve unit subjected to a 70-kv. (crest) surge. With zero ground resistance, the protection obtained was good, the surge voltage being reduced to approximately 10 kv. (crest). With a ground resistance of 50 ohms in the arrester circuit, the voltage from line to earth was doubled. Under similar conditions a transformer on a 2,300-volt line might be expected to fail.

The importance of low-resistance grounds cannot be overemphasized. Too little attention has been given to this phase of the protection problem. If it is intended to protect an electrical system against lightning and if money is to be expended for lightning arresters, it is worth while to add slightly to this expense for the purpose of not only making but also maintaining adequate grounds. This extra effort will repay itself in the ensuing reduction of lightning troubles.

Except where the conductivity of the soil is very poor, driven grounds consisting of pipes or rods forced into the earth give satisfactory resistances, are the easiest to install and consequently are desirable. Where one driven electrode does not furnish a ground of low enough resistance, multiple grounds may be made easily. If further reduction in resistance is necessary, treatment of the soil with a salt must be resorted to.

### INFORMATION SOUGHT

Although many data have been collected by other investigators, there appears to be a lack of comparative information on the characteristics of the different types of driven grounds commonly applied to lightning arresters. Consequently an investigation was undertaken with the purpose of securing answers to the following questions:

1. What reduction in resistance may be obtained by the use of suitable multiple electrode grounds?
2. What reduction is realized by applying various salts to the earth adjacent to the electrodes?
3. How quickly after applying the salts are these effects obtained?
4. How long may the effect be expected to last?
5. What is the corrosive influence of these salts on the materials generally used for electrodes?
6. To summarize, what type of ground is the most economical to use?

This investigation was made entirely on driven grounds; other conditions requiring different types are considered special. However, the data here presented may be applied to any type of ground electrode. The experimental installation of ground electrodes was made near broadcasting station K D K A, in East Pittsburgh, in June, 1926. It is intended to observe these grounds for several years.

Although it is too early to make any observations on the degree of corrosion caused by different salts on the different materials used for electrodes and too early to determine the length of time that the effects of salting the earth may last, observation to date may be of interest. The complete program calls for further observations on these electrodes to determine when the effect of the salts will disappear and removal of the electrodes at the end of three or four years to examine them for corrosion.

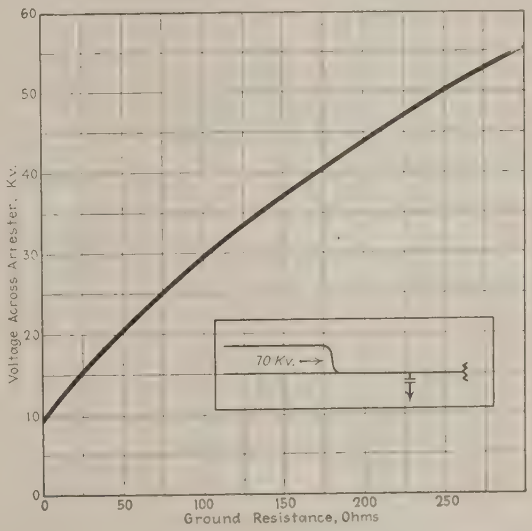


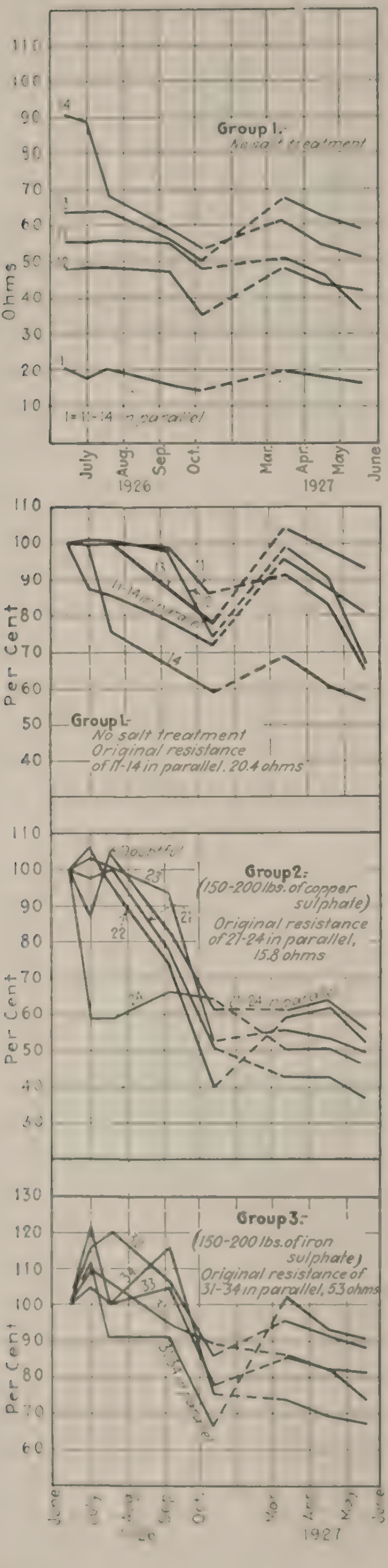
*Fig. 1—Effect of ground resistance on performance of 3,000-volt type LV auto-valve lightning arrester*

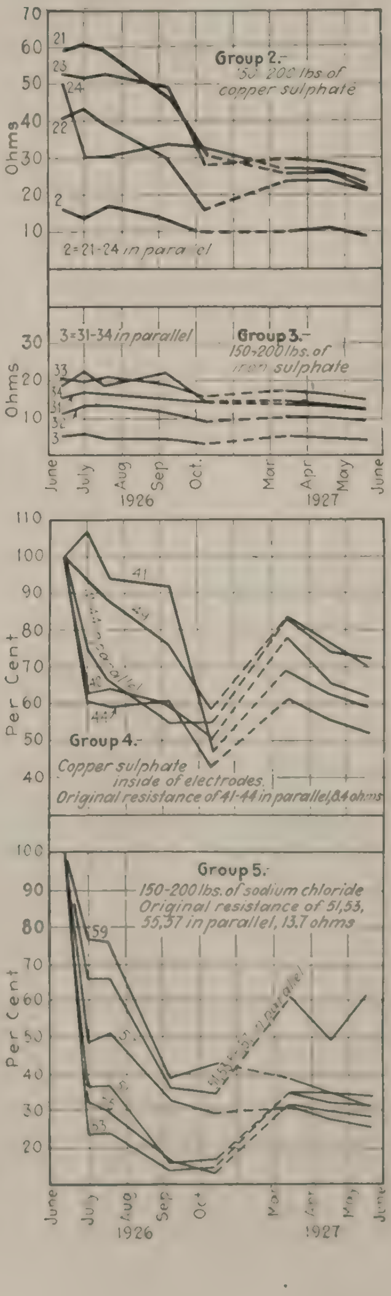
The curve was derived by means of DuFour oscillograph with arrester at transformer at end of line and subjected to a 70-kv. (crest) surge. Excluding direct strokes, it was considered that this would be the maximum surge that might be expected on a 2,300-volt line.

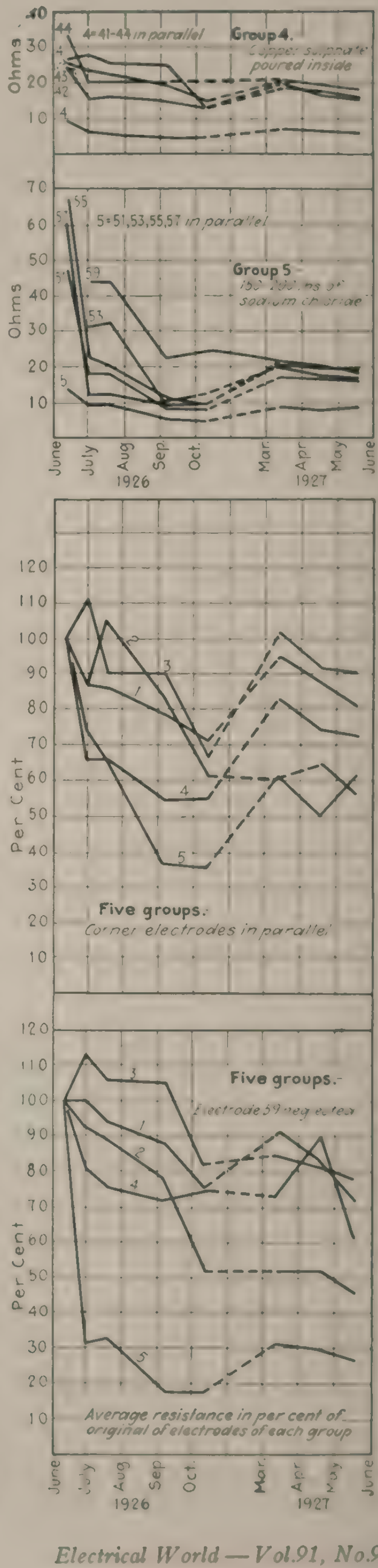
It was endeavored to make the installation typical of good practice in lightning arrester grounds. Numerous facts about grounds have been determined by other investigators. For instance, we know that the diameter of electrodes which can be driven and the material of which they consist have a negligible effect on the resistance, that increasing the depth of driving beyond 6 ft.

*Fig. 2—Variations in Resistance of 31 Ground Electrodes Over Period of Year*

The several groups whose resistances are indicated in ohms and percentage of original values in the accompanying figures consisted of galvanized and plain iron pipes and copper weld rods of various numbers sunk in treated soil. The adopted materials were: Group 1, plain ground; group 2, copper sulphate; group 3, iron sulphate; group 4, copper sulphate inside of pipes, and group 5, rock salt. See Fig. 3, page 445.







is of little benefit except in very dry localities, that the minimum spacing between multiple electrodes should be 6 ft., and that salt, if used, should be applied liberally if an appreciable reduction in the ground resistance is to be secured.

Bearing these things in mind, five groups of electrodes were installed as illustrated. The plain iron pipes external to the square formed by the other electrodes were driven to observe the corrosive effect only, resistance measurements being confined to the others. Group 5 consists of nine electrodes, to permit observation of the effect of electrodes at reduced spacings and of increasing the number of electrodes in a given area.

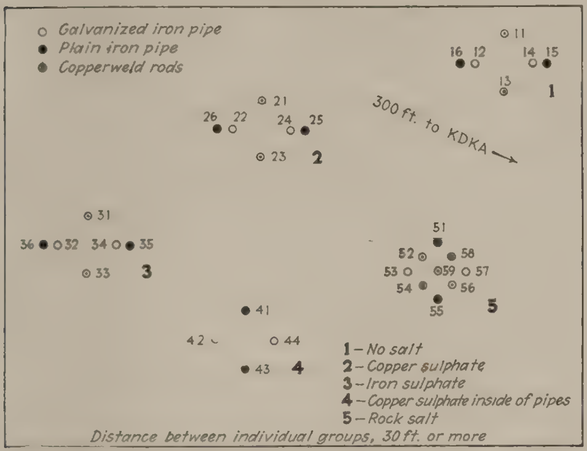


*Fig. 3—Five groupings of ground electrodes were tested under different conditions*

Nature of soil, yellow clay interspersed with shale; rainfall, averages 36 in. per year; location, top of hill, sloping off from group 1 toward 3 and 4 by about 10 ft.; diameter of pipes, 2 in., of rods, 1 in.; spacing between corner pipes, 6 ft., external iron pipes 2 ft. from corners; depth to which driven, 8 to 9 ft.; salts applied to groups 2, 3 and 5 by pouring into a shallow trench surrounding the electrode square.

Group 1, two galvanized iron pipes, two copper-weld rods and two plain iron pipes, no salt, located on the highest elevation; group 2, two galvanized iron pipes, two copper-weld rods, two plain iron pipes, 150 to 200 lb. of copper sulphate; group 3, two galvanized iron pipes, two copper-weld rods, two plain iron pipes, 150 to 200 lb. of iron sulphate. Located in slight depression; group 4, four galvanized and two plain iron pipes, with numerous holes drilled in them, copper sulphate solution poured inside of pipes; group 5, two galvanized iron pipes, two plain iron pipes, five copper-weld rods, 150 to 200 lb. of rock salt (sodium chloride).

As it is impracticable to use coke with driven grounds, the treatment of the soil surrounding the grounds was confined to the application of salts. Those most commonly employed are rock salt and copper sulphate; therefore these were used. A group using iron sulphate was added because this substance is cheap and has about the same conductivity in solution as copper sulphate. It is therefore worthy of consideration as a remedy for high resistance.

The arrangement of four electrodes in a square was chosen because this would be suitable for a multiple lightning arrester ground and furnish data on multiple grounds where the resistance of one electrode alone is too high. The resistances of the electrodes comprising corners of the squares were measured individually and in multiple about once a month except during the winter. No measurements were made during the winter for several reasons. One reason is that thunderstorms are rare when the weather is cold, hence there is no interest attached to the resistances in winter; also the behavior of ground resistances during the time the ground is frozen is well known. (See reference 1 in bibliography, page 447.)

Resistance measurements were made by means of the alternating-current volt-ampere method, using the ground of KDKA as a return. The broadcasting ground was checked occasionally by the three-point method. It was found to be quite constant between 0.3 and 0.4 ohm. It consists of a network of copper strap buried in coke and paralleled with the water-pipe system.

A small two-winding transformer was used to furnish the measuring current. This transformer was equipped with several voltage taps on the secondary. The apparatus is portable (weighing about 50 lb., including meters) and can be carried by one man. The primary is fed through a long cable, kept on a reel, from the 110-volt circuits of KDKA. Currents of the order of 5 to 15 amp. were used for measuring where possible. Checks on the same grounds were made, using currents of the order of 100 milliamperes. No marked deviation from the measurements at higher currents was found. Sometimes the indication was 5 to 10 per cent greater with the small currents. Apparently current strengths varying over a considerable range have no effect on the resistance. That this is so is further demonstrated by the accompanying volt-ampere characteristic made of a column of soil under pressure by means of the DuFour cathode ray oscillograph.

In the author's opinion, there is no apparent reason why the behavior of a low-resistance ground carrying a heavy current should be different from that of a high-resistance ground carrying a small current. It was found impracticable to set up a circuit consisting of earth in the laboratory with low enough resistance to permit the flow of currents of the magnitude of those caused by lightning. It is hoped to obtain such data in the field this summer. However, the maximum current it is practicable to use for measuring ground resistance is not much more than 20 amp., so that from the standpoint of measuring, the soil volt-ampere characteristic is of value. From the foregoing it seems safe to expect a reasonable accuracy if portable instruments of the bridge or ohmmeter types are used to measure lightning arrester grounds, provided they make use of alternating measuring current, although these instruments generate only small currents.

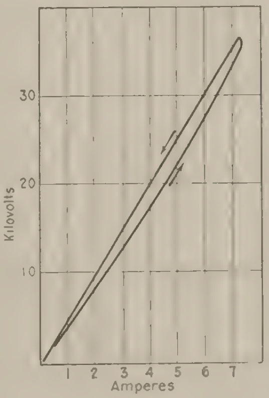


FIG. 4—VOLT-AMPERE CHARACTERISTICS OF 2¼x6-IN. COLUMN OF DAMP SOIL SHOW THAT CURRENT HAS LITTLE EFFECT ON RESISTANCE

Voltage impressed by condenser discharge simulating lightning transient. Resistance calculated from oscillogram was 4,900 ohms; at 110 volts, 60 cycles, 5,000 ohms. Since maximum current was only 8 amp., the results shed no light on behavior of ground electrodes under heavy surge currents.

The variations in resistances of the individual grounds observed during about a year are depicted. The first measurements were made the day after the electrodes were installed; therefore the salts applied to them had not taken effect. The salts began to lower the resistances not long afterward. The measurements indicate that the resistances of the installations treated with common rock salt decrease more rapidly and reach a lower value than those treated with either copper or iron sulphate. (See particularly Fig. 2, "Five groups.") To ascertain whether this conclusion is reasonable, the solubilities of the salts used and the electrical conductivities of their solutions were examined. Their characteristics are illustrated. From these curves it may be seen that common salt is more soluble than either of the two others; also that the conductivity of its solution is about five times that of theirs. It is therefore to be expected that treatment with common salt will produce a lower ground resistance in less time than treatment with other salts. That a reduction in resistance is effected by the salt is shown by the action of the various electrodes in group 5, Fig. 2, page 444. The resistances of the outer electrodes of this group (Nos. 51 to 58) decrease very soon after the application of the salt, whereas the resistance of the center rod (No. 59) remained high for some time and then decreased more slowly, ultimately reaching almost the same value of resistance as the other rods. This occurred because some time elapsed before the salt solution permeated from the outside of the group to the center rod.

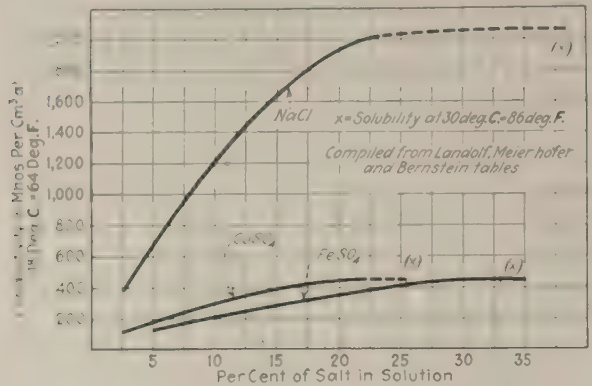


FIG. 5—COMPARATIVE CONDUCTIVITIES OF SALT SOLUTIONS

It was felt that the results of measurements on one group of electrodes did not present conclusive proof of the electrical superiority of rock salt. It was suspected that the progress of the resistances might, in a measure, be due to the character of the soil at that particular location. Consequently in the spring of 1927 a second set of electrode groups was installed in the same locality, removed about 150 ft. from those already driven. This second installation practically duplicated the first except that, to simplify the installation, copper-coated steel rods were used in all but one installation, in which it was desired to observe the effect of pouring salt solution inside of the electrodes. This installation consisted of only four electrodes per group, as it is felt that the data on corrosion could be obtained with the original installation. The rods were 8 ft. apart instead of 6 ft., in order to observe whether there is any material benefit attached to this increased spacing. The results of the measurements to date on the second installation are presented in Fig. 6.

Unfortunately for the comparison, the resistances of the electrodes of the second installation were all much lower than those of the first. However, the graphs again indicate the rapid fall in resistance of those electrodes treated with common rock salt.

The differences in initial resistances of various groups in the first and second installations are interesting because they show the wide divergence that may be expected in comparatively small areas of ground. This emphasizes the need of measuring the resistance of all grounds made in order to determine their value. It is not sufficient to drive an electrode 10 ft. deep and assume therefore that a good ground has been made. It was found, in general, that those electrodes which were driven with the least effort had the lowest resistance. In some cases it was impossible to install the electrodes without first digging a hole. Those electrodes which pass through shale generally had a high resistance. For instance, electrode 14 required much effort to sink it to the required depth, as it was necessary to penetrate considerable shale. Its initial resistance was 90 ohms. As time went on and the earth became well packed around the electrode, its resistance decreased. The rods of group 3 were fairly easy to install; moreover, they are located in a slight hollow where moisture probably gathers; consequently they initially had between 11 and 20 ohms resistance. The electrodes of group 6 are driven close by a tiny stream; their resistances are low, yet not appreciably lower than those of other groups of the second installation.

The reduction in resistance which salting causes in the case of the electrodes which are initially low is apparently much less than that obtained on electrodes which are initially high. It appears that the resistances of electrodes of a salted group gradually fall to about the same value. This is probably so because the salted region of the earth acts like one large electrode for which the driven rods or pipes are terminal posts.

## EFFECTS OF PARALLELING AND SPACING

If the measured resistances of rods in parallel are compared with values calculated from the resistances of the individual rods, it is found that the ratio of the actual to the calculated is of the order of 1.5 to 1.7 except where the resistances are high, in which case the ratio may be nearer to 1. For instance, the measured resistance of the four electrodes of each group in multiple were compared with the theoretical resistance calculated by the formula $\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} \ldots + \frac{1}{r_n}$ The results are given in the accompanying table. .

It appears that the gain in paralleling electrodes is less where the soil resistance is low than where it is high.

Measurements made on the nine electrodes of group 5 for the purpose of checking the benefits of driving electrodes at close spacings or of adding electrodes in a given space gave the results also shown in the table. These measurements were made at the beginning of the

MEASURED RESISTANCE COMPARED WITH THEORETICAL (OHMS)

| Group | Calculated | Measured | Ratio (*M* + ' ) |
|---|---|---|---|
| 1 | 13.9 | 19.5 | 1.40 |
| 2 | 6.7 | 9.6 | 1.43 |
| 3 | 3.4 | 5.4 | 1.59 |
| 4 | 5.0 | 7.0 | 1.40 |
| 5 | 4.8 | 8.4 | 1.75 |
| 6 | 2.0 | 3.3 | 1.65 |
| 7 | 1.7 | 3.0 | 1.77 |
| 8 | 2.9 | 5.0 | 1.73 |
| 9 | 3.3 | 5.9 | 1.79 |
| 10 | 2.5 | 4.7 | 1.88 |

| | Electrodes in Parallel | Resistance (Ohms) Measured | Calculated | Ratio (*M* + *C*) |
|---|---|---|---|---|
| (1) | 51, 53, 55, 57 | 14.0 | 14.1 | 1.0 |
| (2) | 51, 53, 55, 57, 59 | 13.6 | 10.3 | 1.3 |
| (3) | 51 to 58 | 12.9 | 7.2 | 1.8 |
| (4) | 56, 57, 58, 59 | 22.3 | 14.3 | 1.6 |

Ratio of (4) to (1)—that is, 3-ft. to 6-ft. spacing—is 1.6.

investigation. The resistances of the individual electrodes of group 5 varied between 47 and 67 ohms.

These tabulations indicate that closer spacings than 6 ft. are not to be recommended, that increasing the spacing beyond 6 ft. is not worth the trouble and that additional rods in a 6-ft. square are not economical.

## CONCLUSIONS

It is too early to draw definite conclusions regarding the ultimate superiority of a certain salt or a certain electrode material, as the degree of corrosion and the duration of the salting effect cannot be evaluated at this time. Therefore the questions propounded earlier in this article cannot all be definitely answered.

The reductions in resistance that can be obtained by using parallel grounds and by salting are shown.

The question of how quickly the salts take effect may be answered by the statement that in the case of rock salt an appreciable reduction may be realized in about two weeks, but a longer time must elapse in the case of other salts unless the solution is poured around the electrodes, as was done in group 4. The time necessary for the salts to become effective undoubtedly depends on the nature of the soil, and the results obtained at East Pittsburgh may not apply to other localities.

How long the effect lasts has not yet been determined; it appears that it will last at least a year, however.

The most economical ground to use is still undetermined, because the lasting effect of salting and the corrosive effect are not definitely known. Prof. O. B. Wooten (see reference 2 in bibliography) has stated that pipes imbedded in soil treated with rock salt show little corrosion after two years.

From the electrical standpoint, rock salt is the most efficacious in reducing the resistance of driven electrodes. From the first cost standpoint, it also has the advantage over copper sulphate. The costs of the salt used in carload lots at Pittsburgh are as follows per 100 lb.: Copper sulphate, $4.30; iron sulphate, $1.40; rock salt, $1.95.

From the standpoint of ease of installation, the rods possess a distinct advantage. Pipes require driving points and caps and must in general be larger in diameter than rods of equivalent mechanical strength; therefore they require additional effort to drive them.

Treating the soil by pouring electrolyte inside of pipe electrodes that have been drilled with numerous holes apparently possesses certain advantages, as the electrolyte takes effect quickly and it is simple to repeat the treatment. The cost of such an installation is higher. It is doubtful whether the advantages derived outweigh the increase in cost.

No attempt has been made to discuss methods of making earth connections in unfavorable soils. Grounds of that character require special methods, usually costly.

There is one point which the author wishes to stress emphatically. It is that measurement of the resistance of grounds is essentially from the protective and the economic standpoints. If one electrode provides a sufficiently low resistance, it is patently uneconomical to drive more or to salt the earth. Moreover, it is only by measuring the resistance of the ground when it is installed that the necessity for additional electrodes or salting becomes apparent.

Regarding the frequency with which the resistances should be checked, it appears from the data here collected that once a year is sufficient; perhaps the interval may safely be longer. The measurement should preferably be made in April or May. It is to be recommended that in addition to measuring each ground when it is installed, a second test be made about two weeks later.

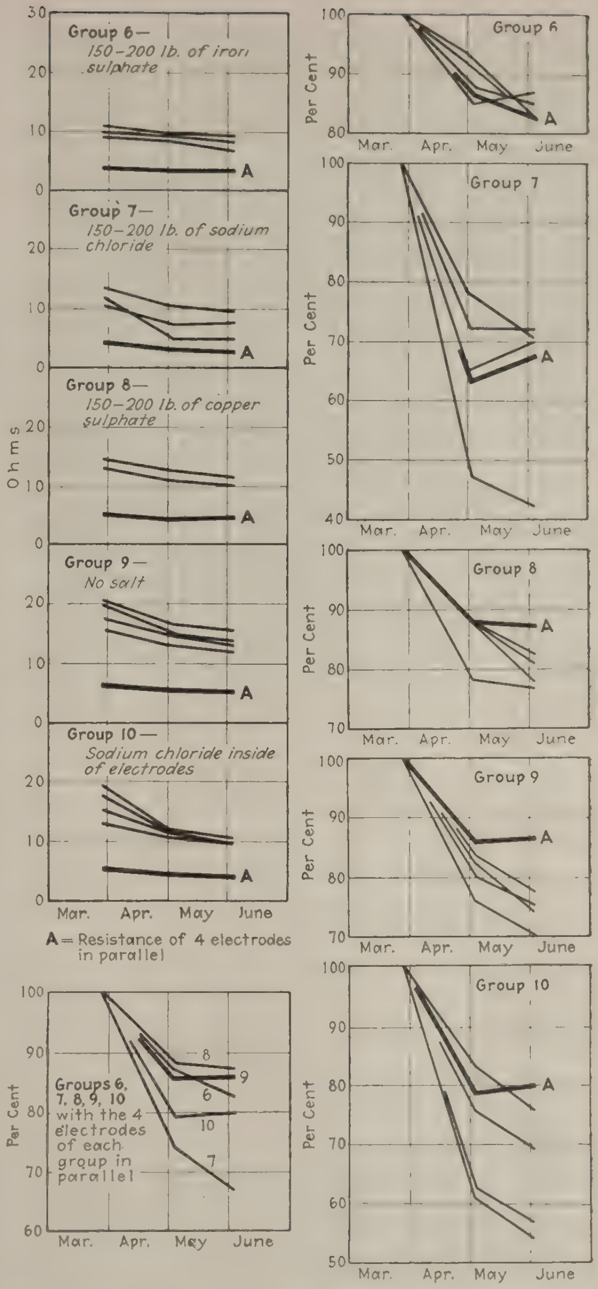


FIG. 6—RESISTANCE OF FIVE GROUPS OF ELECTRODES USING COPPER-COATED STEEL RODS SPACED 8 FT. INSTEAD OF 6 FT.

The author wishes to take this opportunity to express to R. M. Keller, J. B. Leinbach and O. Ackerman his appreciation of their co-operation in conducting this investigation.

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# Reducing Distribution Losses

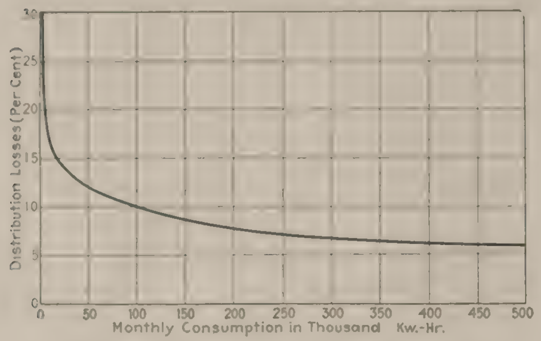
TENTH ARTICLE

## *Results Obtained on One System*

By J. B. Moorhouse
*Electric Distribution Engineer Central Illinois Public Service Company, Springfield, Ill.*

THE economical operation of an electric utility requires consideration of all factors involving operating expense. Where greatest savings may be made the greatest effort should be expended to produce that saving. Power stations have received their share of attention in improvement of design and methods of operation with most gratifying results. As indicated in the previous articles of this series transmission and distribution systems offer a field for further development in reducing losses and improving service and concrete evidence is offered in this the final installment.

The amount of money which may be spent in investigating losses and for reconstruction purposes depends upon the amount which can be saved by the improved system. It is evident that the return on a town of 300 average customers will not warrant the expense of a detailed survey for loss reduction. Cities of 5,000 population and above which have high unaccounted for losses justify the cost of a detailed survey to the extent of using graphic instruments where needed.



DISTRIBUTION LOSSES EXPRESSED AS A FUNCTION OF ENERGY CONSUMPTION

The trend of loss reductions of thirteen towns in the territory served by the Central Illinois Public Service Company is shown in the table. The tabulation is prepared from monthly loss reports over a period of nineteen months. It may be observed that the losses in these towns are approaching values indicated in the accompanying curve. The greatest savings were realized in towns "C" and "I," the least in towns "B," "K," "H" and "M," indicating there was little relationship between community consumption and potential loss reductions. Town "F" of the above list had poorly located distribution transformers of excess capacity. When reconstruction was carried on 84 kva. was removed from the town, leaving 202 kva., yet service was greatly improved. Town "J" is in a coal mining district where it is difficult to plan overhead construction due to the variation in number of customers. Town "L" is located in a flood area; emergency use of unmetered electrical energy raises the loss percentage above normal. Service in town "M" is furnished to several canning companies, whose power load is heavy for a few weeks only. Service to these companies is transferred from small transformer banks to large banks during the canning season, thereby minimizing transformer losses. The variety of conditions encountered makes it necessary for the distribution man to familiarize himself with local conditions before making recommendations for reconstruction.

TABLE OF LOSS REDUCTIONS

| Town | Kw.-Hr. Per Year Supplied to Distribution System | Per Cent Loss Before Survey | Per Cent Loss After Survey and Reconstruction |
|---|---|---|---|
| A | 110,000 | 45 | 39 |
| B | 156,000 | 26 | 24 |
| C | 216,000 | 45 | 22 |
| D | 252,000 | 25 | 14 |
| E | 252,000 | 27 | 19 |
| F | 264,000 | 22 | 16 |
| G | 276,000 | 27 | 18 |
| H | 516,000 | 24 | 19 |
| I | 1,020,000 | 38 | 17 |
| J | 1,080,000 | 27 | 19 |
| K | 1,680,000 | 18 | 14 |
| L | 2,640,000 | 21 | 14 |
| M | 4,245,000 | 10 | 5 |

# Net Cost of Condensing-Water Conduits

IN THE accompanying table are given the estimated installed costs of various condensing-water conduits, exclusive of overhead charges during construction such as organization, engineering, interest, etc., derived from a reproduction cost appraisal of an Eastern central station located on tidewater after a comprehensive survey of the property. Included in these data are also a group of similar net costs taken from the company's field sheets in connection with an extension made during 1925. All data presented, unless otherwise indicated, are based on 1927 figures.

MISCELLANEOUS NET COST DATA FOR CONDENSING-WATER TUNNELS (NO OVERHEAD)

| | |
|---|---|
| Intake tunnel, 322 ft. long, circular brick, inside diameter 6 ft. 6 in., walls 12 in. thick | $36,788 |
| Intake tunnel, 94 ft. long, other dimensions as above, brick | 9,336 |
| Discharge tunnel, 186 ft. long, reinforced concrete, inside dimensions 4 ft. x 5 ft., walls 8 in. and 16 in. thick, roof slab 12 in. thick, inside face of side walls waterproofed with felt and pitch, with 4-in. brick protection course | 5,196 |
| Discharge tunnel, 87 ft. long, reinforced concrete, 4 ft. x 5 ft. inside dimensions, wall 3 in. thick on one side and 16 in. thick on other, roof slab 12 in. thick, waterproofed as above | 2,354 |
| (For contractor's compensation add 5 per cent to above) | |
| **Intake Screens** | |
| Two Link Belt vertical intake screening elevators, 25 ft. 6 in. on centers; 5 ft. 6 in. screening panels of No. 9 BWG 1-in. square mesh screen cloth with steel framework; No. 4103 malleable iron closed joint pintle chain driving machinery, splash plate guards, spray pipes, valves and connections, driven by and including 5-hp., 550-volt, three-phase, 60-cycle motor with reduction gear and including steel framework for hoisting trash racks | 7,644 |
| (For contractor's compensation, add 5 per cent to above) | |
| **1925 Field Costs (net, no overhead)** | |
| Intake and discharge tunnels, each reinforced concrete with 18-in. walls, floor and roof slabs.<br>Intake, 463 ft. long with 7 ft. x 7 ft. inside dimensions and 86 ft. length of sizes ranging from 6 ft. x 6 ft. to 6 ft. x 7 ft., with manholes and gate wells<br>Discharge, 143 ft. of 4 ft. x 7 ft. inside, 60 ft. about 5 ft. 6 in. x 8 ft. 6 in., 340 ft. about 5 ft. 6 in. x 12 ft., 10 ft. of 4 ft. 6 in. x 7 ft., and manholes and connections | 241,937 |
| Screen house substructure and well, 32 ft. 6 in. x 65 ft. x 36 ft. deep, reinforced concrete and structural steel, with six sluice gates 2 ft. x 9 ft., and six gates 2 ft. 6 in. x 7 ft. 6 in. | 202,906 |
| Intake screens 35 ft. 6 in. on centers. Link Belt. panels 8 ft. 11 in. wide, 5-hp. motor drive through reduction gear, and de-watering pump (1,100 gal per minute) with 25-hp., 1,750-r.p.m. motor | 13,771 |
| Gate valve 5 ft x 5 ft (diameter) for tunnel between two units, bronze | 1,182 |
| (For contractor's compensation add 5 per cent to above) | |

# Large-Unit Foundations

By P. D. FREUDENBERGER
*Chief Draftsman Buffalo General Electric Company,*
*Buffalo, N. Y.*

IN DESIGNING and constructing the foundation for the 60,000-kw. turbo-generator at the Charles R. Huntley station of the Buffalo General Electric Company a particular effort was made to hold the possible values of deflection due to dead and live loads within definite limits to prevent misalignment of the large new generating unit.

The total weight of this machine alone is 1,500,000 lb. This load, together with the condenser, piping and dead load, is supported on an isolated island 60 ft. high and resting on bedrock. The rock was located approximately 40 ft. below the grade and was found to be of very high structural strength. A sample tested to 26,000 lb. per square inch in direct compression.

The substructure for the foundation is made up of ten interlocking steel sheet pilings, concrete-filled caissons, with a concrete mat at the top. Stresses in the concrete were kept within the following limits:

Direct compression, 400 lb. per square inch.
Combined compression and bending, 450 lb. per square inch.
Axial compression under column bases, 500 lb. per square inch.
Tension in reinforcing steel, 10,000 lb. per square inch.

No variation in deformation greater than 0.02 in. was permitted in the concrete shafts of the caissons.

The superstructure is made up of structural steel with a 4-in. covering of concrete. The concrete covering was requested by the manufacturer of the turbo-generator as an insulation against temperature changes. However, there are other advantages which warranted its use. The concrete covering forms a preservative against corrosion, is sound deadening and adds to the rigidity of the foundation in general.

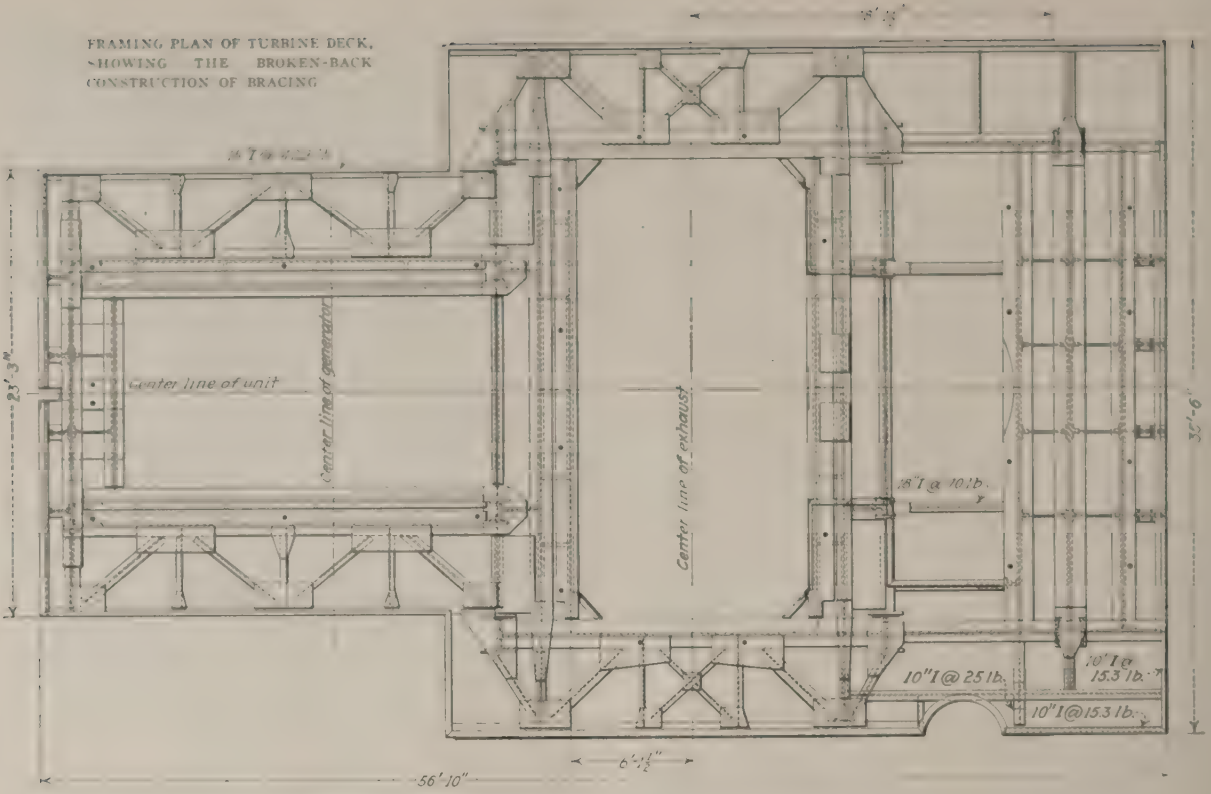
HEAVY BEAM BEYOND CROSS BRACING SUPPORTS CENTER BEARINGS OF THE UNIT

The size of the members forming the steel structure was determined by their deflection due to the dead load, plus 25 per cent of the turbine load as an allowance for impact. The deflection of the beams and girders was kept below 0.002 in. and that of the column shafts 0.04 in., with no variation at any point on the structure greater than 0.02 in. The 0.04-in. deformation referred to in the column shafts includes the dead load, the impact and the bracing stresses. The deformation due to the dead load

THE BRACING BETWEEN THE WIDELY SPACED COLUMNS ON THE RIGHT IS THE SAME AS SHOWN ABOVE

THE GAP IN THE STEEL FLASHBOARD AT THE TURBINE FLOOR LINE IS FOR THE THROTTLE VALVE

FRAMING PLAN OF TURBINE DECK, SHOWING THE BROKEN-BACK CONSTRUCTION OF BRACING



alone is below 0.02 in. The fiber stresses in the beams and girders is approximately 3,500 lb. per square inch throughout the structure.

The steel structure is braced in all directions to withstand shocks and make it rigid. In determining the stresses an arbitrary value of 25 per cent of the machine loads was considered as acting on the plane of the shaft. As the unit is located partly within an already existing building, the main girders could not be made continuous. This broken-back feature was taken care of by providing horizontal bracing in the main deck of the structural steel. Bracing members were designed with an allowable fiber stress of 16,000 lb. per square inch.

A novel method of obtaining the initial tension in the diagonals was employed. The amount of tension varied from 10,000 lb. to 30,000 lb. per member, depending upon its area in cross-section. It was necessary to use the varying values mentioned to produce measurable amounts of draw of from 0.01 in. to 0.015 in. The diagonals were not fabricated until the main members of the foundation were in their exact location and riveted. Each diagonal was then made from accurate measurements and templates taken in the field. The holes in the upper end of the member were made to size, while the ones in the lower end were sub-punched and at a location to allow for draw. With the diagonal in position the upper end was riveted. By means of four drift pins and a man with an air gun at either side, alternately tapping the pins with hammers, the diagonal was stretched to its required length. With the drift pins in place, the remaining holes in the connection were reamed and riveted. Finally the drift pins were removed, the holes reamed and riveted and the structure completed.

Stresses in the rivets were kept below usual values. The rivet values in shear for the primary members were 10,000 lb. per square inch for shop-driven rivets and 7,000 lb. per square inch when driven in the field. Many of the rivets have a very long grip, and at first some difficulty was encountered in making them tight. By double gunning and cooling the ends of the rivets no further difficulty was encountered.

## Cost of Outdoor Station

AN UNUSUAL outdoor hydro plant of 30-kw. rating was described by Joseph Franz, engineer Southern Berkshire Power & Electric Company, Stockbridge, Mass., in the ELECTRICAL WORLD Dec. 31, 1927, page 1350. Since the article was prepared the accompanying cost data have been received in reference to the installation, which is of the induction-generator type with an 18-in. turbine running under a net head of 10½ ft. A concrete dam was already available for use when the hydro plant was built. The generator is provided with a galvanized iron umbrella, built by a local plumber, to insure additional protection against the elements, and its erection cost is included in the erection expense. The umbrella was erected by one man in about one day.

ITEMIZED COSTS OF 30-KW. HYDRO PLANT

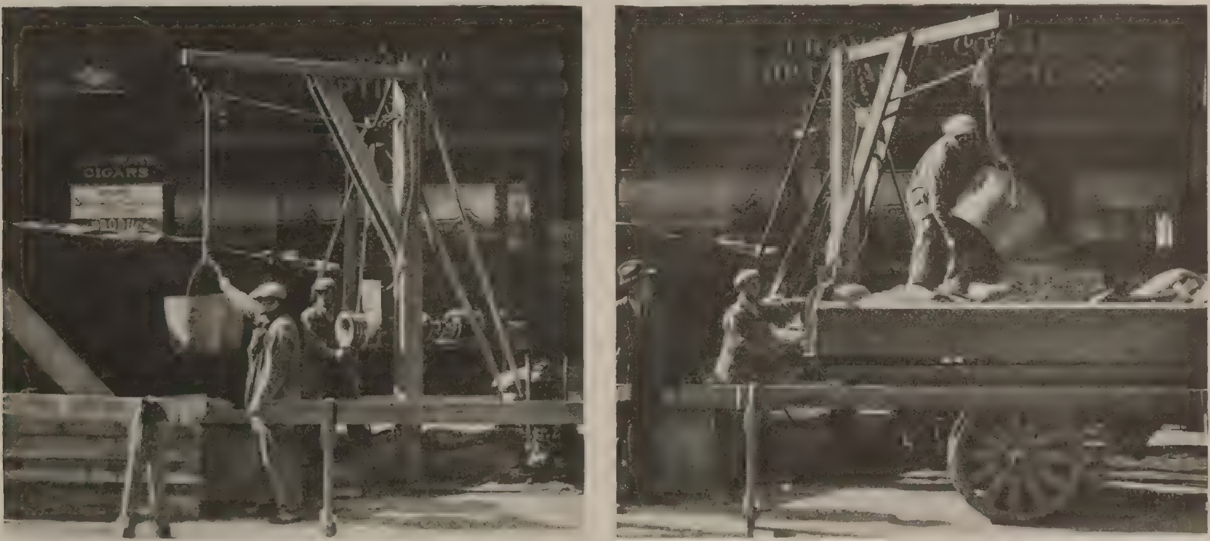
| | |
|---|---|
| Excavation and placing concrete flume | $1 002 05 |
| Headgate and racks | 88 05 |
| Turbine, f.o.b. West Stockbridge | 1,678 72 |
| Generator, f.o.b. West Stockbridge | 1,811 37 |
| Circuit breaker | 50 07 |
| Galvanized iron hood | 18 00 |
| Miscellaneous material and carting | 50 00 |
| Labor erecting and connecting unit | 411 15 |
| Engineering and superintendence | 650 00 |
| Total installation | $5,759 41 |
| Per kilowatt | $191 98 |

# Light-Weight Manhole Hoist

By R. L. Dodd
*General Foreman Underground Division,*
*Milwaukee Electric Railway & Light Company, Milwaukee, Wis.*

EXCAVATING deep manholes in busy city streets often presents a rather vexing problem in digging and disposal of the dirt. The dirt cannot be thrown up with shovels after the hole has gone down more than 6 or 7 ft. and quite frequently a city ordinance requires the immediate removal of the dirt. The use of winch-operated hoists in this work is not uncommon, but the hoists are not always easily portable and are not infrequently awkward and hard to handle. These difficulties have been pretty well disposed of in the hoist that is used by the underground division of the Milwaukee Electric Railway & Light Company.

This particular hoist was built by the company in the fall of 1927, has been in use since that time in the excavation of tunnel shafts and deep manholes and has performed very satisfactorily. The winch is the same as is used in building foundation caissons. It is a Thomas winch, equipped with a 2-hp. motor speed reduction gear, ratchet and large nigger head. The mast is 6 x 6-in. hardwood timber about 12 ft. long. The boom is a 3½x4½-in. x 7-ft. hardwood crossarm reinforced with a ⅛x2½-in. steel strap along the top. The boom braces are 2x6-in. soft wood. The back braces are 1¼-in. iron pipes, with the lower ends 7 ft. from the mast. The pivots at top and bottom of the mast are 1-in. bolts.


LIGHT-WEIGHT HOIST BEING USED TO REMOVE EXCAVATED MATERIAL FROM TUNNEL AND LOAD A DIRT TRUCK

The winch is attached bodily to the mast by means of one bolt and three braces so that it revolves with the crane. The power supply is wired to the top of the back braces, thence to the mast and the motor through flexible leads. The lifting buckets are made of transformer oil barrels cut in half and bail hooks welded on. The capacity of the hoist is about 500 lb. at a speed of 40 ft. per minute. The operator runs the motor continuously and controls the speed of hoisting and lowering entirely with the 1-in. rope wrapped around the nigger head. The ratchet prevents dropping the bucket if the motor should stop. This hoist, on account of the simplicity of its construction and the light weight of its parts, can be disassembled, loaded on a truck, moved a reasonable distance and erected at the new location by four men in two hours.

# Western Utility Freight Bill Is No Small Item

THE results of a recent inquiry among a number of electric light and power companies in the Western States shed light on the magnitude of their annual freight bills. Although a number of companies were unable to make any definite statement, and others could only approximate the annual costs because transportation charges were included in the cost, it was possible to get data for four operating systems. To reduce them to a comparable basis they have been worked out in terms of dollars of freight charges per kilowatt of installed plant capacity, with the following results:

| | Cents | | Cents |
|---|---|---|---|
| Company A | .62 to 78 | Company C | 87 to $1.15 |
| Company B | .67 | Company D | $1.40 |

The figures for Company A are exclusive of charges for some new heavy machinery and, therefore, represent an average year when no considerable amount of new construction is going on. Company D included freight charges on a considerable amount of new construction, which apparently accounts for the high freight charges per kilowatt of plant.

In plant capacity these companies range from somewhat less than 100,000 kw. upward. It is not to be expected that the unit figures will agree even roughly. The items are too few to justify the taking of an average, but they seem to warrant the assumption of 67 cents of freight charges per kilowatt of plant as a reasonable minimum, though this is seriously affected by a number of factors, particularly the rapidity of growth and the distance of transporting fuel and machinery.

If it be granted that the samples are representative of conditions in the eleven Western States, with somewhat more than 3,500,000 kw. of plants, an estimate for the combined freight bills of that section is $2,500,000.

For the same systems the freight bill ranged from 2½ cents to 8 cents per dollar of value of the freight.

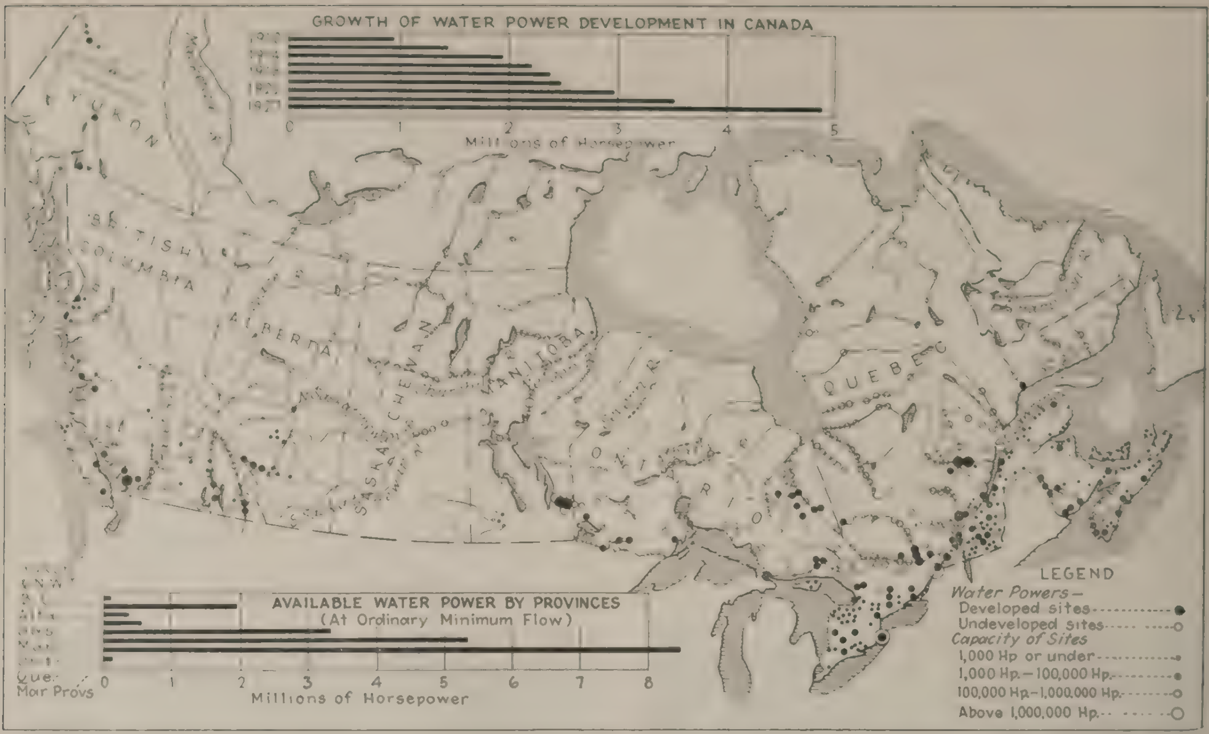


*Fig. 1—Location and growth of Canada water powers*

*Table I—Customers by Provinces in Canada* 1924-1925*

| Province | Total Central Station Customers 1924 | Total Central Station Customers 1925 | Domestic Lighting Customers 1924 | Domestic Lighting Customers 1925 | Commercial Lighting Customers 1924 | Commercial Lighting Customers 1925 | Power Customers 1924 | Power Customers 1925 |
|---|---|---|---|---|---|---|---|---|
| **Canada** | **1,200,950** | **1,279,731** | **988,480** | **1,063,530** | **176,444** | **180,994** | **36,026** | **35,207** |
| Prince Edward Island | 3,717 | 3,706 | 3,061 | 2,813 | 586 | 782 | 70 | 111 |
| Nova Scotia | 40,315 | 40,881 | 31,667 | 32,159 | 7,345 | 7,273 | 1,303 | 1,449 |
| New Brunswick | 27,759 | 30,676 | 21,955 | 24,483 | 5,040 | 5,367 | 764 | 826 |
| Quebec | 321,494 | 347,356 | 271,475 | 297,965 | 40,778 | 40,892 | 9,241 | 8,499 |
| Ontario | 507,038 | 534,513 | 416,376 | 441,622 | 76,575 | 78,415 | 14,087 | 14,476 |
| Manitoba | 92,511 | 102,831 | 76,260 | 86,616 | 12,678 | 13,269 | 3,573 | 2,946 |
| Saskatchewan | 41,807 | 44,394 | 32,219 | 34,188 | 7,962 | 8,475 | 1,626 | 1,731 |
| Alberta | 55,488 | 57,435 | 44,904 | 46,332 | 8,575 | 9,307 | 2,009 | 1,796 |
| British Columbia | 110,341 | 117,457 | 90,209 | 96,996 | 16,791 | 17,100 | 3,341 | 3,361 |
| Yukon | 480 | 482 | 354 | 356 | 114 | 114 | 12 | 12 |

*Dominion Bureau of Statistics.

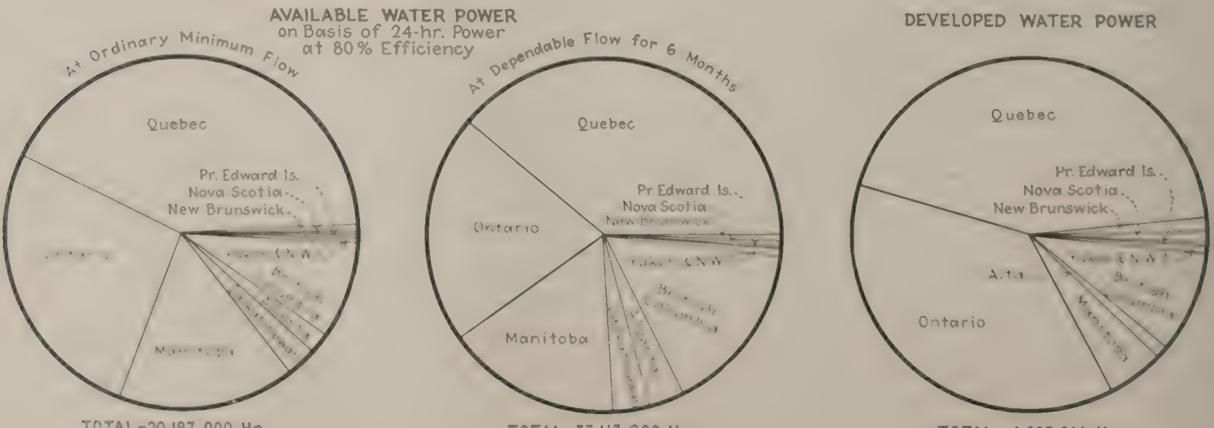


*Fig. 2—Available water power of Canada on basis of 24-hour power at 80 per cent efficiency*

# Water Powers of Canada*

### $900,000,000 invested in 5,000,000 hp. or about $180 per horsepower—33,000,000 hp. still available six months of year

CANADA has abundant water-power resources and they have been developed rapidly in late years. In 1910 the capital invested in water power was $121,000,000, and in 1927 it was $900,000,000—a growth of 600 per cent in seventeen years. The average capitalization per horsepower is $183 and there is a present-developed capacity of installed turbine horsepower of 4,883,266. The available 24-hour power at 80 per cent efficiency is 20,197,000 and that available on a six-month flow basis is 33,113,200. The total recorded resources would warrant the installation of about 43,000,000 hp., according to the Department of the Interior, Canada.*

The distribution of water-power resources is given in the accompanying table. It shows they are well distributed from coast to coast and in transmission distance of the larger cities. The growth in installation has been rapid as shown by the following data on horsepower installed: 1900, 170,000; 1910, 975,000; 1914, 1,946,000; 1920, 2,508,000; 1927, 4,883,000. Many projects are in prospect and it is expected that a rapid growth will continue.

The central stations utilize 4,012,428 hp.; the pulp and paper mills, 526,731 hp., while electrochemical and miscellaneous installations total 344,107 hp. The installation aggregates 5.13 hp. per capita. In the central-station industry there are 308 stations. Of these, 218, with an installation of 2,759,729 hp., are private plants, and 90, with an installation of 1,252,699 hp., are operated by public bodies.

New equipment installed and ready for operation during 1927 totaled 221,655 hp.; other undertakings were advanced to such a stage that additional installation to the extent of 378,000 hp. will be in place by midsummer of 1928, bringing the total for Canada to well over the five million mark, or double the installation at the end of 1920. Other developments in progress or definitely planned are expected to add another 2,000,000 hp. by the end of 1930.

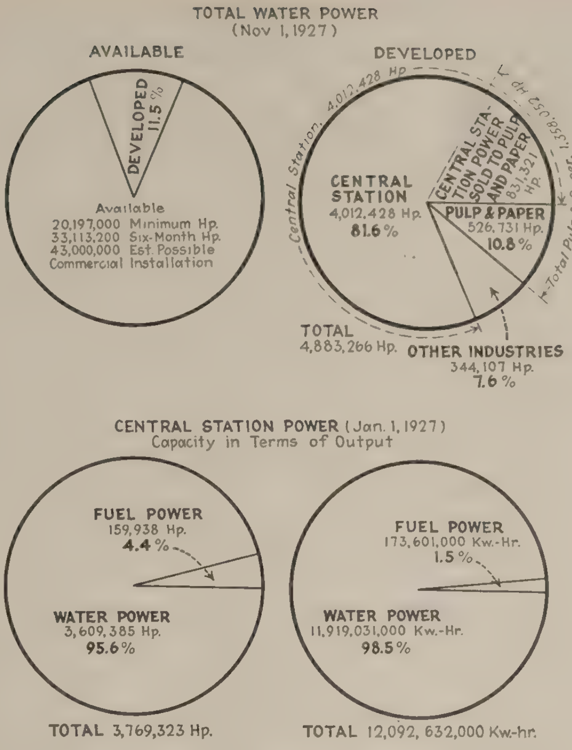


FIG. 3—UTILIZATION OF WATER-POWER RESOURCES OF CANADA

Of the total hydraulic installation 82 per cent is in central electric stations. This percentage has been steadily rising and there is every indication that the trend will continue.

Next to these in magnitude of hydraulic power use is the pulp and paper industry, which, however, is also a heavy user of purchased energy. This industry has a total of 526,731 hp. in connection with the mills themselves and purchases additional energy from central electric stations estimated to represent the use of more than 831,000 hp., giving a total utilization of 1,358,052 hp. of hydro power.

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*Abstract of report of Water-Resources Paper, No. 60, Department of the Interior, Canada.*

*Table II—Distribution of the Developed Water Power in Canada (Nov. 1, 1927)*

| Province | Turbine Installation in Horsepower: In Central Electric Stations | In Pulp and Paper Mills | In Other Industries | Total | Population June 1, 1927 | Total Installation Per 1,000 Population, Hp. | Available 24-Hour Power at 80 Per Cent Efficiency: At Ordinary Minimum Flow, Hp. | At Ordinary Six Months' Flow, Hp. | Turbine Installation, Hp. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| British Columbia | 330,679 | 80,500 | 61,883 | 473,062 | 575,000 | 822.0 | 1,931,000 | 5,103,500 | 473,062 |
| Alberta | 33,520 | ........... | 587 | 34,107 | 617,000 | 55.0 | 390,000 | 1,049,500 | 34,107 |
| Saskatchewan | ........... | ........... | 35 | 35 | 836,000 | 0.04 | 542,000 | 1,082,000 | 35 |
| Manitoba | 238,725 | ........... | 16,400 | 255,125 | 647,000 | 394.0 | 3,309,000 | 5,334,500 | 255,125 |
| Ontario | 1,544,766 | 174,548 | 107,774 | 1,827,088 | 3,187,000 | 573.0 | 5,330,000 | 6,940,000 | 1,827,088 |
| Quebec | 1,796,692 | 242,044 | 126,707 | 2,165,443 | 2,604,000 | 832.0 | 8,459,000 | 13,064,000 | 2,165,443 |
| New Brunswick | 25,825 | 13,003 | 8,403 | 47,231 | 411,000 | 115.0 | 87,000 | 120,800 | 47,231 |
| Nova Scotia | 31,942 | 16,636 | 17,124 | 65,702 | 543,000 | 121.0 | 20,800 | 128,300 | 65,702 |
| Prince Edward Island | 279 | ........... | 1,995 | 2,274 | 87,000 | 26.0 | 3,000 | 5,300 | 2,274 |
| Yukon and North West Territory | 10,000 | ........... | 3,199 | 13,199 | 12,000 | 1,100.0 | 125,200 | 275,300 | 13,199 |
| Canada | 4,012,428 | 526,731 | 344,107 | 4,883,266 | 9,519,000 | 513.0 | 20,197,000 | 33,113,200 | 4,883,266 |

Column 2 includes only hydro-electric stations which develop power for sale.

Column 3 includes only water power *actually developed* by pulp and paper companies. In addition to this total, pulp and paper companies purchase from the hydro-power central stations totaled in Column 2 horsepower estimated at about 831,000, making a total of about 1,358,000 hp. actually used in the manufacture of pulp and paper.

Column 4 includes only water power *actually developed* in connection with industries other than the central-station and pulp and paper industries. These industries also purchase blocks of power from the central stations which are totaled in Column 2.

Column 5 totals all turbines and waterwheels installed in Canada.

Column 6 lists the population as of June 1, 1927, according to estimates made by the Dominion Bureau of Statistics.

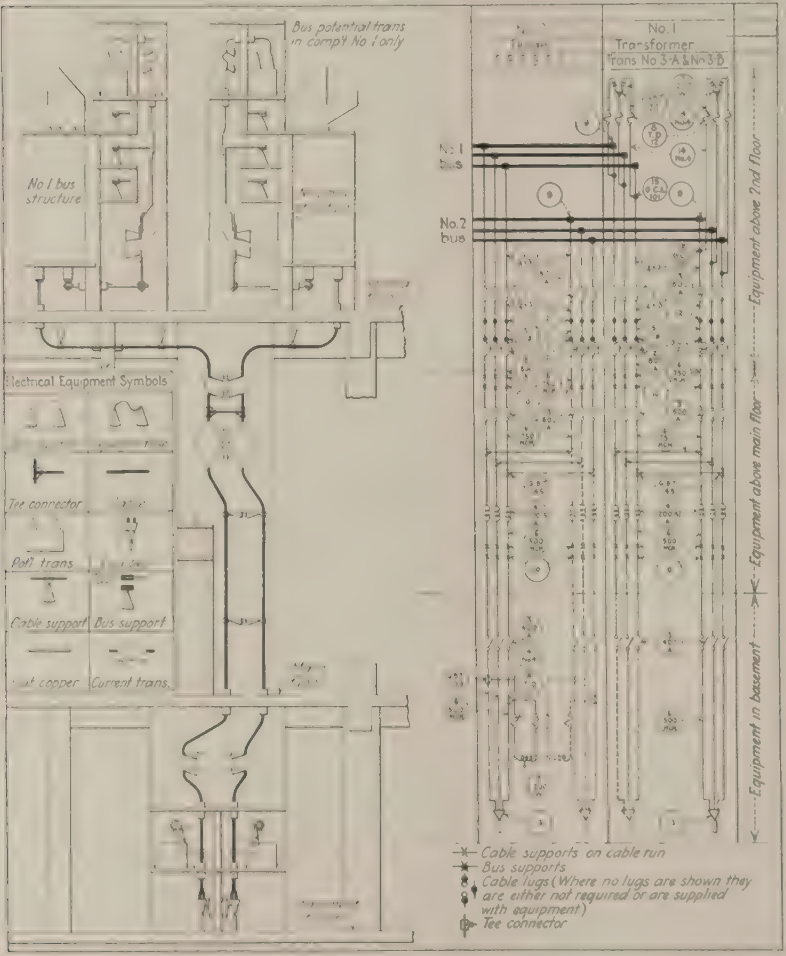
Column 7 averages the developed water power per 1,000 population.

# Switch-Structure Equipment Schedules

### A logically and carefully arranged system of preparing drawings saves time and results in more valuable records

By W. F. Sutherland
*Toronto Hydro-Electric System*

SHOWING of structural details and equipment ratings on the same drawing is open to objections from many standpoints: Confusion frequently results from the admixture of electrical and mechanical features, particularly when structures are built by contractors. Revisions are difficult. Complete information cannot always be provided, owing to insufficient space. After a few years, office records are apt to become obsolete and of little value for accurate reference as to constructional conditions in the station.


Bus potential trans in comp't No 1 only
No 1 bus structure
Electrical Equipment Symbols
Tee connector
Pot'l trans
Cable support
Bus support
copper
Current trans.
No.1 Transformer
Trans No 3-A & No 3-B
No 1 bus
No.2 bus
Equipment above 2nd floor
Equipment above main floor
Equipment in basement
Cable supports on cable run
Bus supports
Cable lugs (Where no lugs are shown they are either not required or are supplied with equipment)
Tee connector

*Figs. 1 and 2—Physical arrangement of equipment shown in separate drawings from circuits and apparatus ratings*

The physical arrangement only, and not equipment, size or capacity, is shown at the left. The size, capacity and kind of equipment, but not the physical arrangement, are shown at the right.

Special symbols have been used where necessary on this drawing to cover apparatus not usually shown on wiring diagrams; otherwise the notation is standard. Equipment is the same on all three phases unless otherwise shown. All equipment to be installed is shown in full. Reference numbers applying to equipment in this structure are shown in the upper half of each circle. Information regarding size or capacity of equipment is given in description column opposite corresponding number in table of Fig. 3 or in lower half of circle. Where nothing is stated in the "Required for Mounting" column, mounting equipment is either not required or is supplied with the apparatus. One set of lugs on each set of switches is to be painted the respective phase colors.

With the practice now followed by the Toronto Hydro-Electric System, a complete inventory of electrical equipment is always available, down to the nuts and bolts used for fixing the various component details. Records are always up to date. Drawings can be revised for the installation of an additional feeder in a few hours, instead of several days.

Three separate types of drawing are now issued: (a) Construction drawings for the building of structures; (b) diagrammatic equipment cross-sections; and (c) electrical equipment schedules.

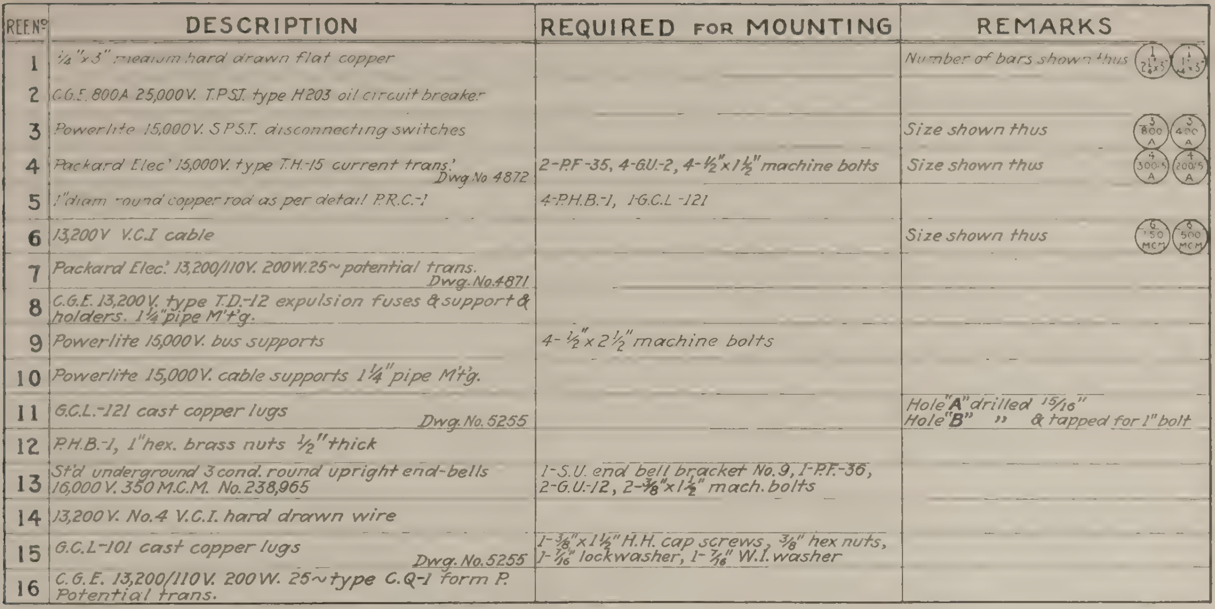
(a) The construction drawings for structures follow standard practice, generally speaking. All details and dimensions necessary for the building of the purely mechanical portions of the structures are given. Conduit is shown on these and the main ground buses are also called for, detail grounding being left to the man on the job, who follows standard practice.

(b) The diagrammatic equipment cross-sections (Fig. 1) show the structure to scale and also the electrical equipment, approximately to scale, in the location intended for it. A separate cross-section is drawn for each type of compartment, feeder, transformer or otherwise, where these differ markedly in detail, and where differences cannot be dealt with satisfactorily by notes. No dimensions are shown, nor is any information given concerning the size of apparatus or type. The drawing is merely a picture, nothing else.

Disconnecting switches, current transformers, etc., are indicated with as little detail as possible, and thus become symbols for the actual equipment. Owing to the absence of detail information, these equipment cross-sections are quite general in their application, and thus one cross-section may readily represent all the feeders in a station irrespective of size of cables, current transformers, or other details subject to variation.

Elevations of compartments have been found of little use, and, in general, have been omitted, the cross-section usually giving all information required for the arrangement of apparatus in the structures.

(c) The electrical equipment schedule (Figs. 2 and 3) is important, for on it is given all the information as to what compartments are equipped, the apparatus used and its capacity. The drawing showing actual circuits and equipment rating (Fig. 2) is ruled off in vertical divisions, each representing one complete compartment. The individual cell or compartment numbers, which also appear on the structure drawing, are given at the top of each compartment. Below these appear the types of service to which the compartments are allocated, and, in a third line, the equipment designations, feeder or transformer numbers appear. Horizontal lines divide the vertical divi-



| REF. N° | DESCRIPTION | REQUIRED FOR MOUNTING | REMARKS |
|---|---|---|---|
| 1 | ¼"x3" medium hard drawn flat copper | | Number of bars shown thus 1 2¼x3" 1 1¼x3" |
| 2 | C.G.E. 800A 25,000V. T.P.S.T. type H203 oil circuit breaker | | |
| 3 | Powerlite 15,000V. S.P.S.T. disconnecting switches | | Size shown thus 3 800 A 3 400 A |
| 4 | Packard Elec' 15,000V. type T.H.-15 current trans.' Dwg No 4872 | 2-P.F-35, 4-G.U.-2, 4-½"x1½" machine bolts | Size shown thus 4 300/5 A 4 200/5 A |
| 5 | 1" diam round copper rod as per detail P.R.C.-1 | 4-P.H.B.-1, 1-G.C.L-121 | |
| 6 | 13,200V V.C.I cable | | Size shown thus 6 750 MCM 6 500 MCM |
| 7 | Packard Elec.' 13,200/110V. 200W.25~ potential trans. Dwg. No.4871 | | |
| 8 | C.G.E. 13,200V. type T.D.-12 expulsion fuses & support & holders. 1¼" pipe M't'g. | | |
| 9 | Powerlite 15,000V. bus supports | 4-½"x2½" machine bolts | |
| 10 | Powerlite 15,000V. cable supports 1¼" pipe M't'g. | | |
| 11 | G.C.L.-121 cast copper lugs Dwg. No. 5255 | | Hole "A" drilled 15/16"<br>Hole "B" " & tapped for 1" bolt |
| 12 | P.H.B.-1, 1" hex. brass nuts ½" thick | | |
| 13 | St'd underground 3 cond. round upright end-bells 16,000 V. 350 M.C.M. No. 238,965 | 1-S.U. end bell bracket No. 9, 1-P.F.-36, 2-G.U.-12, 2-⅜"x1½" mach. bolts | |
| 14 | 13,200 V. No. 4 V.C.I. hard drawn wire | | |
| 15 | G.C.L-101 cast copper lugs Dwg. No. 5255 | 1-⅜"x1½" H.H. cap screws, ⅜" hex nuts, 1-7/16" lockwasher, 1-7/16" W.I. washer | |
| 16 | C.G.E. 13,200/110V. 200W. 25~ type C.Q-1 form P. Potential trans. | | |

FIG. 3—EQUIPMENT IN THIS FORM IS INCLUDED ON DRAWINGS LIKE FIG. 2

sions into sections corresponding to station floors. Three lines not shown in Fig. 2 are reserved at the bottom for further reference notes, the bottom one carrying a designating letter corresponding to the section designations..

A complete wiring diagram is drawn, showing all apparatus in one typical compartment of each kind, the others being left blank except for notes calling for equipment similar to the typical compartments. If a compartment has no equipment, it is, of course, left blank. Each item is given a designation seen in the upper halves of the circles; the lower halves are reserved for size, in the case of copper and cables, or capacity in amperes for disconnecting switches, etc. The designation refer to a table on the same drawing, but shown separately here, in which complete details, except for size or capacity, are given. Only capacities or sizes appear on the diagram in most cases, not in the table, thus avoiding a multiplicity of references.

As arranged, the schedule provides a means of recording all essential information in a most convenient form. It is a wiring diagram, a means for installing the equipment, and a permanent record of all that has been installed. The arrangement has proved most successful on the Toronto Hydro-Electric System both in office and field.

## Remote Starting of Fire Pump

By D. F. Richardson

*General Electric Company, New York City*

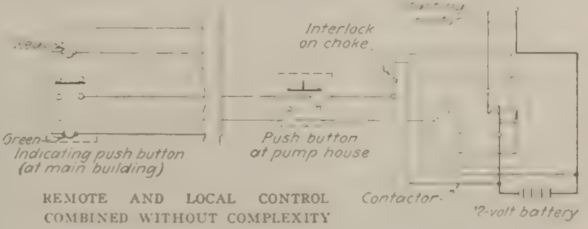
RECENTLY the owner of a large country estate installed a gasoline-engine-driven centrifugal pump in a pump house remote from his home for the purpose of fire protection. It was desired to provide a simple method of remote starting, parallel to the control in the pump house, by means of which the pump could be started in either place.

The engine is started by an electric motor, power for which is supplied by a 12-volt storage battery. A contactor was installed in the pump house and its pilot circuit was wired for push-button control from either the pump house or the owner's residence, with indicating lamps at the latter point. The 12-volt battery circuit is also used for the pilot circuit.

Pressing the button at either point energizes the holding coil in the contactor and closes the motor circuit, starting the motor. A second set of contacts mechanically connected to the contactor shaft closes simultaneously with the motor circuit contacts and thus maintains the circuit to the holding coil after the pilot circuit is opened upon removal of pressure on the push button.

As soon as the engine starts firing a plunger attached to a piston in a small cylinder rises by oil pressure. This opens the engine choke and also opens a contact in the holding coil circuit, breaking the motor circuit and thus disconnecting the starting motor. This is particularly necessary as the engine runs faster when firing than when driven by the starting motor. This plunger-operated contact, when once opened by the operation of the engine, also prevents restarting the motor when the engine is running.

A red indicating lamp at the residence control point is wired in parallel with the motor terminals, and indication is thus given by the lighting of this lamp when the motor is started, the lamp remaining lit as long as the motor is running. When the engine starts firing and the motor is de-energized the lamp, of course, goes out. A pressure switch in the discharge line of the pump closes when water pressure is built up, thus completing a circuit to a green lamp which lights and indicates that the pump is operating satisfactorily.


Interlock on choke
Green
Indicating push button (at main building)
Push button at pump house
Contactor
12-volt battery

REMOTE AND LOCAL CONTROL COMBINED WITHOUT COMPLEXITY

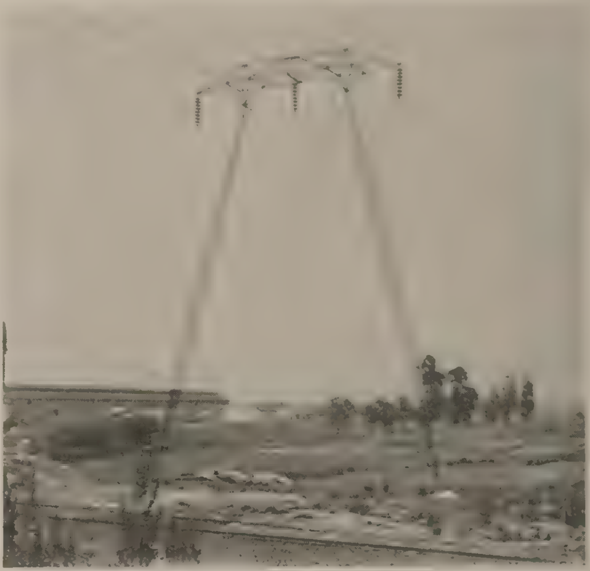
## Declares Selfishness Is an Evil of American Industry

SELFISHNESS is the greatest underlying evil that American industry is up against today and it is sapping the life out of practically all competitive lines, according to Charles J. Graham, president of the Bolt, Nut and Rivet Manufacturers' Association, Pittsburgh, in speaking before the Pennsylvania State Chamber of Commerce at Harrisburg, Pa., recently. In discussing the change in the bolt, nut and rivet industry, when from a high loss of $12,000,000 in 1924 the industry made a profit of approximately $6,000,000 per year in 1925, 1926 and 1927 on an invested capital of about $150,000,000, Mr. Graham said: "We found that we were conducting our individual companies on a basis that had lost all semblance of decency or fairness—fairness to ourselves, our competitors, our customers or to the world at large. We have entirely revolutionized our business methods. We have dug in deep and brought to the surface all of the evils we could find and have killed them one by one. We have developed a degree of unselfishness never before attained either in our industry or any other we know anything about.

"What has been the result other than a return in dollars? We can look the world in the face today with a degree of pride, our competitors are our friends rather than our enemies and we are conducting our business on a higher ethical plane than ever before and have created the same honest conduct in our business as heretofore ruled in our social lives. We have gone further than this. We have started a movement which we feel has solved the distribution problem in our own industry, and if the same plan is followed by all other industries it will be the greatest automatic stabilizer of business and labor conditions of anything heretofore attempted. Our distribution plan is very simple but very effective. We have been brought to realize the importance of the jobber in the proper and economical distribution of our merchandise.

"During the period of ruthless competition which culminated in our financial distress of 1924 we had ignored the existence of the jobber and became his chief competitor, thereby creating in him an enemy and becoming the chief aggressor in the rapid decline of our markets, brought about entirely by our lack of appreciation of his importance to us. This recent move of ours, in creating the proper channels of distribution of our products, is the greatest we have ever made in cost reduction. It will mean a marked reduction in our sales expense, and will also go completely through the organization, beginning where actual manufacturing stops—shipping expense, packing expense, clerk hire, accounting, stationery and office supplies—and such savings eventually will react to the benefit of the ultimate consumer."

## French Claim Many Advantages for New Towers



AN EXPERIMENTAL line has been placed in operation using articulated towers of unusual design, according to a correspondent in France. Among the advantages claimed are extreme lightness, greatly reduced foundation requirements, long spans, high resistance to transverse stresses, great adaptability to local conditions, unimpaired strength under conditions of conductor breakage and ensuing unbalanced forces and economies of construction and maintenance.

## Operators of These Stations Work Under Difficulties in Winter

(A) SLEET STORM GRIPS STATION OF THE CONSUMERS' POWER COMPANY. (B) HEAVY SNOWFALLS ADD TO THE BURDEN OF OPERATING MEN IN SUBSTATION OF THE BUFFALO, NIAGARA & EASTERN POWER COMPANY

# Holding Company Upheld*

### Parent organizations evolve naturally. Have made possible tremendous growth and immeasurable economies. Objections discussed

By Col. George T. Buckingham
*Vice-President Illinois Power & Light Corporation*

The term "holding company" is a very loose and ill-defined term. It describes a great number of different things. In its broad sense it is a corporation which holds the stock of another corporation. In that sense fully 20 per cent of all existing corporations are holding companies. Banks, trust companies, insurance companies, investment trusts, personal family corporations and the like are as numerous as the sands of the sea, and all of them are holding companies.

But the term has come to have more limited meaning in financial circles, where it indicates in a general way a "parent company," one that not only holds the stock of operating corporations but exercises some degree of supervision over their operations. In the year 1924 one-fifth of all corporate dividends paid out by corporations in the United States was paid to other corporations which were the stockholders. This would indicate that one out of five of all corporations is to some degree a "holding company."

#### Developed From Small Beginning

In December, 1926, the output of current was more than 7,000,000,000 kw.-hr. That was considerably more than the output for the entire year 1903. On statistics the size of the industry has been multiplied by twelve in twenty years. In 1903 and theretofore the electrical industry consisted for the most part of single plants operating in a single town. The plant was a small affair; 250 kw. was a good big unit of generation; 500 kw. was a big plant. That plant furnished what lighting was required for that small community. The radius over which it could distribute energy was a few miles. The cost of production in these primitive plants was such that it did not occur to anybody to use electric current for power.

But as years went by the art developed with a rapidity and momentum never before known. Larger generating units constantly became the standard installation, and corresponding improvements in transmission were perfected at the same time, so that now, in the most recent study made by the Bureau of Commerce in the New England district, it is reported that the most economical plant for producing electricity is a plant of 200,000 to 300,000 kw.-hr. capacity; that no single generator smaller than 20,000 kw. capacity can economically be installed, and that the high-tension trunk lines, which had jumped up from 8,000 to 16,000 to 32,000 to 64,000, should be of 132,000 voltage capacity. Even now throughout the Middle West electric energy is generated in these huge central plants and transmitted over spider web tentacles hundreds of miles in every direction, so that one single central plant serves, not only for lighting but also power, literally scores of communities. Now, this rapid development of the industry necessitated huge capital investments and great corporate organizations, and so throughout the years a number of operating electrical companies have steadily decreased by consolidations and the size of the operating corporations have steadily increased.

Obviously, the machinery set up for that control, methods of accounting, methods of appraisement, local laws, etc., of the various states are different, and therefore the tendency is that every operating corporation in the electrical field should operate in a single state. Not only that, but in some states, such as Illinois, utility properties cannot be operated except by an Illinois corporation. If, therefore, a Delaware or any other foreign corporation desired to own property and conduct operations in, say, Illinois, Missouri and Kansas, the naturally indicated program would be to set up a parent company, which holds the control of separate operating companies, one or more in each state.

By this natural process the holding company came into being, and it is these holding companies whose securities are distributed to the public, and in the ownership of which thousands of people participate. Having traced briefly the genesis and evolution of the holding company, we may also consider briefly some of the objections that are urged against them in some quarters and that are the basis of inquiry here and there, even in some high quarters.

#### Some Objections That Are Raised

The first of these is that these huge holding corporations are interlocked and either are or tend to a unified single monopoly. That objection has recently been dispelled by two successive reports of the Federal Trade Commission, which put in about two years investigating it at the request of the United States Senate. That report showed that the largest of all the holding groups, Electric Bond & Share, is in some way related to an aggregate output of 10 per cent of the total in the country. The next largest single aggregation, the Insull group, is 8.7 per cent of the total. The North American Company is next with 7.1 per cent of the total. There are many others, but none of them, not even the great Byllesby organization, exceeds 4 per cent of the total. So the Federal Trade Commission reported that there is nothing that approximates a monopoly and that no such thing is possible.

The next objection which has been urged, notably by Senator Walsh, is that the great holding companies have been selling to the public enormous quantities of their securities and that the amount of these new securities put out in the last few years has greatly exceeded the value of the actual improvements and extensions that have been made. A committee of lawyers recently sent out a questionnaire to all the great holding companies inquiring what securities they and their subsidiaries had outstanding in the hands of the public, eliminating, of course, intercompany holdings, and, on the other side of the ledger, upon what actual assets these securities were based. Now, have in mind that the securities which the holding companies hold are for the most part the stocks of operating companies. These can be issued and get into existence only when approved by the commissions of the various states, as based upon adequate actual assets. In other words, the assets of the holding companies on their books are more closely appraised and approved in point of valuation than those of any other holding companies in existence.

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*From an address before the Electric Association of Chicago.

The first 24 companies that reported these data (these were not selected but simply were the first ones that came in) were then tabulated. These 24 companies were representative and typical holding companies, representing in the aggregate 43.5 per cent of the whole output of the United States. The figures disclosed that in the years 1920 to 1926, inclusive, the ratio of actual investment assets to total outstanding capitalization varied from 110 per cent to 118 per cent. This is a showing which I believe cannot be duplicated by any group of holding companies in any other field.

Furthermore, there appeared before the Senate committee outstanding economists, state officials concerned with the administration of the state laws, officials of insurance companies and investment bankers. These people bore witness that, because of the rigid state regulation of the issuance of securities on the part of operating companies, the careful scrutiny and analysis that is given all these issues by the great banking houses, the tremendous publicity given to their operations, the securities of the great holding companies in the electric field are considered by investors to be at the very top in point of desirability and soundness. No security issue of any major holding company in the electric field has defaulted in years.

### Pyramiding of Control

Another objection that has been raised to the holding company is what Professor Ripley calls their "pyramiding of control." He says, in effect, that a holding company holds the controlling stock of a number of operating companies. The holding company itself has outstanding preferred stock which does not vote. Its common stock, or a majority of it, having voting rights, is held within the control of a small group of people, who are the leading spirits in the enterprise. This, he says, is wrong; that all stock, common or preferred, should have, but does not have, a vote; that it is a vicious thing for a comparatively small percentage of the stock to control a great corporation.

With the professor on this basic, economic question I take direct issue, both in fact and in theory. I affirm that his statement of fact is erroneous. In many of the leading holding companies, if not most of them, all shares of stock have a vote. Indeed, in some states, like Illinois, for instance, all shares must have a vote.

And I also affirm that in principle it is not of the slightest consequence whether all of the stock of a great holding company held by the public votes or whether it does not. The result is exactly the same. Swift & Company, by way of illustration, a great corporation not in the utility field, has only one class of stock and all of it votes. The Swift family has managed the corporation for many years and holds only a minor fraction of that stock. The stockholders, without exception, and practically unanimously, send their proxies to the managing people in favor of retaining the management in its place.

There are many other minor questions which have been raised as to the operation of holding companies. Time is too short to review them all. We have considered the major ones, but it is my belief that the great holding company of the present day is just as much a necessity of the modern industrial era as is the locomotive, the super-power house and the giant transmission line. These things all go together of economic necessity, and they all develop along parallel lines.

### Work of Promoters Not Typical

Parenthetically, it may be said that there are certain companies, evolved by promoters rather than by constructors, which fall outside these generalizations. There are sporadic instances of inflated capitalization in the public utility field, exactly as there are in other fields, but they are not typical, are not numerous and, in size, are relatively unimportant. What shortcomings and misdeeds are to be laid at their door are not fairly attributable to holding companies generally. Disregarding this very insignificant minority, the achievements and the benefits of the great holding companies in the electric field may be fairly summarized thus:

They have brought to every city, to most hamlets and within striking distance of most farms a reservoir of power—power which is the cornerstone of civilization—in quantity never before dreamed of.

They have made this power reliable and dependable, so that users everywhere, large and small, may with confidence base their operations on a constant, as well as a limitless, supply.

By the economies of financing, manufacture, organization and operation, inherent in their great operations, they have made power available to the user at low cost.

This is practically the only product, commodity or service now sold to the public at prices lower than pre-war and while all other prices have been upward.

By the wide sale and distribution of their securities they have brought millions of citizens into the ownership of the utilities which serve them. They have done more to "peopleize" industry and thus to combat socialism than all other agencies combined.

Their properties are owned by more people than any other group of properties in the world. Their securities have a record of safety of principal and continuity of interest and dividends not even approximated by the record of any other industry.

This, then, is a résumé, abbreviated and inadequate, of the record of the great holding companies in the public utility field. Collectively they may, without fear, challenge comparison with the record of any other group.

Their operations have been conducted in broad daylight, with the utmost publicity to their millions of customers and to their millions of security holders.

When the amazing history of the twentieth century comes to be written—the century of super-power—and of the prosperity that follows in its train, the achievements of the great holding companies and their developers will be remembered by the millions to whose well-being and prosperity they have contributed so materially.

# Appliance Repairs— A Profitable Utility Service

By H. W. Ewald
*General Sales Department Duquesne Light Company, Pittsburgh, Pa.*

BROKEN APPLIANCES in customers' homes bring no return to the central station and represent an investment loss on the part of the purchaser. By helping our customers to get their electrical devices repaired, we not only add load to our lines, but we increase the public's confidence in things electrical and pave the way for the selling of new appliances.

The Duquesne Light Company has a special department equipped for repairing all electrical appliances used in the home. Our customers are invited to leave their depreciated equipment at any one of our thirteen gas and electric shops. From these stores they are sent to the appliance repair department. It matters not where the device was originally purchased, we are glad to repair it, if it is worth fixing, and the cost of this service to the customers is very reasonable. We aim to give prompt service, and, in many cases, the appliances are repaired within twenty-four hours. It often happens that a device has to be taken apart before one can tell if it is worth repairing; if it is not, the customer is notified, as a rule by telephone. In this way, the customer can decide upon the desirability of extensive repairs or the purchase of a new appliance.

A merchandising truck is also operated for appliance selling, together with home service work. The men on this truck have been trained in our appliance repair department. They make minor repairs in the customer's home, free of charge. When more extensive repairs are required, they bring the apparatus into our shop and later return it to the customer ready for service.

Several years ago the policy of exchanging new iron cords for old ones, free of charge, was inaugurated. From that time until now, this service has grown steadily. We are replacing about 15,000 iron cords a year. No charge is made, except in those cases where the terminals of the cord are damaged. Many appliances are put on the shelf because the cords are damaged, but, as a rule, the customer thinks the fault is more serious.

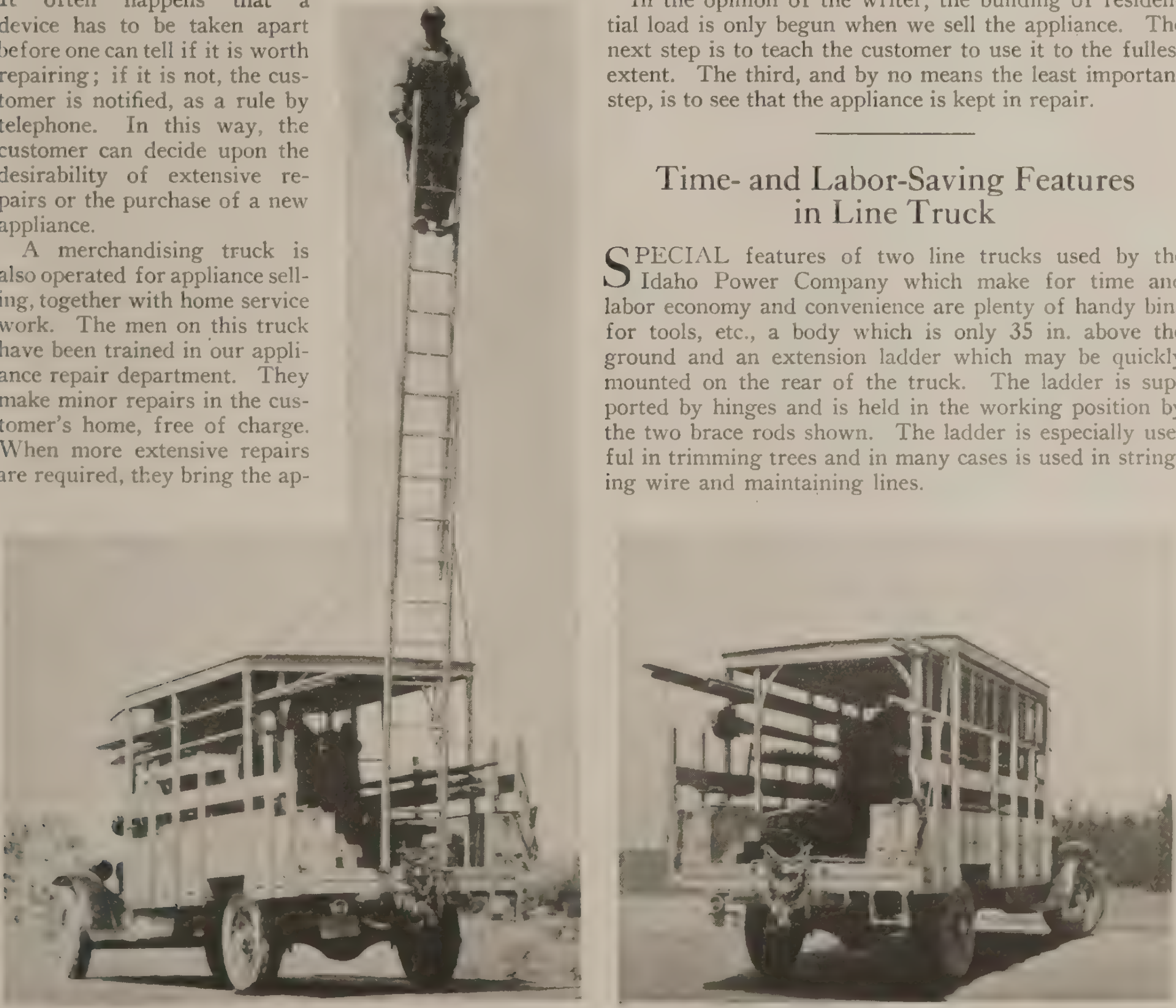
We have had special iron cord boxes manufactured for our free cord service. Attractive ads appear on the sides of the box telling the high points of this service. Rubber stamps are used to mark each box with the kind of cord that is inclosed in order to assure correct exchanges. Special gummed labels, carrying announcements of our repair service, are used to paste on the special boxes containing the repaired devices and greatly assist us in returning the appliances in good order.

The repair department also serves the function of a laboratory for testing new appliances put on the market from time to time. The shop is fully equipped with modern machinery and special tools, together with a personnel of experienced mechanics. A complete stock of parts for all makes of recognized standard appliances is kept on hand.

In the opinion of the writer, the building of residential load is only begun when we sell the appliance. The next step is to teach the customer to use it to the fullest extent. The third, and by no means the least important step, is to see that the appliance is kept in repair.

# Time- and Labor-Saving Features in Line Truck

SPECIAL features of two line trucks used by the Idaho Power Company which make for time and labor economy and convenience are plenty of handy bins for tools, etc., a body which is only 35 in. above the ground and an extension ladder which may be quickly mounted on the rear of the truck. The ladder is supported by hinges and is held in the working position by the two brace rods shown. The ladder is especially useful in trimming trees and in many cases is used in stringing wire and maintaining lines.



EXTENSION LADDER ADDS TO USEFULNESS OF LINE TRUCK

# A Banker's View of the Electric Refrigeration Industry

### Situation in the industry such there is little fear of competition. Financial backing for new enterprise would be extremely hard to obtain

By F. J. Fuller
*Vice-President Central Union Trust Company*

ELECTRIC refrigeration has been in the process of intensive development during the last five years and has met with all of the vicissitudes which a new industry should expect to encounter. Difficult patent situations have had to be worked out and in all probability additional adjustments and litigation of patent rights will be necessary in the future. Large capital expenditures have been made for plant facilities, equipment, inventory, experimental work and the establishment of sales organizations. This capital was, for the most part, obtained by the sale of stock to an enthusiastic public under very favorable market conditions. In some instances bonds and other fixed obligations were issued and a fairly wide distribution of the refrigerating-company securities was obtained.

As is usual in the case of a more or less novel product, the electric refrigerator has, in many directions, had a popular appeal, stimulated by costly advertising and other high-pressure methods of publicity. In the early stages of the development the demand outstripped the supply and many companies, lured by the possibilities of large profits, entered the field, each offering an article for which it claimed superiority by reason of improved patents, greater efficiency in operation, simplicity in construction, and so forth.

In the efforts to get into production on a large scale, many of the companies in the industry suffered severely from mistakes in engineering, errors in design and mechanical defects. Overhead in all departments increased enormously, economy in operation was lacking and, despite a large volume of business, the capital investment showed little, if any, return in far too many instances.

With the distribution of the product, servicing problems were encountered, and the result of hasty manufacture, both of machines and of boxes, began to tell. Dissatisfaction spread among the users of the machines and the good will of the companies was, to some extent, impaired. The resulting sales resistance can be successfully combated only if the manufacturer offers a "quality product," provides adequate servicing facilities and maintains a selling organization thoroughly equipped to educate an unconvinced but expectant public in the advantage, convenience and even the necessity of electric refrigeration.

The situation in the industry is so well and generally known that there should be little fear of competition from new enterprises for some time to come. Assuming that the inventor or promoter has the temerity to seek entrance into a field that is so thoroughly covered, he will, undoubtedly, find it quite impossible to obtain the requisite financial backing.

On the whole, the securities of the companies in the industry have proved a distinct disappointment, and substantial losses have been suffered by their holders, justifying the attitude of the investment banker and his public to look askance at the securities of new electric refrigerating companies, which have to go through the lengthy and discouraging processes of organization, experimentation and development with their attendant uncertainties and disappointments.

A great deal has been accomplished during the recent months toward the stabilization of the industry, but the field is highly competitive and few companies have the financial resources with which to carry out the program indicated. Satisfactory results will be slow in forthcoming, but an efficient and careful management, with adequate working capital, building cautiously from a solid foundation, with a view to development and expansion in a conservative way, can look with confidence to the future. It will virtually be a case of the survival of the fittest.

## *Five Recommendations Made to the Refrigeration Industry*

A REFRIGERATOR manufacturer believing that the industry will not prosper until something has been done to stabilize it offers the following five recommendations:

1. Some organization corresponding to the Society of Automotive Engineers (S.A.E.) is needed in order to stabilize and standardize engineering.

2. To stop constant bickerings between the major companies as regards infringement some solution along the line of cross-licensing of patents should be worked out.

3. There should be a curtailment of unwarranted advertising claims, which are detrimental to the industry as a whole.

4. Price cutting should be stopped and prices stabilized so that every one in the industry, who is entitled to do so, can get a fair return on the money invested.

5. The ethics to be followed by salesmen should be laid down by the executives of the company and "knocking" of a competitor's product should not be resorted to as often has been done in the past.

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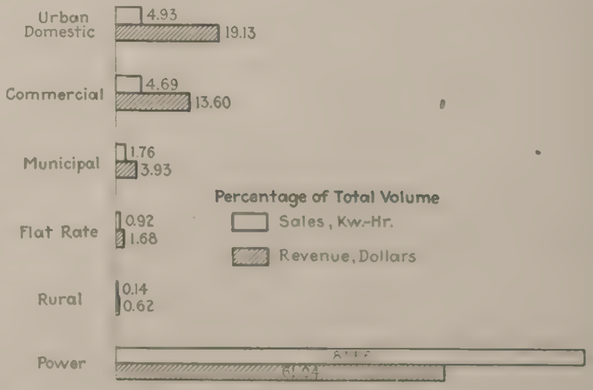
## Customer-Revenue Values Compared



AN ANALYSIS of customer classifications and resulting revenues has been prepared by E. H. Jenness of the Ohio Public Service Company, Elyria, Ohio. The records of this utility indicate that the factors are distributed as shown above.

# Southern Pine and Creosoting*

### Opinions of pole users. Data on cost of poles. Methods of inspection and purchase. Life of poles in Southern territories

By L. W. W. Morrow
*Managing Editor* Electrical World

IN A survey of opinions in all sections and after talking with both producers and users of creosoted poles the writer gained some general impressions and facts which are presented for constructive purposes. A very important part of the job involves the timber before treatment. Careful inspection in the woods should be followed by an immediate shipment to the storage yards or to the treating plant. The green timber decays rapidly if left lying on the ground or if subjected to moisture. Upon arrival at a treating plant the timber, if stored, should be watched carefully and treated when seasoned sufficiently. If proper precautions are taken in these matters, it makes little difference whether the timber is cut in winter or in summer. Winter-cut timber is less apt to be affected by decay or checking during the seasoning process, but it is difficult to peel the inner bark. Summer-cut timber peels readily but is more apt to weather check during seasoning.

If time is available for air seasoning, less creosote is needed in the treatment and therefore the product is more satisfactory from the standpoint of immediate use after treatment, because leaching is less. Buyers of poles, ties and structural timber, however, usually wish immediate deliveries, and the creosoting companies find it uneconomical to fill their yards with timber that may or may not satisfy the various purchasers' requirements. When air seasoning is complete, the creosoted treatment of 4 lb. per cubic foot must be given and the material then stored again in the yards until purchase is made, when a further treatment is necessary. This practice involves double handling and added costs. Thus the long time required for air seasoning places a time premium on using an immediate treatment of green timber. This requires about sixteen hours at a modern plant.

### Storage Prior to Shipping Reduces Leaching

Another aspect of the situation involves the practice of immediate shipment after treatment. The poles are covered with creosote oil and are subject to some surface leaching, and thus are inconvenient to handle, but if the treated poles are stored for a short time, practically all leaching ceases and dry and more conveniently handled material is available for use. Some telephone and railroad companies specify storage after treatment as part of their practice in using creosoted material.

Another element is that buying habits and market demands are not adjusted for best results. The pole producer is compelled to cut, treat and ship the poles quickly to meet a construction program that is almost contemporaneous with the purchasing program of the utility.

Personal observation leads to the belief that a better understanding of the creosoting business on the part of purchasers would help greatly in smoothing out the production programs of the creosoting companies and at the same time insure to the purchasers a uniformly good product.

Rigid inspections by utilities are difficult to institute in many cases and the best protection for small purchasers is to buy from creosoting companies of established reputation. Any creosoting company that expects to remain in business must develop a method of inspection and treatment that will insure the production of a uniformly good product.

### Service Experience and Opinions of Four Utilities

Service experience with creosoted timber may be had in many sections of this country, and a typical cross-section of comment is given in the following excerpts:

*Utility A.*—We have standardized on creosoted poles for all service from secondary distribution to 110-kv. transmission lines. The replacements are from 1½ to 2 per cent for the first six or seven years, after which they cease until about the fifteenth year, when some poles start to decay. The first replacements result from the use of poor timber or from improper treatments. The life of a good and properly treated pole we find is from 25 to 30 years. Our linemen have no criticism of these poles as regards working on them.

*Utility B.*—We are using creosoted poles entirely now and have over 40,000 of these poles on our system. We find creosoted poles very satisfactory and their life is at least twenty years. In very hot weather the linemen take some precautions in working on these poles because of their conductivity. The men who object to working on the poles at first are linemen from the North or East who have had no experience with creosoted timber.

*Utility C.*—As a result of various investigations we have standardized on the use of creosoted poles. These are purchased on strict specifications so far as mechanical defects are concerned. They must be thoroughly seasoned and then are given a 10-lb. treatment. This treatment penetrates to a depth of from 3 to 4 in. from the surface. Our poles with this treatment give an average life of about 25 years.

*Utility D.*—The use of creosoted poles on a 44-kv. line on this system dates back to 1907. These poles are now standard with us on all 44-kv. and 110-kv. lines and have been recently adopted for 2,300-volt lines and secondary distribution in towns and cities. We have had time to form a true estimate of the two elements often mentioned as disadvantages of creosoted poles—

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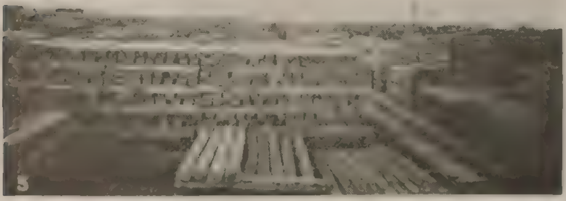
**Conclusion of article started in Feb. 18 issue.*



*Handling, framing, inspecting and seasoning of poles preparatory to treatment*

1. Incoming poles being unloaded in the yards of one large creosoting company
2. Framing and inspecting poles in the yard before treatment.
3. Trams loaded with poles and entering the treating retort.
4. Poles stored in the yards for air seasoning.
5. Ties stored in the yards for air seasoning.

TABLE I—NUMBER, UNIT COST AND LIFE OF POLES IN SOUTHEASTERN AREA*

| Kind of Pole | Number | Unit Cost in Yard | Unit Cost in Place | Life in Years | Treatment |
|---|---|---|---|---|---|
| Chestnut........... | 207,253 | $6.64 | $11.20 | 9 | Practically none, a few brushed carbolineum |
| Cypress............ | 35,700 | 8.20 | 11.20 | 12 | Practically none, a few brushed carbolineum |
| Western red cedar... | 16,033 | 17.60 | 21.10 | 11½ | ⅜-in. and ½-in. Pentrex |
| Native red cedar.... | 14,673 | 11.40 | 16.20 | 21½ | None |
| Creosoted pine...... | 143,171 | 14.92 | 20.30 | 23 | 8, 10, 12-lb. empty cell and 10, 12-lb. full cell |
| Juniper............ | 46,282 | 6.83 | 10.96 | 9 | None, a few brushed carbolineum |

* Southeastern Section N.E.L.A. overhead systems committee, Memphis, 1927.

TABLE II—RANGE IN POLE PRICES OF SIX KINDS OF POLES USED IN THE SOUTH*

| Kind of Pole | Price, f.o.b. Yard Low | Price, f.o.b. Yard High | Price, f.o.b. Yard Average | Price in Place Low | Price in Place High | Price in Place Average | Cost of Installation, Average |
|---|---|---|---|---|---|---|---|
| Chestnut....... | $4.25 | $12.75 | $6.64 | $7.00 | $14.75 | $11.20 | $4.56 |
| Cypress........ | 5.00 | 17.00 | 8.20 | 7.00 | 18.00 | 11.20 | 3.00 |
| Western red cedar........ | 13.85 | 25.00 | 17.60 | 19.10 | 35.00 | 21.10 | 3.50 |
| Native red cedar | 7.50 | 15.30 | 11.40 | 12.50 | 19.90 | 16.20 | 4.80 |
| Creosoted pine.. | 11.00 | 25.00 | 14.92 | 14.87 | 32.50 | 20.30 | 5.38 |
| Juniper........ | 5.00 | 8.00 | 6.83 | 9.15 | 12.95 | 10.96 | 4.13 |

* Overhead systems committee, Southeastern Section, N.E.L.A., 1927

TABLE III—LIFE OF SAME KIND OF POLES IN THE SOUTHEAST*

| Kind of Pole | Minimum Age, Years | Maximum Age, Years | Average Age, Years | Treatment |
|---|---|---|---|---|
| Chestnut........... | 3 | 15 | 9 | None |
| Cypress............ | 6 | 20 | 12 | None |
| Western red cedar... | 8 | 20 | 11½ | Butt |
| Native red cedar..... | 18 | 25 | 21½ | None |
| Creosoted pine...... | 17 | 40 | 23 | 8, 10-lb. empty cell |
| Juniper............ | 7 | 10 | 9 | None |

*Overhead systems committee, Southeastern Section, N.E.L.A., 1927

that is, conductivity and leaching. These factors receive practically no consideration now and are regarded as of very minor importance compared with the advantages resulting from the use of creosoted poles. We use a 10-lb. treatment.

Many other utilities, railroad and telephone companies can be quoted in about the same words and these purchasers continue to use and to buy creosoted products. Their major consideration has been the purchase of poles that satisfy service conditions, delivery conditions and that are available on a competitive basis in the pole market.

### N.E.L.A. Committee Reports Practices of Twenty Southeast Companies

In a recent survey of the overhead systems committee of the Southeastern Section of the N.E.L.A. some interesting data on the use of poles in that region were compiled. These data are given in Table I. It may be noted that of the 463,112 poles reported in this 1927 report the following percentages exist:

| | |
|---|---|
| Chestnut, 45. | Native red cedar, 3.1. |
| Cypress, 7.7. | Creosoted pine, 31.0. |
| Western red cedar, 3.4. | Juniper, 9.8. |

Of the twenty utilities reporting, twelve used chestnut poles, eight cypress, two native red cedar, nine Western red cedar, fifteen creosoted pine and three juniper. The utilities which used chestnut poles were in the mountain section of the region and those using cypress poles were in the tidewater region. The native timber is thus used in local markets. Several companies in the territory which is covered by the Southeastern Section of the N.E.L.A. have discontinued the use of chestnut and Western red cedar poles for no announced reason and there is a marked trend toward a greater use of creosoted pine poles because of long life and great strength.

In Table I the average cost was based on a 35-ft. pole with 7-in. top, but the range in prices as given by the utilities show data which give an interesting bearing on commercial conditions in the pole industry in the South. These data are given in Table II. The life of poles depends upon many factors, but Table III gives the data on Southern utility experiences as compiled by the overhead systems committee of the Southeastern Section of N.E.L.A. The native red cedar shows a remarkable life span. Data of a complete character are still meager on pole life, so that generalizations are unsafe.

### Compares Cost and Life of Different Classes of Poles

An interesting comparison of pole cost and life of pole was made by the committee. The poles chosen were 35 ft. with 7-in. top made of juniper, Western red cedar and creosoted pine. Costs were computed at the end of twenty years and at the end of 40 years and the assumption was made of 40 years of life for creosoted pine. These cost data are as follows:

TABLE IV—COST OF JUNIPER, WESTERN RED CEDAR AND CREOSOTED PINE POLES AT END OF TWENTY YEARS

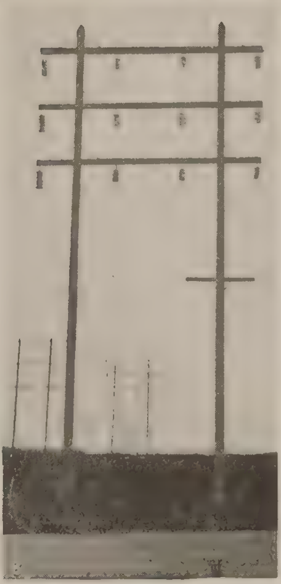
| | Juniper | Western Red Cedar | Creosoted Pine |
|---|---|---|---|
| First cost | $13.88 | $19.07 | $18.04 |
| Replacement at end of life | 13.88 | ...... | ...... |
| Transferring | 2.00 | .... | .. |
| Total | $29.76 | $19.07 | $18.04 |
| Annual cost at end of twenty years | 1.49 | 0.95 | 0.91 |

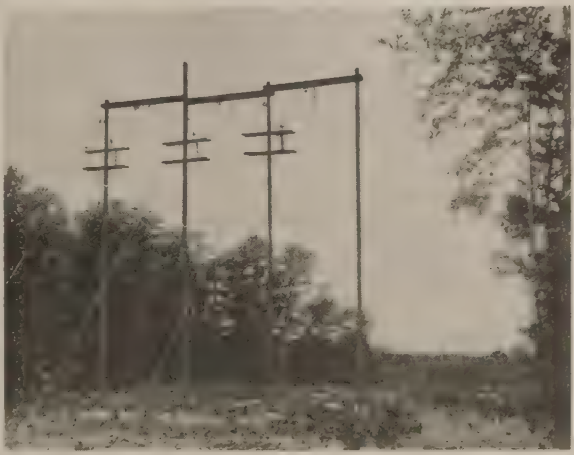
TABLE V—COST OF THE SAME KIND OF POLES AT END OF FORTY YEARS

| | Juniper | Western Red Cedar | Creosoted Pine |
|---|---|---|---|
| First cost | $13.88 | $19.07 | $18.04 |
| Replacement cost | 47.64 | 21.07 | ...... |
| Total | $61.52 | $40.14 | $18.04 |
| Annual cost at end of 40 years | 1.54 | 1.00 | 0.45 |
| Per cent | 2.42 | 1.22 | ...... |
| Force to break pole, lb | 1,140 | 1,420 | 2,200 |

The consensus of opinion favors the use of No. 1 domestic oil for creosoting, using the A. T. & T. empty cell specifications with 8 or 10 lb. treatments. No very accurate records are kept on life of poles and effects of treatment, but the trend is to discontinue butt treatment toward the full creosoted treatment.

The use of creosoted products is increasing rapidly, and the woods operations and treatment processes have been perfected by reputable companies. There is no doubt this strong, long-life material will continue to hold an important place in the timber market and will afford utilities a source of supply for poles, ties and structural timber. Many reports on service experience with creosoted poles where the poles have been handled properly from woods to consumer show that failures in service are negligible and that a long life can be obtained. The creosoted pole purchased in an intelligent manner is a pole that may be relied upon by the industry.





*Three types of Southern lines using creosoted Southern pine poles*

6. Ties loaded on freight cars ready for delivery to the treating retorts.
7. A 66-kv. line using creosoted poles. Southwestern Gas & Electric Company.
8. A four-circuit, 66-kv. line using creosoted poles and crossing swampy territory.
9. Unusual construction of a 66-kv. line using creosoted poles for supporting the conductors.

# Analyzing Economies of Purchased Power

### Study of power requirements of expanding industrial plant shows that it is cheaper to buy power than to make it

By H. C. Thuerk
*Manager Erie Lighting Company, Erie, Pa.*

> *When several methods of doing a job are available, there is no more reliable way of determining which is the most economical than to establish a balance sheet on which advantages and disadvantages of each procedure can be listed and evaluated. The accompanying article illustrates an analysis which one industrial concern made to determine whether to purchase power or generate it. When all fixed and operating charges are included there will be little opportunity for differences in conclusions unless choice of unit figures or evaluation of intangibles are questioned.*—Editor.

In the early part of 1926 it became necessary, on account of an increased demand for its product, for one of the primary power customers of the Penn Public System to erect new factory buildings. This company manufactures a specialty product and employs a considerable number of automatic machines in its manufacturing process. All of the heat-treating necessary is accomplished in six electrically heated furnaces. No process steam is required in the manufacturing process, the only requirement for steam being for heating in the winter time.

An investigation was made at this particular time to determine if any savings could be made by installing a small power plant and generating power instead of purchasing it as was being done at the time. A preliminary investigation showed that it was not practicable to consider the installation of a steam-engine-driven plant. The consideration finally narrowed down to either the continuation of purchased power or the installation of a Diesel engine-generating plant.

The power requirements during the first six months of 1926 are given in the table below.

On the basis of power requirements for the first half of 1926 it was decided that the present load should be considered as having a demand of 150 kw. and a monthly consumption of 40,000 kw.-hr. It was estimated that when the industry moved into its new buildings the average monthly consumption should be 80,000 kw.-hr., with a maximum demand of 225 kw. The power factor was assumed to be 90 per cent, as a considerable portion of the load consisted of electric heat-treating furnaces, which operated at a very high power factor.

It was agreed that the proposed Diesel engine plant should consist of two units, each unit to consist of one 350-hp. engine direct connected to a 225-kva., 230-volt, three-phase, 60-cycle alternator. The estimated cost of the proposed plant is given in the accompanying table.

In the first item of the table it is assumed that this includes the erection of the engines and the services of an erecting engineer. It also includes a complete switchboard for the two units and all other auxiliaries not mentioned elsewhere in the estimate. It will be noted that the table does not include the cost of the building to house the power plant, nor the rental value of space which might be occupied by the plant in one of the new buildings. No allowance was made for the installation of a crane or hoist for facilitating repairs or for possible alterations to one of the new buildings to accommodate the proposed engines. It will be seen that the cost of the proposed plant was approximately $133 per kilovolt-ampere, which represents a conservative estimate for a plant of this size.

### Fuel and Lubricating Oil Costs

In determining the fuel and lubricating oil consumption and maintenance costs for the proposed plant reference was made to the operating data of a large number of Diesel engine plants. This substantiating data appeared in the Electrical World of March 5, 1927, under the title "What Are Diesel Engine Power Costs?" Since the results of 58 Diesel engine plants were tabulated in this article, it was felt that these operating data were fairly reliable.

A fuel consumption of 0.75 lb. per kilowatt-hour generated was used in determining the fuel cost of the proposed plant. With fuel oil weighing 7½ lb. per gallon, this represents a performance of 10 kw.-hr. per gallon of fuel. The management of the company based the cost of fuel oil at 8 cents per gallon delivered in tanks at the power plant. Lubricating oil consumption was taken at 800 kw.-hr. per gallon, at an average cost of 60 cents per gallon.

### Repairs and Maintenance

Maintenance was taken at 2¼ mills per kilowatt-hour generated. This includes both labor and material. The item of maintenance is one which varies widely, depending upon a number of factors. It is only by taking an average value of a number of plants which have been in actual operation for some time that it is possible to obtain an estimate that will be reliable.

### Attendance Labor

The management of the company decided that one-half of one man's time at 70 cents per hour should be charged against the operation of the oil engine plant. There was some question as to whether a competent

POWER REQUIREMENTS DURING FIRST SIX MONTHS OF 1926

| Month | Kilowatt Demand | Kilowatt-Hours |
|---|---|---|
| January | 160 | 38,000 |
| February | 152 | 38,400 |
| March | 152 | 40,400 |
| April | 144 | 38,000 |
| May | 152 | 28,800 |
| June | 136 | 24,800 |

ESTIMATED COST OF PROPOSED GENERATING PLANT

| | |
|---|---|
| Engines and alternators, including erecting | $50,000 |
| Freight—300,000 lb. at 16½ cents per 100 lb. | 495 |
| Haulage at $3 per ton | 450 |
| Foundations—100 cu.yd. per unit at $12 | 2,400 |
| Fuel oil storage tanks and piping | 2,000 |
| Auxiliaries, including air compressor, oil pump, etc | 2,000 |
| Engineering, supervision, inspection and contingencies at 5 per cent. | 2,800 |
| | $60,145 |

operator could be obtained at this figure, but it was finally decided to use this amount in determining the power costs.

The power taken by the auxiliary equipment in the plant would probably approximate between 3 and 5 per cent of the gross generated kilowatt-hours. It was assumed that the losses in transformers when power is purchased would just about compensate for the power used by the auxiliaries. It was estimated that for cooling water 1 cu.ft. per kilowatt-hour would be required.

Fixed charges, which included interest, depreciation, taxes and insurance, were taken at 15 per cent. In the comparison of power costs it was pointed out that one manufacturer of oil engines places depreciation alone at 8 per cent, and that the Inland Revenue Authorities in England increased the depreciation from 5 to 10 per cent in 1927 on Diesel engine plants after such a request had been made by the Diesel Engine Users' Association of that country.

### Comparison of Total Costs

Having decided upon the various quantities to be used in the cost computation, a table showing power costs under existing and future load conditions was prepared.

The total annual cost of purchased power for the present load was $10,231.44, or an average cost of 2.13 cents per kilowatt-hour. This represents an annual saving through the purchase of power of $5,458. This cost was based on the use of the regular industrial power schedule of the Penn Public System.

Under future load conditions it would be possible to make use of a combination of the regular power rate and the off-peak power rate. The total annual cost of purchased power for future load conditions would be $16,233.60, or an average cost of 1.69 cents per kilowatt-hour. The total annual saving of purchased power under future load conditions would be $5,096.

The investment cost necessary in transformer equipment for purchasing future power requirements was approximately $2,000. At 15 per cent the annual fixed charges on this equipment would be $300. Deducting this from $5,096 gives a net annual saving of $4,796.

COST OF GENERATING POWER FOR PRESENT AND FUTURE LOADS

| | Present Load | Future Load |
|---|---|---|
| Fixed charge—15 per cent of $60,000 | $9,000.00 | $9,000.00 |
| Fuel at $0.08 per gallon | 3,840.00 | 7,680.00 |
| Lubricants at $0.60 per gallon | 360.00 | 720.00 |
| Repairs and maintenance at $0.00225 per kilowatt-hour | 1,080.00 | 2,160.00 |
| Cooling water at $0.10 per thousand gallons | 360.00 | 720.00 |
| Attendance labor | 1,050.00 | 1,050.00 |
| Total | $15,690.00 | $21,330.00 |
| Annual kilowatt-hours | 480,000 | 960,000 |
| Cost per kilowatt-hour | $0.0327 | $0.0222 |

In the cost comparison no mention was made of the costs for supervision. The operation of a 700-hp. Diesel engine plant would require a certain amount of some executive's time. A conservative value of the item of superintendence in this case would be $500 per year. It was pointed out that in considering the cost of operating an oil engine plant it should be remembered that there has been a decided upward trend in the price of fuel oil. This was shown in charts giving the posted prices of crude oil at the wells.

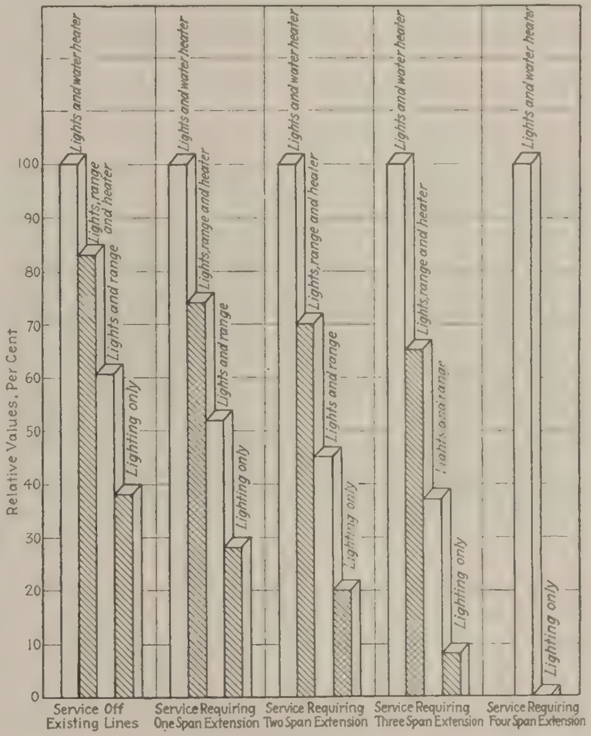
As a result of the investigation and comparison of costs, it was decided to purchase power and new contracts were accordingly signed.

# Relative Values of Different Classes of Residential Service

By D. F. McCurrach
*Rate Engineer Northwestern Electric Company, Portland, Ore.*

IN ORDER that salesmen and solicitors of residence business might be informed as to the relative values of different classes of residential business and also advised as to the decrease in value of business due to line extensions required, as compared with the same service rendered from existing distribution facilities, the Northwestern Electric Company, Portland, Ore., prepared the accompanying chart.

In order not to complicate the matter with allocation of power plant, transmission line, substation and distribution system investment, which, notwithstanding the number of theories advocated, must of necessity be arbitrary, the investment in the service, transformers, meters and the additional span costs alone were considered. The fixed charges on this investment were assumed at 15 per cent and the operating costs, such as cost of energy, operation and maintenance of meters, services, ranges, etc., commercial expenses and miscellaneous expenses, were assigned on the basis of average unit costs maintained by this company. On this basis a net revenue was obtained by deducting these costs from the gross revenue to be obtained by application of existing tariff rates. The ratio of net revenue to cost of extension was then obtained and each ratio expressed as a function of the most favorable condition, namely, that resulting from the greatest utilization of service from the existing distribution system, which has been plotted as 100 per cent value.



CONSUMER-VALUE CLASSIFICATION FOR RESIDENTIAL DISTRICTS UNDER SIMILAR CONDITIONS OF SERVICE

The chart is self-explanatory and shows comparative relative values for the classes of service shown. It is believed that this method, while probably not perfect, is a considerable guide and help to salesmen in visualizing the situation and realizing the importance of increasing the load of existing customers on existing lines, as contrasted with soliciting business that requires considerable distribution extension for small loads, the effect of which must of necessity have a material adverse effect on the net income.

## Bus Used for Appliance Demonstrations

THE Pennsylvania Edison Company is using a city type bus with seats removed to show the public the latest labor-saving household devices operated by electricity. The company does not solicit sales, but demonstrates the various machines on display. A desire is created in the minds of the visitors for a waffle iron, dishwasher or other appliance and a broader market for electric energy is produced. No prices are mentioned unless a direct request is made regarding a certain machine. In other words, the whole idea is to educate the public in the use of electricity and therefore increase the consumption of electric energy.

*Motor bus becomes an itinerant showroom*

An 8-gal. capacity tank underneath the vehicle supplies water for demonstrating the dish-washing and clothes-washing machines as well as an electric pump which is used to force the water into these machines from the tank. Among the various items exhibited in the bus are washing machines, an electric dishwasher, an automatic water heater, an electric range, and electric refrigerator, fans, waffle irons, percolators, small heaters, vacuum cleaners, and a sewing machine.

Power for the operation of the various appliances in the bus is taken from the company's service lines near the spot where the traveling exhibit is parked. A transformer has been installed on the back of the bus to take care of the energy requirements. When the bus is moving the lights use 12 volts direct current from the engine. When the exhibit is parked in a residential community power is supplied from the service line and the lighting supply is stepped down to 12-volt alternating current through a special transformer. The truck is a standard city type bus, six-cylinder model, a product of the Mack-International Motor Truck Corporation, altered by the addition of more lights, a water tank and a few power sockets. This traveling electrical exhibit before it gets back home this spring will have covered many communities in New Jersey, eastern Pennsylvania, southern New York and towns along the Atlantic seaboard.

# Letters from Our Readers

### *What Can Be Done for the Budding Engineer?*

*To the Editor of the* ELECTRICAL WORLD:

It is generally recognized that the successful professional engineer must have a fundamental engineering background, possess self-confidence, vision and the ability to write and speak forcible and convincing English, and exercise reasonableness in his dealings with subordinates.

What about the adolescent engineer, who has obtained the engineering fundamentals and knowledge of English in our colleges, but who has had no opportunity to realize that self-confidence, vision and reasonableness are essential in business? These aptitudes are not given in the college curricula, hence they must be obtained in the industry if we are to bring forward our future executive engineers.

Manifestly vision covers length and breadth of view, also correction of perspective. Length of view enables the engineer to judge the trend of events so that he may allow for the future. Breadth of view allows him to consider the problem from all angles. Correction of perspective permits its possessor liberty from prejudice and prevents him from enlarging on small matters, as well as making him think that the improbable is impossible. Correction of perspective makes him lean toward allotting his detail work to specialists, thus leaving the executive free to direct. These ideas may be given to the junior engineer in the form of guidance.

Self-confidence should not be confused with positiveness, for they are clothed much the same, but produce entirely different results. The self-confident man can be relied upon to have a large percentage of success in his problems and studies. In considering his few failures he has learned to investigate before making a decision, also to evaluate all factors concerning the problem and to distinguish the imperative from the nonessential, which he neglects. He realizes that when the job has been started it must continue, and that an alternative plan must not be considered unless pressure is brought to bear due to unforeseen obstacles. Before considering a job complete he reviews it, thus weighing his various ideas and factors governing its progress, and then ratifies or confirms them according to their relative importance. Accordingly, he knows how to attack a problem when it presents itself for solution and can therefore expect a reasonable amount of success.

But how can self-confidence be conveyed to the adolescent engineer? By a sympathetic superior. What more will retard self-confidence in the junior than to have his plans and ideas continually criticised and reected? It is, then, important, though often difficult, for the superior to conceive the idea that there are many logical ways of attacking a problem; further, he may be getting somewhat set in his methods and does not see that the original plan submitted by the junior may, once slightly reclothed, be better than his own. Considering the furtherance of self-confidence, it is often advisable to pass a reasonably good plan presented and let it be carried out, even when you know a better way. It is useful, though not flattering to your vanity, to guide the subordinate carefully until he suggests, as he thinks on his own initiative, the plan you desire to have followed.

M. D. S.

# Digest of Electrical Literature

## *Generation, Control, Switching and Protection*

*The Parallel Operation of Generating Stations.*—J. Defreyn.—The author has illustrated, by means of vector diagrams and charts indicating system and station operating conditions, a means of independent voltage regulation using the power factor. The problem of voltage regulation is stated to have been successfully solved in several ways, one consisting of the introduction into the circuit of an additional electromotive force which compensates either for the drop in pressure alone or also for the poor power factor resulting from the distribution of energy in the transmission lines and in the apparatus comprising the load. Such a result is obtained by means of the compounding of voltage regulators or by multi-tap transformers, boosting transformers, induction regulators or by rotary boosters. The placing of synchronous condensers in part of the networks is a common method of utilizing the second principle.—*Brown Boveri Review* (*Switzerland*), February, 1928.

*Electrical Engineering in 1927.*—A review of the developments in contemporary electrical engineering practice, including a reference to design improvements in iron-clad switchgear. It is stated in this review that outdoor iron-clad switchgear may now be obtained in England for potentials up to 220 kv. New designs combine the principles of compound-filled gear with the ordinary cubicle type layout, a device which is said to enable the engineers to inspect the isolating switch contacts and their operation, while at the same time each piece of apparatus is essentially iron-clad without intervening bare connections. The equipment is suitable for indoor or outdoor use and permits phase separation. Circuit breakers having a rupturing capacity of 1,500,000 kva. are now available in British manufacture.—*Engineer* (*England*), Jan. 13, 1928.

## *Transmission, Substations and Distribution*

*Arcing Tests on Cables.*—D. I. Fuchs-Kaufmann.—Wind or the sudden shedding of sleet may cause cables of an overhead transmission line to clash, causing destructive arcing. The authors investigated the durability of various types of cables when subjected to heavy arcs. A certain length of each cable tested was stretched out with a tension comparable to standard line practice. A copper block was fastened $\frac{1}{8}$ in. away from the cable and a single-phase short-circuit arc from a 750-kva. generator, corresponding to 350 amp. at 2,500 volts, was established between the copper block and the cable. Stop-watch timing was used from the instant of closing the breaker to the rupture of the cable due to melting. Two series of tests were made, with: (1) one end of the cable connected to the generator, and (2) both ends of the cable connected to the generator; the first series to resemble a single-way transmission line, the second series to imitate a ring or tie-line. Fifteen types of cables were tested, representing solid copper, solid aluminum, combination aluminum and steel, and hollow cables. Solid copper cables withstood longest, with copper alloy cables in second place, combination cables in third place and aluminum cables in the last place. Hollow cables lasted longer than equivalent solid cables. — *Elektrotechnische Zeitschrift*, Jan. 26, 1928.

*Overhead Transmission.*—G. R. Falkiner Nuttall.—A general consideration of the various factors utilized in the specification and design of overhead transmission lines. Among the factors considered are steel-core aluminum cables, progress in insulator design, reinforced concrete and galvanized steel structures, the determination of clearances, the spacing of conductors, the method of erection, and excavating practices. A tabulated record of contemporary transmission line practices in the United States is offered in connection with the discussion. The result of investigations upon the characteristics of porcelain in tension and a comparative estimate of the value of the several means of supporting the line are offered. —*Electrician* (*England*), Jan. 27, 1928.

## *Units, Measurements and Instruments*

*Daylight Recording by Means of the Photo-Electric Cell.*—L. R. Koller.—The recording of daylight intensity is another application of the photo-electric cell. This device, coupled to a suitable automatic recording instrument, offers a simple arrangement providing a means of great possibilities for investigating daylight conditions. The limitations of the usual photometer render the use of the photo-electric device of particular interest. — *General Electric Review*, February, 1928.

*Harmonic Analyzer for Use on Power Circuits.*—Rapid advances and refinements in the science of inductive co-ordination have made imperative the securing of accurate information concerning wave forms in both communication circuits and power circuits. An instrument which meets the requirements of portability and ease of operation without excessive cost has been developed, and while it is not offered as a perfect device it is believed that refinements have proceeded to a point where reasonably satisfactory results may be obtained. The analyzer consists essentially of a voltmeter capable of measuring the magnitude of any single-frequency voltage in the range of 60 to 3,000 cycles. Analyses of current are made by measuring the voltage drop across a resistance or inductive shunt. The sensitivity for current measurements may be increased by means of an input coil which is provided for the purpose. The apparatus is fundamentally a double-tuned circuit with single-stage vacuum tube amplification, the output of which is fed into a copper oxide rectifier. The rectifier current is passed through a direct-current micrometer, affording a direct reading of the measured voltage.—*Serial Report Inductive Co-ordination Committee, National Electric Light Association*, January, 1928.

## *Illumination*

*Lighting Measurement.*—G. W. Stubbings.—A discussion of the determination of the mean spherical candlepower by means of the Rousseau curve. The author has pointed out the desirability of utilizing this diagram in the determination of illuminating effect and points out that such a period does not meet all of the usual requisites and that a modification somewhat similar to the plan proposed by Dr. Rousseau has notable advantages.—*Electrical Review* (*England*), Jan. 20, 1928.

*The Effect of Different Systems of Lighting on Output and Accuracy in Fine Work.*—H. C. Weston and A. K. Taylor.—A joint report of the Industrial Fatigue Research Board and the Illumination Research Committee of Great Britain. A previous report embodied the results of an investigation into the optimum illumination required for typesetting by hand or composing in the printing industry and was limited to the study of adequacy in a quantitative sense, and no attention was paid to the almost equally important matter of distribution of light over the working area or, in other words, to the system of lighting tending to give the best results. The results of the experiments described are not so positive as those obtained by varying the degree of illumination provided, but, given sufficient illumination, there is no reason to expect that large differences either in output or accuracy would result in the different characteristics of most of the methods of lighting tried. It is stated that in some composing rooms general lighting may be unsuitable on account of structural features which will prevent the elimination of undesirable shadows, and in such cases the combination of general and local lighting in which the two types of source will give approximately the same proportion of the total illumination is to be recommended. Totally indirect lighting involves a loss of output but has the advantage of reducing the reflected glare on the type. It is stated that there is some evidence that the color of the light used in composing rooms may be of importance in relation to the question of glare, but that without further experiments no definite statements on this point can be made. Particulars of the installation relative to the output and comparison of morning and afternoon work under various conditions of illumination are described. — *Department of Scientific and Industrial Research (England)*, 1928.

## Heat Applications and Material Handling

*Large Electric Baking Ovens.*—W. Ellerd-Styles.—The progress that has been made in the development of small electric ovens in England is stated as being extensive, whereas larger installations have lagged behind in most instances. In dealing with the cost of operation the author states that the average consumption is about 90 watts per pound of baked bread. The various factors entering into the cost of electrical operation and the advantages attendant upon the use of this heating medium, as well as the features of automatic temperature control which have been provided for such installations and a consideration of the interest of the supplying utility, have been included.—*Electrician (England)*, Feb. 3, 1928.

*Large Pipe for High Head Made by Arc Welding.*—T. Ujiiye. — Electric welding was applied in the construction of a 1,942-ft. penstock of a Japanese hydro-electric development. The procedure under which the material was fabricated, the specifications under which the job was done, the anticipated advantages of welding construction, with particular reference to the present undertaking, and the duty requirements of the installation are given.—*Iron Age*, Feb. 16, 1928.

## Electrophysics, Electrochemistry and Batteries

*Some Principles Governing the Choice and Utilization of Permanent Magnet Steels.* — Raymond L. Sanford. — The addition of substantial percentages of cobalt to the composition of permanent magnet steel leads to markedly superior qualities. The cost of cobalt steels may be several times that of the older types and consequently their use is warranted only under certain conditions. Criteria for the comparison of magnet steels are discussed and conditions under which the use of the more expensive steels is justified are outlined. The author states that cobalt steels, while superior in quality to tungsten and chromium steels, may not display this superiority unless appropriate designs are utilized. Magnets may be stabilized against permanent deterioration from transient demagnetizing fields by partial demagnetization. The cobalt steels can be stabilized by this method to a greater degree than the steels having lower values of coercive force. In general, it is concluded that by the use of cobalt steels some results may be obtained which are utterly impossible with the tungsten and chromium steels more commonly employed, but that the economical justification for their use is not encountered except in cases where space or weight are of primary importance and cost is of secondary consideration or where particularly severe conditions must be met.—No. 567 *Scientific Papers of the Bureau of Standards.*

*New Type Storage Cell.*—L. Jumau. —When charged and then left idle for one year before it is discharged, the cell will give only 33 per cent less energy than if it had been discharged immediately after the charge, according to the author. The cells are made in three sizes, from 20 to 80 amp.-hr., and are completely sealed except for a self-closing gas vent. There are only two very thick plates in each cell, and the unusual charge-retention characteristics are due primarily to the exclusion of local chemical action in the plates. Exceptional purity of all active materials, a special form of the plates, very careful perforation and secure lodging of the plates in a grooved glass container are contributing factors. When used for signaling purposes, heating of filaments in radio tubes, electric clocks, etc., it was found satisfactory to charge such batteries only twice a year.—*Revue Générale de l'Electricité*, Dec. 3, 1927.

## Telegraphy, Telephony, Radio and Signals

*Television.*—A. Dauvillier. — In a series of three consecutive articles the author summarizes all the hitherto known and practically applied methods of transmitting an image over wires. Each method is described and illustrated with a sufficient amount of detail to comprehend its operating principles. The second part of the paper is devoted to an unusual X-ray method, utilizing the basic principles of television; that is, instead of subjecting the subject to a flood of X-rays and examining the shadowgraph on a fluorescent screen, the new method uses only a very small beam of X-rays, which is quickly moved over the examined area and is at the same time integrated again to give the complete image. This process is so fast that the object under examination may be in motion. Heart palpitation may thus be readily examined. Two great advatages are claimed for this new X-ray process: (1) The patient is subjected to only a fraction of the commonly required dose of rays, eliminating entirely the possibility of X-ray burns; (2) a much clearer image is obtained, since the veiling action of all secondary rays is eliminated.—*Revue Générale de l'Electricité*, Jan. 7, 14 and 21, 1928.

*The New York-London Telephone Circuit.*—S. B. Wright and H. C. Silent.—The special provisions which are in use on the transatlantic telephone to compensate for the variability of the wire and ether paths, for the radio noise and for the fact that two-way transmission is effected upon a single wave length is discussed in this paper. Technical operators are in attendance at each end of the radio path and are equipped to adjust the magnitude of the speech currents entering the radio transmitters to such a value as to load these transmitters to capacity. The amplification introduced at the radio receivers can also be adjusted to compensate for changes in the transmission efficiency of the radio paths. Finally, voice-operated relays together with suitable delay circuits are provided which so control the apparatus that at any given time it can transmit in but one direction. By this arrangement, a speaker's voice upon leaving his transmitting station cannot operate his own receiver, although this is tuned to the transmitting wave length.—*Reprint B-275 Bell Telephone Laboratories, Inc.*

## Traction

*Electric Snowplow.*—An electric rotary snowplow has recently been installed on a section of the Swedish State Railway lying above the Arctic Circle. Because of the extreme climatic conditions special precautions were necessary in the design of this equipment. The snowplow is not provided with motive power, but is pushed from behind by an electric locomotive which may be controlled from the driving cab of the snowplow. The motor for the operating of the plow-wheel shaft has a rating of 565 hp., but may be momentarily overloaded by 100 per cent. The motor is a series-wound, single-phase device of the same type and appearance as those used for electric locomotive drives. The motor is placed longitudinally and is provided with a cast-steel stator frame bolted to the bedplate. The plow-wheel shaft is driven through a helical single reduction gear. The gear pinion is combined with a brake drum and against this two brake blocks can be pressed, the operating force being secured by the use of air pressure so that both the rotor and plow wheel may be braked at the same time.—*Electrician (England)*, Jan. 20, 1928.

## Miscellaneous

*The Maclaurin Smokeless-Fuel Plant at Glasgow.*—The design and construction of a plant for the production of smokeless fuel is offered in this article. The producer unit bears some resemblance to a blast furnace, although it is square and raised above the ground on piers. A center wall near where the air ports enter divides the producer into two large chambers, while higher up are an oil trap and a gas and oil outlet. The coke, after cooling, is discharged through chutes at the bottom of the producer. The operation of the plant is referred to in considerable detail.—*Engineering (England)*, Feb. 3, 1928.

# News of the Industry

## New San Francisco Rates

*Domestic Customers Will Pay Monthly Service Charge of 40 Cents Plus Energy Charge Beginning at 5 Cents for First 200 Kw.-Hr.*

REDUCTIONS in the electric light and power rates of the Pacific Gas & Electric Company and the Great Western Power Company, representing a saving to consumers of nearly $2,000,000 a year, briefly referred to last week, have been approved by the Railroad Commission of California in a decision giving the consumers the immediate benefit of the reduced rates. The commission has, however, continued for further hearing and final determination the various rate proceedings relating to those two companies which have been pending before it as the result of complaints by various cities and on the commission's own investigation.

In addition to authorizing the reductions proposed by the power companies affecting residential and general power and light consumers, the commission ordered a revision of agricultural power rates the net result of which will be a saving of approximately $65,000 to that class of consumer. The change in agricultural rates was ordered by the commission in response to the plea of the California Farm Bureau Federation for a new agricultural pumping service rate which would eliminate optional rates now in effect, open the schedule to new types of service and effect a general reduction, although increasing the bills of a few consumers.

The principal effect of the proposed changes in the general and domestic electric rates will be a lowering of the lighting rate to the lowest point yet reached in the territory of the companies involved and the establishment of extremely low rates for the operation of electrical appliances and household devices. The reductions applicable to general lighting service, including household appliances and small power service, became effective for meter readings on and after March 1, and the reductions in the general power and agricultural rates and the new combination domestic service rate will be effective on and after April 1.

The new domestic rates in San Francisco, Oakland, Berkeley, Piedmont, Emeryville, San Leandro and Albany are as follows: Service charge per meter per month, 40 cents; energy charge (to be added to service charge), first 200 kw.-hr. per meter per month, 5 cents; next 800 kw.-hr., 4 cents; next 2,000 kw.-hr., 3 cents; all over 3,000 kw.-hr. 2½ cents. In incorporated cities served by the companies outside those above named the rates will be the same except that the service charge will be 50 cents. In unincorporated territory the service charge will be 70 cents and the energy charge for 200 kw.-hr. 6 cents, for the next 800 kw.-hr. 5 cents; for the next 2,000 kw.-hr. 4 cents, and for all over 3,000 kw.-hr. 3½ cents.

The general domestic combination service rate in San Francisco, Oakland, Berkeley, Piedmont, Emeryville, San Leandro and Albany will be (with extra charges where there are more than six rooms or where devices rated at more than 1 kw. are installed): Service charge per meter per month, 40 cents; energy charge, first 30 kw.-hr., 5 cents; next 140 kw.-hr., 3½ cents; all excess, 1½ cents.

## Engineers Will Honor Dr. Cornelis Lely of Holland

Engineers will honor Dr. Cornelis Lely, president and honorary member of the Netherlands Royal Institute of Engineers and member of the Royal Academy of Sciences, at a luncheon to be given at the Engineers' Club on Tuesday, March 6, at 12 o'clock. This luncheon will be under the auspices of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Dr. John R. Freeman will preside.

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## Amendment to Norris Resolution Favored

### Harrison's Plan Vests Question of Government or Private Operation of Muscle Shoals in Secretary of War—Federal Trade Commission Ready to Subpoena

By Paul Wooton

*Washington Correspondent of* ELECTRICAL WORLD

MUSCLE SHOALS legislation which is fairly acceptable to the opponents of the government's entering business apparently is about to be approved by the Senate. As this is written, it seems probable that the Harrison amendment to the Norris resolution will be adopted. The Norris resolution requires that the power plants be operated by the government, which is to sell energy to "states, counties, municipalities, corporations, partnerships or individuals," giving preference to states, counties and municipalities. The Harrison amendment vests in the Secretary of War the decision as to whether the power plants are to be leased to private operators or are to be operated by the government. In the event of government operation of the dam and steam plant, however, no municipality may receive a greater amount of power than it is entitled to receive under the principle of equitable distribution for which the amendment stands, and all power sales are confined to the switchboard. The Harrison amendment also provides that the energy is to be sold for public use subject to state regulation.

The theory of the Norris resolution, as well as of substitutes proposed by Senator Tyson of Tennessee and by Senator Sackett of Kentucky, is to separate power and fertilizer production. This is in line with the view of the majority of the members of the Senate. In each of these measures the proceeds from power are to be used for a period of years in an effort to demonstrate the practicability of the use of air nitrogen as a fertilizer ingredient. In addition, experiments are to be conducted in the production of phosphoric acid and other ingredients of fertilizers in an attempt to devise means of reducing production costs. It is the conception of these three bills that a considerable part of the money, however, shall be used to conduct on farms practical demonstrations of concentrated fertilizers.

All of the proposals authorize the Secretary of War to enter upon transmission-line construction in order to place him "upon a fair basis for making contracts and for receiving bids." Proceeds from the sale of power may be used for that purpose without additional authority from Congress. The Norris resolution authorizes additional equipment for the dam and for the steam plant. This equipment, it is estimated, will cost in excess of $10,000,000. The Harrison amendment does not modify the Norris resolution in that respect.

It is generally conceded on the House side that the Madden bill is dead. Apparently a majority of the House military affairs committee now favors the Morin bill, which is very similar to the Norris resolution. It is believed that the Norris resolution, as amended, will be just as acceptable to the House committee, but no decision has been made as to which of the two bills will be pushed by the House committee.

The Federal Trade Commission is about to decide upon the form its investigation of the electrical and gas industries will follow. The adoption of this plan has presented numerous difficulties, as have the questions involved in the subpœnaing of witnesses. As this is written, it is expected that the subpœnas will go forward within a few days. As a result of the publicity given the utilities investigation, the commission has been deluged with applications for employment from persons who state that they are particularly qualified to be of assistance in such work. It became necessary for Chairman Humphrey to issue a public statement pointing out that the commission has received no extra appropriation for this investigation and at present expects to proceed with the inquiry without additions to its regular staff. Numerous engineers and economists were among the applicants.

## La Guardia Bill to Limit Federal Court Jurisdiction

Congressman F. H. La Guardia of New York has again introduced his bill to restrain the United States courts from setting aside orders made by state public service commissions concerning the operation or rates of public utility companies until the state courts have passed upon the points at issue. This is the third time that he has fathered this bill, which is similar to one formerly championed by Congressman Bacharach of New Jersey. Mr. La Guardia has issued a statement denouncing federal court findings in the New York City gas cases and asserting: "It was never intended that United States district courts should intervene in the first instance to permit public utility companies disregarding law or obligations under contracts. The custom now has become so general, the power of traction and other public utility companies so great, the exploitation of the people so ruthless, that Congress must step in and curb this evil."

## Legislator Questions Rates in Boston and Near By

H. L. Shattuck, a member of the Massachusetts House of Representatives, has filed an order asking the Department of Public Utilities to inform the House not later than March 15 whether the commission favors making inquiry with the object of bringing substantial reductions in the rates of the Boston, Lowell, Lawrence, Lynn, Fall River, New Bedford, Malden, Quincy and Brockton companies, and also whether the Boston Edison company's maximum rate of 8½ cents per kilowatt-hour is in part due to the extension of the company's service into sparsely settled territory, and whether the establishment of a zone system of rates is advisable in order that the congested portion of the area served may obtain a rate which takes into account the lower cost of serving that part of the territory.

# Men from Four States at Albuquerque

### Thoroughly Practical Three-Day Convention of New Mexico Utilities Association Appeals to Executives of Rocky Mountain Region and Western Texas

MEN from Colorado, Wyoming, New Mexico and Texas were in attendance at the thirteenth annual convention of the New Mexico Utilities Association, which was held at the Franciscan Hotel in Albuquerque on Feb. 20-22. J. B. Ledlie, Mesilla Valley Electric Company, former president of the association, reviewed its past accomplishments and outlined future opportunities. Sales efforts, he said, are of immediate importance and "our biggest job."

Miss Frances B. Ryder, chairman of the women's committee, Rocky Mountain Division, N.E.L.A., painted a picture of the increasingly large and important part that women are taking in the field of public service. Dr. James F. Zimmerman, president of the University of New Mexico, outlined difficult problems in the field of education. "Public Relations—the New Concept" was the subject of V. L. Board, general superintendent Public Service Company of Colorado. Mr. Board thought that prejudice against the public utilities is largely inherited and can be dissipated by education.

A. R. Woolley, Edison Electric Appliance Company, Denver, spoke on "Central-Station Merchandising from the Standpoint of the Manufacturers." He asked whether the utilities are analyzing the merchandise they offer from the standpoint of its dependability and the integrity of its manufacturer. H. B. Dwight, engineer for the Colorado Public Utilities Commission, took up public relations, which, he said, are "nothing more than public confidence, and confidence can be established in a large measure through the proper training and education of employees." "Why All the Secrecy?" was the question asked by George E. Lewis of the Rocky Mountain Committee on Public Utility Information. Mr. Lewis insisted that utility managers let their employees in on the results obtained from conventions such as the one in session.

J. J. Cooper of the Mountain Electric Company, Denver, had for his subject "What Price Success?" He outlined the "new competition" and emphasized the necessity for intensive market development. H. C. Webb, Jr., sales manager El Paso (Tex.) Electric Company, pointed out that production problems have received far greater attention than those related to merchandising. He told of an experiment his company is now trying which calls for the establishment of district representatives for all residential territories within the city. These men have approximately 900 customers each and are doing the combined work of meter reader, salesman and collector.

Tuesday morning's session was given over to a complete discussion of the Colorado River development. Following a brief review of the situation by Merrit C. Mechem of Albuquerque, Francis C. Wilson of Santa Fe, Colorado River commissioner for New Mexico, explained the many features of the proposal in detail and prophesied practical reconciliation of the various opposing factions.

"Central-Station Possibilities in Street and Highway Lighting" was handled by A. S. Anderson of the General Electric Company, Denver. Philip S. Donnell, dean of engineering, University of New Mexico, presented "The Problem of Power Factor." Its technical side has been taken care of, he asserted, and it now remains for the utilities to convince the consumer. Recent engineering developments in the electrical industry were described by R. W. McNeill, Westinghouse Electric & Manufacturing Company, Denver, who dealt with steam-turbine construction, synchronous motors, electric house heating, transportation, transmission equipment and automatic substations.

A. C. Cornell of the Graybar Electric Company, Denver, talked on "Possibilities of Developing an Electrical Consciousness." Of commercial managers he said: "Five-thousand-dollar-a-year executives are expected to do the work that should be done by fifteen-thousand-dollar men."

Officers elected to serve the New Mexico Utilities Association for the ensuing year are: President, C. C. Ogle, Agua Pura Water Company, Las Vegas; first vice-president, W. W. Nielson, Santa Fe Water & Light Company; second vice-president, C. S. Makeig, Roswell Public Service Company; secretary-treasurer, B. L. Wiles, Albuquerque.

## Northern States Power Budget Includes New Offices

Construction of a twelve-story downtown office building in Minneapolis is one of the major projects of an eight-million-dollar budget for this year which has just been announced by Robert F. Pack, vice-president and general manager of the Northern States Power Company. Work is to be started on the new structure May 1. It will be built at 21 Fifth Street, South, to make a part of the present structure adjoining at 15 Fifth Street, South, and seven additional stories will be added to the newest five-story unit of the old building. The building is to be ready for occupancy May 1, 1929. The power company will occupy ten floors of the new addition and the remainder will be available for rental to electrical firms.

The second largest item in the 1928 budget is one, already noted, of about $1,500,000 for the completion of the company's hydro-electric plant and dam at Chippewa Falls, Wis. Nearly $1,500,000 has been spent already on this development, which is to be ready for service next September. The program further includes betterments and expansions of both production and distribution facilities in five states—Minnesota, North Dakota, South Dakota, Illinois and Wisconsin. Several new substations are to be built, and it is estimated that more than 200 miles of cable and conduit will be installed, to replace present equipment and for extensions to the company's lines. In the Minneapolis area heavier cables and larger vaults will be installed in the downtown district and an additional feeder built from the Aldrich Avenue substation to the "Loop" district. In St. Paul a second bank of 15,000-kva. transformers will be installed at the High Bridge plant. Improvements to the electrical systems at Grand Forks, Fargo and Minot, N. D.; Sioux Falls, S. D.; St. Cloud, Stillwater, Mankato and Red Wing, Minn., and Eau Claire, Wis., also figure in the program, and a 35-mile, 11,000-volt transmission line will be built from Clara City to Cosmos, Minn.

## Referendum Versus New Power Survey

*Partisan Gestures on St. Lawrence Development Indulged in by Both Sides at Albany—Savings Banks Investment Bill Reintroduced*

A NEW proposal on St. Lawrence River water power from Governor Smith of New York is now before the Legislature in a bill introduced by the leaders of the Democratic minority to hold a referendum at the general election next fall on the question of whether the state's remaining water-power resources shall be developed by a state Power Authority, as advocated by the Governor, or by private corporations under leases, as urged by the Republicans, who control both houses at Albany.

This proposal has been met by the Republicans by the introduction of a water-power bill along the same lines as one passed by them last year and vetoed by the Governor. It provides for an impartial commission of five members to make a survey of the state's water-power resources and the best method of developing them. It is reported that all the Republican senators have been pledged by caucus action to support this measure.

The bill to amend the savings banks investment law so as to permit these institutions to invest in the bonds of certain electric, gas and telephone companies which meet specified requirements has been reintroduced in the Assembly and referred to the committee on banks. This measure was defeated last year in the Assembly by 85 to 49, and so far the prospects for its passage at this session do not seem hopeful.

Assemblyman Hearn of Brooklyn has introduced a bill amending the Public Service Commission law by empowering the commission to require every gas and electric corporation to publish proposed changes in rates in a daily newspaper. At present the only publication, except as news, is by a tariff filed in the office of the corporation which may be inspected by the public.

Under the provisions of a bill introduced by Senator Brereton of Essex County the Public Service Commission law would be amended by giving to the commission supervision over a corporation or person controlling through lease, voting trustees or operating contract a corporation subject to jurisdiction of commission or which furnishes products or service to such corporation for ultimate distribution to the public. A similar bill failed of passage last year.

## Beacon Lights of Great Size Continue to Be Installed

An aeronautical beacon of more than 1,000,000,000-beam-candlepower rating is to be placed on a 1,320-ft. tower in the "Loop" district of Chicago, according to Paul Henderson, vice-president and general manager of the National Air Transport, Inc., which operates the Eastern division of the transcontinental air mail between New York and Chicago. Elmer A. Sperry, head of the Sperry Gyroscope Company of Brooklyn, has donated the light to Chicago, and a survey is under way to select the site for the tower, which will be built on one of the high buildings in the "Loop."

Herbert Photos Inc.

AIR BEACON ON HOTEL ST. GEORGE, BROOKLYN, RATED AT 480,000,000 BEAM CANDLEPOWER

The new light will have a lens and reflector 63 in. in diameter and will project a revolving five-foot beam. The power plant, tower and installation of the light will cost about $2,000,000.

A new airplane beacon erected last week on the roof of the St. George Hotel, Brooklyn, has 480,000,000 cp. and is said to be the largest beacon ever built for private use. Two revolving beacons now being erected in California by the Standard Oil Company for the guidance of West Coast fliers develop 10,000,000 cp. each. One will be placed on top of Mount Diablo, 25 miles southeast of San Francisco, at an altitude of nearly 4,000 ft. and will be visible from points within a radius of 100 miles. The other is to be among the Merced Hills in the Los Angeles basin, just north of Montebello. It will be similar to the Mount Diablo installation. The standard revolving beacons on the night air-mail routes in the United States, which are visible for 40 miles or more, are of 2,000,000 cp.

## White River Conflict Is Probably Adjusted

*Federal Power Commission May Now Act on Application for Plant in Arkansas, but Situation on Missouri Application Is Still Blocked*

THE Ozarks Hydro-Electric Company has withdrawn its application to the Federal Power Commission for a preliminary permit covering the 200,000-hp. project on the White River near Cotter, Ark. The commission now is in a position to act promptly on the conflicting application of the White River Power Company. This marks a definite step in a project which has been through many vicissitudes. Since the defunct Dixie Power Company received a preliminary permit for it following the first application made under the water-power act eight years ago. The project is related to that on the upper White River, across the line in Missouri, where the Empire District Electric Company has applied for a license covering an 80,000-hp. project at Table Rock. In this case the commission is withholding action on the application because of the opposition of the authorities of Stone County, Mo. The local officials are insisting that the power company build a bridge, which would cost in excess of $500,000, over its reservoir.

An unfavorable report on the proposed development at Wolf Creek, on the Cumberland River, in Kentucky, is understood to have been approved by the Chief of Engineers. The report is said to indicate that the project is not feasible under market conditions prevailing in the area or likely to prevail for a long period. With this report in hand it is believed that the commission will act in the near future on the application of the Cumberland Hydro-Electric Company proposing the utilization of the power resources of Cumberland Falls—the development that has been so strenuously opposed by those who contend it will mar the natural beauty of the Cumberland Falls.

A license has been issued to Henry V. Gates for a small project on Crooked River in Oregon. The license is of particular importance, however, because it contains a clause subordinating the use of the water to any future irrigation requirement. This is the first time that such a provision has been written into a license.

The Starr-Collinson Packing Company of Portland, Ore., has applied for a minor license for a project on an unnamed creek tributary to North Arm of Moira Sound, Prince of Wales Island, Alaska; the Feather River Trust of San Francisco, Calif., for a minor license covering a project on Dogwood Creek, Plumas County, and the California-Oregon Power Company for a license covering a transmission line 25 miles long from its Chiloquin substation to Fort Klamath.

## News from the Dominion

*Bill to Prohibit Exportation of Power Introduced at Ottawa—Dispute with Provinces Over Federal Rights Continues—Alarmists Take the Floor*

ACCORDING to Charles Stewart, Minister of the Interior, it is the opinion of the Canadian government that export of electric power should be prohibited. The Minister made this statement during a discussion of a bill to regulate the exportation of electric power which is now before the House of Commons at Ottawa. The purpose of the bill is to make the export of electric power subject to an act of Parliament, instead of leaving it in the hands of the government.

At the opening session of the Ontario Legislature Premier Ferguson dealt at length with the dispute between the Dominion and provincial governments over power rights. The reference recently taken by the federal government to the Canadian Supreme Court concerning power rights had been undertaken without consulting the provinces, after it had been agreed at the interprovincial conferences in January that both interests should be consulted on the questions to be submitted, the Premier stated. The questions submitted by the Dominion were vague, indefinite and general, and the Premier doubted if any court would answer them. It came as a distinct surprise to him when the reference was announced.

Quebec power interests have failed in their efforts to secure a measure of relief from the Dominion government in respect to income tax as applied to users of electrical energy in that province. The annual budget of that government has been brought down and there is no provision in it dealing with this question.

To renew public agitation in favor of construction of the Georgian Bay canal as opposed to the St. Lawrence waterway project is the expressed object of the Montreal Chamber of Commerce. This body at a recent meeting decided to study the all-Canadian plan again, to invite an engineer of authority to speak on the subject and to approach members of Parliament. One member said that, whereas the St. Lawrence waterway might cost anywhere from a billion and a quarter to a billion and a half dollars, it was known that the Georgian Bay project would cost only $150,000,000. It would also furnish a million horsepower to Ontario.

An ostensibly serious warning has been sounded by John R. Robinson, editor of the *Evening Telegram*, Toronto, that the Hydro enterprise of Ontario is in grave danger of being absorbed by international capital and private ownership. According to him "the interests" are fighting to remove from their path the "menace" of people's power. Attacking the "electric ring" of the United States and Canada and Sir Herbert Holt, Montreal financier, Mr. Robinson declares: "I fear some of you will live to see the day when the whole Hydro system will be sold out to private corporations."

Another alarmist is James H. Hunter, vice-president of the Engineering Institute of Canada, who urges that control of the Canadian sections of the St. Lawrence River should be kept by Canada and should not be risked in an international arrangement with the United States. Mr. Hunter holds that the upper, or Morrisburg, part of the project could be put through immediately by Canada and 300,000 hp. readily absorbed by the Hydro-Electric Power Commission. The second development, at the foot of the Long Sault rapids, should be undertaken only when Canada can utilize the power to which it would be entitled, about 700,000 hp., he says.

## Commonwealth Edison to Spend $27,346,000

All the proceedings of the annual meeting of Commonwealth Edison Company stockholders, held in the Edison Building, Chicago, on Feb. 27, were, as has been the custom for a number of years, broadcast by radio for the benefit of the thousands unable to attend. President Samuel Insull in his official address put the number of stockholders at more than 40,000 and the company's customers at 906,000. Total business in 1927 was $71,629,000. Mr. Insull continued:

> We have spent during the year 1927 in additions for plant and distribution system $26,057,000, and we figure it will be necessary to spend in the year 1928 $27,346,000 for the same purpose. Thirty-three per cent of the energy that we put out last year came from our new Crawford Avenue plant. In 1927 the largest turbine we have, at Crawford Avenue, has a capacity of 88,000 kw., and the total capacity of all our stations is 1,042,000 kw. Before this year closes we shall have a turbine in operation at Crawford Avenue station that will have a capacity of 100,000 kw., and we shall have a total station capacity in all our stations of 1,053,000 kw. In 1927 our load factor was 48.4 per cent as compared with 47.9 per cent in 1926. Our total output is about 5 per cent of the total output of electrical energy for the entire United States, figured on the basis of a population of 3,100,000, which is about 2½ per cent of the total population of the United States. It is a very proud boast of the personnel of the Commonwealth Edison Company that it has never raised its rates.

After referring to the change in the company's method of billing for energy consumed, which was explained in the ELECTRICAL WORLD for last week (page 419), Mr. Insull went at some length into the Chicago transit situation, in which the Commonwealth Edison through a subsidiary is interested, and declared: "If I am going to be the subject of constant public attack, I shall personally withdraw from all effort to bring about a merger of the various traction properties and content myself with just looking after your interests in the Chicago Elevated Railways."

Samuel Insull, Jr., was elected as a director to succeed the late Watson Blair.

## High-Frequency Freaks

*Unusual Results Follow Experiments with a Tube Recently Developed in the General Electric Laboratory at Schenectady*

EXPERIMENTS with a new type of high-power short-wave tube recently developed by engineers of the General Electric Company laboratories at Schenectady, N. Y., have produced results of an unusual and decidedly interesting character.

Those in control of the experiments report that meters in adjacent rooms have run wild, that delicate measuring instruments have been twisted or broken, that the new apparatus has emitted a warm glow subjection to which has been followed by increasing pain in limbs and joints, that rats in a cage placed close to the radiating wire have become excessively animated and then, if exposed too long, have died, that a new incandescent lamp has been lighted to full brilliancy without wires or socket, that a cold copper bar lying on the floor has blistered the hand of a man picking it up, that a neon tube has suddenly flooded the room with its glow when merely touched, that simple food has been cooked in a glass tube suspended from a receiving aërial, and that many less spectacular effects have been experienced.

The vacuum tube, 5 in. in diameter and about 2 ft. long, is inclosed in a wooden cage and surrounded by a network of wires, condensers and meters. The tube operates as a self-excited oscillator on a wave length of 6 m. and is capable of radiating from 10 kw. to 15 kw. of high-frequency power—probably fifty times as much as any short-wave tube has heretofore been able to produce. The tube is connected through a coupling system to a copper bar approximately 3 m. long, which constitutes the tuned aërial circuit, and is able to radiate into space the full 15 kw. generated by the oscillator.

Most striking of the short-wave effects was the standing electric arc, a close imitation of the famous ball of fire reputed to accompany tropical thunderstorms. The operator touched the end of the radiating aërial with a metal-tipped pole, and immediately a greenish white arc arose to a height of a foot or more. When the pole was removed the arc remained, like a plume of fire, sputtering and sending molten copper in all directions until blown out. By skillful manipulation as many as three of these arcs were established simultaneously along the aërial, giving the appearance of a row of flaming gas jets. Smaller standing arcs of this nature were established on the ends of a receiving aërial several feet from the radiating system, demonstrating the transmission of power currents through space.

Experiments of the same nature are known to be under way also in the laboratories of the Westinghouse Electric & Manufacturing Company, wave lengths of 1½ m. being employed for the purpose.

## Purchases and Mergers

*American Gas & Electric Buys Princeton (W. Va.) Power Company—Little Rock Municipal Plant May Be Sold to Arkansas Power & Light*

THE American Gas & Electric Company, of which the Appalachian Electric Power Company is a subsidiary, has purchased the electric light and power property of the Princeton (W. Va.) Power Company for a sum said to be around $700,000, and the contract has been ratified by the stockholders of the latter. The Princeton Power Company had divorced its light and power business from the street railway, and all the street-railway property was conveyed to the Tri-City Traction Company, a corporation formed among the old stockholders.

Negotiations for the sale of the Little Rock city power plant, now operated to furnish power for the street-lighting system, to the Arkansas Power & Light Company, provided that company makes a satisfactory rate for street-lighting service, are under way. This plant has been valued at prices ranging from $150,000 to $200,000.

The sale of the Yellville (Ark.) lighting plant to the Arkansas Power & Light Company is thought to be a preliminary step to bids for the smaller plants between Batesville and Yellville, which would give an unbroken chain to the contemplated dam on the White River site which the company bought a year ago. It is reported that negotiations are under way by the Couch interests to buy the plants at Calico Rock and Cotter, but sales are not closed.

Transfer of the capital stock and properties of the Clear Spring Electric Light & Power Company and the Potomac Light & Power Company to the Potomac Edison Company of Hagerstown has been authorized by the Maryland Public Service Commission. For the Potomac Light & Power Company's stock the Potomac Edison paid $106,000, the par value.

Approval of the Maryland commission has also been given to the transfer to the Consolidated Gas, Electric Light & Power Company of Baltimore of all property and assets of the twelve subsidiary companies referred to last week.

The Interstate Public Service Company has filed a petition with the Indiana Public Service Commission asking authority to buy for $97,500 properties in Johnson, Shelby and Bartholomew Counties, with a combined valuation of $110,000. Transmission lines near Columbus, Ind., owned by the H. F. Clevenger Electric Company; the Winterrows transmission lines near Flatrock and the Trafalgar Light & Power Company of Johnson County are the properties.

A special election will be held in Rochelle, Ill., March 26 on a proposal of the Federal Public Service Company of Chicago to purchase the Rochelle municipal electric plant and properties and water system for $500,000.

Purchase of the Adrian, Burnside, Colusa & Ferris Light & Power Company properties in Hancock County, Ill., for $34,050 by the Central Illinois Public Service Company has been authorized by the Illinois Commerce Commission.

Electric transmission lines east from Lake Park to Lake Okoboji, Iowa, have been purchased from the Central States Electric Company by the Northwestern Light & Power Company.

The Otter Tail Power Company has been authorized to purchase the electric property at Wilton, N. D., from the Washburn Lignite Coal Company.

The Western Public Service Company has purchased the municipal lighting plant at Ogallala, Neb. The Iowa-Nebraska Light & Power Company has purchased distribution systems at Burchard and Steinauer, Neb., and a transmission line from Dubois. These towns have been buying from the municipal plant at Pawnee City.

Approval has been granted by the Kansas Public Service Commission for the sale to the Kansas Power & Light Company, Topeka, of the electric distribution system and transmission line of the city of Huron.

The Tennessee Railroad and Public Utilities Commission has approved the purchase by Frank A. Reid from T. G. Avery of the electric distribution system in Halls and Gates and the transmission line connecting the two towns for $52,000.

Negotiations between the Southern Cities Utilities Company of Chattanooga and Tullahoma (Tenn.) representatives for the sale of the municipal electric plant and waterworks at Tullahoma to the company are in progress.

Crystal Springs (Miss.) municipal authorities are considering the sale of the water and light plants for $145,000 cash to Kulley & Williams of Jackson, who have applied for a charter under the name of the Mississippi Utility Company.

It is reported in San Francisco that H. M. Byllesby & Company are negotiating with the Snow Mountain Water & Power Company for the purchase of its properties in the Ukiah and Lake Pillsbury section.

Sale of the Laurentian Power Company to the Quebec Power Company has been approved by the shareholders of the Laurentian. The Quebec Power Company will thus come into possession of a 30,000-hp. development on the St. Anne River, with a 40-mile high-tension line to the city of Quebec.

Senator Walter Schlosser of Grand Forks, N. D., head of the Northern Light & Power Company, has just made an offer of $140,000 to the town of Estevan, Saskatchewan, for the power plant recently erected there. His proposal is to build a central power station at Estevan, using lignite coal for the supply of electric power to southern Saskatchewan.

## Program for Policies Division of the N.E.M.A.

Definite action on the matter of an "all-electrical industry show," on tariff matters and on adequate statistics is expected at the spring meeting of the Policies Division, National Electrical Manufacturers' Association, to be held on March 14-16 at the Edgewater Beach Hotel, Chicago. A request for definite support of the program of the Industry Sales Conference will also be presented. N. A. Wolcott, chairman of the N.E.M.A. committee on codes of ethics and sound merchandising principles, will discuss that subject at the first general session. Other speakers scheduled are R. J. Russell, Century Electric Company, who will discuss "Terms of Payment," and W. S. Rugg, Westinghouse Electric & Manufacturing Company, who will talk on "Minimum Standards of Performance for Electrical Products" at the second day's session. "Cost and Channels of Distribution" is scheduled for general discussion following Mr. Rugg's address.

## Portland Has Commercial Meeting

*Range Sales, Appliance Merchandising and Electric Refrigeration Discussed by Members of the Northwest Electric Light and Power Association*

COMMERCIAL leaders of the Northwest Electric Light and Power Association gathered at Portland, Ore., on Feb. 20 and 21 for the annual midwinter meeting of the Commercial Section and, under the chairmanship of J. C. Plankington, discussed reports of the year's work. The lighting committee showed that much is being accomplished in bringing about better lighting in the factory, store, office and home through the presentation of lighting talks and demonstrations before luncheon clubs. Twenty-nine talks in all will be given by the committee this year. Work of the street and highway lighting committee centered on the job of compiling data to show street-lighting costs per capita, percentage of street-lighting costs to police expense, etc., to be used as sales material in the case of municipalities.

A survey made by the commercial cooking committee to determine the cost of electrical energy per unit of output will aid salesmen in obtaining more of this class of business. The competitive power committee found that, even with the very low prevailing prices of wood waste, many woodworking plants are finding it economical to purchase central-station service. Moreover, the increasing use of stoker-fired wood waste in household furnaces is providing a market for wood refuse.

One of the things the electric range committee expects to accomplish is to replace obsolete electric cooking equipment in the domestic science departments of schools and universities with modern equipment. Special sales versus continuous selling came in for considerable discussion, and it was quite generally agreed that the greatest volume of sales will result from following the vogue of the times—the special sale.

Figures compiled by the merchandising committee on sales of small appliances led the committee to conclude that insufficient effort has been placed upon this form of merchandising. Several told of company policies to assist dealers in every possible way to tie in with the central station on appliance sales. A general discussion of electric refrigeration showed that the servicing problem is causing power companies less concern, owing to better product and the larger distributors' policy of maintaining a well-trained and efficient service organization of their own. Some power companies have been successful in establishing a policy of passing service charges on to the customer, and several felt that this is the solution to the servicing problem.

# Briefer News

Ready to Build Martin Dam Transmission Line.—By an order of the Alabama Public Service Commission just issued the Alabama Power Company is authorized to construct a transmission line from Martin Dam to the Alabama-Georgia line, a distance of 46 miles. Work will begin in a short time.

New Substation at Pulaski, Va.—Among structures lately completed by the Appalachian Electric Power Company is the Pulaski (Va.) 7,800-kva. substation, which is fed by two 88-kv. transmission lines, one from Byllesby and the other from Glen Lyn. A 33,000-volt bus feeds three outgoing lines, one extending to Radford and Christiansburg, another serving Dublin, Belspring and several mines, and the third to supply the Empire mines.

"White Ways" for Miami and Little Rock.—A "white way" is to be installed in the business district of Miami by the Florida Power & Light Company. It will consist of 197 400-cp. ornamental lamps and four of bracket type. A new "white way" installed by the Arkansas Power & Light Company at Little Rock, Ark., on Louisiana Street, comprising 32 ornamental posts surmounted by 1,000-watt lamps, makes that the brightest street in the city.

Northwest Engineering Section Program.—The program for the fifth annual meeting of the Engineering Section, Northwest Electric Light and Power Association, to be held at Spokane, Wash., on March 8 and 9, includes, besides many technical committee reports with a wide purview, addresses by Major H. S. Benion, N.E.L.A., and E. C. Stone, chairman Engineering National Section, N.E.L.A. An illustrated report of the Lake Chelan project will be another item.

Cultivating Good Will in Oklahoma.—At another of the "good will" conventions being held by the Oklahoma Utilities Association, Public Relations Division, in various cities of the state—this one in Lawton on Feb. 23—E. R. Ernsberger, president of the association, gave the executive's viewpoint as head of the Southwestern Light & Power Company, and E. F. McKay, secretary of the association, told how that body "ties in." Many utility men took part, and there was a banquet and entertainment in a church dining hall in the evening.

Cooper Gets Rights on Fork of Columbia.—Acting under the authority conferred in an Attorney-General's opinion (Electrical World, Feb. 18, page 370), R. K. Tiffany, State Hydraulics Supervisor, has bestowed Washington water rights for a power development to cost $17,600,000 upon Hugh L. Cooper of New York City. This is the 260,000-hp. "Z" Canyon enterprise, on Clark's Fork of the Columbia River, already described. The power plant, reservoir and impounding dam will all be in the immediate vicinity of Metaline Falls, Wash.

Ohio State University Offers Technical Fellowship. — The Ohio State University announces the Stillman W. Robinson fellowship, having an annual value of $750, for graduate study and research in electrical, mechanical or civil engineering. Further information may be obtained from the dean of the Graduate School, Ohio State University, Columbus, Ohio.

Growth of Shawinigan System.—The annual report of the Shawinigan Water & Power Company refers to an extension of its No. 2 power plant at Shawinigan Falls which will be carried through during 1928 and will add 43,000 hp. to its rated capacity. During the year there were added to the company's systems 82 communities, with an addition of 648 miles of lines, through construction and purchase. Two new customers were the Ste. Anne paper plant at Beaupré and the Anglo-Canadian Pulp & Paper Mills at Quebec City.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

American Institute of Electrical Engineers—St. Louis regional meeting, March 7-9; Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11. F. L. Hutchinson, 33 West 39th St., New York.

Northwest Electric Light and Power Association — Engineering Section, Spokane, Wash., March 8 and 9; Accounting Section, Portland, Ore., March 12. Berkeley Snow, 1208 Spaulding Building, Portland, Ore.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

International Association of Electrical Inspectors—Madison, Wis., March 17-18. W. Wilke, 4211 Eiring Place, Milwaukee.

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N. E. L. A.—Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Memphis Rates to Be Cut, but How?—Negotiations for a reduction in electric light rates that will save some classes of Memphis consumers $90,000 a year have been under way between city officials and the Memphis Power & Light Company. The light company has a surplus of $200,000 over the percentage of profit allowed to it by the state. Under the law it must cut its rates so that its revenues will be decreased by $90,000 each year for the next three years. The question to be settled is whether the saving shall go to the home users or the commercial consumers.

Pennsylvania Railroad Has Electrification Plans for Baltimore.—The Pennsylvania Railroad's plans for increased facilities in Baltimore, costing from $22,500,000 to $30,000,000, include electrification of all its lines in the main part of the city, at an estimated cost between $7,500,000 and $15,000,000, and construction of two additional tunnels approximately paralleling the present Pennsylvania tubes under the city. The Baltimore electrification program is distinct from the previously announced plan to electrify the Pennsylvania's main line from New York to Washington.

New Power Company for Southern Maryland.—Application for permission to construct an electric power system in southern Maryland to serve communities in St. Mary's, Calvert, Charles and Prince George's Counties where electric service has not existed heretofore has been filed with the Public Service Commission by the Suburban Light & Power Company, an organization of Maryland and Cleveland business men. Either contracts will be made for the purchase of power from Baltimore or Washington utilities or the company will build its own power plant.

Pacific Gas & Electric Company's 1928 Program Involves $22,500,000.—The Pacific Gas & Electric Company's construction and maintenance budget for 1928 for additions and betterments to plants involves expenditures in excess of $22,500,000. One of the major activities is the Mokelumne River development, which was described in the Electrical World for Dec. 31 (page 1367). In Placer and Nevada Counties additions to the Spaulding-Drum developments will be completed, involving the erection of the Spaulding No. 3 plant, a 10,000-hp. unit on Lake Spaulding; the replacing of temporary structures and relining of the Drum Canal, providing increased water capacities, and the installation of a penstock and a fourth generating unit of 20,000 hp. at the Drum plant near Colfax, which will bring this plant up to an installed capacity of 70,000 hp. In the East Bay territory work will continue on the enlargement of the company's steam-electric plant in Oakland, where, as already reported, a new 37,500-kw. turbine is being installed.

**Vermont Electrical Association Meets at Burlington.**—The Vermont Electrical Association held its winter meeting in Burlington on March 1, and members had an opportunity to visit the new hydro-electric plant of the Burlington Light & Power Company at Winooski Gorge. At the banquet H. B. Kinnison, United States Geological Survey, was to talk on "Special Features of the New England Flood of 1927," and M. G. Clark, vice-president of the People's Hydro-Electric Vermont Corporation, was down to give "an executive's viewpoint of problems resulting from the freshet."

**Kentucky Utilities Shuts Down a Generating Station.**—The Kentucky Utilities Company has announced the shutdown of the Dorchester generating station of the Old Dominion Power Company, a subsidiary, near Norton, Va., following the addition of a 33,000-volt circuit to its steel-tower transmission line between the Pocket (Va.) generating station and Imboden and the reconstruction of the old circuit. With the improved transmission facilities it was found that the Pocket station could easily carry the increased power load of the Dorchester station and at a reduced cost. The Dorchester plant will be held as an emergency unit.

**Electrically Welded Railroad Bridge Ready for Use.**—An electrically welded steel-truss bridge has been set in place across a canal at Chicopee Falls, Mass., and as soon as flooring and track have been laid it will be in regular use by the Boston & Maine Railroad in moving freight to and from the river plant of the Westinghouse Electric & Manufacturing Company, where large radio transmitters are being produced for naval and marine use. The bridge is 175 ft. long and its weight is 80 tons. It meets the same requirements as a riveted structure of 120 tons and is considered more satisfactory and durable Studies are being made for eight main-line railroads contemplating the use of such bridges, according to Gilbert D. Fish, consulting engineer with the Westinghouse company

**Iowa's Claim to Leadership in Electrical Saturation.**—Production and sale of electrical energy in Iowa during 1927 surpassed all previous records, and figures from the Geological Survey reports quoted by Joe Carmichael at the Iowa Power Conference put the total excess for last year over 1926 at almost 60,000,000 kw.-hr. Production for 1927 was approximately 1,403,684,400 kw.-hr. Iowa claims to be the most thoroughly electrified state. Electric service is now available to 99.7 per cent of her urban population, the estimate says. She has approximately 11,000 miles of transmission lines, and during 1927 the State Board of Railroad Commissioners granted franchises for the construction of 827 miles, and county boards of supervisors for the construction of 188 miles. Of the 922 cities and towns in Iowa, 884 have electrical energy available. Those not served have populations under 400.

**Record-Breaking Turbines for Conowingo.**—Unprecedented in physical dimensions, according to the manufacturer, the Allis-Chalmers Manufacturing Company, the four 54,000-hp. hydraulic turbines built for the Conowingo development of the Philadelphia Electric Company, two of which are already installed, have many points of interest. They will operate at a speed of 81.8 r.p.m. under a normal head of 89 ft. The turbines are single-runner, vertical-shaft type with steel-plate spiral castings. The cast-steel runners have an over-all diameter of 17 ft. 9 in. and weigh approximately 100 tons each. The butterfly valves have a diameter of 27 ft.

**Philadelphia Suburban-Counties to Expand Barbadoes Island Plant.**—The Philadelphia Suburban-Counties Gas & Electric Company will spend more than $6,000,000 during the current year for plant extensions and improvements, according to an announcement made by H. H. Ganser, vice-president and general manager of the company, which is a subsidiary of the United Gas Improvement Company. Contemplated improvements in the electric department include the expansion of the Barbadoes Island power plant in the Schuylkill at Norristown, additional facilities at various substations throughout the territory and numerous power-line extensions to tie in the system.

**New York City's Three Coming 160,000-Kw. Generators.**—The next twelve or fifteen months will see an increase in the generating machinery serving the New York Edison and United Electric Light & Power companies in the Manhattan and Bronx boroughs of New York City of 50 per cent. This will be brought about by the installation of three 160,000-kw. generators, two at the Hell Gate and one at the East River station. Thus the rating of Hell Gate, now 285,000 kw., will increase to 605,000 kw. and that of East River, now 120,000 kw., to 280,000 kw. The entire system will go up from 925,000 kw. to 1,405,000 kw.

**Coming Hydro Development Near Ogdensburg, N. Y.**—The St. Lawrence Valley Power Corporation will begin extensive developments at the Eel Weir, about five miles from Ogdensburg, N. Y., about April 1, according to an announcement made by F. A. Stoughton, president of the corporation, which purchased the Eel Weir some months ago. A concrete dam 14 ft. high will be built, also a large power house of the three-unit type, the turbines for which have already been ordered. The total capacity will be 3,000 hp. The company has the right-of-way from Eel Weir direct to Ogdensburg. Sept. 1 is set for the completion of the work.

**California-Oregon Suing to Get Fort Klamath Territory.**—The Oregon Public Service Commission is the defendant in a suit by the California-Oregon Power Company to set aside an order of the commission (Electrical World, Dec. 17, page 1270) which gives to the Wood River Power Company the exclusive right to furnish light and power to Fort Klamath on the ground of priority. This suit is the outcome of a long and bitterly contested controversy. The California-Oregon company claims that it was first in the territory by reason of negotiations with prospective customers and the government long prior to the existence of the Wood River Power Company. The suit raises the question of the comparative importance of a blanket franchise granted by a county court and a certificate of convenience and necessity.

**Manhattan (Kan.) Voters Demand Low Rates.**—Refusing by a vote of three to one to renew the franchise of the United Power & Light Corporation, despite an accompanying rate reduction of about 15 per cent, citizens of Manhattan, Kan., through the City Commission, have served notice on the company that franchise negotiations will not be reopened until still lower rates are offered. Unless such rates are offered "within a reasonable length of time," the city will petition the state commission for them. The proposed franchise had been recommended by the City Commission and Mayor, a special franchise committee, the Chamber of Commerce and leading newspapers. The company has also prepared reduced schedules for Salina and is doing so for Junction City.

**Electric-Steam Generator Installed at Lewiston, Me.**—Lewiston, Me., now boasts an electric-steam generator installed by the Central Maine Power Company at its steam plant there to utilize surplus hydro power from Gulf

Island. The boiler is 66 in. in diameter, 19 ft. over all and contains 72 steel tubes 3 in. in diameter by 16 ft. in length. The boiler was constructed for a working pressure of 125 lb. and is rated at 1,200 kw. The electrical equipment, furnished by the General Electric Company, consists of 144 heating units, four control panels and four pressure governors. The boiler is designed for a 440-volt, three-phase circuit. The energy is furnished by two 600-kw., 10,000/460-volt transformers outside the boiler room. It furnishes heat to the plant itself, the company's office building and storeroom, a hotel and a theater.

Stone & Webster Open Office in Paris.—An office for investigation and valuation of utility companies, industries and governmental and municipal projects for American bankers and investors has just been opened at 2 Rue des Italiens, Paris, by Stone & Webster, Inc. James F. Case, who has had engineering and financial experience in Europe, South America, China, the Philippines, Canada and Cuba, will be in charge. He was chairman of the American delegation to the French International Engineering Congress, which studied plans for restoring the French devastated regions. He resigned from Ulen & Company, New York, which has affiliations with Stone & Webster, on Feb. 1.

California Railroad Commission to Investigate Rates of Los Angeles Gas & Electric.—The California Railroad Commission has instituted an investigation into all electric rates charged by the Los Angeles Gas & Electric Corporation in the city of Los Angeles and vicinity. This action is the result of the company's filing a revised schedule of rates applicable to street-lighting service and embodying a reduction from 4 cents a kilowatt-hour to 3 cents. This circumstance, the commission held, invited an investigation into the company's other rates for electric service. Its order brings the rates of virtually all the larger utilities of California before it for investigation or action in some form or another.

Work on New Holtwood Plant to Start in April.—Construction of the thirty-million-dollar hydro-electric plant on the Susquehanna River at Safe Harbor, Pa., 9 miles above the present Holtwood plant and about 25 miles above the Philadelphia Electric Company's Conowingo dam, will be started in April by the Pennsylvania Water & Power Company. Final plans are rapidly nearing completion and bids will be asked soon. It is generally expected that the successful bidder will be the Arundel Corporation of Baltimore, builder of the Conowingo plant. The company has executed with the Consolidated Gas, Electric Light & Power Company of Baltimore a new 43-year agreement covering the use of the Pennsylvania company's power and other facilities in Maryland by the Baltimore central station.

Deepwater Plant to Operate Entirely on 1,200-Lb Steam.—The generating station to be built at Deepwater, N. J., opposite Wilmington, Del., by the American Gas & Electric Company and the American Electric Power Corporation (Stevens & Wood, engineers), which will have an initial generating capacity of 118,500 kw., will have its entire steam demand supplied by high-pressure boilers. There will be two main cross-compound turbine sets, each rated at 54,000 kw. Each set will consist of a 12,500-kw. high-pressure unit operating at 3,600 r.p.m. and a 41,700-kw. low-pressure unit operating at 1,800 r.p.m. The initial steam conditions will be 1,200 lb. gage pressure and 725 deg. F. total temperature. A third high-pressure single-cylinder turbine of 12,500 kw. will be installed and will operate non-condensing. The turbines, generators and exciters will be manufactured and installed by the General Electric Company, which says that Deepwater will be the first central station to operate entirely on a pressure of 1,200-lb. steam.

# Recent Court Decisions

Oral Permission of Husband for Erection of Poles on Wife's Property Accepted at Company's Risk.—Asserting that he had falsely represented himself as his wife's agent and granted oral permission to the Legget Electric Company to erect poles on her land which she afterward forced the company to remove, suit was brought by the latter against the husband for damages based on the alleged deceit (Legget Electric Company vs. Morrison). The North Carolina Supreme Court sustained judgment in favor of the defendant, holding that since the company knew the wife to be the owner, its proceeding to erect the poles without her written authority was at its own risk. (139 S.E. 455.)*

Responsibility of Power Company for Injuries Due to Explosion in Manhole.—The Supreme Judicial Court of Massachusetts found, in Tucker vs. Haverhill Electric Company, that a power company is not liable for injuries resulting from an explosion in a manhole by which the cover was thrown up, the accident apparently being caused by excessive rainfall accumulated in the manhole, unless it had failed to perform some duty which prudence and reasonable care imposed upon it. So finding, the court sustained instructions in the trial court which relieved the Haverhill company from liability because of alleged negligence in failing to prevent the accumulation of water, to inspect the manhole before heavy rain or to provide it with a drain or a secure cover. Where it could not be shown that the explosion would not have happened without the power company's fault the Supreme Court declared, the doctrine of *res ipsa loquitur* ("the thing speaks for itself") did not apply. (159 N.E. 447.)

# Commission Rulings

Colorado Municipal Plant Forbidden to Seek Business Outside Corporate Limits.—The Colorado Public Utilities Commission has denied the municipally owned plant of Loveland permission to sell electricity to customers outside of the corporate limits of that city. The manager of the Loveland plant was said to be encroaching upon the territory served by the Public Service Company of Colorado. It will be recalled that after considerable litigation the city of Loveland about three years ago gained the right to condemn the Public Service Company's plant in Loveland and add it to the municipal electric system of the latter city.

Commission's Jurisdiction Not Terminated by Simultaneous Court Action.—The Clear Creek Power & Development Company complained that in making certain orders connected with alleged invasion of its territory the Colorado Public Utilities Commission was exceeding its jurisdiction. In answer the commission maintained (1) that in a proceeding commenced by filing a complaint against an electric utility alleged to be invading the territory of another company the commission may determine a question raised by an answer asking alternative relief, namely, whether in the event the defendant is not entitled to operate in the vicinity a certificate of public convenience and necessity should be issued to it authorizing such operation; (2) that the commission has jurisdiction to determine the questions raised by a complaint against an alleged invasion of territory by an electric utility and, if the facts should warrant, to grant relief; (3) that a company complaining to the commission against an alleged invasion of territory and also going into a court of equity to secure a temporary injunction to maintain the *status quo* does not by this procedure terminate the jurisdiction of the commission over the complaint.

Uniform Rates Set Up for Rival Municipal and Private Plants.—The municipal plant of Logan City, Utah, and the Utah Power & Light Company are rivals in the light and power business in the city named. In March, 1927, the Utah Public Utilities Commission brought about between them an understanding that both should abandon flat-rate service, install meters and serve their respective consumers on meter rates. The city proceeded to install meters, but again came before the commission to aver that the company had failed to do so and continued to serve its patrons at flat rates, which the city alleged to be unreasonable, discriminatory and in violation of the public utilities act. The company filed objections to the complaint to the effect that its purpose was not to procure reasonable rates to be charged by both plants, but to compel the company to establish rates higher than those established by the city, and that the order applied for would deny the defendant equal protection of the law and its constitutional rights. As an outcome of the above complaint and counter-complaint, the Utah commission has ordered both plants to serve their customers upon a meter basis for a test period of one year at substantially the uniform meter rates charged throughout the state by the Utah Power & Light Company.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *Greenwood Heads N.E.L.A. Commercial Department*

C. Ernest Greenwood of the Edison Electric Illuminating Company of Boston has been appointed director of the newly created commercial department of the National Electric Light Association and will join the headquarters staff March 15. The new department is to function under the direction of the Commercial National Section in an advisory capacity on commercial and merchandising problems confronting electric light and power companies. Mr. Greenwood has always been a resident of Boston. Shortly after his graduation from Harvard he entered the commercial department of the Boston Edison Company and later served in the statistical department on rate analysis problems. He then represented his company in negotiations for service to new buildings and isolated plants and in 1916 was appointed superintendent of the appliance department. Since that time he has specialized in public utility merchandising.

C. E. GREENWOOD

He has for years been active in the work of the National Electric Light Association on the merchandising, refrigeration, range, commercial cooking and promotional rates committees. He was vice-chairman and chairman of the merchandising bureau in 1921 and 1922 and served for two years as chairman of the appliance department of the joint committee for business development. For the last two years Mr. Greenwood has been chairman of the general merchandising committee and inaugurated the Intertrade Conference. He has devoted much of his time to trade relations and co-operative merchandising with dealers. Incident to his other duties he has been editor of *Edison Life*, the employee publication of the Boston Edison.

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Arthur B. Lisle, formerly general manager of the Narragansett Electric Lighting Company, Providence, R. I., has been elected president of the New England Water, Light & Power Associates, a newly chartered organization controlling the Central Connecticut Light & Power Company and a number of water companies located in various parts of New England. Mr. Lisle recently became president of the Central Connecticut Company, and will continue to make his headquarters at Providence.

Hobart Beresford has been appointed agricultural engineer of the Idaho Power Company, Boise, Idaho.

Gerard Swope, president of the General Electric Company, returned from Europe Feb. 27 aboard the *Leviathan* after a short sojourn abroad.

Philip Gossler, president and chairman of the board of the Columbia Gas & Electric Company, New York, sailed for Cuba last week on the *Munargo*.

John J. O'Brien, president of the Byllesby Engineering & Management Corporation, Chicago, has been elected a member of the board of directors of the Harris Trust & Savings Bank, Chicago.

John W. Storrs, a member of the New Hampshire Public Service Commission, has been named chairman of that body to succeed the late William T. Gunnison. M. M. Morse of Berlin, N. H., has been appointed by Governor Spaulding a member of the commission to fill out the unexpired term of Mr. Gunnison.

Thomas W. Martin, president of the Alabama Power Company, has been elected a member of the board of trustees of the George Peabody College of Nashville, Tenn. Peabody College is an institution for the training of school teachers.

Guglielmo Marconi has been invited by Premier Mussolini to assume the presidency of a committee for the organization of an Italian National Research Council. Such a council has been in existence since 1921, but on account of its peculiar organization it has not been able to obtain satisfactory results. The new council will be a permanent consultative and informative organ of the government concerning the development and progress of scientific activity at home and abroad.

D. Edgar Manson has been elected president of the Gloucester (Mass.) Electric Company, which utility was recently acquired by Charles H. Tenney & Company. Mr. Manson is an executive of several other utilities in the Tenney group. Other officers elected were: Albert B. Tenney, vice-president; Elihu A. Bradley, treasurer; Rockwell C. Tenney, assistant treasurer. W. L. Brown, Jr., who has been with the Gloucester Electric Company for the past twelve years, will continue to act in the capacity of manager.

## *Julian C. Smith New President of Canadian Institute*

Julian C. Smith, vice-president and general manager of the Shawinigan Water & Power Company, Montreal, Que., was installed as president of the Engineering Institute of Canada for 1928 at the Institute's recent annual convention. Mr. Smith has been an outstanding figure in engineering circles in Canada for a number of years, though an American by birth. Elmira, New York, is his native city and Cornell University his alma mater. He began his business career as draftsman with Wallace C. Johnson, consulting engineer, Niagara Falls, N. Y., and when Mr. Johnson removed to Shawinigan Falls, Que., Mr. Smith accompanied him in the capacity of assistant engineer.

J. C. SMITH

It was in 1903 that he threw in his lot with the Shawinigan Water & Power Company, when he became superintendent, advancing to the position of general superintendent three years later. Subsequently he was named general superintendent and chief engineer and in 1913 he was made vice-president. At present, in addition to being vice-president and general manager of the Shawinigan company, he is vice-president of the Dominion Engineering Works, Lachine; president of the Quebec Power Company and of the Montreal Tramways and a director of the Dominion Bridge & Laurentide Power Company and of the Montreal Light, Heat & Power Consolidated. Mr. Smith is a member of the British Institution of Electrical Engineers, the American Institute of Electrical Engineers and the American Society of Civil Engineers.

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William Lawyer Hinds of Syracuse, N. Y., was elected a director of the New York Telephone Company at the meeting of the board held Feb. 23. Mr. Hinds is vice-president of the Crouse-Hinds Company of Syracuse, manufacturer of electrical supplies, and is also a director of the First Trust & Deposit Company, the Syracuse Savings Bank and the Onondaga Pottery Company of Syracuse. He is also a member of the Syracuse Chamber of Commerce.

**R. C. Hendrickson** has been appointed superintendent of transmission lines of the New York Power & Light Corporation.

**Stanley W. Stoddard** has been appointed assistant electrical engineer of the New England Power System. A native of Massachusetts and a graduate of the University of Maine, Mr. Stoddard has been identified with the New England Power System since 1920, when he entered its employ in the capacity of electrical designer. Formerly he had been identified with Stone & Webster at Boston and with the H. M. Hope Engineering Company. About four years ago Mr. Stoddard was transferred from the drafting room to the electrical engineering office.

**William O. Wood**, widely known in the public utility industry, has just been elected vice-president of Waterbury Cable Service, Inc., New York and Chicago. The Waterbury organization is active in the field of underground cable installation and in street lighting, as well as in furnishing special supplies and accessories necessary to this type of installation. Mr. Wood has for many years past been identified with railroads and electric railways in New York, the South and the Middle West, having been for fifteen years president and general manager of the New York & Queens County Railway Company.

**William Stephen Hart** has been made a vice-president of the Shawinigan Water & Power Company, Montreal, Que. Mr. Hart has been for some years treasurer and director of the Shawinigan company and a director of subsidiary companies. He is a treasurer and a director of the Quebec Power Company and Quebec Railway, Light, Heat & Power Company. Born at Foxborough, Mass., in 1878, Mr. Rart was educated at the Massachusetts Institute of Technology. He took up his residence in Canada in 1903, and in that year joined the Shawinigan Water & Power Company as accountant. He was made secretary in 1906, treasurer in 1912 and director in 1916.

**William L. Abbott**, chief engineer of the Commonwealth Edison Company, Chicago, was the guest of honor at a dinner given at the Palmer House Feb. 14, the occasion commemorating Mr. Abbott's birthday. More than a thousand friends were present and Louis A. Ferguson, toastmaster, read letters and telegrams from many others who were unable to attend. Addresses were made by Samuel Insull, Col. Peter Junkersfeld and Dr. David Kinley. At the close of the speeches Mr. Ferguson presented to Mr. Abbott a silver service as a remembrance of the happy occasion. Mr. Abbott has been affiliated with the Commonwealth Edison Company for 42 years.

## *W. C. Hornberger Vice-President of Arizona Utility*

William C. Hornberger, a public utility man of wide experience, who has been prominently identified with the rapid development of Arizona, became vice-president and general manager of the Arizona Edison Company Feb. 1. The Arizona Edison Company is a subsidiary of the Peoples Light & Power Corporation. Mr. Hornberger's record in the industry shows that he is eminently fitted for his new position. He is a native of Michigan and a graduate of the University of Michigan. Following graduation he was associated for a while with a firm of consulting engineers in Detroit and then went to Phoenix, Ariz., where in 1902 he became connected with the Phoenix Light & Fuel Company, now the Central Arizona Light & Power Company. Beginning work as a switchboard wireman, Mr. Hornberger was steadily promoted to higher positions, in later years becoming successively general superintendent, assistant secretary and assistant general manager of the Central Arizona Light & Power Company. He has held the last-named position for the past eight years. Mr. Hornberger is a director of the Pacific Coast Gas Association, president of the Arizona State Utilities Association and president of the Salt River Valley Electrical League.

W. C. HORNBERGER

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**W. R. McGeachin**, who has been serving as contract engineer and rate manager for the Iowa-Nebraska Light & Power Company, has been advanced to the position of assistant general manager to Frank H. Brooks, vice-president in charge of operation. Mr. McGeachin is a graduate of the University of Nebraska and for eleven years was in charge of government electrical development in the Philippines, serving as manager of the Manila electrical system. He served in the World War in France as a captain of engineers, and after his return entered the service of the Iowa-Nebraska company. He has served in various capacities in Missouri, Iowa and Nebraska. Other changes in the headquarters staff include the promotion of **Otto R. Mallat**, assistant to the manager of the Lincoln district, to the position of assistant secretary, and the naming of **B. H. Conlee**, formerly manager of the Beatrice district, to the place of general contract representative.

## Obituary

**Edward McDonald**, formerly plant superintendent of the Nebraska Power Company, died Jan. 11 in his 59th year. Mr. McDonald had been affiliated with the company for more than ten years.

**Walter Bauer**, president of the Pyrene Manufacturing Company, Newark, N. J., died Feb. 12 in his 44th year. A native of Fort Wayne, Ind., Mr. Bauer became identified with the Fort Wayne Electric Company and later with the General Electric Company. Following this connection he was appointed general manager of the American Eveready Company. After serving for two years as vice-president and general manager of the American Chicle Company, he was named president of the Pyrene Manufacturing Company in 1918, the position he occupied at the time of his death. Mr. Bauer was president of the Fire Equipment Institute for several years.

**Charles P. Hugo Schoellkopf**, a member of the firm of Schoellkopf, Hutton & Pomeroy, Inc., bankers of Buffalo, and vice-chairman of the board and a member of the executive committee of the Niagara Falls Power Company, died Feb. 14 in the Lenox Hill Hospital, New York, after an illness of eight weeks. For many years Mr. Schoellkopf was vice-president of the Niagara Falls Power Company, but he retired from active business several years ago. He was a former treasurer of the Shafer Decker Company of Buffalo and a director of the Buffalo, Niagara & Eastern Power Corporation and the Marine Trust Company of that city. He had large mining interests in Mexico and was connected with many other business enterprises.

**George Urban, Jr.**, 77 years old, one of the early pioneers in the electrical development of the Niagara Frontier, died at his home, near Buffalo, Feb. 23. He was ill but three weeks. Mr. Urban was born in Buffalo in 1850. Many years ago, attracted by the practical possibilities of electricity, Mr. Urban journeyed to New York to interview a rising young inventor, Thomas A. Edison by name. The result of the interview was that Mr. Urban returned to Buffalo with a small electric generator, one of the first Edison built. This generator, now in the possession of the Buffalo General Electric Company, was the first electrical machine in Buffalo. Mr. Urban was vice-president and director of the Buffalo General Electric Company, president and director of the Niagara Electric Service Corporation and a director of the Buffalo, Niagara & Eastern Power Corporation.

# Financial and Statistical News

### *Stocks Remarkably Firm*
### *Levels Changed Little*
### *Recalls 1926 Break*

THE recent stock market decline presents an interesting parallel to that which swept averages down in all markets two years ago. In the case of the power and light stocks, however, federal investigation notwithstanding, the decline has been much less severe and the recovery more prompt.

It is impossible to state definitely that any one factor, such as the investigation, has had any effect. There are two other powerful factors, the general condition of the market and the Federal Reserve policy of tightening money rates. It is a rather remarkable evidence of the strength of these issues that the combination of factors referred to has had so little effect. In fact, a representative group of fifteen common stocks of companies having more than one-third of the total assets of the industry show a gain this week of more than one point on the average. Montana Power is again over 160, against a recent low of 147. Brooklyn Edison is 227, against a low for the year of 206¾. Detroit Edison is more than ten points above the low this year to date. American Gas & Electric Company is over 129, against a recent low of 117½.

These few examples are more or less representative of the more active stocks. There is another large group of inactive issues, but it is impossible to find any substantial number that are materially below levels of a couple of months ago.

## Middle West Utilities to Issue Common Stock

Directors of the Middle West Utilities Company have voted to offer additional common stock to all stockholders at $110 a share in the ratio of 10 per cent of holdings. Rights to stockholders of record March 2 will expire May 15.

## New England Utility Associates Organized

Formal organization of the New England Water, Light & Power Associates has been completed at Boston, Mass., under the auspices of the banking house of Pearson, Erhard & Company. The associates constitute a holding company which has acquired control of various water supply properties in Rhode Island and Massachusetts and also the Central Connecticut Power & Light Company, East Hampton, Conn. The officers of the trust are Arthur B. Lisle, president, and Clarence I. Worcester, vice-president. It was voted to issue $1,450,000 of 5½ per cent collateral twenty-year lien bonds and $750,000 in 6 per cent preferred stock of $100 par value. Two classes of common stock, "A" and "B," will also be issued, but will not be offered to the public. The properties merged now represent a total of about $4,000,000 from the investment standpoint.

**New York Utility Reduces Capital.**—The Orange & Rockland Electric Company has filed a certificate in the office of the Secretary of State reducing its capital stock from $6,000,000 to $5,000,000 and changing par value of shares from 45,000 shares preferred stock $100 par value, 20,000 shares preferred $25 par value and 10,000 shares common $100 par value to 50,000 shares $100 par value. The company's headquarters are at Monroe

## Pacific Gas Capital Increased $240,000,000

The Pacific Gas & Electric Company stockholders at a special meeting voted an increase in capitalization by $240,000,000, making total new capitalization $400,000,000. Under the plan, $80,000,000 in common stock was increased to $200,000,000 and $80,000,000 in 6 per cent preferred to $140,000,000. Two additional classes of preferred stock consisting of 5½ per cent and 5 per cent in the sums of $40,000,000 and $20,000,000 respectively were created. Such action was prompted by the fact that only $1,000,000 in preferred stock remained for sale. Original capitalization was $160,000,000, consisting of one-half common and one-half 6 per cent preferred.

# Regulation Discussed in Massachusetts Hearings

### Attwill's Arguments in Favor of Bill to Insure Jurisdiction by Contract Between Commission and Companies—Some Utilities Attacked Because of Rate Policies

CHAIRMAN HENRY C. ATTWILL of the Massachusetts Department of Public Utilities severely criticised the rate and dividend policies of a number of power companies in the state when recently addressing the legislative committee on power and light in support of a bill to strengthen the regulative powers of the commission. The proposed regulative contract with the state which the bill forces upon the companies under penalty of increased municipal competition, loss of the right of eminent domain and estoppal of capital expansion and the summarized arguments for and against this measure presented at the hearings have been briefly outlined in the news columns of the Electrical World. In view of the widespread interest manifested in the industry and by publicists in the regulative situation in Massachusetts as it has been affected by the appeals of the Worcester and Cambridge Electric Light companies to the federal courts against recent orders of the board reducing rates from 7 to 5 and from 8 to 5.5 cents per kilowatt-hour respectively, extracts from Mr. Attwill's argument for the bill are printed below. In a later issue the major points of opposition made by the companies will be published. Mr. Attwill's defence of the bill follows:

> This recommendation is made by the department with no hostility to the conduct of gas and electric companies by private capital, subject to state regulation. Some of the regulated and protected monopolies in this state resent the thought that rates should be made reasonable and that the public should share in their prosperity. All the members of the department, I think, believe that the principle of regulated monopoly as heretofore obtaining in Massachusetts cannot prevail and that the public will be forced into public operation of the electric utilities unless some means can be advanced by which the greed of some of the electric companies can be curbed. To our minds it is obvious that these utilities cannot continue to boast of their ability to serve the public better and to furnish service at cheaper rates than the public can do itself unless at least some of them approach the efficiency of public-operated utilities of like character and furnish service at somewhere near the rates which the publicly owned plants have shown in this state. . .
>
> If there are no companies in this state operated by private capital which can approach a rate which the Holyoke municipal plant is now giving, and making also a handsome return upon its investment, then it seems to me that the field of the private utility is gone in this Commonwealth, or I mistake very much the temper and the character of the people of the state.
>
> Our suggestions are in no way directed at those utilities which try to do the honorable thing, and which recognize that they owe some duty to the Commonwealth and to their fellow man, but we have got to a place here in the Commonwealth where if what they say is true, if the situation in which the Commonwealth and the people find themselves, according to their theories and assertions, is true, then regulation in Massachusetts in so far as rates are concerned is no longer effective. . . . Constitutional law is largely determined in the last analysis by public sentiment. A true doctrine of public opinion, a true economic theory will never be stopped by any decision of any court in this land. . . .

The battle to free the slaves was not stopped by any decision of the Supreme Court, notwithstanding the Supreme Court in the Dredd Scott case said that it was unconstitutional to free the slave.

After discussing various instances, Mr. Attwill said:

Now I think here in Massachusetts, where, as I recall it, the torch was first raised for liberty of opinion, where was first raised the torch of assault on human slavery, we ought not to be timid in asserting the right that when we grant to a monopoly the right and the power to carry on what I believe to be a state and government function, when we grant and farm out that right to some corporation, that we have the right to impose conditions upon that corporation as to how it shall conduct that governmental function which we have intrusted to it. . . . We are asserting here the principle that the time has come when we should tie up the power to regulate rates as the part of the charter of each of these corporations, the same as we have done time and time before, the same as we did when we granted the Elevated Railway the right to build its elevated structures in the city of Boston. We then said, "You shall charge so much, and no more." Many are the instances of toll bridges being erected in this Commonwealth and throughout New England where they have said exactly the same thing.

The first section of the bill provides that the gas and electric companies may readjust their stock so that the premiums and any profits that they have not withdrawn, up to 7 per cent on an average since their existence, may also be capitalized; that by that adjustment and by that rearrangement of stock they agree with the Commonwealth that there shall be an amendment to their charter to the effect that they shall thereafter be subject to such rates and charges as the Commonwealth may prescribe, subject, however, to the condition that the Commonwealth shall never again prescribe rates which will prevent them from paying dividends sufficient and adequate to maintain their stock at par.

When we guarantee, in effect, a public utility corporation—as we do in this Commonwealth, in a sense—against loss, because everybody must recognize that in a way the statutes of this Commonwealth at the present time provide that no stock can be issued except at par, we have got to maintain the credit of that company at all times, so that its stock will sell at par, in order that it may be able to get the capital needed to make extensions and improvements which the public service may require.

Now, as a practical matter we give them a monopoly of operation; we in effect guarantee the integrity of their stock, and it would seem that we ought to receive some consideration in exchange for those wonderful privileges that we give them.

Think of it, under Massachusetts rules, the rules we have had here, the war came on and these companies expected that they would be allowed by the department to increase the tax upon the public to preserve the integrity of their investment. Which was done! In largely every instance relating to gas and electric companies you will find that when they asked for an increased rate to preserve the integrity of their investment during the war it was allowed; they levied that burden upon the public, and they received the privilege of doing that very thing. Now, after the war is over and they are prospering and taking exorbitant profits, they decline to divide with the public, and they intrench themselves behind this alleged right to practice extortion and corporate greed upon the public of this Commonwealth.

Now, I am not saying that this applies to all of the companies. It certainly does apply to some of them. And if the Commonwealth of Massachusetts is to receive no relief otherwise, there has got to be some legislation of this sort or the only recourse is to go into public operation and ownership of these utilities.

That is all there is to the bill. We say to the corporations that are unwilling to do that, "Very well; you cannot, then, expect the Commonwealth to protect you from competition. You cannot expect that the cities and towns and the people of the cities and towns before they can go into business

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday Feb. 28 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 74 | 72 | 81 |
| Ala. Pwr., $7 com. pf.—no par | 114¼ | 114½ | 115½ |
| Allis-Chalmers Mfg., 6% com | 119 | 115¼ | 125 |
| Aluminum Co. of Amer., com | k127 | 120 | 136 |
| Aluminum Co. of Amer., 6% pf | 106½ | 105¾ | 107¼ |
| Amer & Foreign Pwr., 7% pf.—no par | 107 | 105½ | 108½ |
| Amer. & Foreign Pwr., com.—no par | 23 | 22⅝ | 27½ |
| Amer. Bosch Magneto, com.—no par | 16½ | 15⅜ | 22½ |
| Amer. Brown Boveri Elec.† | 15¾ | 14½ | 18 |
| Amer. Brown Boveri Elec., pf. $7 | k 57½ | 55 | 63 |
| Amer. Gas & Elec., 6% pf.—no par | 107¼ | 106¾ | 109 |
| Amer. Gas & Elec., com. †—no par | 129¼ | 117½ | 131⅞ |
| Amer. Lt. & Trac., 6% pf | 115 | 116 | 120 |
| Amer. Lt. & Trac., new com | k184 | 170 | 191 |
| Amer. Pwr. & Lt., 6% pf | 106 | 104 | 109⅛ |
| Amer. Pwr. & Lt., com. †—no par | 66⅛ | 62¼ | 69¼ |
| Amer. Pub. Serv., 7% pf | a100 | 99 | 100 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf | 90 | 90 | 93 |
| Amer. Pub. Utilities, 7% pr. pf | 100 | 98 | 100 |
| Amer. Pub. Utilities, com | k 60 | 60 | 65 |
| Amer. States Sec., A | a 5 | 4 | 5⅝ |
| Amer. States Sec., B | a 6⅞ | 4⅝ | 6 |
| Amer. Superpwr., 6% ptc pf.—25 | 30 | 28⅝ | 30 |
| Amer. Superpwr., 6% 1st pf. | l 103¾ | .... | .... |
| Amer. Sup'pwr., Class A† —no par, ex rts. | k38½ | 37 | 41⅜ |
| Amer. Sup'pwr., Class B† —no par, ex. rts. | 38¾ | 37½ | 43 |
| Amer. Wtr. Wks. & Elec., 6% pf | k103 | 101½ | 105 |
| Amer. W. W. & E., com. new—no par | 53⅜ | 52⅝ | 61 |
| Anaconda Copper cap. $3 | 54¼ | 53¾ | 59⅜ |
| Appalachian Electric Pwr., 7% pf | 109 | 108½ | 109½ |
| Arkansas Pwr., & Lt. 7% pf | 107½ | 108 | 109¼ |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 95 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par | 47⅛ | 47 | 51½ |
| BABCOCK & WILCOX, 7% com | 120 | 120 | 124⅜ |
| Binghamton L., H. & P., $6 pf | 105½ | 102 | 105½ |
| Birmingham Elec., pf.—$7—no par | 110 | 109½ | 111 |
| Blackstone Valley G. & E., 6% pf | k107 | 109 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | 140 | 132 | 143½ |
| Blaw-Knox, com.† | i103½ | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com | f199¼ | ... | |
| Brazilian Trac., Lt. & Pwr., com., new | f 51½ | .. | |
| Broad River Pwr., 7% pf | 105½ | 105 | 107½ |
| Brooklyn Edison, 8% com | 227 | 206½ | 235½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26½ | ... | .. |
| Buffalo, Niagara & East. Pwr. com. $1 20—no par | l 35¼ | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf | k 99 | 98 | 101 |
| California Ry. & Pwr., 7% pf | k135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l110½ | 109 | 110½ |
| Central & S. W. Util., $7 pf.—no par | a102 | 99½ | 105 |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a103½ | 103½ | 108 |
| Central Ark. Ry. & Lt., 7% pf | 104 | 105 | 107 |
| Central Ill. Pub. Serv., $6 pf | a 98½ | 97⅞ | 99½ |
| Central Ind. Pwr., 7% pf | a 97½ | 95 | 99½ |
| Central Maine Power, 6% pf | 95 | .... | .... |
| Central Maine Power, 7% | 107 | 109 | 112 |
| Central Pwr. & Lt., 7% pf | 104½ | 104½ | 105½ |
| Central States Elec., 7% pf | 106 | 104 | 107 |
| Century Elec., 6% com | m145 | 140 | 145 |
| Chicago Fuse Mfg., com.—$2.50 no par | a 30 | 30 | 33½ |
| Cincinnati Gas & Elec., 5% com | g 98¾ | 97½ | 100 |
| Cities Service, $6 pf.—no par | l 96¾ | 94½ | 96¾ |
| Cities Service, pf B—no par | k 8¾ | 8½ | 9⅛ |
| Cities Service, pf BB—no par | k 90¾ | 88 | 90¾ |
| Cities Service, com—20 | l 56¾ | 54 | 56¾ |
| Cities Service, Bks. Shrs—10 | m 27½ | 22½ | 27 |
| Cities Service Pwr. & Lt., 7% pf | l 106 | 107 | 109 |
| Cities Service Pwr. & Lt., 6% pf | k 95 | 95 | 96 |
| Cleveland Elec. Illg., 6% pf | 114 | 113 | 115 |
| Cleveland Elec. Illg., 10% com | 360 | 350 | 370 |
| Columbia Gas & Elec., 6% pf | 107⅛ | 107⅛ | 110⅛ |
| Columbia G. & E. com. $5—no par | 91½ | 89⅜ | 97⅜ |
| Columbus Elec. & Pwr., $2 com.—no par | m 70 | 66 | 71 |
| Columbus Elec. & Pwr., 7% pf | 113 | | |
| Columbus Ry., Pwr. & Lt., 7% pf | 106½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 105½ | .... | .... |
| Columbus Ry., P & Lt. com.—no par | 105 | .. | .... |
| Commonwealth Edison, 8% com | a174 | 165 | 189 |
| Commonwealth Pwr., 6% pf | 102½ | 102⅛ | 104⅛ |
| Commonw'th Pwr., $2, com.—no par | 66¼ | 62¼ | 69 |
| Conn. Lt. & Pwr., 8% pf | 119 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf | 116 | 118 | 121 |
| Cons. Gas of N. Y., pf | 101½ | 101¼ | 102½ |
| Cons. Gas of N. Y., com. $5—no par | 130⅜ | 119⅜ | 139¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf | e112½ | 110⅛ | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf | e110½ | 110¼ | 113½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf | e110½ | 110½ | 115 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf | e125½ | 125½ | 128½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 70 | 67½ | 72½ |
| Consolidated Pwr. & Lt., 7% pf | 105 | .... | .... |
| Consumers Pwr., 6% pf | 104½ | 105½ | 106½ |
| Consumers Pwr., 6.6% pf | 106½ | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf | 106½ | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par | k235 | 240 | 265 |
| Crocker Wheeler, com.† | 30 | 23 | 38 |
| Crocker Wheeler, 7% pf | 90 | 78 | 91 |
| DALLAS PWR. & LT., 7% pf | 110½ | 110 | 111 |
| Dayton Pwr. & Lt., 6% pf | 108½ | 108½ | 109 |
| Detroit Edison, 8% com | 178⅜ | 166½ | 194½ |
| Dubilier Condenser, com.—no par | 3½ | 2½ | 3¼ |
| Duke Pwr., cap | k135 | 130 | 145 |
| Duquesne Lt., 7% pf | 116⅜ | 115½ | 116⅜ |
| EASTERN NEW YORK UTIL., $7 pf | k110½ | 111 | 112½ |
| Eastern New York Util. com | k 65 | | |
| Eastern States Pwr. $7, com | k 12 | 12 | 14½ |
| Eastern States Pwr., pf | k 97 | 98 | 99 |
| East Tex. Elec., 7% pf | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com | d256 | 252 | 268 |
| El Paso Elec. 7% pf | 113 | 110 | 112½ |
| Elec. Bond & Share, 6% pf | l109½ | 109¼ | 111½ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 87½ | 76 | 94½ |
| Electric Household Util.† | a 14½ | 13½ | 15½ |
| Elec. Investors, 6% pf.—no par | 102 | 101 | 102⅛ |
| Elec. Investors, com.†—no par | 41½ | 40¼ | 45⅜ |
| Elec. Pwr. & Lt., ctfs. pf | 109½ | 106¼ | 109 |
| Elec. Pwr. & Lt., ctfs., 40% pd | k122½ | 120½ | 123 |
| Elec. Pwr. & Lt., ctfs., com.—no par | 33⅜ | 28½ | 34½ |
| Elec. Refrig. cap.† | 14⅜ | 11¼ | 15½ |
| Elec. Ry. Securities, com.—no par | 6½ | 6½ | 7 |
| Elec. St. Battery com. $5.25—no par | 71⅜ | 69 | 75½ |
| Elmira Wtr., Lt. & R.R., 7% pf | k105 | 104 | 105½ |
| Empire Pwr., ptc.† | 30½ | 27½ | 35⅜ |
| Engr. Pub. Serv. $7. pf.—no par | k108½ | 107 | 109 |
| Engr. Pub. Serv., com.—no par | 34½ | 33 | 36⅜ |
| Eureka Vacuum Cleaner com. $4—no par | 71½ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf | k106 | 104 | 106⅜ |
| F.-M., com.—$3—no par | 37½ | 32¼ | 40½ |
| Federal Lt. & Trac., com. $1.40 | 51½ | 42 | 55 |
| Federal Lt. & Trac., $6 pf.—no par | 101 | 98 | 105 |
| Florida Pwr. & Lt., 7% pf | 107 | 105 | 107½ |
| Ft. Worth Pwr. & Lt., 7% pf | i113¼ | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf | 77 | 75 | 78 |
| Galveston-Houston Elec., com | 32 | 31 | 34 |
| General Cable Cl A | a 62¼ | 56 | 64 |
| Gen. Elec. $3 com.—no par | 126½ | 124 | 138¼ |
| Gen. Elec., special 6% | 11¼ | 11⅛ | 11½ |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 40½ | 35½ | 40½ |
| Gen. G. & E. (Del.) pf. A $8—no par | k123 | 122½ | 126½ |
| Gen. G. & E. (Del.) pf. A $7—no par | k112¼ | 108½ | 112¼ |
| Gen. G. & E. (Del.) pf. B $7 | 107 | 105½ | 107 |
| Gen. Pub. Serv. $7 cum. pf.—no par | k119½ | 115 | 120 |
| Gen. Pub. Serv. com.—no par | 19 | 16½ | 20½ |
| General Public Utilities, $7 pf | 98⅜ | 98 | 99 |
| Ga. Lt., Pwr. & Rys., com | k 58 | 55 | 65 |
| Ga. Ry. & Pwr., 8% pf | k125 | ... | ... |
| Ga. Ry. & Pwr., 7% pf | k113½ | .. | |
| Gt. Western Pwr., 7% pf | h105 | | |
| IDAHO PWR., 7% pf | 108½ | 109 | 110 |
| Ill. No. Utilities, 6% pf | k 96 | 96 | 98 |
| Ill. Pwr. & Lt., 7% pf | 104 | 103 | 105 |
| Ingersoll Rand com | k 90 | 90 | 94 |
| Int. Combus. Engr., com. $2—no par | 47½ | 45½ | 55½ |
| Int. Combustion Engr., 7% pf | k103½ | 103½ | 105½ |
| Int. Util., Class A $3.50—no par | k 45½ | 45 | 51½ |
| Int. Utilities, Class B—no par | k 7½ | 3½ | 10 |
| Interstate Pwr. pf. $7—no par | 101 | 99 | 101 |
| Interstate Pub. Serv., 7% pf | 104 | 103 | 104 |
| Iowa Ry. & Lt., 7% pf | k100 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 107½ | 105 | 107 |
| Johns-Manville com.†—no par | 116½ | 114 | 125 |
| Johns-Manville, 7% pf | m119½ | 119½ | 120 |

Stock Exchange. aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Feb. 25. lBid price Wednesday, Feb. 29. mLatest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

**(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)**

| Companies | Bid Price Tuesday Feb. 28 | Low 1928 | High 1928 |
|---|---|---|---|
| **KANSAS CITY PWR. & LT. pf. $7** | k116 | 115 | 116 |
| Kansas Gas & Elec., 7% pf. | l109½ | 107 | 109 |
| Kentucky Hydro-Elec., 7% pf. | k103 | 100 | 104 |
| Kentucky Sec., 6% pf | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | k101 | 100 | 102 |
| LACLEDE GAS LT., 10% com. | k260 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 25 | 19¾ | 27¼ |
| Long Island Ltg., 7% pf. | 112 | 110½ | 112½ |
| Long Island Ltg., com.†—no par | k170 | 170 | 180 |
| Los Angeles Gas & Elec., 6% pf. | 108 | 105 | 109 |
| Louisville Gas & Elec., cl. A. $1.75 | 28¾ | 28 | 29¾ |
| MAN. ELEC. SUPPLY, cap. $5—no par | 53 | 50 | 54¾ |
| Manila Elec., com.†—no par | k 45 | 45½ | 50 |
| Maytag Mfg., com 50—no par, | 31 | 30½ | 34½ |
| Memphis P. & L., pf. $7 no par | h109½ | 109 | 111 |
| Metropolitan Ed., pf. $6 no par | 106 | 103 | 107½ |
| Metropolitan Ed., pf.—$7—no par | 109 | 109 | 111 |
| Metropolitan Ed., com. $5—no par | k140 | .... | .... |
| Middle West Utilities, 7% pf | a123½ | 116½ | 124½ |
| Middle West Util., 7% pr. lien | a128 | 125½ | 129½ |
| Middle West Util., com. $6—no par | a132 | 123½ | 135 |
| Midland Utilities, pr. ln. 6% pf | a 95½ | 94 | 96½ |
| Midland Utilities, 7% pf. A | a103 | 103 | 104 |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k 99 | 98 | 101½ |
| Minn. Pwr. & Lt., 7% pf. | l109 | 107 | 109 |
| Miss. River Pwr., 6% pf. | 108 | 94 | 108 |
| Miss. River Pwr., 3% com | m 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7 no par | k107 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | h104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 29¾ | 29¼ | 31½ |
| Montana Pwr., 5% com. | 164¼ | 102¼ | 167 |
| Montreal Pwr., 7½% com. | f 90½ | .... | .... |
| Mountain States Pwr., 7% pf. | k103 | 97 | 103 |
| Mountain States Pwr., com.† | 16½ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109 | 98 | 110 |
| National Carbon, 8% pf | a138½ | 138 | 139 |
| National Elec. Pwr., A† | a 31½ | 27½ | 32½ |
| National Lt., Ht. & Pwr., com. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 109¾ | 108½ | 111 |
| National Pwr. & Lt., com.†—no par. | 25¾ | 21¾ | 27¾ |
| National Pub. Serv., 7% pf. | 102 | 99 | 103 |
| National Pub. Serv., 7% ptc., pf. | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 25¾ | 22 | 27½ |
| National Pub. Serv., B com.—no par | 27¼ | 24¼ | 30 |
| Nebraska Pwr., 7% pf. | l110 | 110 | 111½ |
| Nevada-Calif. Elec., com | k 35 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | k 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k110 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | 108 | 95 | 100 |
| New Orleans Pub. Serv.—7% pf. | 108½ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf | k103 | 101 | 104 |
| New York Power & Light 7% pf. | 114½ | .... | .... |
| New York Power & Light, 8% pf. | 114 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com | 109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | 109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28½ | 28 | 28½ |
| No. Amer., 6% pf.—50 | 54¾ | 53½ | 55 |
| No. Amer., com.—10 | 61½ | 58¾ | 62½ |
| No. Amer. Edison, $6 pf.—no par | 103 | 102½ | 105¾ |
| No. Caro. Pub. Serv., pf.—$7—no par | 109 | 93 | 105 |
| Northeastern Pwr., com | 20½ | 19¾ | 23 |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 24½ | 18 | 24½ |
| No. Ont. Lt. & Pwr., 6% pf. | k 98 | 94 | 99 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf | k108 | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 131½ | 123 | 136½ |
| No. Texas Elec., 6% pf | 58 | 45 | 70 |
| No. Texas Elec., com. | 18 | 5 | 36 |
| OHIO BRASS, com. B $4—no par. | k97½ | 89 | 98½ |
| Ohio Brass, 6% pf. | k107 | 100 | 111 |
| Ohio Pwr., 6% pf | 106½ | 104 | 107½ |
| Ohio Pub. Serv., $6 pf | k102½ | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | 111 | 107 | 111 |
| Ohio River Edison, 7% pf. | 109 | 106 | 109½ |
| Oklahoma Gas & Elec., 7% pf. | 112 | .... | .... |
| PACIFIC Gas & ELEC., 6% pf. | 27½ | 26¾ | 28¾ |
| Pacific Gas & Elec., 8% new com. | 44½ | 43½ | 49¾ |
| Pacific Pwr. & Lt., 7% pf. | l109 | 106 | 108½ |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 79½ | 77¾ | 79¾ |
| Penn-Ohio Edison, 6% pf no par | 94 | 93½ | 96 |
| Penn-Ohio Edison, 7% pf | 106½ | 106½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l110¼ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2 50 com., new | e 70 | 68 | 72½ |
| Phila. Co., 5% pf.—50 | k 45½ | 46½ | 48¾ |
| Phila. Co., 6% pf.—50 | 53¼ | 52 | 53 |
| Phila. Co., com.—50 | k148 | 149½ | 163 |
| Phila. Elec., 8% com.—25 | c 57 | 55½ | 59 |
| Portland Elec. Pwr., 7% pf. | 103¼ | 100 | 104½ |
| Portland Elec. Pwr., 6% pf. | 94 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 85 | 55 | 70 |
| Portland Elec. Pwr., com. | 48 | 22 | 30 |
| Potomac Elec. Power, 6% pf. | j110½ | .... | .... |
| Pwr. Sec., pf.—no par. | k 58 | 50 | 60 |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf., | l108 | .... | .... |
| Pub. Serv. of N. J., 6% pf | 106½ | 103¾ | 106¾ |
| Pub. Serv. of N. J., 7% pf. | 119¾ | 118 | 120½ |
| Pub. Serv. of N. J., $2 com.—no par | 43 | 41½ | 45 |
| Pub. Serv. of No. Ill., 6% pf. | a110 | 110 | 113½ |
| Pub. Serv. of No. Ill., 7% pf. | a119 | 119 | 121 |
| P. S. of No. Ill., com. $8—no par. | a170½ | 159½ | 180 |
| Pub. Serv. of No. Ill., $8 com. | k165 | 130½ | 160 |
| Pub. Serv. of Okla., 7% pr. ln. | k105 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109¾ | 109 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | k110 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 98 | 92 | 98½ |
| Puget Sound Pwr. & Lt., com. | 48 | 34½ | 50 |
| RADIO COPR. OF AMER., $3.50 pf.—50 | k 93¾ | 85½ | 104½ |
| Radio Corp. of Amer., com.—no par. | 93¾ | 85½ | 104¾ |
| Rhode Island Public Service, pf. $2—no par | k 31½ | 30½ | 31½ |
| Rochester Gas & Elec. 6% pf. D. | 105 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B. | 107 | 105 | 107 |
| Rochester Gas & Elec., 7% pf. C. | 105 | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | k114 | 110 | 115½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | 6¾ | 4½ | 7¾ |
| Sierra Pacific Elec., 2% com. | 35¾ | 29 | 38¾ |
| Sioux City Gas & Elec., 7% pf. | 107 | .... | .... |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 108½ | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 68 | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 42 | 41¾ | 44¾ |
| So. Calif. Edison, 8% pf. | k 45½ | 38¾ | 41 |
| So. Calif. Edison, 7% pf. | k 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | k 26½ | 25½ | 28 |
| So. Calif. Edison, 8% com | 45½ | 43½ | 47½ |
| Southern Cities Utilities, 7% pf. | k 76 | 75 | 77 |
| Southwestern Lt. & Pwr., A $3 | 70 | .... | .... |
| Southwestern Lt. & Pwr., B. | 65 | .... | .... |
| Southwestern Lt. & Pwr., $6 pf | 91½ | | |
| Southwestern Pwr. & Lt., 7% pf | h111½ | 103 | 113 |
| Standard Gas & Elec., 8% pf | 68 | 65 | 68 |
| Standard Gas & Elec., 7% pr. pf | 111½ | 108 | 113 |
| Standard G. & E., com. $3 50 | 61½ | 57¾ | 65 |
| Standard Power & Light, com. | 41 | 29¾ | 42 |
| Standard Pwr. & Lt., 7% pf. | k105 | 98 | 105 |
| Staten Island Edison, pf.—$6—no par. | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | 170 | | |
| Syracuse Lighting, 7% pf. | k110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 62 | 62 | 64 |
| Tenn. Elec. Pwr., 6% pf. | 103½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109½ | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 10 | .. | |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf | l113½ | 113½ | 115 |
| Tide Water Pwr., 8% pf | 111 | . | . |
| Timken Roller Bear., com.—$4 no par | 118 | 113¾ | 134 |
| Toledo Edison, 7% pf. | l109 | | |
| Toledo Edison, 6% pf. | k103 | 95 | 105 |
| Toledo Edison, 6% com. | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | k100 | 96 | 99 |
| UNITED GAS & ELEC., 6% pf. | 99 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c114½ | 111½ | 117½ |
| United Lt. & Pwr., pf.—$4—no par. | a 55½ | 53 | 55½ |
| United Lt. & Pwr., pf.—$6 50—no par | a 99¾ | ... | |
| United L. & P., com. A .48—no par | a 17¾ | ... | |
| United L. & P., com. B .48 no par | m 18 | | |
| Utah Pwr. & Lt., 7% pf. | i 113 | 109½ | 112½ |
| Utica Gas & Elec., 7% pf. | 105 | .... | |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 100½ | 98 | 101½ |
| Utilities Pwr. & Lt., com. A $2. | 31 | 28½ | 31½ |
| Utilities Pwr. & Lt., com. B $1—no par | 24½ | 18½ | 24½ |
| VERMONT HYDRO-ELEC., 7% pf. | k100 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k111 | 108 | 111 |
| WAGNER ELEC., 7% pf. | b 99 | 96½ | 99 |
| Wagner Elec., com.—no par | b 40½ | 37 | 40½ |
| Washington Ry. & Elec., 5% com | j485 | .. | .... |
| Washington Ry. & Elec., 7% pf. | j103½ | ... | .. |
| Washington Wtr. Pwr., 8% com. | k225 | | |
| West Penn Elec., 7% pf | 113½ | 109½ | 114½ |
| West Penn Elec., Cl. A $7. | k109 | | |
| West Penn Pwr., 7% pf. | 115½ | 114¾ | 116¾ |
| West Penn Pwr., 6% pf. | 109½ | 109½ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf | k102 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 104 | 101 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 92 | 88½ | 100¾ |
| Weston Elec. Instrument, Cl. A $2 no par | k 32 | 30½ | 30½ |
| Weston Elec. Instrument, com.—no par | k 12½ | 12½ | 14½ |
| Wheeling Elec., 6% pf | k104 | 95 | 104 |
| Worthington Pump, 7% pf. A | k 49½ | 46½ | 55 |
| Worthington Pump, 6% B | k 43 | 41 | 49½ |
| Worthington Pump, com | k28 | 28 | 34½ |
| YALE & TOWNE com. $5—25, | k 73 | 72½ | 75 |

**Stock Exchange:** *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Feb. 25. *l*Bid price Wednesday, Feb 29. *m*Latest quotations available. †Dividend rate variable.

in competition with you must be required to buy out your plant. You cannot have your cake and eat it at the same time. And if you are going to take that attitude with the Commonwealth, the people may well say, While we have granted you the sovereign power of eminent domain, we are not justified in doing that unless you are performing a state service or a governmental function, and if you take the attitude that you are a private corporation that is not performing any state or governmental function, you cannot complain if you are not authorized to exercise the sovereign power of eminent domain.

### Public Protection Needed

We have no pride in phraseology, but we do say that we ought to have some such legislation or the people of Massachusetts will realize that they have no protection against extortionate charges and corporate greed in the operation of the public utilities; that all they can do is to rely upon the kindness, charity and generosity of these gentlemen who run public utilities in the Commonwealth.

In the first place, it seems to me that we here in Massachusetts are not asking for charity, we are not asking for generosity. We ought not to put ourselves under obligation to these gentlemen who want to make 40, 50 and possibly 60 per cent upon their original investment.

Think of it! Here is a company located in this Commonwealth, amply able to approach and meet the rate which is now charged by the municipal plant in Holyoke, taking the attitude that it ought to receive for its stock in the market, if it sells it, nine times its par value, which means, in order to make the stock worth that amount on a basis of 6 per cent, that it has got to charge the public rates which will produce 54 per cent upon the par value of the stock each and every year. When it does that, do you think the public is going to stand for it? Do you think the public is going to sit idly by, and not go into the business itself, rather than have that sort of situation existing, that sort of burden imposed upon the people of the Commonwealth?

## Radio Corporation Shows Record Net Earnings

Gross income from operations of the Radio Corporation for 1927 has reached the high record of $65,082,074 and net income transferred to surplus, is $8,478,320, against $4,661,397 in 1926. Surplus account shows a write-off of $1,000,000 in the patent account, a reserve of $4,500,000 for plant and equipment and a writing down of $799,310 in sundry, machinery, tools and furniture. Dividends were $1,368,150, leaving surplus at the close of 1927 at $7,029,621, against $6,218,761 a year previous.

Income account shows the deduction of reserves amounting to $3,321,330, against $2,735,090 in 1926. Of 1927 reserves, $2,371,330 has been set aside for federal income taxes and amortization of patents, and $950,000 as a general fund reserve and as reserve against foreign investments, etc.

## Engineers Public Service Earnings Up 12.5 Per Cent

The high lights of the financial statement of the Engineers Public Service system are a 10.7 per cent increase in gross earnings and an expansion of only 9.6 per cent in operating costs, making possible a growth of net earnings amounting to 12.5 per cent. The balance for reserves and for Engineers common stock, after deducting dividend requirements for Engineers preferred stock, increased 26.7 per cent over 1926. The average net return shown by the properties for the year was slightly less than 6 per cent of the net book value.

Operating statistics of the company readily explain the gratifying progress noted above as reflected in the earnings statement. The electrical output of the system is up 17.1 per cent to 746,521,859 kw.-hr. The light and power departments serve a population of 1,314,200, and these departments account for 60.4 per cent gross earnings. The operating ratio in the light and power departments is 46.8, which is considerably better than the average for systems of this type.

Interest, amortization, etc., for the entire system were earned well over three times during the past year, as has been the case since the company's inception. The balance after interest, etc., was $7,921,822, or 26.9 per cent of gross. Balance after subsidiary preferred dividends was $6,312,274. Parent company preferred stock required $2,173,276, leaving $4,034,702 applicable to reserves and to common stock dividends. There are 310,468 shares of no-par $7 preferred outstanding in the hands of the public and of the no-par common about 797,240 shares are outstanding and 200,000 reserved for issue under option warrants. The preferred is currently quoted around 10[illegible] and the common around 34.

HOUSTON LIGHTING FINANCES POWER PLANT ENLARGEMENT.—An amendment to the charter of the Houston Lighting & Power Company, Houston, Tex., increasing its capital stock from $7,000,000 to $9,000,000 has been filed in the Secretary of State's office. The proceeds from the additional stock will be used for enlarging the company's power plant at Deepwater.

## Substantial Volume of New Offerings in February

THOUGH new financing by the electric light and power companies of the country shows signs of easing off this year, the substantial sum of $103,255,500—February's total—is evidence that the electrical utilities will continue to play an important part in the securities market. The figure recorded for February compares with $98,850,000 for January and with $166,000,000 for February, 1927. New securities brought out during the two-month period total $202,105,500, as compared with $389,859,000 during the corresponding period of the preceding year. The Pacific Gas & Electric Company contributed $20,000,000 to the total, as did also the National Public Service Corporation, these being the largest individual issue floated during the month.

Attention is called to the prominent part taken by refunding operations. The public utilities are taking advantage of low money rates by retiring their securities bearing high interest rates in favor of lower interest bearing securities. An interesting feature of the month's financing was the issuance by the Public Service Corporation of New Jersey of 4½ per cent convertible debentures to the amount of $43,689,000 to holders of its common and 8 per cent preferred stock. The average rate of return yielded the investor on the February offerings declined to the 5.20 per cent mark from 5.40 in January.

### *Security Issues of Electric Service Companies in February*

| Name of Company | Amount of Issue (Par Value) | Period Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Pennsylvania Water & Power Co. | $6,000,000 | 40 | First refunding mortgage gold bonds, series B | To retire bonds | 4½ | 99 | 4.55 |
| Pacific Gas & Electric Co. | 20,000,000 | 29 | First and refunding mortgage gold bonds, series E | To retire funded debt of subsidiaries recently acquired | 4½ | 99 | 4.56 |
| Indiana Service Corp. | 5,000,000 | 35 | First lien and refunding mortgage gold bonds, series A | To reimburse for capital expenditures and for additions and improvements | 5 | 99½ | 5.03 |
| National Gas & Electric Corp. | 3,400,000 | 25 | First mortgage collateral gold bonds | To provide funds for purchase of securities of subsidiaries or for other capital requirements | 5½ | 98½ | 5.60 |
|  | 1,800,000 | 3 | Convertible gold notes |  | 5½ | 100 | 5.50 |
| Ohio Power Co. | 10,018,000 | 29 | First and refunding mortgage gold bonds | To retire outstanding bonds | 4½ | 96 | 4.75 |
| Alabama Power Co. | 1,950,000 |  | Cumulative preferred stock | To raise funds for construction and additions, and to reimburse for expenditures made on improvements | 5 | 97½ | 5.12 |
| National Public Service Corp. | 20,000,000 | 50 | Secured gold debentures | To retire bonds and for other corporate purposes | 5 | 93½ | 5.35 |
| New England Public Service Co. | 2,412,500 |  | Preferred stock | To refund short-term loans outstanding and for other corporate purposes | 6 | 96½ | 6.20 |
| American Superpower Corp. | 9,225,000 |  | First preferred stock | To raise funds for the acquisition of additional interests in certain light and power companies and for other corporate purposes | 6 | 102½ | 5.85 |
| Western Power, Light & Telephone Co. | 2,750,000 | 20 | First lien collateral gold bonds, series A | To retire notes, acquire new subsidiaries, to provide additional working capital and for other corporate purposes | 6 | 100 | 6.00 |
| Central Arkansas Public Service Corp. | 2,700,000 | 20 | First lien and collateral trust gold bonds, series A | To redeem bonds, for additions and extensions and for other corporate purposes | 5 | 94½ | 5.45 |
| Northwestern Public Utilities, Inc. | 350,000 | 1 | Gold notes, series A | To acquire properties, to reimburse for capital expenditures and for other corporate purposes | 5 | 99 | 6.04 |
| Birmingham Electric Co. | 9,200,000 | 40 | First and refunding mortgage gold bonds | To retire bonds and for other corporate purposes | 4½ | 95¾ | 4.77 |
| National Electric Power Co. | 2,500,000 |  | Cumulative preferred stock | To acquire additional securities of subsidiary companies | 6 | 94½ | 6.35 |
| New England Water, Light & Power Associates | 1,450,000 | 20 | Collateral lien gold bonds, series A |  | 5½ | 100 | 5.50 |
| Oklahoma Power & Water Co. | 4,500,000 | 20 | First mortgage gold bonds, series A |  | 5 | 96½ | 5.30 |
| Total | $103,255,500 |  | Rights | $43,689,000 |  |  |  |
| Total amount actually realized | 100,432,217 |  | Total financing for February | 144,121,217 |  |  |  |

# Business News and Market Conditions

## Base Wire Price Indicates Small Differential

*Present Price Lower Than That Quoted at Beginning of 1927 — Margin in Carload Lots About 1½ Cents*

DESPITE the complaint of wire manufacturers that prices are very close owing to keen competition, the year 1927 closed with a base copper wire price lower than that quoted at the beginning of the year. The base price is only 1¾ cents higher than the market price of electrolytic copper and is that figure today. The published base prices for the year 1927 are given in the accompanying table. The figures shown are the same as those printed in the ELECTRICAL WORLD each week in connection with the non-ferrous metal market prices and survey.

PUBLISHED BASE WIRE PRICES

| Date<br>1927 | Copper | Differential | Finished Base |
|---|---|---|---|
| Jan. 4 | 13¼ | $2.00 | 15¼ |
| Jan. 13 | 13⅜ | 2.00 | 15⅜ |
| Jan. 28 | 13¼ | 2.00 | 15¼ |
| Feb. 1 | 13 | 2.00 | 15 |
| Feb. 7 | 12¾ | 2.00 | 14¾ |
| Feb. 8 | 12⅝ | 2.125 | 14¾ |
| Feb. 11 | 12⅞ | 2.00 | 14⅞ |
| Feb. 21 | 13⅛ | 2.00 | 15⅛ |
| Feb. 28 | 13⅜ | 2.00 | 15⅜ |
| April 7 | 13 | 2.00 | 15 |
| April 20 | 13⅛ | 2.00 | 15⅛ |
| May 24 | 12¾ | 2.00 | 14¾ |
| June 22 | 12½ | 2.00 | 14½ |
| July 18 | 12¾ | 2.00 | 14¾ |
| July 25 | 13 | 2.00 | 15 |
| Aug. 2 | 13¼ | 2.00 | 15¼ |
| Nov. 9 | 13¾ | 1.75 | 15½ |
| Nov. 19 | 13⅞ | 1.75 | 15⅝ |
| Dec. 1 | 13⅞ | 1.75 | 15⅝ |
| Dec. 2 | 14 | 1.75 | 15¾ |
| Dec. 7 | 14⅛ | 1.75 | 15⅞ |

NOTE.—Base wire prices are listed only when a change in the price of copper takes place.

In carload lots the differential is about ¼ cent less, making a present differential of only about 1½ cents over the actual selling price of electrolytic copper delivered.

In discussing the situation and to emphasize that wire business is being done on an extremely close and unprofitable margin, manufacturers estimate that the gross business of the whole wire industry is between $150,000,000 and $200,000,000 and the capital investment is over $100,000,000. The return on the capital investment is estimated as probably not more than 5 per cent. In addition to the poor return, it is pointed out that the manufacturer carries a very high business risk when one considers the violent fluctuations in the copper market over the last ten years and the possibility of similar fluctuations at any time.

## *Value and Destination of Electrical Exports for December, 1927, Compared With Corresponding Month in 1926*

(Issued by Bureau of Foreign and Domestic Commerce)

| Articles | December | |
|---|---|---|
| | 1926 | 1927 |
| Generators: | | |
| Direct-current: | | |
| Under 500 kw. | $83,270 | $76,946 |
| 500 kw. and over | 12,150 | 86,026 |
| Alternating-current: | | |
| Under 2,000 kva. | 3,313 | 8,646 |
| 2,000 kva. and over | 198,629 | 77,918 |
| Steam turbine generator sets | 38,699 | 115,996 |
| Accessories and parts for generators | 97,428 | 963,738 |
| Self-contained lighting outfits | 115,563 | 162,272 |
| Batteries: | | |
| Flashlight batteries | 181,504 | 255,686 |
| Other primary batteries | 195,034 | 218,047 |
| Storage batteries | 343,773 | 324,208 |
| Transforming or converting apparatus: | | |
| Power transformers | 195,143 | 137,364 |
| Other transformers | 115,685 | 78,924 |
| Rectifiers, double current and motor generators, dynamotors, synchronous and other converters | 140,420 | 245,881 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephone | 103,597 | 192,462 |
| Switches and circuit breakers over 10 amp. | 262,467 | 147,354 |
| Fuses and fuse blocks | 24,056 | 29,943 |
| Watt-hour and other measuring meters | 35,614 | 48,576 |
| Volt, watt, and ampere meters and other recording, indicating, and testing apparatus | 202,570 | 213,064 |
| Lightning arresters, choke coils reactors, and other protective devices | 57,644 | 55,212 |
| Motors, starters, and controllers: | | |
| Stationary motors: | | |
| Motors under 1 hp. | 186,205 | 225,478 |
| 1 to 200 hp. | 216,820 | 186,889 |
| Over 200 hp. | 38,134 | 11,552 |
| Railway motors | $56,244 | $115,777 |
| Electric locomotives: | | |
| Railway | 72,562 | 35,042 |
| Mining and industrial | 29,817 | 127,610 |
| Starting and controlling equipment for: | | |
| Industrial motors | 83,406 | 115,783 |
| Electric railway and vehicle motors | 5,872 | 21,189 |
| Portable electric tools | 66,175 | 82,406 |
| Accessories and parts for motors | 154,096 | 209,299 |
| Electric appliances: | | |
| Electric fans | 56,876 | 44,074 |
| Electric lamps: | | |
| Metal filament | 137,918 | 124,587 |
| Other electric lamps | 28,707 | 50,934 |
| Flashlights | 166,361 | 236,460 |
| Searchlights and projectors | 121,228 | 173,739 |
| Motor-driven household devices | 214,933 | 156,780 |
| Domestic heating and cooking devices | 172,788 | 150,616 |
| Industrial electric furnaces and ovens | 23,391 | 37,794 |
| Therapeutic apparatus, X-Ray machines, galvanic and faradic batteries, etc. | 123,120 | 148,683 |
| Signal and communication devices: | | |
| Radio apparatus: | | |
| Transmitting sets and parts | 8,005 | 93,131 |
| Receiving sets | 361,132 | 314,888 |
| Tubes | 67,702 | 106,354 |
| Receiving set components | 264,901 | 242,529 |
| Receiving set accessories | 269,449 | 277,862 |
| Telegraph apparatus | 75,144 | 162,274 |
| Telephone apparatus: | | |
| Telephone instruments | 19,048 | 29,681 |
| Telephone switchboards | 25,204 | 3,259 |
| Other telephone equipment | 200,367 | 224,179 |
| Railway signals, switches and attachments | $29,358 | $61,190 |
| Bells, buzzers, annunciators, and alarms | 27,285 | 21,137 |
| Other electric apparatus: | | |
| Spark plugs, magnetos, and other ignition apparatus | 114,114 | 158,956 |
| Insulating material | 106,188 | 98,082 |
| Metal conduit, outlet and switch boxes | 97,298 | 98,241 |
| Sockets, receptacles, and lighting switches | 152,859 | 157,808 |
| Electric lighting fixtures, interior and street | 155,064 | 167,063 |
| Other wiring supplies and line material | 85,149 | 75,855 |
| Other electrical apparatus, not elsewhere stated | 666,417 | 665,049 |
| Rubber and friction tape | 27,931 | 29,393 |
| Globes and shades for lighting fixtures | 60,558 | 49,802 |
| Electrical glassware except for lighting | 36,518 | 14,702 |
| Electrical porcelain: | | |
| For less than 6,600 volts | 48,499 | 71,819 |
| For 6,600 volts and over | 52,576 | 49,047 |
| Carbons, carbon brushes and electrodes: | | |
| Electrodes for electric furnaces | 151,066 | 243,444 |
| Other carbon products | 153,216 | 55,399 |
| Insulated wire and cable (iron and steel) | 42,439 | 9,294 |
| Copper, bare wire | 112,956 | 137,044 |
| Copper, insulated wire and cable | 350,274 | 390,287 |
| Refrigeration sets up to 1 ton capacity | * | 369,937 |
| Domestic washing machines | 138,127 | 107,193 |
| Total | $8,272,864 | $10,178,854 |

*Not collected in 1926.

DESTINATION OF ELECTRICAL EXPORTS

| Country of Destination | December, 1927 |
|---|---|
| EUROPE: | $1,682,952 |
| Belgium | 73,931 |
| France | 129,103 |
| Germany | 129,507 |
| Italy | 106,340 |
| Netherlands | 96,866 |
| Spain | 144,011 |
| United Kingdom | 577,183 |
| Other countries | 426,011 |

| Country of Destination | December, 1927 |
|---|---|
| WESTERN HEMISPHERE: | $5,769,295 |
| Canada | 1,971,553 |
| Mexico | 522,926 |
| Cuba | 353,932 |
| Argentina | 1,411,180 |
| Brazil | 381,858 |
| Chile | 268,539 |
| Colombia | 166,951 |
| Peru | 71,436 |
| Venezuela | 117,261 |
| Other countries | 503,659 |

| Country of Destination | December, 1927 |
|---|---|
| ASIA, AFRICA AND OCEANIA: | $2,726,607 |
| British India | 285,758 |
| China | 119,625 |
| Japan | 722,039 |
| Philippine Islands | 196,701 |
| Australia | 530,333 |
| New Zealand | 251,102 |
| British South Africa | 225,245 |
| Other countries | 395,806 |

## Table of Preferred Numbers Issued by A.E.S.C.

The American Engineering Standards Committee has just published and informally approved a table of preferred numbers which is being recommended to American industry for trial and criticism. This system of preferred numbers with the approval of industry may at a later date be considered for adoption as an American standard. The committee, in discussing the system of preferred numbers, states that its purpose is to eliminate the economic loss involved in the haphazard and often needlessly numerous gradations of size that characterize most of our common commodities. The fundamental elements of the system lie in the proposal to arrange standard size series so that each succeeding model in a series shall be larger than the preceding size, not by a definite amount, but by a fixed percentage. By decreasing the number of sizes within a certain range, while retaining a sufficient number of sizes in all parts of the range, a system of preferred numbers makes it possible to effect savings in materials, labor, storage space, gages, containers, catalogs, sales cost, etc. As an example of the working of preferred numbers, it is pointed out that a difference of ¼ in. in width would be important in a brush ½ in. wide, while in a brush 5 in. wide a difference of ¼ in. would be hardly discernible. Instead of having quarter inch increases throughout the whole range of sizes, therefore, sizes can be increased by a fixed percentage without eliminating any which are necessary and decreasing the total number. It is further added that preferred numbers have been used with success in many European countries, including France and Germany, and their adoption in this country is considered by many engineers to be one of the most important steps in the industrial standardization movement.

# Market Conditions

VIRTUALLY throughout the country activities in the industry are reported at a good level, with some interesting orders placed. In the New England district increasing strength is noted. Small motor sales gained and shipments of pole line hardware, cross-arms and wire to northern New England are recorded in good volume. Industrial electric heating also is active. Large substation equipment orders amounting to nearly $500,000 were placed in the New York district and current inquiries point to a heavy volume of buying at an early date. A Long Island company bought $100,000 worth of switching equipment and a central-station company in northern New York ordered generating equipment amounting to $130,000.

Trade is quiet in the Southeast, but a good deal of industrial business is in prospect. An Alabama steel mill purchased $70,000 worth of motors and control equipment. A new city ordinance in Atlanta has stimulated sign business, and three municipalities purchased $12,000 worth of motors and pumps for water works. Industrial equipment sales are active in the St. Louis district. A manufacturer ordered $25,000 worth of motors and an oil company bought $100,000 worth of apparatus. An order for $175,000 worth of substation equipment also was placed in St. Louis. Sales of small industrial equipment are above normal. Utilities continue active buyers in the Middle West and building construction is increasing. On the Pacific Coast an active week has been reported, many pole orders were placed, and oil field buying was very good. Motor sales in Seattle exceeded those of any one week since the first of the year.

### *Low Prices Stimulate Sales in Metal Market*

At the expense of a decline in price the tonnage sold in the non-ferrous metal market was the best for a considerable period. Copper touched 13.875 cents on some sales on Tuesday, and on Monday 5.40 cents was done for zinc. There has been some upward reaction in both metals since then. Lead is now 6 cents in New York and could probably be obtained in St. Louis at 5.75 cents. Tin has been up and down with little or no net change.

NEW YORK METAL MARKET PRICES

| | Feb. 21, 1928 Cents per Pound | Feb. 29, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic...... | 14 | 13.95 |
| Lead, Am. S. & R. price | 6¼ | 6 |
| Antimony............... | 10⅝ | 10½ |
| Nickel, ingot........... | 35 | 35 |
| Zinc spots............... | 5.80 | 5.825 |
| Tin, Straits.............. | 51.725 | 51⅝ |
| Aluminum, 99 per cent... | 24.30 | 24.30 |

Base copper price Feb. 29, 1928, 15¼ cents.

### *Industrial Prospects Bright in the Southeast*

Trade in the Southeast is quiet, with central-station companies not yet buying in the volume to be expected for this period. There is a very satisfactory amount of industrial business in prospect. The largest order reported was placed by an Alabama steel mill for synchronous motors and control equipment amounting to $70,000, the same mill also ordering $25,000 worth of small motor equipment. A central-station company ordered distribution and small power transformers agrgegating $14,000 and creosoted pine poles totaling $4,200. Another central-station order was for house-type meters amounting to $2,200. Small sign installations are showing a healthy increase, particularly in Atlanta, where a city ordinance has been changed to permit of signs projecting over the sidewalks. One order covered $1,400 worth of sign equipment.

Orders from three municipalities for motors and pumps for municipal water works, amounting to $12,000, were reported by a manufacturer. "Whiteway" equipment continues in satisfactory demand and among the orders for this material was one for $4,400 worth of metal standards and parkway cable for a Georgia town and two orders from Louisiana towns for equipment totaling $3,000. Merchandising activities of central-station companies continue brisk, one of the larger companies having recently sold 1,975 waffle irons in an eight-day sales campaign.

Construction projects are as follows: The Strowd-Holcombe Cotton Mills, Inc., Birmingham, Ala., plans an addition to cost $100,000. Henderson, Ky., plans extensions in its light and power plant to cost $50,000. The Henry Vogt Machine Company, Louisville, Ky., plans an addition to cost $100,000. Louise, Miss., plans a transmission line from Yazoo City, and the installation of a light and power system. Marshall, N. C., plans a hydro-electric power plant on the French Broad River to cost $100,000. The American Tobacco Company, Reidsville, N. C., plans an addition to its plant to cost about $750,000. The United States Corrugated Fibre Box Company, Wheeling, W. Va., plans a new plant unit to cost $125,000.

### *Market Gains Strength in New England District*

Increasing strength in the electrical market is noted in the New England district. While no sales of outstanding interest were reported there was an encouraging activity in many lines. Small motor sales gained and one manufacturer reports that New England motor business is in advance in volume to date as compared with other districts, while another company records a steady demand for fractional-horsepower motors with the weekly volume comparable with that of last year. Shipments of pole-line hardware, cross-arms and wire to northern New England are recorded in good volume, and central-station buying is showing more vigor. Industrial electric heating is active. From southeastern Massachusetts and Rhode Island reports from manufacturers show much encouragement. The demand for special heating types is marked. Street lighting negotiations are numerous. A manufacturer of arc-welding equipment reports February orders advancing over those of January. Electric refrigerator sales are promising and one manufacturer plans for a 100 per cent increase in New England during the coming year.

New projects include an expansion of the Firestone Mills, New Bedford; a new mill will soon be erected for a Keene (N. H.) silk company; the American Electric Manufacturing company, Phillipsdale, R. I. plans the purchase of new equipment, and Middletown, Conn., plans a lighting system on Main Street.

## *Large Substation Equipment Buying in Eastern District*

Substation business features equipment sales in the Eastern district and current inquiries point to a heavy volume of commitments at an early date. One company placed orders for nearly $500,000 worth of substation apparatus. Transformer business is trending upward and a leading manufacturer reports that the volume of sales for the first two months of this year exceeds those for the same period a year ago. While orders are relatively smaller, the broader extent of gross sales gives this showing. Out-door switching equipment is growing in demand. A Long Island company placed an order for about $100,000 worth of switching equipment. A utility operating in northern New York has been an active purchaser of switching apparatus, and also has purchased a 12,500-kva. waterwheel generating unit, with transformers and auxiliary apparatus aggregating $130,000. Orders from one company for motor-generator units for traction service amounted to $70,000. Transmission line business is quiet, although the early prospects appear better.

Industrial business continues at a good rate with motors and control apparatus especially active. Business in that line is advancing, with a call from iron and steel mills, textile mills, pulp and paper mills, and baking plants exceeding those of other basic industries. Baking plants have been prominent consumers in recent weeks. The Bethlehem Steel Company recently contracted with a leading manufacturer for control apparatus to cost about $42,000 for extensions in its limestone quarries at Naginey, Pa., to cost $200,000. A paper-manufacturing company at New York soon will place orders for control equipment for a proposed bag and paper mill at Tacoma, Wash., to cost more than $1,500,000. The Donner Steel Company, Buffalo, has placed an order for a 60-ton oil-electric locomotive, and the American Rolling Mill Company, Middletown, Ohio, has contracted for a unit of 100 tons capacity for service at its local mills. Minor demand and equally minor sales prevail in the electric railway equipment field, inquiries are scattered and business does not hold any promise for some weeks to come.

Construction projects comprise the following: The Signal Corps Procurement District, Governors Island, New York, is asking bids until March 13, for voltmeters, ammeters, etc. (Circular 123); for 38,300 ft. of conduit (Circular 125); for 32,100 ft. telephone cable (Circular 126). The Bayonne Steel Ceiling Company plans a plant at Long Island City to cost $100,000. The Bureau of Supplies and Accounts, Washington, D. C., is asking bids until March 6, for five motor-generator sets, with control panels and spare parts for the Brooklyn navy yard (Schedule 8525); also for spare parts for turbo-generators, (Schedule 8585). Spring Lake, N. J., plans municipal power plant. The Kensington Shipyard & Dry Dock Company, Philadelphia, Pa., plans extensions to cost $500,000. The National Lumber & Creosoting Company, Kansas City, Mo., plans a new plant at Wilmington, Del., to cost $1,000,000. The American Analine Products Company, Lock Haven, Pa., plans a new addition to cost $200,000. The United States Engineer, Pittsburgh, Pa., will soon take bids for a power house at Lock 6, Allegheny River, near Clinton, Pa. The Suburban Light & Power Company, Baltimore, Md., plans transmission lines and a distributing system in Calvert, Charles, St. Mary's and Prince George Counties to cost $750,000. The general purchasing officer, Panama Canal, Washington, D. C., will receive bids until March 10, for motors, transformers, switches and other electrical equipment (Schedule 1860). The chief of engineers, United States Army, Washington, D. C., is asking bids until March 27, for one 200-kw. Diesel engine-generating unit, switchboard and auxiliaries (Circular 15).

## *Utilities Continue Active Buyers in Middle West*

Business in the Middle West is good. Here and there a slight slowing down is noticeable. Building activity is increasing, the railroads are contemplating large expenditures for equipment, and the steel industry is in good shape. The various utility companies are planning a good deal of construction work, and the Illinois Bell Telephone Company anticipates an expenditure for the year of $38,000,000. Considerable puchasing of apparatus is going on among which was an order for a number of oil circuit breakers, another for a total of nearly 27,000 kva. of transformers, and three 20-ton electric traveling cranes with appurtenances. Three construction orders, one for coal storage trackage construction valued at $95,000, duct and furnace insulation at $35,000 and pipe covering and insulation materials valued at $30,000 also were placed. Jobbers' sales are normal. Industrial activity is a trifle spotty but municipal and railroad business is good. Appliances are moving in fair volume.

Construction plans are as follows: The American Zinc, Lead & Smelting Company, East St. Louis, Ill., will make plant additions to cost $500,000. The University of Michigan, Ann Arbor, plans a power plant addition to cost $100,000. Detroit, Mich., plans an addition to its Springwells waterworks station to cost $4,000,000. The Michigan Public Service Company plans extensions at Ludington, Mich., to cost $75,000. Moose Lake, Minn., plans a municipal power plant. The Cudahy Packing Company, Newport, Minn., plans a five-story and basement cold storage and refrigerating plant, to cost $115,000. The Glancy Malleable Iron Corporation, Waukesha, Wis., plans an addition to its plant to cost $200,000 Mundelein, Ill., Carrington, N. D., and Neenah, and Kendall, Wis., plan an installation of street lighting equipment.

## *Active Week Reported on the Pacific Coast*

An outstanding construction item reported on the Pacific Coast covers a 16-mile feeder line near Lisbon for the San Francisco-Sacramento electric line estimated to cost $700,000. Work on this line will begin in April. Many pole orders were placed. Oil field orders also were prominent. A steel company bought a switchboard for $2,500. A San Francisco power company bought a switchboard for $15,000. A lime company is in the market for $2,000 worth of wiring material and five assorted motors, a lumber company in the Sierra pine belt bought $3,000 worth of motors, and another lumber company needs $2,000 worth of wiring supplies. A San Francisco jobber bought a carload of electric ranges valued at $10,000. Snow conditions, while low, probably will not affect power supply but may help pumping plant sales.

The city of Seattle passed a bill appropriating $625,000 and authorizing extensions at the Gorge Creek hydroelectric plant on the Skagit River. Weatherproof copper wire amounting to $15,000 and 100 cedar poles also were purchased by the city. A contract for street lighting in Olympia was let for $17,000 and Oregon City, Ore., and Wenatchee, Wash., are planning additional street lighting installations. The Grays Harbor Railway & Light Company, Hoquiam, plans an expenditure of $60,000 for light and power transmission lines, and the Washington Water Power Company plans installing a second unit of 32,200 hp. at Chelan during this summer. Seattle jobbers report motor sales exceeded those of any one week since the first of the year.

Construction projects are as follows: The Arizona Wax Paper Company, Benson, Ariz., plans a plant at Salinas, Calif., to cost $100,000. A. M. Gilstrap, 3002 Logan Street, Oakland, Calif., plans a fruit-canning plant at Yuba City, to cost $450,000. The Pacific Gas & Electric Company, San Francisco, plans a hydro-electric development on the Mokolumne River, near Jackson; and a 50,000-hp. steam plant at Oakland. The Portland Electric Power Company plans a storage plant at Salem, Ore., to cost $50,000. The Airway Division, Department of Commerce, Salt Lake City, Utah, will receive bids until April 14, for 51-ft. steel towers, beacon lights, underground cable, etc., for the Beacon airport. The Western Cold Storage Company, Wenatchee, Wash., plans an ice plant to cost $500,000. The Union Pacific Railroad Company plans a rock-crushing plant near Grand Canyon, Wyo., to cost $200,000. The San Joaquin Light & Power Corporation, Fresno, Calif., plans three 110,000-volt steel tower transmission lines, to connect with Rio Bravo, Corcoran and Taft substations, to cost $550,000.

The Great Northern Utilities Company plans a transmission line between Coutts and Sidney, Mont. The Utah Power & Light Company plans a transmission line from Echo to Evanston, Wyo., to cost $80,000. Stockton, Willows, Madera, Alameda and Berkeley, Calif., and Great Falls, Mont., plan ornamental lighting systems.

### *Industrial Equipment Sales Active in St. Louis*

Conditions in the St. Louis district are holding to a normal level with signs of early spring business in good volume. A large manufacturing company changing from 25 to 60-cycle operation placed an order for motors aggregating $25,000. An oil company operating in the southwestern part of the district closed a contract for 44 400-hp. induction motors and 14 four-panel switchboards for driving pipe line pumps at a total cost of over $100,000. A large local power company closed contracts for transformers, circuit breakers, control and regulating apparatus for a large substation at a total cost of $175,000. Sales of small industrial equipment throughout the district are above normal.

Construction projects are as follows: The Arkansas Power & Light Company will build a transmission line from Gurdon to Delight, Ark., to cost $75,000. The Eastern Arkansas Compress Company, Forrest City, Ark., plans a new plant to cost $100,000. Trenton, Mo., plans a municipal power plant to cost $50,000. The Oklahoma Gas & Electric Company plans substations at Lexington, Meeker, Healdton and Wynnewood to cost $100,000. The Southern Ice & Utilities Company plans an ice plant at Big Spring, Tex., to cost $100,000. The Southwest Textile Mills, Inc., Dallas, Tex., plans a cotton mill to cost $750,000. The Hidalgo Utilities Company, Hidalgo, Tex., plans an ice plant to cost $50,000. The Texas Utilities Company plans a 60-ton ice plant at Mineral Wells, Tex. Muskogee, Okla., plans an ornamental lighting system to cost $50,000.

# Activities of the Trade

## Stone & Webster Open Office in Paris

Stone & Webster, Inc., Boston, announces the opening of a Paris (France) office at 2 Rue des Italiens, in charge of James F. Case, whose engineering and financial career has covered many parts of the Orient and North and South America. In announcing this new office Stone & Webster point out that this step reflects the rapid growth in American financing and enterprises abroad and the increased activity indicated by this country's loans to foreign governments. Among the recent foreign projects upon which the Stone & Wester organization has reported are the Adriatic Electric Company, Lombard Electric Company and the Italian Public Utility Credit Institute.

## American Electric Motor Part of Splitdorf-Bethlehem

The American Electric Motor Company, Cedarburg, Wis., has become a subsidiary of the Splitdorf-Bethlehem Electrical Company, Newark, N. J. In addition to the American Electric Motor Company the Splitdorf company controls the Splitdorf Radio Corporation, the Splitdorf Company of Canada, the Splitdorf Electrical Company, the Splitdorf Manufacturing Company and the Perfection Appliance Company. The American Electric Motor Company, in its new plant at Cedarburg, will continue to manufacture a self-ventilated polyphase induction motor from $\frac{1}{2}$ hp. to 125 hp. supplied with standard sleeve bearings or ball bearings. W. R. Davis has been appointed general manager of the American company and W. M. Sprinkman will have charge of industrial sales.

## General Electric Company Rewards Employees

Twenty-six awards were made to General Electric employees by the Charles A. Coffin Foundation for achievements during the year 1927. Announcement of the names of the winners and the formal presentation of the honorarium of $300, the certificate of award and the lapel button were made recently. The awards were divided as follows: Workmen, seven; tool designers and expert mechanics, three; foremen, five; construction foremen, one; engineers, six, and commercial employees four.

**The Union Metal Manufacturing Company**, Canton, Ohio, through its representative the Southwest General Electric Supply Company, has received an order from Houston, Tex., for 96 twin-light pressed-steel lamp standards, which will be installed on Main Street. Houston will be host to the National Democratic convention this year. The standards will be installed prior to the opening of the convention in June. The company has also received an order from Houston for 21 traffic standards. These standards are of the same general appearance and design as the lighting standards and will carry a side bracket type signal.

**The Wolcott Manufacturing Company**, 80 Pliny Street, Hartford, Conn., and the Beardsley Manufacturing Company, Waterbury, Conn., will be consolidated as the Beardsley & Wolcott Manufacturing Company. Both companies manufacture a line of household appliances. The new officers are: C. E. Beardsley, president-treasurer; Frank E. Wolcott, vice-president; Rowley W. Phillips, secretary; Elton S. Wayland, Henry W. Adams, Jr., George T. Wigmore, Irvin W. Day and William S. Fulton, directors and officers.

**The Stylograph Company**, Rochester, N. Y., announces that its wax sensitized charts used on different types of recording instruments are now available for general purchase. The manufacturer claims that the use of Stylograph charts instead of pen and ink charts permits the installation of permanent points on the graphic instrument and no attention is required throughout the life of the instrument.

**The Allis-Chalmers Manufacturing Company**, Milwaukee, has appointed R. T. Stafford, for years manager in Seattle, Wash., of the Northwest branch of the company, as assistant manager of the electrical department of the Pittsburgh Transformer division of the company at Pittsburgh, Pa. Mr. Stafford will be succeeded as Northwest branch manager by John Alberts, who has been identified with the Allis-Chalmers company for the past sixteen years.

**The General Electric Company**, merchandise department, announces a reduction in the price of its vacuum cleaner. This cleaner, which formerly sold, complete with attachments, for $49, will now be sold without attachments for $35, the present attachments being sold separately for $10. A special set of attachments also will be sold for $6.50.

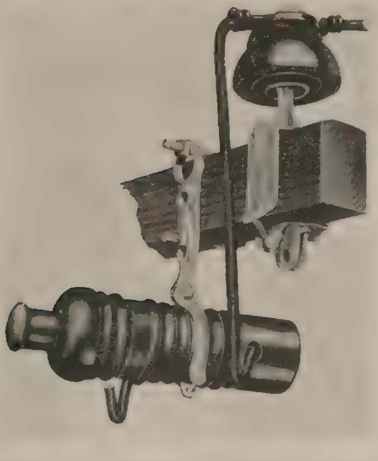
**The Tafel Electric Company**, Louisville, Ky., announces that a fire which gutted the building next to its Louisville house on Feb. 13 only caused damage by water to a portion of its stock of about $40,000 worth of merchandise in its basement. The company states that the majority of its stock on the other four floors of the building was not damaged and owing to prompt shipments of manufacturers and co-operation of local competitors only a half dozen shipments were delayed over 24 hours.

**The Louis Allis Company**, Milwaukee, manufacturer of direct and alternating-current motors, announces the opening of a district sales office in Cleveland. W. F. Glaser has been appointed district sales manager with headquarters at Room 409, Union Building, 1836 Euclid Avenue.

# New Equipment Available

## Fuse and Disconnect Cutout

The Kearney double-duty fuse and disconnect cutout in fuse capacities from 1 amp. to 200 amp. and made of plastic wet process porcelain has been developed by the James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis. The cartridge contacts make direct contact with the machined surfaces of the copper castings to which the line wires are fastened. The contacts are made of spring phosphor bronze. Each line terminal is equipped with two extra heavy screws to eliminate the possibility of the line wire working loose in the terminal block. By interchanging the cartridge with a disconnect blade the unit can be used as a disconnect with a range of capacities from 75 amp. to 300 amp.



METHOD OF MOUNTING KEARNEY DOUBLE-DUTY FUSE AND DISCONNECT CUTOUT

## Spring Clutch

The L. G. S. spring clutch, having only three working parts, the driving member, the driven member and the connecting link, has been placed on the market by the L. G. S. Manufacturing Company, Indianapolis, Ind. Operating within the recesses of the driving and driven members the smooth-surfaced spring-connecting link expands and contracts under friction according to the direction in which the mechanism is turning. Thus a right-hand turn makes a positive connection and the driven member revolves, while a left-hand turn releases the pressure and the driving member runs free.

The clutch is made in three general types. In the ratchet type the clutch may be freely rotated in one direction, but automatically engages when rotated in the opposite direction. With the manual type the clutch is thrown in and out by the operator. In the centrifugal type the clutch is automatically thrown in and out at certain speeds as may be required by the machine to which it is attached. Some of the applications referred to by the manufacturer are as an unloading clutch for electric motors, pumps, air compressors, refrigerating machines, etc.; as a clutch for machine countershafts, washing machines, change feed devices, etc.; as an overrunning clutch for separators, feeding devices, punch presses, etc.; as a reverse mechanism for washing machines, tapping machines, etc., and as a ratchet wrench or for other ratchet tools.

## Line-Start Induction Motors

A line of squirrel-cage induction motors suitable for starting on full-line voltage is being placed on the market by the Allis-Chalmers Manufacturing Company, Milwaukee. These motors are normal-torque, high-reactance machines and will not draw starting currents in excess of limits recommended by the electrical apparatus committee of the National Electric Light Association. They are built in ratings from 7½ hp. to 30 hp., 600 to 3,600 r.p.m., low voltage, and are available with either sleeve or roller bearings. The company states that all the features of Allis-Chalmers construction employed in squirrel-cage motors are maintained in this new line.

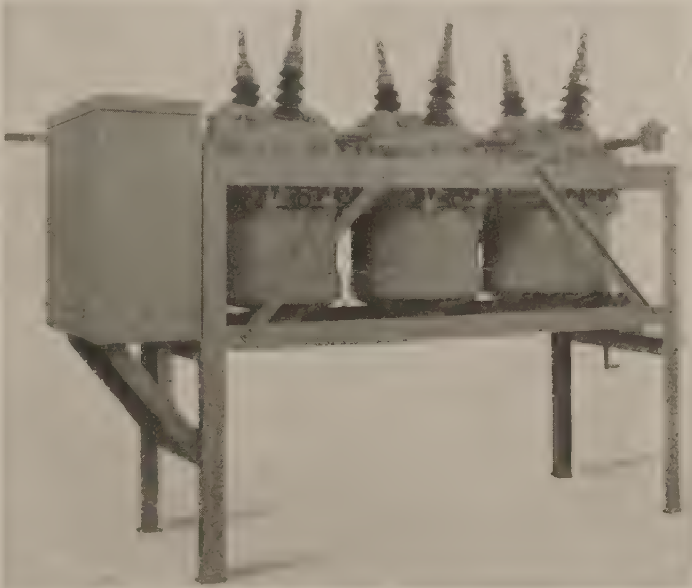
## Subway Sectionalizing Unit

A new type of subway sectionalizing unit for branching underground distribution lines has been placed on the market by the Metropolitan Device Corporation, 1250 Atlantic Avenue, Brooklyn. By its use it is possible to branch main feeders, connect transformers to a low-tension network, connect sub-feeder taps, tie lines and service and to sectionalize safely any section for any reason. The manufacturer states that these units provide a safe, convenient and economical method of branching underground distribution lines and that many combinations and groupings are possible. The units are available in two types, one rated at 250 volts, 500 amp., and the other at 250 volts, 1,500 amp.

## 25-Kv. Circuit Breaker

A high-tension outdoor-type oil circuit breaker for 25-kv. service, known as the type FO-40-25, has been placed on the market by the Condit Electrical Manufacturing Corporation, Boston. The design is based on that of the company's type FO-40 for 37-kv. service and above. The new breakers are furnished for 2,000 amp. or less at 25 kv. and the maximum estimated interrupting capacity is 1,500,000 kva. These breakers may be manually or electrically operated by either alternating or direct-current control, and automatic reclosing service of one or more closing cycles with constant or varying time delay may be added.

The units are mounted on a channel and angle-iron framework, and large porcelain type solid bushings of high mechanical strength extending below the oil line and securely clamped to the pole top with watertight gaskets provide insulation in excess of the A. I. E. E. voltage test requirements. The tanks are cylindrical with rounded bottoms and are built of welded steel plate. The pole top castings are of massive design and are heavily ribbed with a deep extending flange surrounding the tanks to facilitate withstanding gas pressures or secondary explosions incident to rupturing high-powered circuits. Condit laminated brushes are furnished, protected on closing and opening by arcing contacts arranged to provide four breaks in series.



OUTDOOR-TYPE OIL CIRCUIT BREAKERS FOR 25-KV. SERVICE

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Feb. 14, 1928)

1,658,832. Safety Electric Coupler; L. A. Brown, Uniontown, Pa. App. filed Jan. 5, 1926. For connecting shot firing cables used in mines to a magneto or other source of current.

1,658,848. Theft Alarm; S. M. Kalikow, Brooklyn, N. Y. App. filed Feb. 8, 1926.

1,658,861, 1,658,862. Electrical Outlet Device; H. E. Slade, Glen Ridge, N. J. Apps. filed Dec. 11, 1926.

1,658,872. Electrolytic Apparatus; H. J. Yeager, Lancaster, Pa. App. filed Jan. 16, 1925. For use in the electrolytic deposition of metals.

1,658,884. Electric Knife; M. Cysick, Cotton, Minn. App. filed Feb. 7, 1927. Which can be used most efficiently for cutting warm or hot bread, which if cut by a cold knife will be made heavy.

1,658,887. Duct Grapple; J. F. Dotzauer, Newark, N. J. App. filed Jan. 22, 1926. Used in connection with the placing of cables in underground ducts or conduits.

1,658,900. Time-Controlled Switch; S. Jimenez, San Antonio, Texas. App. filed Sept. 10, 1925.

1,658,902. Electrical Measuring Instrument; R. T. Pierce, East Pittsburgh, Pa. App. filed March 24, 1924. Of the indicating or deflecting type.

1,658,905. Fuse Mechanism; M. J. Sandin, Wilkinson, Pa. App. filed Jan. 23, 1923. Inclosed expulsion-fuse mechanism for outdoor installations.

1,658,906. Phase Balancing System; J. Slepian, Swissvale, Pa. App. filed June 10, 1922. Employing single-phase synchronous condensers for effecting a phase balance.

1,658,912. Electric Circuit Breaker; F. W. Alder, Oakland, and S. N. Baruch, Palo Alto, Cal. App. filed Feb. 24, 1920. Automatic circuit breaker in which all of the separable contacts are submerged in oil.

1,658,913. Switch Mechanism; H. K. Ansingh, Toronto, Can. App. filed Feb. 20, 1923. Circuit breakers of the safety type wherein the circuit breakers and disconnecting switches are inclosed within a metal housing.

1,658,914. Salt for Electrolytic Rectifiers; F. W. Barhoff, Hartford, and W. C. Brooks, Meriden, Conn. App. filed May 26, 1927. A dry salt, needing only the addition of water to form a complete electrolyte for current rectifiers and electrolytic condensers having tantalum or similar filming metal electrodes, which salt is chiefly composed of ammonium bisulphate.

1,658,918. Motor Control System; R. Brooks, Ashton-on-Mersey, and E. H. Croft, Leeds, England. App. filed Jan. 8, 1923. In which the acceleration of a motor by short-circuiting a series resistor is automatically effected by means of electrically actuated switches or contactors.

1,658,926. Selective Overload Trip Relay; F. B. Kniskern, Wilkinsburg, Pa. App. filed Sept. 23, 1924.

1,658,945. Bus-Line Connecter; S. B. Schenck, Wilkinsburg, Pa. App. filed June 5, 1922. A device for connecting up the power line between cars in an electrical railway train.

1,658,948. Phase Balancing System; J. Slepian, Swissvale, Pa. App. field June 10, 1922. Employing single-phase synchronous condensers for effecting a phase balance. A system wherein the respective single-phase components of the delta voltages across three line conductors of a polyphase system are independently regulated in such a manner as to provide an equality or any other predetermined relationship between the magnitudes of the various single-phase delta voltages.

1,658,953. Signaling Apparatus; L. S. Theremin, Leningrad, Russia. App. filed Dec. 5, 1925. For generating sound or producing visual signals for alarm purposes.

1,658,972. Regulator System; O. C. Cordes, Wilkinsburg, Pa. App. filed March 2, 1926. Speed-regulating systems for electric motors. Means for maintaining the speed of an electric motor constant that is easily adjustable to maintain different predetermined speeds and is sensitive in its operation over a wide speed range.

1,658,980. Phase Balancing System; C. Le.G. Fortescue, Pittsburgh, Pa. App. field June 23, 1925. Systems of this character as employ single-phase synchronous condensers for effecting a phase balance. A system wherein two single-phase reactance devices may be utilized to balance the voltage and current in a three-phase or four-phase system or, in general, in any polyphase system.

1,658,983. Signal Wire Hanger; A. J. Gurney, Canton, Ohio. App. filed Nov. 7, 1923.

1,658,990. Electric Heating Unit; A. D. Keene, Pittsburgh, Pa. App. filed March 26, 1925. Embedded electric heating unit.

1,659,013. Spot Lamp; E. G. K. Anderson, Evanston, Ill. App. filed Oct. 25, 1924.

1,659,027, 1,659,028. Clock; F. C. Holtz, Springfield, Ill. Apps. filed Nov. 15, 1924. With a low power electric motor drive.

1,659,050. Storage Battery Charging Apparatus; R. J. Sasseman, Chicago, Ill. App. filed Jan. 30, 1925. For charging the storage batteries of radio receiving apparatus, or for similar purposes.

1,659,058. Thermostatic Switch; R. R. Stitt and C. F. Warrick, Detroit, Mich. App. filed May 1, 1924.

1,659,059. Adjustable Resistance Unit; C. E. Stryker, North Chicago, Ill. App. filed Oct. 21, 1925. As used in railway battery and signal circuits.

1,659,062. Coil Mounting; R. Varley, Englewood, N. J. App. field Nov. 15, 1926. Adapter for the mounting of small coils such as are used in the smaller type of transformers.

1,659,071. Sign Flasher; E. W. Applebaum, Chicago, Ill. App. filed May 27, 1926. For alternating current service.

1,659,091. Portable Oven; R. P. Fabbrini, Chicago, Ill. App. filed May 12, 1926.

1,659,094. Conduit Attaching to Outlet Boxes; F. A. Godfrey, Chicago, Ill. App. filed Oct. 21, 1925.

1,659,102. Electric Water Heater; G. Harvis, Detroit, Mich. App. filed Sept. 24, 1925. Portable type.

1,659,106. Dynamo Electric Machine; F. Hillebrand, Niederschonhausen, Berlin, Germany. App. filed Aug. 22, 1927. Of the split-pole commutator type and has for its object the provision of a self-excited generator of this character in which the voltage may be adjusted over a range from substantially zero to the full voltage of the machine, and in which the terminal voltage for any given adjustment will remain substantially constant.

1,659,110. Continuous Current Transformer; T. C. Lennox, Pittsfield, Mass. App. filed Aug. 20, 1925.

1,659,134. Automatic Electric Water Heater; M. C. Crawley, Groton, N. Y. App. filed Feb. 26, 1924.

1,659,160. Light Extension; A. Richards, Mexico, Me. App. filed June 4, 1924.

1,659,183. Insulator; A. O. Austin, Barberton, Ohio. App. filed Oct. 20, 1921. For high tension use.

1,659,208. Self Winding Clock and the Like; S. Manheim, Bridgeport, Conn. App. filed Dec. 19, 1925.

1,659,256. Clock; M. A. Gerson, Jersey City, N. J. App. filed July 20, 1926. Self-winding electrical clock.

1,659,267. Panel Cabinet for Electrical Connections; J. W. Hooley, Larchmont, N. Y. App. filed Sept. 20, 1926.

1,659,278. Combination Radiant Heater and Curling Iron Attachment; H. E. Meltzer and M. J. Svoren, Racine, Wis. App. filed Aug. 9, 1926.

# New Trade Literature

WIRES AND CABLES. — The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-905 covering its insulated wires and cables, including data on current-carrying capacities of its paper-insulated, lead-covered cables.

LIGHTNING ARRESTERS.—"Discharge Rate of Lightning Arresters vs. Protection Afforded" is the title of booklet No. 247, the third of a series covering lightning protection and which is being issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia.

POLYPHASE INDUCTION MOTORS.—Bulletin No. 1118-E issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes and illustrates its type "AR" squirrel-cage and type "ARY" slip ring poyphase induction motors, with either sleeve or tapered roller bearings.

MOTORS AND GENERATORS. — Bulletins No. 6023, No. 6022 and No. 6025 issued by Engberg's Electric & Mechanical Works, St. Joseph, Mich., describe and illustrate the Engberg constant and adjustable speed, ball bearing, direct-current motors; the type M ball bearing bracket type direct-current generators and motor-generators. Dimension tables are also included in the bulletins.

BEARINGS AND PILLOW BLOCKS.—The Rollway Bearing Company, Inc., Syracuse, N. Y., has issued catalog No. 4-A covering its wide series and utility types of bearings. The company is also distributing bulletins Nos. 53, 54, 55 and 56 covering respectively the self-aligning pillow blocks equipped with Rollway adapter type bearings to fit standard commercial shafting, various precision types of Rollway radial bearings, self-aligning pillow blocks equipped with standard bearings and large Rollway bearings in the recently adopted international sizes.

PLIERS.—A pamphlet issued by the Utility Equipment Company, 1035 East 76th Street, Chicago, covers its high-voltage pliers.

OIL CIRCUIT BREAKERS. — Bulletin GEA-925 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its types FK, FKO, FHK and FHKO-139 station oil circuit breakers for 7,500 to 220,000 volts and 600- to 2,000-amp. service. Bulletin GEA-926 gives the dimensions of these station oil circuit breakers.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Rome, Italy (No. 29,754), for electrical bakery ovens, etc.

An agency is desired in Alexandria, Egypt (No. 29,858), for electric bulbs, fuse boxes, switches and insulated and bare copper wire.

An agency is desired in Berlin, Germany (No. 29,774), for electric dental and medical apparatus.

An agency is desired in Arnhem, Netherlands (No. 29,761), for household electrical appliances.

An agency is desired in Cochabamba, Bolivia (No. 29,840), for household electrical appliances and wiring supplies.

An agency is desired in London, England (No. 29,861), for household labor-saving devices.

Purchase and agency are desired in São Paulo, Brazil (No. 29,871), for farm-lighting sets.

Purchase is desired in Plzen, Czechoslovakia (No. 29,854), of electric planes.

Purchase and agency are desired in Osaka, Japan (No. 29,756), for electric railway equipment.

An agency is desired in Vienna, Austria (No. 29,860), for electric household refrigerators.

Purchase and agency are desired in Magdeburg, Germany (No. 29,856), for electric washing machines.

Purchase is desired in Erfurt, Germany (No. 29,857), of electric washing machines.

Purchase is desired in Magdeburg, Germany (No. 29,855), of electric washing and wringing machines.

The General Engineering Company, 13 Union Bank Building, Apollo Street, Fort Bombay, India, desires to purchase transformers and auxiliary equipment, house service meters and line materials. This company wishes a list of prices and other information in duplicate. A copy of the specifications for this material is available for loan to interested American firms and may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., reference EE 1064.

Carrick Wedderspoon & Company, New Zealand, wishes to get in touch with American manufacturers of electrical equipment with a view to securing agencies. The company is interested in electric ranges, 230 volts; vacuum cleaners; time clocks, 40 days winding, used mostly for hot water heaters, single pole, single throw; electric refrigerators, 230 volts, 50 cycles; electric washing machines, electric sewing motors, domestic heating and cooking devices, electric ironing and washing machines, as well as battery-charging plants for garages. Further information may be obtained upon request to the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., reference EE 1065.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## Two Homes Out of Three Electrified

With the rapid increase of the number of residential connections to electric power circuits the question has arisen in the electric light and power industry as to the effect of increasing saturation in this respect. It is probably equally pertinent in other lines, notably in the telephone and automobile industries, for by a coincidence the number of telephones, of automobiles and of electric light and power customers are roughly equal, all being in the general neighborhood of 20,000,000, although the distribution between private or residential users on the one hand and commercial or industrial users on the other probably differs.

The total number of electric light and power customers in the United States as of Jan. 1, 1928, was 21,694,100, of whom 17,596,400 were residential, according to figures published in the Electrical World of Jan. 7, 1928.

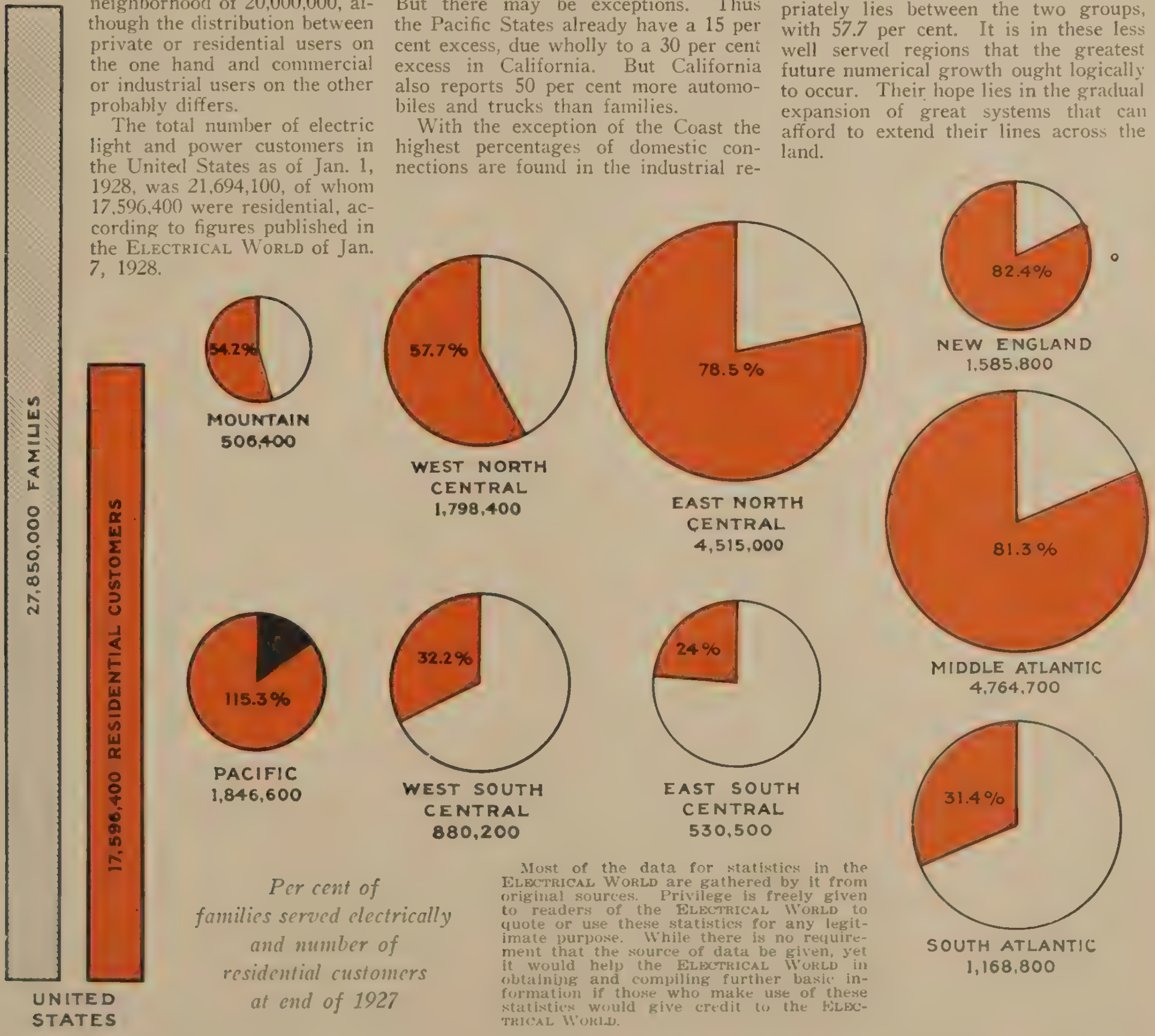
The number of families may be taken approximately at 27,850,000. The number of residential electric customers is thus about 63 per cent of the number of families. It has multiplied tenfold in twenty years.

What of the future? The assumption has been made that the number of residential customers is definitely limited by the number of families. That is probably true in general, and must be seriously considered in future plans. But there may be exceptions. Thus the Pacific States already have a 15 per cent excess, due wholly to a 30 per cent excess in California. But California also reports 50 per cent more automobiles and trucks than families.

With the exception of the Coast the highest percentages of domestic connections are found in the industrial regions; New England has 82.4 per cent; the middle Atlantic States, 81.3 per cent; the East North Central States, 78.5 per cent.

In regions predominantly rural, electrification is far more difficult and has proceeded more moderately. Thus the proportion of residential consumers to families is only 24.0 per cent in the East South Central States, 31.4 per cent in the South Atlantic States and 32.2 per cent in the West South Central States.

The West North Central region, with its mixture of manufacturing industries in large cities and of agriculture with its low population density, very appropriately lies between the two groups, with 57.7 per cent. It is in these less well served regions that the greatest future numerical growth ought logically to occur. Their hope lies in the gradual expansion of great systems that can afford to extend their lines across the land.



*Per cent of families served electrically and number of residential customers at end of 1927*

Most of the data for statistics in the Electrical World are gathered by it from original sources. Privilege is freely given to readers of the Electrical World to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the Electrical World in obtaining and compiling further basic information if those who make use of these statistics would give credit to the Electrical World.

# Seasonal Increased Production in North Central States

THAT the manufacturing plants of the North Central States witnessed materially increased productive activity during January over those of December is indicated by reports on electrical energy consumption received by the ELECTRICAL WORLD from about 850 large manufacturing plants operating in this section. This increase in operations of about 7.8 per cent appears to be largely seasonal in nature, but is less than the increase recorded during January, 1925 and 1927, but greater than that recorded for January, 1924, and January, 1926. It might be said, therefore, that an average increase in productive operations was recorded during the current January.

The increased operations of general industry during January was due very largely to the materially increased rate of activity recorded by the metal industries, the automobile manufacturing industry and the textile industry, the increased activity of these industrial groups more than offsetting the decreased operations in some of the other industrial groups. During January seven of the section's primary industrial groups—textiles, lumber and its products, automobiles, including the manufacture of equipment and parts; rolling mills and steel plants, metal working plants, food and kindred products, and leather and its products—witnessed productive activities materially over those reported for December, 1927.

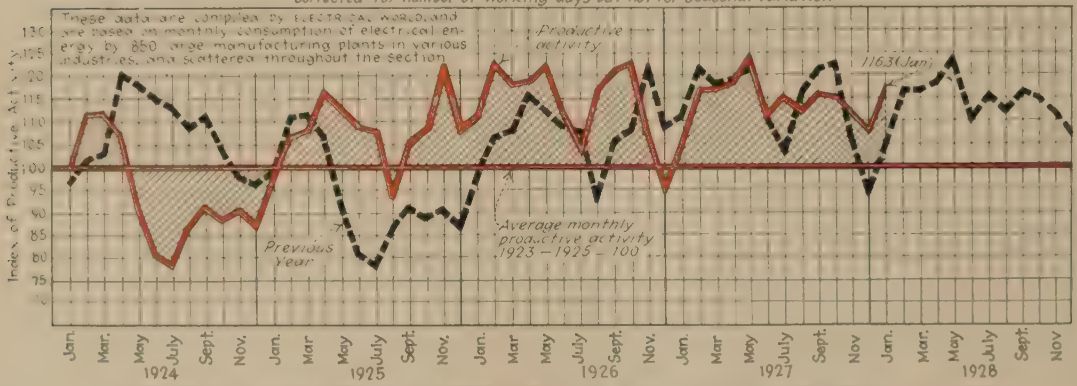
*Indexes of Productive Activity in the North Central States*

All Figures Adjusted for Number of Working Days

| | Jan., 1928 | Dec., 1927 | Jan., 1927 | Average for Full Year, 1927 | Average for Full Year, 1926 |
|---|---|---|---|---|---|
| All industries | 116.3 | 107.8 | 105.5 | 114.5 | 114.4 |
| Chemical and allied products | 82.3 | 99.4 | 92.3 | 100.5 | 112.8 |
| Textiles | 126.3 | 110.0 | 141.0 | 126.1 | 106.4 |
| Lumber and its products | 120.2 | 113.2 | 114.2 | 121.5 | 117.6 |
| Paper and pulp | 105.8 | 129.3 | 119.9 | 110.2 | 110.0 |
| Automobiles, including parts and equipment | 135.8 | 106.4 | 78.2 | 110.1 | 113.7 |
| Metals group | 128.7 | 104.3 | 112.0 | 113.2 | 116.2 |
| Rolling mills and steel plants | 132.8 | 113.3 | 116.6 | 118.1 | 118.6 |
| Ferrous and non-ferrous metal working plants | 124.6 | 95.2 | | | |
| Food and kindred products | 103.3 | 100.2 | ..... | ..... | ..... |
| Leather and its products | 113.8 | 101.2 | ..... | ..... | ..... |

ELECTRICAL WORLD *Barometer of Industrial Activity in the North Central States*

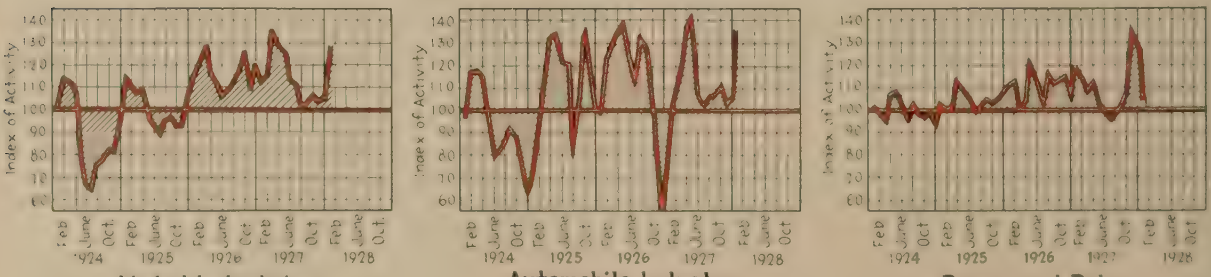
Corrected for number of Working days but not for seasonal variation



*States in* NORTH CENTRAL GROUP

Ohio,
Indiana,
Illinois,
Michigan,
Wisconsin,
Minnesota,
Iowa,
Missouri,
North Dakota,
South Dakota,
Nebraska,
Kansas.

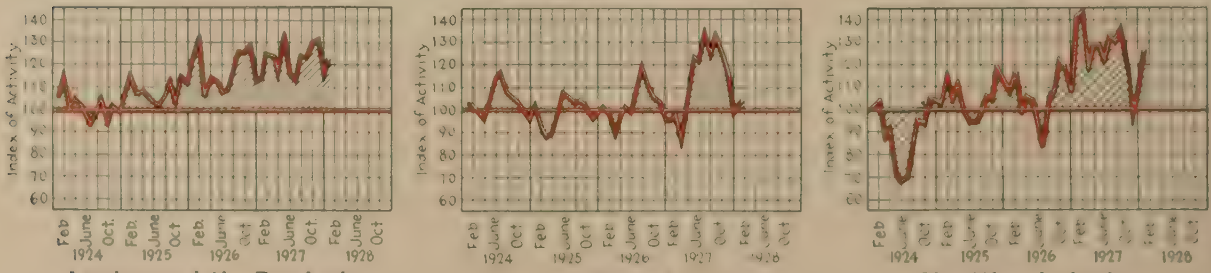
GENERAL INDUSTRIAL ACTIVITY IN THE NORTH CENTRAL STATES



Metal Industries

Automobile Industry (Including Equipment and Parts)

Paper and Pulp



Lumber and its Products

Food and Kindred Products

Textiles Industry

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NORTH CENTRAL STATES

Electrical World

*Published by McGraw-Hill Publishing Company, Inc.*
W. H. ONKEN, JR.
*Editor*

VOLUME 91 *New York, Saturday, March 10, 1928* NUMBER 10

## *Limited Dividends*

THE president of the American Telephone & Telegraph Company, Walter S. Gifford, has announced a definite policy of no further increase in dividend rate on the common stock of the world's largest public utility. In adopting this policy he said to stockholders:

"Earnings must, of course, be sufficient to permit the best possible telephone service at all times and to provide a reasonable payment to stockholders with an adequate margin to insure financial safety. Earnings in excess of these requirements will either be spent for the enlargement and improvement of the service furnished or the rates charged for the service reduced. This is the fundamental in the policy of the management."

If the earnings are limited through voluntary rate reductions or adjustments, a stabilizing factor is introduced. This is not a new thought for utility men but is unusual because it has been applied by such a large company. Several chief executives of electric light and power utilities have succeeded in inaugurating a similar policy in their organizations, and possibly more will find it advantageous to follow these examples. The telephone company and the electric light and power industry are outgrowing the speculative age and, as befits the maturity of their development, are settling down to the task of supplying to their customers the fundamental thing that they have to sell—service.

* * * *

## *Apologia Is Not Advertising*

THE man on the curb is not favorably impressed with public utility advertising that resorts to either apologia or braggadocio. Neither appeals to the public. Apologia is not advertising. In the public prints it excites suspicion. "What have these people been up to that they thus sprinkle themselves with sweet perfume?" asks the cynical "Vox Pop." And if he happens to remember his high-school excursions into the classics of our tongue he may add: " 'Methinks the lady doth protest too much' !" Braggadocio is even worse. To publish encomiums on one's own courage, integrity, vision, leadership, consummate skill, unfailing efficiency and splendid zeal arouses not admiration but a species of pity. Men in whom these attributes are inherent do not openly advertise them.

Unquestionably good-will advertising designed to checkmate action which might result in any degree of nationalization of the electric light and power industry is desirable and important. Certainly something should be done to preserve the industry from becoming a political football. But boasting, apologizing and reiterating the high-sounding phrase "freedom of individual initiative" is a wrong and harmful way to go about it. A better way is to tell the public in direct, vigorous and persuasive advertising of the almost miraculous advantages of electric service—in other words, to sell the electric idea. Broadly, this has never been done. It should be done now. When the public are made truly conscious of the blessings which accrue to them from electric service they can be relied upon to protect the source of that service.

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## *Temperance and Conciliation Needed in the Bay State*

BAY STATE power companies are under heavy fire on Beacon Hill. The Department of Public Utilities is seeking a guarantee of continued regulation of these properties through company assent to a proposed legislative act which industry leaders assert would abrogate their constitutional rights—guarantee, because the board fears that if the United States Supreme Court should sustain the reproduction-cost rate base on final appeal of the Worcester Electric Light or any other company, regulation in Massachusetts would become a hissing and a byword.

The Worcester appeal to the federal courts apparently brought this matter to a head, although the chairman of the commission maintains that the proposal has been under more or less open consideration for several years and that the board is actuated by a desire to safeguard the consumer against possible exploitation in the form of increased rates on properties lately acquired by nonresidents of the state. This Banquo ghost of rate increases leers horribly across the commission's table, but it is bound to fade from sight when the daylight of promotional rate successes in other jurisdictions sweeps away the shadows of flat-rate limitations from the council chamber of this hard-working but overanxious tribunal.

We do not believe that regulation in Massachusetts is in desperate case because a single company is exercising its legal rights in asking the courts to pass upon the fairness of a commission decision. The Worcester company's rate and dividend policies have been both criticised and defended within the industry itself; but do this and other rate situations in the Bay State call for such a remedy as nullifying the constitutional right of court appeal by signing it away virtually at the point of a pistol? It is difficult to believe that the Massachusetts Legislature will enact such a measure into law at this time, in view of its many objectionable features, including its questionable economic soundness, its dubious effect upon credit and investment values, its threatened impairment of surplus and its repugnant requirement of contract under duress.

Despite confidence that ultimately the situation will be adjusted, just now it is not a pleasant one. Bickering and strife lead nowhere but to confusion, and there is need for some one to take the commission and the utilities by the hand and say, "Come now and let us reason together." Certainly, our highest court does not "promote greed and gluttony," and one who contends for his legal rights is not a "hog." A little more tolerance and consideration on the part of both the commission and the utilities will lead to understanding and to a way out. The issue is too serious and the consequences of hasty action are too great to be decided in any other way. The Commonwealth of Massachusetts, we are sure, does not seek to confiscate property or to deal unjustly with public utility corporations. It has not done so in the past and has hardly become socialistic now. Neither do the utilities, if they are wisely managed, seek to charge rates out of all proportion to the value of the service. What differences exist should be quickly adjusted and composed in keeping with the spirit of regulatory law and to the mutual advantage of consumer and producer.

* * * *

## *Research Not Foreign to Operation*

IMAGINATION allowed to run rampant may seldom be productive of anything commercially applicable, but who can say this of directed, logical speculation on the course that electrical development will take? Successful research requires physicists with imagination. Business is demanding sales managers with imagination to develop new markets. Then why should not every one in a field as fertile for development as electrical engineering stimulate and exercise his imagination? This is particularly needed because of the advances which are being made in electron control—a phenomenon not confined to radio communication by any means. Virtually every electrical problem with which light and power companies are trying to cope involves electron control.

Manufacturers' engineers who are in close touch with research laboratories are not likely to overlook the visualization of ways in which scientific developments may modify present methods of production, transmission and control of electrical energy. But the practical-minded operators of electrical systems are not prone to speculate. As a consequence they may extend systems in such a manner that it will be very costly to adapt them to new and desirable discoveries. If the operators who think in terms of economy and the practical needs of their companies would delve into the results of research occasionally, perhaps they could suggest to manufacturers ways in which present physical knowledge could be combined to serve commercial needs even more than now. At least such studies would prepare them to handle power applications of electron control knowingly when they arise.

For example, who can say that we may not have an electron control device some day that will combine a power rectifier and circuit breaker for feeding Edison systems? Research pointing in this direction has been reported. Again, with a d.c.-a.c. tube working on the electron-control principle and delivering alternating current of adjustable frequency, the speed of ordinary induction motors could be gradually raised from zero to maximum without loss of torque and without complexity of control, opening the field for direct-current transmission and simple motor and control apparatus if they are desirable for train operation. Since arcs involve the discharge of electrons from one conductor to another and since research indicates that electrons can be controlled, would it be unreasonable to expect that entirely different insulators might be developed?

These dreams are just indicative of others that may materialize into commercial realities if engineers outside laboratories and manufacturing plants will study research results and add their ideas to those of the manufacturers and scientific workers.

* * * *

## *"Shoestring" Tie-ins Challenge Engineering Analysis*

BETWEEN many adjacent utility systems are interconnections whose usefulness is taken for granted when there should be a rigorous inquiry into their justification. A vast difference exists between low-capacity frontier contacts and intersystem ties or interstation trunks that serve for transfer of substantial blocks of energy. In many cases the limitations of low-capacity tie lines are so great that they cut virtually no figure in regional operations. Sometimes they actually prevent territorial load dispatching along the high-grade lines now regarded as standard practice.

Such ineffective "shoestring" tie-ins should be checked regularly by engineering departments and a program outlined providing for their retention, their future development or their abandonment for salvage. The substitution of interplant and intersubstation trunks for such lines has been effective in some quarters in providing adequate channels for transfer of energy and improvement of service continuity and voltage regulation.

* * * *

## *High-Frequency Freaks*

ONE of the byproducts of the development of high-frequency equipment for radio transmission, and particularly of the recent tendency to shorter waves and higher frequencies, is the interest aroused in many unusual and striking physical, chemical and biological effects of high-frequency electric fields. The general character of these effects has been known for many years and was emphasized by the experiments of Sir Oliver Lodge and Tesla, not to mention numbers of others. As the equipment of these early investigators was usually of limited capacity, the amounts of energy associated with the high-frequency phenomena were small and their application was limited to laboratory demonstrations and therapeutic effects.

However, the development of the electron tube has afforded a high-frequency generator of high capacity, and recent reports from the General Electric research laboratories refer to a 15-kw. oscillating tube and circuit in which the energy is radiated into space from a copper bar a few feet long and at frequencies of the order of fifty million cycles per second. This equipment is remarkable and noteworthy because of its high rating and the extreme concentration of energy radiation in the neighborhood of the short antenna. It will undoubtedly be a powerful instrument for the study and development of short-wave radio transmission.

Very striking results are reported from the electrical disturbances caused in proximity to the tube, and particularly such phenomena as standing unipolar electric arcs, the cooking of food and the warming of the blood of persons standing near by. It is suggested that the last-named phenomena may have a useful medical and therapeutic value. It is interesting to note that the phenomenon of high-frequency fields warming the blood was apparently first noted by Wood and Loomis and reported in the *Philosophical Magazine* for September, 1927, using similar equipment and frequencies in the neighborhood of a hundred million cycles, but of very much lower rated output. It is possible that some of the other manifestations of concentrated radio energy may find useful application.

* * * *

## *Appliance Servicing an Obligation— But Whose Responsibility?*

NO CENTRAL-STATION company, regardless of how energetically it merchandises appliances, expects or wants to do all the selling in its territory. In fact, utility companies welcome other dealers and hope to see their sales volume grow. What the central-station companies do not like to see is the failure of dealers in their territory for whatever reason. Such failures act as a damper on all appliance selling. As servicing seems to be the rock upon which many dealers founder, would it not be good business for the central-station companies to act in a standby capacity in this matter of servicing?

If a local power company lets its customers know it can be depended upon to keep their electrical appliances in operation, it will greatly increase the confidence of prospective purchasers. Many companies are already tacitly doing this. The Detroit Edison Company, has organized service departments which answer trouble calls and make repairs on all household appliances regardless of where these were purchased. Such a service need not be extended to substandard equipment. This practice would automatically discourage the sale of devices of questionable merit. It would give the central-station company more effective supervision of the kind of appliances being sold to its customers. It would encourage the responsible dealer to know that he had the local utility company back of him. It should encourage the manufacturer to make a device requiring a minimum of service.

Whether or not and how servicing is to be charged for, it appears that the electrical industry eventually will be obliged to assume the major part of the responsibility. If this responsibility and control were centered in one place — the electric utilities — it would be a long step forward in stabilizing the electric appliance business and reducing the cost of individual services.

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## *Greenwood's Appointment Is Good News*

THERE is good promise in the appointment of C. Ernest Greenwood as commercial director of the National Electric Light Association. After more than a year of discussion and deliberation, the job has found the man. It was a difficult place to fill. It needs a man who understands the N.E.L.A. and how it works and can establish leadership in harmony with traditions and established practices. Greenwood has had years of active committee work for background. It needs a man who can help carry forward the two pressing commercial objectives that are at the forefront at the moment—the adequate wiring of homes and the development of better trade relations. For, to speed the building of domestic load, facilities must be provided for the use of more appliances in the 17,600,000 incompletely equipped wired homes and for a more effective flow of electrical merchandise into those homes from all the natural neighborhood sources of household supply—department stores, hardware stores, drug stores, as well as electric shops and central-station salesrooms. Greenwood has led the recent movement for better understanding and co-operation between the trades and as chairman of the N.E.L.A. Commercial Section merchandising committee and head of the appliance department of the Boston Edison company has had appropriate training. Fortunately, in Boston he also for a time was in charge of negotiations for service to new buildings and isolated plants, and prior to that he served in the statistical department in rate analysis problems. His experience is, therefore, well rounded and comprehensive.

The establishment of a commercial director at N.E.L.A. headquarters is just another sign of the quickening interest of the industry in the importance of the sales function. It should greatly strengthen and accelerate the work of the Commercial Section, because it will bring continuity of effort to committee activities and the co-ordination of purpose that is only possible when some one with responsibility and initiative carries on from year to year.

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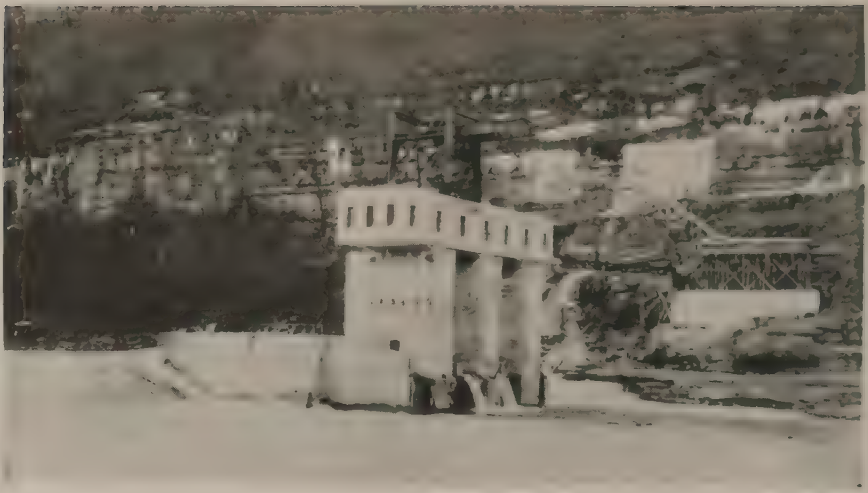
## *"Totin' Together"*

"TOTIN' TOGETHER" means carrying the load together, each one doing his share of the job. Just as it is possible for one man to slack off and make his team mate do more, so is it possible for one of two interconnected electric systems to shirk its portion of the mutual service responsibility. Manifestly it is impossible to cover in an interconnection contract all of the operating conditions that may arise. Any attempt to do so would result only in a contract that would fail in its purpose because of complexity. Unless an interconnection contract represents an agreement between two or more systems that will voluntarily "tote" the load together, the contract is hardly worth the paper it requires. Without this attitude there are plenty of ways in which the spirit of the contract may be encroached upon without transgression of the letter.

Interconnections might better be dissolved than to have the parties to them observe only the letter of the law. For example, what value would written agreements have if, because relay settings were not mentioned, relays were adjusted by one party to free itself of entangling alliances when trouble occurred on the connected company's lines? It would not compensate for failure to give relief merely to express regrets because the system broke loose or to protest most strenuously that the cause of the separation was a mystery. Just because meters at an interconnection point are not equipped with ratchet registers one party is not warranted in trying to trade back off-peak energy for on-peak kilowatt-hours. A few such evasions of moral obligation have regrettably occurred and probably will arise again, but they are not in keeping with the spirit of interconnection.

With all the opportunities for evading written agreements, which an ingenious mind may devise, it is almost futile to guard against them in interconnection contracts. The full benefits of interconnection are more liable to be realized if two systems will join hands with the simple statement that they will be square with each other and will work out their common problems in a spirit of fair play.

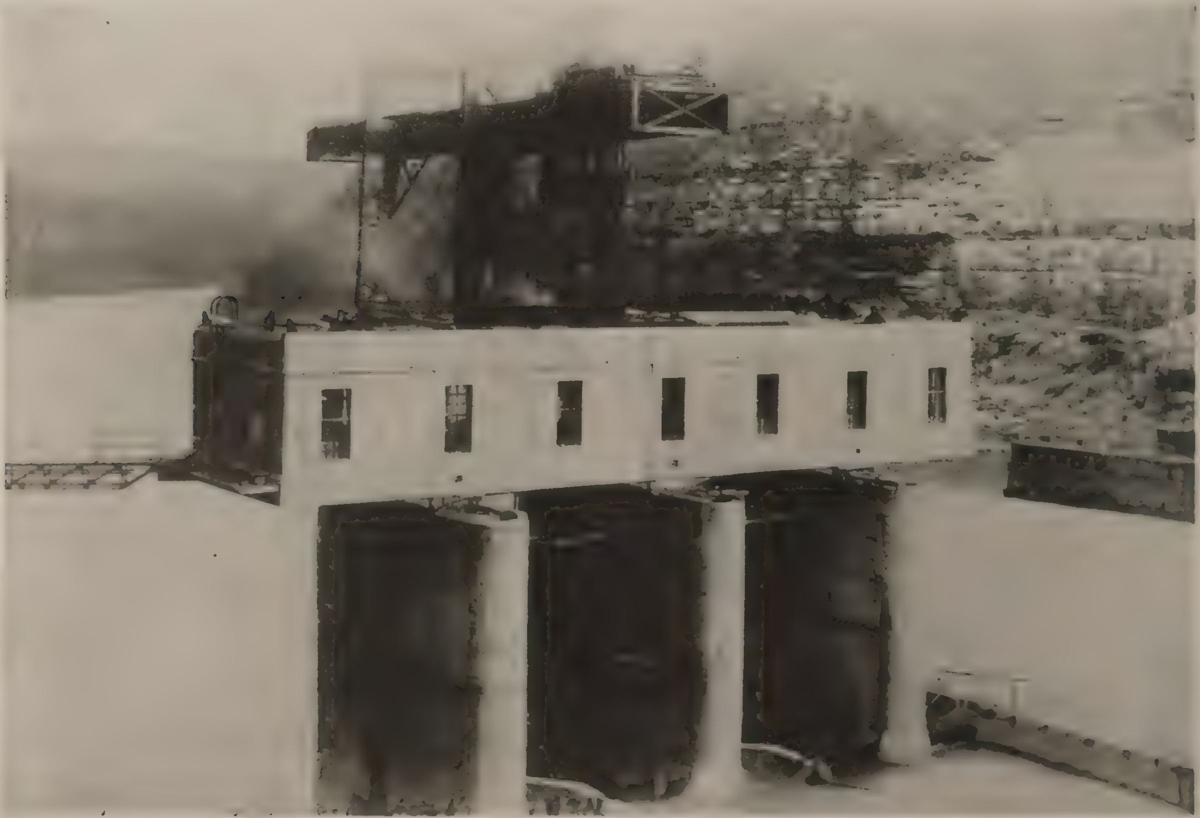
# *A Hydro-Electric Plant on Stilts*



THIS unusual plant, shortly to be completed for the Kentucky Hydro-Electric Company at High Bridge, Ky., was designed to comply with topographical conditions at Government Lock No. 7 on the Kentucky River. The valley is so narrow that there was not room for a plant beyond the end of the dam. Furthermore, the spillway could not be restricted because of the sudden and violent floods which occur.

In the lower part of the plant, over which floodwaters will flow, are the floodgates, draft tubes, etc. The generators and electrical control are in the upper section well above high water. The piers house the shafting and some auxiliary machinery. Equipment is handled through hatches in the roof by the outdoor crane. Transformers and switching equipment will be located on the left bank of the river and connected to the plant by a light foot bridge shown below at left of plant.

The equipment involves three 650-kw. generators driven by 150-r.p.m. propeller-type turbines, operating at a maximum head of 15 ft., and will be controlled from the Dix Dam power house, more than 3 miles away, by supervisory control.



# 220-Kv. Carrier-Telephony

### Southern California Edison Company installation covers over 270 miles of 220-kv. transmission line: Single-frequency duplex system with selective ringing used

By Roy B. Ashbrook* and Ralph E. Henry†

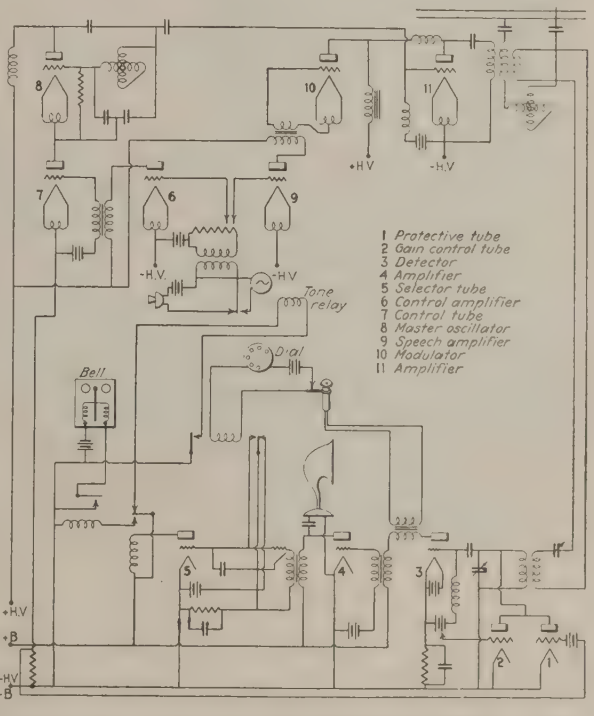
*Southern California Edison Company, Los Angeles, Cal.*

POWER companies have followed with keen interest the rapid development of carrier-current telephony over transmission lines. Interest was further stimulated when the development reached the stage where many of the advantages of wire line communication could be enjoyed. Carrier-current equipment now permits of duplex operation, selective calling, full "party line" communication, wire line extensions and intersystem connections. The method of coupling the equipment to the transmission line has simplified the installation problem considerably; concentrated capacity coupling has marked advantages, in most cases, over the antenna type, and coupling condensers may be installed with the same degree of facility as power equipment. Installation of the radio-frequency line between the capacitors and the equipment has heretofore presented some difficulty at congested stations. This has been overcome by the development of tuning units which permit the use of lead-covered cable run underground. Thus the terminal equipment may be placed in the most advantageous location to meet operating requirements and station or office design limitations.

Having in view the many advantages offered by carrier-current telephony over transmission lines, and for the purpose of studying its operation to determine to what extent it would supplement wire line communication, the Southern California Edison Company placed two General Electric type CC3D sets in operation over its 220-kv. transmission lines. Installation was completed Oct. 1, 1926, and the circuit has been used continuously by the load dispatchers since that time. One set is installed at Big Creek power house No. 3 and the other at the Laguna Bell substation, the latter station being 270 miles from Big Creek and 15 miles from the Edison Building in Los Angeles. A type CC61 extension connects the primary carrier equipment at Laguna Bell to the load dispatcher's office in the Edison Building over a private open wire telephone line and gives the dispatcher remote control of the carrier equipment.

The primary carrier equipment is connected to the 220-kv. system through two General Electric 220-kv. oil-filled capacitors of 0.001 mfd. capacity each. The high side of these capacitors is connected directly to the "A" and "B" phases of the operating bus and the low side through suitable protective equipment to the primary sets. One of the accompanying illustrations shows the condenser coupling installation at Laguna Bell. The carrier equipment of Laguna Bell is temporarily installed in a small steel building approximately 300 ft. from the 220-kv. bus. The location of the capacitors with reference to the bus permits phase connections to be easily shifted. At Big Creek the equipment is installed in the emergency telephone house, some 250 ft. from the 220-kv. bus. The capacitors are connected to the bus in the same manner as those at Laguna Bell.

The primary equipment embodies what is known as "single-frequency" duplex operation with selective ringing." This single-frequency duplex operation can be explained as follows:



*Condensers couple this carrier-current telephone equipment to 220,000-volt transmission line*

If two stations are arranged to communicate by carrier-current telephony they may, by using different frequencies and each having a receiver tuned to the other's transmitting frequency, carry on a duplex, or two-way, conversation. That system would be called two-frequency duplex carrier-current telephony. With both stations tuned to the same frequency it is evident that the transmitter must be inoperative during reception and that the receiver be disconnected or otherwise protected from the transmitter during transmission. If this is accomplished by manual operation of a switch each time it is desired to change from transmitter to receiver the service would be called single-frequency simplex carrier-current telephony. If by some means the transmitter could be caused to operate whenever an audio signal of sufficient intensity reached the microphone, and to cease to operate at the end of the audio signal, and if the receiver could be made operative at all times except when the local transmitter was actually operating, it would be possible to carry on a two-way conversation, as on any wire phone using one frequency. The system is called single-frequency duplex.

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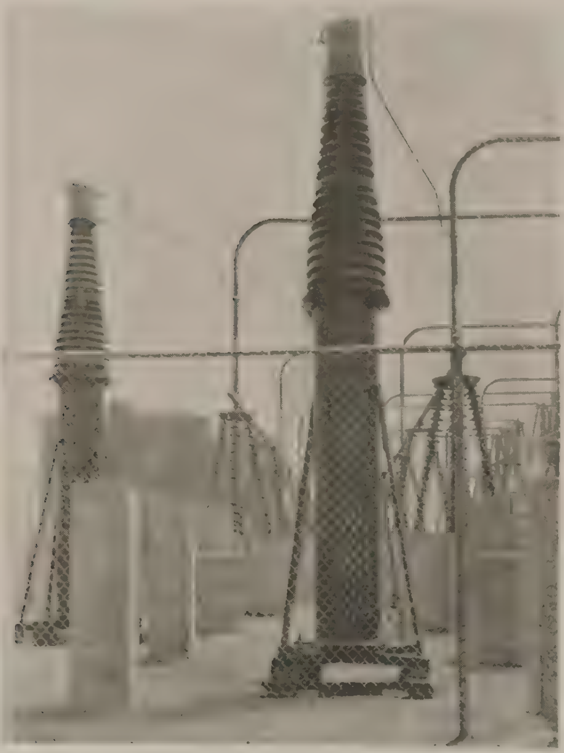
*Communication engineer. †Department of engineering design.

The outstanding advantage of the single-frequency duplex system is that a number of stations can enter into a full "party-line" communication. Thus, a dispatcher and several other stations may be in full communication with each other at one time, each being able to talk to all the others and each being able to hear the speaker.



*Capacitators link communication system to high-tension lines*

Specifically, the General Electric Company type CC3D set used by the Southern California Edison Company is designed to give duplex conversation between similar sets, using the same frequency for transmission and reception. It is designed to be a multipower set; that is, the transmitter may be operated at three power levels, namely, 7½, 50 or 250 watts. The power supply is a 125-volt storage battery driving the necessary motor-generator sets.

The transmitter is composed of a master oscillator, control tube amplifier, control tube, speech amplifier, modulator and power amplifier tubes, together with the necessary circuit accessories. For duplex operation the master oscillator must operate with each audio signal above a certain intensity (room noise) and must cease to operate at the end of this sound. This is accomplished by means of the control tube in the following manner:

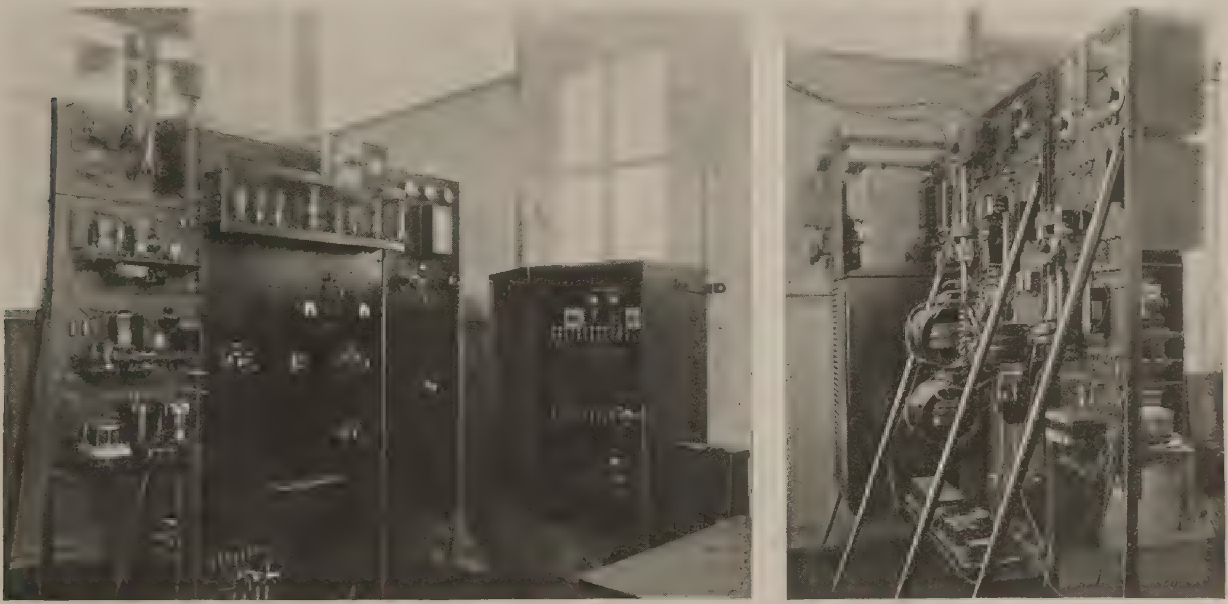
The control tube plate is connected to the filament of the master oscillator and the control filament returns to negative high voltage. There is, of course, positive high voltage on the master oscillator plate. The two tubes are, therefore, in series and a very high bias is normally on the control tube grid. Therefore, while "standing by" practically all of the voltage drop is across the control tube and the master oscillator cannot operate. When an audio signal of sufficient intensity reaches the microphone it is amplified by the control tube amplifier and impressed on the grid of the control tube. This lowers the resistance of the control tube, allowing more current to flow through the master oscillator, which causes it to operate. The audio-frequency signal (voice or "tone") is simultaneously amplified and impressed upon the output by the Heising system of modulation.

### FEATURES OF RECEIVING EQUIPMENT

The receiver is practically a standard two-circuit receiver without regeneration or radio-frequency amplification. Sufficient signal is received from the transmitting station to permit using a detector tube only for the reception of speech, thus avoiding the amplification of noise. The protection of the receiver against the high voltages induced during transmission and the automatic gain control of the received signal are the only uncommon principles involved. Two tubes, known as the protective tube and gain control tube, have their plates in parallel and connected to one side of the secondary inductance of the receiver and their filaments to the other side of the same inductance. The grids are normally held slightly negative by separate bias batteries. The filament return circuit of the master oscillator flows through a 1,000-ohm resistance to negative high voltage. When the master oscillator draws plate current there is a voltage drop across this resistor. The grid of the protective tube is connected to the positive end of this resistor, which means that a positive bias is impressed on it, and the protective tube becomes a very low impedance which shunts and detunes the secondary tuned circuit, thus protecting the receiver from abnormal voltages. The operation of the gain control tube is quite similar to that of the protective tube, except that its grid potential is controlled by the drop across a 3,000-ohm resistor in the filament return of the detector tube to the negative of the plate supply. A separate six-volt filament battery is used on the detector tube to isolate it from the other tubes in the receiver.

For calling, one stage of amplification and what is known as the selector tube are used. The selector tube has a Wheatstone relay in the plate circuit, the plate current being biased to zero. When the 500-cycle dial-interrupted tone is received the plate current is increased, causing the Wheatstone relay to operate a selector relay, which, upon receiving the proper combination, rings a bell.

The type CC61 remote-control extension between Laguna Bell substation and the dispatcher's office in the Edison Building, Los Angeles, is a combination radio and audio channel. If audio, or, in other words, a standard telephone channel, were used, it would require two pairs of wires, since the inherent characteristics of the primary carrier necessitate the keeping separate of the transmitted and received signal. This, of course, could be accomplished by using a hybrid coil and balancing network on one pair. In fact, this method was employed prior to the delayed receipt of the CC61 extension.



*Front and rear views of instrument panels for carrier-current telephone of Southern California Edison Company*

Front view of board shows metal cover removed from four-section panel on left.
Equipment in small cabinet on right is for remote-control extension to dispatcher.

The present extension transmitting unit located in the dispatcher's office is a low-power carrier-current transmitter, employing a 7½-watt oscillator and a modulator tube of like rating. The filaments are lighted by alternating current and the plate supply is obtained from a half-wave rectifier tube. To assure continuous service the 110 volts a.c. for filaments and plate supply rectifier is obtained from a 100-watt, 110-volt alternator direct connected to a d.c. motor operating from a 32-volt storage battery.

The extension receiver unit, located in the same building with the primary carrier at Laguna Bell, utilizes a detector tube and one stage of audio amplification. The detector tube has in its plate circuit a sensitive polarized relay. The plate current is biased down to about 1 milliampere. When the dispatcher starts the extension transmitter unit by lifting his receiver from the hook radio-frequency current is sent over the phone line, which causes the detector to pass more plate current, and the polarized relay operates. Associated relays are in turn energized by the polarized relay and the primary carrier equipment is started. Replacing the receiver on the hook shuts down the set by releasing the relays which function during operation.

### Operation of the Equipment

Over a period of eight months a careful record was kept of all interesting details of the operation of the equipment. Operations averaged 50 per day. Transmission tests were made from time to time, under varying line conditions, covering the entire frequency band of the equipment, i.e., 150 kilocycles. Sixty kilocycles was selected as the optimum operating frequency for the Edison system. As yet by-pass condensers at the various switching points between Laguna Bell and Big Creek have not been provided. However, communication has been maintained under very adverse line conditions. One rather severe test was made, as follows:

The carrier equipment at Big Creek was connected to the east line and the Laguna Bell equipment connected to the west line. The west line was energized and the east line was dead. Proceeding as shown in the following, satisfactory communication after each operation was established:

(a) Opened oil switches in the east line at three intermediate points, namely, Eagle Rock, Magunden and Vestal.

(b) Opened disconnects at the same three intermediate points.

(c) Shorted and grounded each line at each point.

Although under the above conditions it was found that 250 watts put through the best signal, it was possible to communicate satisfactorily on 7½ watts. Results of this test were quite pleasing. The manufacturer had offered no encouragement in the matter of getting through in a case of this kind unless by-pass condensers were installed. It is quite obvious that by virtue of the coupling between the adjacent lines the radio-frequency current was by-passed around the breaks. Should a break occur at the same point in both lines there is no doubt that communication would be interrupted on the carrier system.

Disturbances on the transmission system caused by flashovers, which frequently interrupt wire line telephone service, do not interfere with the operation of the carrier. On several occasions when flashovers have been of sufficient duration the dispatcher has been successful in communicating with Big Creek while the arc was taking place. We feel justified in stating that the carrier phone, because of the inherent strength of the transmission line and the immunity from power line disturbances, offers a very reliable channel of communication. In view of its dependability, the carrier phone adds a valuable supplement to the dispatching and operating communication system and the company expects to expand its carrier facilities from time to time.

# Ice Prevented Along Spillway by Compressed Air

By F. A. Dale
*Hydro-Electric Engineer Indiana Hydro-Electric Power Company, Indianapolis, Ind.*

A COMPRESSED air system for preventing ice formation along spillway flashboards has been in successful operation for two winters on the Tippecanoe River in Indiana at the Norway plant of the Indiana Hydro-Electric Power Company. The flood discharge works at this plant consist of three stony gates and an overflow spillway 225 ft. long. This spillway is a solid masonry dam, the crest of which carries 2 ft. of flashboards supported on conventional steel pins or rods. Pond level is generally carried within 6 in. of the top of these boards, and if ice were allowed to form against the boards they would soon be carried away. In the past an open channel had been maintained along the boards by hand chopping, the men standing on the narrow ledge behind the boards. This work was hazardous and expensive and some improved scheme was sought.

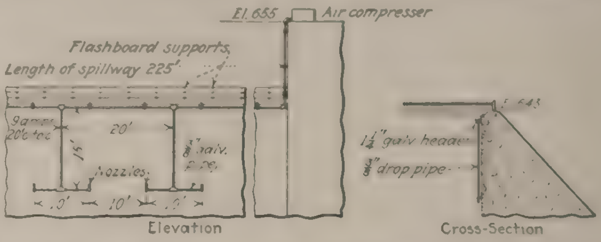
A permanent addition to the top of the spillway was not feasible because of encroachment on discharge capacity and also because the masonry section was insufficient to withstand ice loading at the higher level. Collapsible flashboards set at an angle flat enough to turn the expanding ice were considered, but the cost proved greater than a compressed air system. It was decided, therefore, to keep an open channel in front of the flashboards by means of air discharged under water. Normally no trouble arises from drifting floes of ice because the velocity in the pond is very low and the ice sheet generally melts away in place.

*Ice-prevention system at Norway plant of Indiana Hydro-Electric Power Company*

The average width of the open channel is about 8 ft. The picture was taken immediately after a period when the temperature reached 8 deg. below zero for four days. The ice on the pond was about 6 in. thick. In extreme temperatures of 20 deg below zero the width of channel decreases to about 4 ft.

The location and arrangement of the air piping are shown in the attached elevation and section. The air outlets or nozzles, which are simply pipe caps with proper sized holes drilled in them, were originally spaced 20 ft. on centers, but this spacing allowed ice to form between outlets. The eleven outlets were graduated in size from $\frac{1}{16}$ in. nearest the supply to $\frac{5}{16}$ in. at the farthest outlet. With this graduation too much air was delivered to the far end. The number of outlets was then doubled (making 22) by adding a 10-ft. tee extension at the bottom of each drop, as shown, with an outlet at each end. This placed the outlets 10 ft. on centers. The openings were also decreased in size, with a range from $\frac{1}{32}$ in. to $\frac{5}{32}$ in., increasing away from the source. This arrangement proved satisfactory.

The pressure at the compressor is about 10 lb. per square inch, being equivalent to the hydrostatic pressure at the nozzles plus the velocity and friction losses. It was discovered that a slight slope on the cross tee supplying each nozzle pair would give one nozzle more air than the other. For this reason individual drops to each nozzle would be preferred. Air is supplied by a Worthington-Laidlaw vertical inclosed, self-oiling, feather-valve, air-cooled compressor with 4¼-in. bore and 4-in. stroke. The compressor is belted to a 5-hp., 1,800-r.p.m. motor driving the compressor at 500 r.p.m. and delivers 13 cu.ft. of free air per minute. The outfit is mounted on top of one of the floodgate piers, and although protected from rain and snow by an inclosure no attempt has been made to keep it warm. No difficulty has been experienced with the compressor or air lines due to low temperatures. The cost of compressor and motor amounted to $170, that for the entire installation being $443.



*Open channel maintained above spillway by escaping air*

# Special Alloy Eliminates Erosion of Impulse-Wheel Nozzles

EROSION of impulse waterwheel nozzles, always a problem in high-head plants, seems to have been successfully met by the San Joaquin Light & Power Corporation, Fresno, Calif., by the use of "Stellite," a very hard and tough alloy. At the company's recently completed Balch high-head plant bronze or cast-steel nozzles had a life of from 35 to 40 days only, due to the cutting action of the water.

Although the water is very clean and free from abrasive material it was found that the water passing through the 7½-in. nozzles with a velocity of 360 ft. per second under an effective head of 2,243 ft. had a very decided erosive action on the throat rings and nozzles of the 40,000-hp. double overhung waterwheel. By welding "Stellite" onto cast-steel nozzles no signs of erosion are evident on the main waterwheel nozzles after two months and on the exciter wheel nozzles after six months of operation. The alloy comes in ½-in. rods and is welded onto the steel nozzles with an acetylene torch, after which the nozzles are put into a lathe and ground down with an emery wheel, since the metal is so hard and tough that it cannot be worked with a lathe tool. The work is done by the power company's men on the job at a cost of approximately $75 per nozzle.

# *Simplified*
# Distribution Planning

### Methods of calculating the economic characteristics of electrical distribution systems, particularly transformer spacing and sizes of line conductor

By W. R. Bullard

*Electric Bond & Share Company, New York City*

*The system of planning described by the author was utilized in the rebuilding of an extensive and heavily loaded distribution system in a Southern city. The use of this method permitted the completion of the necessary preliminary calculations in record time, a few weeks sufficing, whereas if other means had been employed the job would have been greatly prolonged. The system has the particular advantage of permitting the inclusion of growth factors, thereby involving another improvement over other similar plans.*

*The primary distribution system of economical design is discussed in this first of four articles by Mr. Bullard. The secondary system will be incorporated in the next two installments. The fourth article will show the actual solution of a specific distribution problem by means of the equations previously developed.*

*As this device may be applied, through the choice of proper values, to any general problem of such character, the development should possess unusual interest.*—Editor.

THE methods of establishing general features of economical distribution system design, with particular reference to conductor sizes and distribution transformer spacing, will be considered in this discussion. Once these features are established for any given system, their application to construction and operation becomes comparatively simple. Furthermore, these features, once properly determined, will usually be applicable for a period of several years without change, unless unforeseen circumstances should arise that would materially change local conditions.

Due to the variable nature of many factors that enter into the problem, it is not possible to reduce economical design to terms of absolutely correct figures. However, if the calculations are based upon reasonably sound general principles and are tempered with good judgment, the application of the results to a particular system cannot result in very great error in the over-all economics. This is particularly true since curves expressing the total annual cost of electrical distribution in terms of the various design factors are generally quite flat in the neighborhood of the point of minimum cost, and therefore small variations from exactly correct characteristics will not result in material changes in the total cost.

The methods described in this article will give approximate results only. However, for the reasons stated, it is believed that by their use sufficient accuracy for all usual purposes can be obtained. The methods given are applicable primarily to radial systems of usual types, but can be applied to automatic low-voltage alternating-current network distribution if the proper assumptions are made.

The writer gratefully acknowledges the assistance of W. T. Hess in offering many valuable suggestions during the preparation of this article, and of Malcolm W. Stumpf and Alfred Hudson in handling the detailed mathematics in the development of many of the equations.

## Preliminary Calculations

The first step in a study of the economics of the characteristics of any given distribution system is the calculation of two factors which will later be used repeatedly in calculations. These are: Copper loss duration factor and unit energy cost.

*Copper Loss Duration Factor.*—By copper loss duration factor is meant a factor that takes into account the shape of the daily and yearly load curves of any particular part of the system and enables the yearly copper loss to be derived from the copper loss at the yearly peak load by a simple calculation. A method of obtaining this factor is as follows:

First, a number of typical daily load curves for the particular territory in question are selected from a complete set of curves representing the whole year. These curves should represent the four seasons of the year and the different classes of days of the week for each season. For instance, curves representing a Sunday, a Saturday and a week day in each of the four seasons might be selected.

After selecting these curves, the next step is to pick values from each curve at equally spaced points of time throughout the day. The values should then be squared, and the squares, thus obtained, averaged for each curve under consideration, each resulting daily average being then multiplied by the number of the corresponding days in the season—that is, the mean square value for the Sunday curve in summer should be multiplied by the number of Sundays in the summer season, etc. The values should then all be totaled and this total divided by the number of days in the year. The resulting value when divided by the square of the peak load will be a fraction which, when multiplied by the copper loss at peak load, will give the average copper loss for the whole year. If the number of hours in the year is then multiplied by this fraction, the result will be a figure which, when multiplied by the kilowatt copper loss at peak load, will give the kilowatt-hour copper loss for the year.

As an example: The load factor in the business district of a large Southern city is approximately 36 per cent. The copper loss factor calculated by the method described is 18.2 per cent, or the figure to be used as a multiplier for the kilowatt loss at peak load to get yearly kilowatt-hours is 18.2 per cent of 8,760, or 1,600. The symbol *f* will be used to designate this latter factor in the equations given in this paper.

This process is rather laborious if a large number of representative curves are used. However, the method is subject to as great or as little refinement as may be desired, this refinement depending upon the number of typical curves that are selected and the number of points taken from each curve. The result is a very useful factor, since it can be used in the solution of many small problems that come up from day to day, as well as in the calculations described in this article.

The load curves of any given district, of course, do not represent exactly the load curves of individual small portions of the district. However, since we are concerned with average conditions and not with individual conditions, the factor derived by the method described will be sufficiently accurate for general application to various individual parts of the system in the district under question.

Since copper loss is a function of current rather than power consumption, the load curves should be reduced to values of kilovolt-amperes rather than kilowatts if convenient to do so. However, if the power factor is reasonably constant, it will be sufficient to use values of kilowatts throughout, since the desired value is a function of the shape of the load curves and not of the absolute values represented by these curves.

*Unit Energy Costs.*—The calculation of energy cost to any great degree of refinement is a laborious process. There are available in published form whole volumes of data concerning the methods and details of making such calculations. In this article, therefore, no attempt will be made to go into minute details of energy cost calculations. A very brief discussion will be given of a method of deriving approximate costs. If greater refinement of calculations is desired, other literature should be consulted.

In a general way it may be said that the costs of energy losses in a distribution system involve something more than bare production costs at the generating station. To obtain the actual production cost of energy losses measured at the point where they occur in the system it is, of course, necessary to increase the amount of these losses to their total value at the generating station, including the losses which they produce while passing through other portions of the system.

In addition to this, however, to obtain the total energy cost it is usually necessary to add a demand charge to the production charge, since in most cases the maximum losses in a general distribution system occur during the peak load of the system as a whole.

### DEMAND CHARGE

The demand charge is in the nature of a charge on system investment in the portions of the system through which the losses have to pass before reaching the coal pile. To be exact, a demand charge should include certain items of operating expense at the generating station and substations. However, it is usually sufficient in calculating the cost of system losses to consider the demand cost as a definite percentage of the capital investment that is necessitated by reason of the additional system capacity necessary to supply the losses. When calculated in this manner, the demand charge should include allowance for interest on investment, maintenance, depreciation, taxes and insurance. To be theoretically exact, the demand charge in such portions of the system as substations, transmission lines, etc., should be calculated on the basis of kilovolt-ampere demand; and in such portions of the system as boilers and turbines should be calculated on the basis of kilowatt demand. However, if, as is usually the case, the power factor of the load in question is high during the peak load, it will be sufficient to use kilowatts as a basis for the entire calculations.

When the production charge and the demand charge have been calculated, these two charges should be combined to form the value for total cost per kilowatt-hour for copper losses and for transformer core losses. This can be done by using the copper loss duration factor in the case of copper losses and by using the total number of hours in the year in the case of transformer core losses.

As an example, assume that the average production cost at the generating station is $0.00665 per kilowatt-hour. The investment in various portions of the system per kilowatt peak load are as follows: Transmission system, $20; generating station, $140; substations, $60; distribution primary, $18. The energy losses at peak load are 5 per cent for substations, 5 per cent for transmission lines and 5 per cent for distribution primary. The yearly energy losses are 5 per cent for substations, 1 per cent for transmission lines and 1 per cent for distribution primary. The total production charges per kilowatt-hour on losses at the distribution transformers are therefore $0.00665 divided by 93 per cent, or $0.00715 per kilowatt-hour. The system investment necessary to serve 1 kilowatt of distribution losses is $18 plus ($60 ÷ 95 per cent) plus ($20 ÷ 90.3 per cent) plus ($140 ÷ 85.7 per cent), or $267.

### FIXED CHARGES

If the fixed charges on investment, including interest, maintenance, depreciation, etc., are 15 per cent of the investment, the demand charge per year per kilowatt loss at peak load is 15 per cent of $267, or $40. Assuming that the load in question has a copper duration factor of 1,600 hours per year, the demand charge for copper losses reduced to cost per kilowatt-hour is $40 divided by 1,600, or 2.5 cents per kilowatt-hour; the cost per kilowatt-hour of copper loss at the distribution transformer is therefore 2.5 plus 0.715, or 3.215 cents per kilowatt-hour. Similarly, using 8,760 hours duration factor, the cost of transformer core losses is 1.17 cents per kilowatt-hour.

These values for investment charges are unusually high due to the geographical location of the system from which they were taken. In the example selected the location of the losses in the system was at the distribution transformers and fixed charges on the primary system were included. For other points in the distribution system the cost of losses would of course be different, depending upon the amount of distribution system through which they would have to pass. Therefore, if a high degree of accuracy is desired, a different cost value should be calculated for the losses in each portion of the distribution system. However, reasonably accurate results can be secured by making the calculations for some mid point in the distribution system and applying the results to all the distribution losses.

In applying the cost of energy to calculations of system economics some engineers consider it permissible to neglect the charges for system investment. The argument is frequently used that the system is already installed and is available for serving load and that the losses form a very small part of the total load. The investment cost of serving losses is therefore assumed to be an imaginary rather than a real cost. Such assumption may be useful if it is desired to hold the distribution system investment down to the minimum consistent with reasonably good service, or, in other words, if it is desired to place a low valuation upon the cost of losses in the calculation of system economics, thereby permitting the installation of a cheap system with correspondingly high losses. Such procedure, however, should be used with great caution, since it may result eventually in increasing the investment in other portions of the system through which the losses have to pass to a greater extent than the investment is reduced in the portions of the system under consideration.

There can hardly be any more doubt that the investment cost of serving, say, 5 per cent of the system load in losses is a real cost than there is that the investment cost in generating station, transmission system, substations and distribution system to serve a 1-kw. customer connected to a large distribution system is a real and not an imaginary cost. The fact that the system may at present have sufficient capacity to take on additional load will not under usual conditions excuse the additional load represented by losses from bearing its share of the investment cost. With the steady growth of main system load additional system capacity must eventually be added and the present addition of any unnecessary load will necessitate the adding of that capacity proportionately sooner than would otherwise be the case.

### PRIMARY SYSTEM

*Spacing of Substations.*—Much has been written about the economics of substation spacing and many formulas are available for the determination of such economics. Therefore no attempt will be made to treat this subject in detail in this article.

*Primary Voltage.*—The primary voltage of existing distribution systems is in many cases fixed by the previous history of the system's installation and growth. Due to the cost of making a change, the original primary voltage is often continued in effect year after year, or if a change is made this is done in such manner as to involve the least cost. However, with the rapidly increasing load densities that are usually encountered under modern conditions, many systems are now being changed to higher primary voltages and the economics of many other systems may demand that a complete change be made in such practices.

The primary voltages now in use for general types of distribution systems (referring particularly to three-phase systems) are 2,300 delta, 4,000 Y, 6,600 delta, 11,000 Y and 13,200 delta and Y.

The 2,300- and 4,000-volt systems are in the great majority and owe their popularity chiefly to the standardization during the past years of 2,300-volt distribution transformers and auxiliary apparatus. The 4,000-volt Y system is a natural outgrowth of the old 2,300-volt system, since by its use the load capacity of the primary conductors of an old 2,300-volt system can be increased 70 per cent merely by reconnecting distribution transformers in Y instead of delta and possibly reinsulating the primary system. For this reason the 4,000-volt system is used extensively in modern distribution practice and in fact during the past few years has almost become standard for three-phase radial overhead systems. However, in some cases economies are now being effected by the use of voltages higher than 4,000.

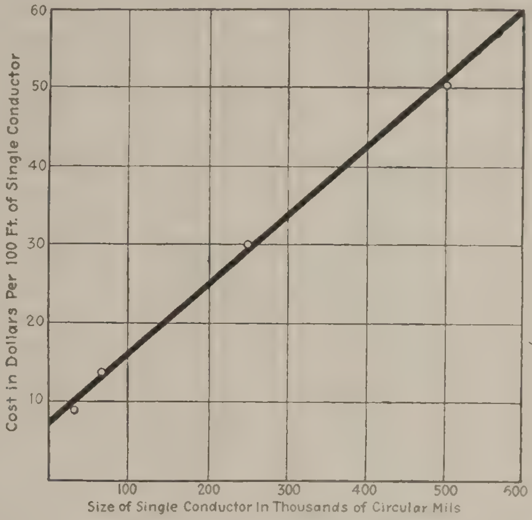


*Fig. 1—Cable costs per conductor based on cost of four-conductor, low-voltage, lead-covered, paper-insulated, armored cable*

The chief advantage of the higher voltages over a 4,000-volt system lies in the fact that generating voltages can be employed and the use of step-down substation can be eliminated (assuming, of course, that the distance of the distribution system from the generating station is not so great as to require a transmission voltage higher than that of the generators). The use of the higher voltages may thus both improve the system efficiency and reduce the investment cost, unless perhaps the higher cost of line insulation and non-standard distribution apparatus should offset the saving made by the elimination of substations. This is seldom the case, however, since the latter saving is usually a very considerable one.

The chief disadvantage of the higher voltages are: First, that under many local conditions it is impracticable to work primary lines of voltages above 4,000 alive, thus necessitating some measure of interruption of service in radial systems when it is necessary to do work on the lines; second, that the natural consequence of the use of higher voltages is the concentration of large amounts of power in individual feeders of the primary system, thus causing interruptions of service to a comparatively large number of customers in radial systems in case of a primary short circuit or other trouble affecting the primary feeder; third, that governmental regulations in many cases prohibit the use of the higher voltages in overhead line construction in the city streets; fourth, that it is sometimes difficult to obtain the proper clearances necessary for the higher voltages in overhead construction, and, fifth, that the communication companies object to joint construction when certain of the

## *Symbols Used in the Development of Equations in This and Following Installments*

**$a$ = Cross-section of each line conductor in thousands of circular mils.**

$b$ = Size of conductor in thousands of circular mils necessary to carry 100 amp. from heating standpoint.

$C$ = Cost of copper loss expressed as a fraction of a dollar per kilowatt-hour. For accuracy the value of $C$ should be different for the different parts of the distribution system. However, sufficient accuracy may usually be obtained by calculating $C$ for some mid point between the substation and the customer's service and applying the value thus obtained to all parts of the distribution system.
NOTE: In systems where it is possible to keep transformers very nearly uniformly loaded and symmetrically spaced, the calculated value of $C$ should be reduced by 25 per cent before insertion in the equations.

$C_1$ = Yearly cost of each transformer installation, including cost of losses and fixed charge on investment in dollars per installation per year. Cost independent of size of transformer.

$C_2$ = Annual fixed charges on investment in line conductors, exclusive of installation costs and including only that portion of the cost which is directly proportional to the size of conductors, in dollars per year per thousand circular mils per 100 ft. of single conductor.

$C_3$ = Annual fixed charges on average total investment costs of primary laterals in dollars per year per 100 ft. of complete circuit.
NOTE: For alternating-current, low-voltage network systems of the full automatic type, the calculated value of $C_3$ should be multiplied by the factor $(3 + x) \div 4$ before insertion in the equations. $X$ equals the number of primary circuits feeding a single network.

$C_4$ = Cost of core loss expressed as a fraction of a dollar per kilowatt-hour.

$C_5$ = Annual fixed charges on cost of transformer installation, including cost of installing, purchase cost of transformer independent of size, cost of auxiliary equipment installed and cost of housing if any.

$D$ = Load density at yearly peak load in amperes per 100 ft. per current-carrying conductor of secondary mains, exclusive of large concentrated loads.

$f$ = Yearly duration factor for copper loss in equivalent hours per year for loss at peak load.

$I_F$ = Current density at peak load in primary feeders in amperes per 1,000 circ.mil.

$I_L$ = Current density at peak load in primary laterals (maximum current or current at end toward primary feeders) **in amperes per** 1,000 circ.mil.

$L$ = Average length of each side of a block in 100-ft. units.

$n$ = Number of current-carrying conductors in secondary mains, assuming balanced current.

$n_1$ = Total number of conductors in secondary mains, assuming neutral conductor to be same size as current-carrying conductors.

$V$ = Maximum volts drop per conductor in secondary mains.
NOTE: In systems where it is possible to keep transformers very nearly uniformly loaded and symmetrically spaced, the value of calculated voltage drop obtained from the equations should be reduced 25 per cent, or the value of estimated allowable voltage drop $V$ for insertion in the equations should be increased 33 per cent.

$W$ = Power loss in kilowatts per 100 ft. per current-carrying conductor of secondary mains.

$W_1$ = Transformer copper loss in kilowatts per transformer installation, independent of transformer size.

$W_2$ = Transformer core loss in kilowatts per transformer installation independent of transformer size.

$X$ = Number of primary circuits feeding a single network in a full-automatic, low-voltage alternating current network system.

higher voltages are used. Both of the first two objections to the use of higher primary voltages can be somewhat offset by the use of a higher factor of safety in line construction and by the installation of sectionalizing devices of both manually operated and automatic types, so as to break up the primary circuits into smaller units, both for purposes of working upon lines and for short-circuit protection. Both the increased cost of the higher grade of construction and the use of additional apparatus, of course, tend to offset the saving effected by elimination of substations.

Assuming that the last three of the five objections mentioned can be overcome, it may be said in general that the selection of high primary voltages in order to obtain the economies afforded by the elimination of substations involves mainly the question of the importance of reliability of service. If a somewhat less degree of reliability of service can be tolerated, then usually it is advantageous to select the higher primary voltages, the result in most cases being a saving in investment and improvement in system efficiency. This statement, of course, applies to radial systems and not to multiple-feed, low-voltage networks. In the latter type of systems reliability of service is assured by the automatic features of the system and the chief objections to the higher primary voltages are thereby eliminated, particularly since low-voltage network systems usually involve underground construction and therefore the last three objections mentioned do not apply.

*Determination of Loads of Individual Feeders.*—The determination of the loads of individual feeders for a radial distribution system is something more than a question of economics. Theoretically the most economical size of feeder would involve concentrating as much load on a single feeder as geographical considerations and distances of feed would permit. However, the question of reliability of service is an important factor in the problem and the requirement for greater service reliability is that the primary system be split up into units of very small size. The actual selection of the loads of primary feeders must therefore usually be based upon a compromise between economy and reliability of service. This becomes largely a matter of judgment concerning the importance of the reliability of service in any given system. If small primary feeders are used, relatively small portions of the system will be affected by a single primary short circuit, but the investment cost in the system will be comparatively great. If large units are used, the cost will be reduced, but larger areas will be affected in case of primary short circuit.

There are, however, certain other factors that enter into the problem—namely, available standards of feeder terminal equipment and local geographical conditions.

By feeder terminal equipment is meant such apparatus as induction regulators, feeder circuit breakers, etc. Such equipment has been fairly well standardized, and in general it will be found that a reasonable compromise between service reliability and economy can be made by the selection of feeder loads to fit existing equipment standards. Such selection will, of course, result in a lower relative cost of the terminal equipment than if non-standard sizes are used.

Geographical conditions may also sometimes play an important part in the determination of feeder loads, That is, in some cases the configuration of the system and the geographical distribution of the system load may be such that primary circuits will fall naturally into certain uniform units of load.

The above discussion of course applies to radial systems of distribution. In the case of multiple-feed, low-voltage networks the conditions are somewhat different. Here the reliability of service is reasonably independent of the number or size of primary feeders and it is possible in many cases to work out mathematically the proper size of feeder from considerations of economics. The mathematical solution of this problem is quite complicated and will not be included in this article.

*Voltage Drop and Current Capacity vs. Economical Current Density.*—The above discussion relates to the determination of the loads for which primary feeders and circuits are to be designed. So far nothing has been said concerning the size of copper which should be used in the primary feeders to handle a given amount of current. In the solution of this problem three factors must be considered—namely, economical current density, voltage drop and current-carrying capacity.

The investment cost of primary lines is made up of two parts, one being a value that is practically independent of the size of copper and which, therefore, does not enter into the problem. In overhead lines this includes poles, hardware, insulators, etc., and in underground lines conduit, manholes, cable insulation, lead sheath, etc. The costs of such things as cable sheath, cable insulation, etc., in underground lines are not entirely independent of the copper size. However, by plotting cost per unit length of line against copper size a curve can be obtained which is usually very nearly a straight line. In Fig. 1 the point where this curve cuts the cost axis represents a cost that is entirely independent of the copper size, and this cost, therefore, does not enter into the calculations of economics. The slope of the curve, however, is a measure of the variation of cost with copper size and is very useful in determining the economical current density.

If $I_F$ represents the current density at peak load in amperes per 1,000 circ.mil of conductor cross-section; $C_2$ represents the fixed charge in dollars per year on the cost of copper per 100 ft. of conductor per 1,000 circ.mil; $C$ equals the cost of copper loss in dollars per kilowatt-hour, and $f$ equals the duration factor previously described, then the total variable yearly cost per ampere of load per 1,000 circ.mil cross-section per 100 ft. of conductor, including fixed charges on investment and cost of copper loss, is given by the expression $C_2 \div I_F + 0.0011CfI_F$, where 0.0011 is a factor determined by the resistance per 100 ft. for 1,000 circ.mil cross-section, a reasonably high temperature of copper being assumed.

In order to obtain the value of $I_F$ for minimum cost, it is merely necessary to use the familiar method of differentiating the expression of total variable cost and equating the result to zero. This gives

$$I_F = \sqrt{\frac{C_2}{0.0011Cf}} \qquad (1)$$

This formula can be used for calculating the economical current density in a primary feeder. It may be, however, that for given system conditions the use of the economical size of copper would give a greater voltage drop than can be permitted. Therefore, after calculating the economical current density, the resulting values should be tested for voltage drop in the individual feeders. If the result of this test is a greater voltage drop than permissible, then the proper current density must be determined by calculation from allowable voltage drop, unless the current-carrying capacity of the copper as limited by temperature should still further limit the current density.

In overhead systems current-carrying capacity is hardly ever the limiting factor in determining current density. However, in underground systems the reverse is sometimes true. Therefore, after the above calculations for economics and voltage drop are made, the resulting current density should be examined to determine whether it would overload the copper. If so, then the current density to be used must be recalculated with the heating of the copper as the limiting factor.

By use of this method the calculation of the proper size of copper for primary feeders is a comparatively simple process. However, in the case of primary laterals, there are other factors that must be considered. In a radial system it is usually convenient to use two or three different sizes of copper in the primary laterals beginning with the largest size directly at the feeder terminal and tapering off toward the smallest size at the greater distances from the feeder. It must be borne in mind, however, that the primary system is continually changing to meet load demands. Therefore too great use of the smaller sizes of laterals should not be permitted. The larger sizes should be extended to form at least a skeleton of trunk lines interconnecting with the trunk lines of other feeders so that the copper of the primary laterals will be sufficient to permit shifting of load from one feeder to another by cutting and splicing or to permit picking up the load of an adjacent feeder in case of emergency.

In a system in which the primary laterals are thus laid out to take care of load growth and to permit emergency operation, the size of copper in a large portion of the laterals usually bears little relation to the load carried under normal conditions, and the losses are usually so small that the economics of copper loss vs. cost of copper do not enter into the problem. The laying out of the primary laterals thus becomes a matter of judgment and careful planning for future system conditions. However, cases may be encountered where it is desired to determine the economics of current density in primary laterals. In such cases a modification of equation 1 can be used as follows:

In a primary feeder the current is the same throughout the entire length. In a primary lateral the current varies from point to point due to the distribution of load along its length. For convenience a uniform distribution of load can be assumed. With such load distribution the power loss in the copper is one-third what it would be if the current at the end toward the feeder were present throughout the entire length. Thus, if $I_L$ equals the maximum current of the primary laterals, or, in other words, the current at the end toward the feeder, we get by introducing the factor $\frac{1}{3}$ in the derivation of equation 1

$$I_L = \sqrt{\frac{3C_2}{0.0011Cf}} \qquad (2)$$

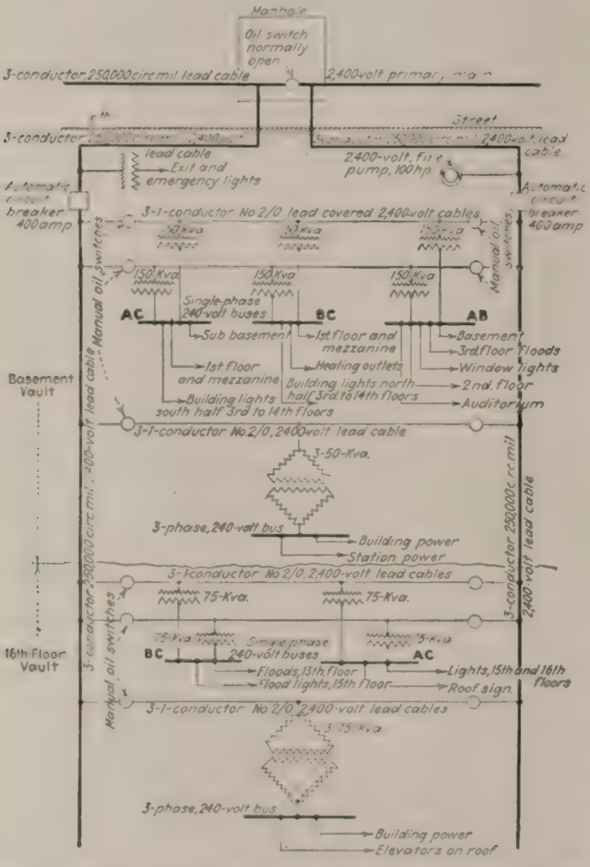
# Transformers on Upper and Lower Floors Save Copper

By T. W. Swartz

*Assistant Engineer Underground Department,*
*Northwestern Electric Company, Portland, Ore.*

STUDY of the distribution problem in the new sixteen-story office building housing the three American Power & Light organizations centered in Portland, Ore., showed that two transformer vaults centrally located with respect to the 750 kva. demand to be served would result in reducing secondary copper expense and add to the reliability of service.

The accompanying schematic diagram shows how the problem was worked out. Two transformer vaults were provided, one in the basement and the other on the sixteenth floor. The latter contains 300 kva. in lighting transformer capacity and a 225-kva. bank for three-phase power service and is fed by two three-phase, 2,400-volt lead-covered cables carried 240 ft. vertically in the building.


Manhole
Oil switch normally open
3-conductor 250,000 circ mil lead cable
2,400-volt primary main
Street
3-conductor
lead cable
Exit and emergency lights
2,400-volt, lead cable
2,400-volt, fire pump, 100 hp
Automatic circuit breaker 400 amp
Automatic circuit breaker 400 amp
3-1-conductor No 2/0 lead covered 2,400-volt cables
50 kva
50 kva
150 kva
150 Kva
150 Kva
150 Kva
Manual oil switches
Single-phase 240-volt buses
AC
BC
AB
Sub basement
1st floor and mezzanine
Basement
3rd floor floods
1st floor and mezzanine
Heating outlets
Window lights
Building lights north half 3rd to 14th floors
2nd. floor
Building lights south half 3rd to 14th floors
Auditorium
Basement Vault
3-1-conductor No.2/0, 2400-volt lead cable
3-50-Kva.
3-phase, 240-volt bus
Building power
Station power
3-conductor 250,000 circ mil. 400-volt lead cable
3-conductor 250,000 circ mil 2,400-volt lead cable
3-1-conductor No 2/0, 2,400-volt lead cables
75-Kva.
75-Kva.
75-Kva
75-Kva
Single phase 240-volt buses
BC
AC
16th Floor Vault
Floods, 13th floor
Lights, 15th and 16th floors
Flood lights, 15th floor
Roof sign.
Manual oil switches
3-1-conductor No 2/0 2,400-volt lead cables
3 75 kva
3-phase, 240-volt bus
Building power
Elevators on roof

*In serving a large office building 2,400-volt feed was carried to a roof transformer vault to reduce total wiring cost*

All lighting and power on the fifteenth and sixteenth floors and a 100-kw. floodlighting load on the thirteenth and fifteenth floors are fed from the sixteenth floor vault. A large saving was made on the elevator feed, which consists of six 750,000-circ.mil rubber-covered cables supplying four 35-kw. motor-generator elevator sets, with provision for a fifth. The wire run was reduced from 250 ft. to 14 ft.

In the basement vault there is 900 kva. in lighting transformer capacity and 150 kva. for three-phase power. The service feed from this vault is indicated by the secondary feeder designations in the diagram. Duplicate 2,400-volt feeders from a ring feeder system serve the building as a whole. A sectionalizing switch was placed between the two building feeders in the street manhole to permit the load to be separated normally.

Two 250,000-circ.mil lead-covered cables were carried up the elevator shaft in conduit to the roof vault, without change in size to avoid fusing at points of reduced size, in compliance with the city code. At the end of each 10 ft. section of conduit was placed a pull box, in which the cable is supported by a woven copper wire strap.

In both vaults the lighting load is supplied by what amounts to a duplicate feed. The lighting transformers are banked in pairs and loaded to 150 per cent of the rating of one transformer. Normally each transformer in a bank carries 75 per cent of rated load, but in case of emergency one transformer can operate at 150 per cent of rated capacity to carry the entire load. All transformer secondary leads are carried to copper buses in the vaults to facilitate connection changes in emergencies.

Further details as to switching arrangement, buses, etc., are shown by the schematic diagram.

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# Costs of Central Station Service Buildings

FROM the cost-estimate sheets of an Eastern power company are taken the data in the accompanying table relative to various building construction work required in connection with miscellaneous maintenance activities. The costs represent 1927 figures.

SERVICE BUILDING COSTS, 1927
(Excluding All Overhead)

| | |
|---|---|
| Group consisting of<br>Heavy storage building, one story, 101 ft. 4 in. x 222 ft. 10 in. x 29 ft. 10 in. high; concrete foundations, steel frame, brick walls, concrete floor, two indoor railroad track pits, two indoor motor truck pits, four rolling steel doors, two 10-ton Shaw electric cranes:<br>Connecting building, one story, 18 ft. 8 in. x 222 ft. 10 in. x 17 ft. 4 in. high, general construction similar to above, one Sheppard hand travel electric lift crane: and<br>Light storage building, three stories, same ground dimensions as heavy storage building, 42 ft. high, first floor concrete and other floors mill construction, shipping platform and two Otis freight elevators, all above with heating, lighting and plumbing | $385,793 |
| Office building, three stories, 41 ft. 6 in. x 153 ft. 6 in. x 39 ft. 4 in. high, and 10-ft. basement, concrete foundations and basement floor, mill type construction, concrete walls, two dumb waiters and one automatic passenger elevator, with heating, lighting and plumbing | 190,454 |
| Garage, one and two-story building: first story 115 ft. x 263 ft. x 18 ft. 4 in. high; second story 115 ft. x 62 ft. x16 ft. 6 in. high; reinforced concrete construction, brick walls, with lighting, heating and plumbing equipment | 218,383 |
| Oil house, one story, 27 ft. 10 in. x 93 ft. 2 in. x 17 ft. high, with 10-ft. basement and wing 17 ft. 1 in. x 22 ft. 2 in. x 14 ft. high, reinforced concrete construction, wood block platform, one Sheppard 1-ton electric crane, lighting, heating and plumbing | 18,841 |
| Gate house, one story, 10 ft. x 17 ft. x 10 ft. 6 in. high, concrete foundations and floor, brick walls, tar and gravel roof, with lighting and heating equipment | 2,113 |
| Tank and tower, capacity 100,000 gal., foundations plain concrete, 11 ft. square on base and 3 ft. 8 in. square on top, 8 ft. high, reinforced concrete pit, steel tank and tower 123 ft. 2 in. (top of tank above ground) | 10,919 |
| Storage sheds, nine, 15 ft. x 31 ft. x 8 ft. 6 in. high; foundations 6-in. x 14-in. hard pine mud sills, wood superstructure and floor | 3,136 |
| Blacksmith shop, 8 ft. x 10 ft. x 7 ft., foundations 6-in. x 6-in. hard pine and sills, wooden superstructure and floor | 157 |

# Service Restoration Expedited

A detailed description of how service or trouble dispatching is organized and handled by the Metropolitan Edison Company

By J. E. Shalter

*Chief Service Dispatcher Metropolitan Edison Company, Reading, Pa.*

*Service dispatching office — Under glass cover of center cabinet are maps showing locations of transformers, feeders, arc and incandescent-lamp circuits. Below are feeder boxes, gasoline lamps and storage-battery portable spotlights used for distribution trouble. Pneumatic tube communication is afforded with the system operator's office.*

THE service dispatching department of the Metropolitan Edison Company at Reading, Pa., takes care of all troubles on the distribution system supplying 34,096 customers within a radius of 20 miles, making about 500 calls per month of an average length of 1 hour and 13 minutes. The personnel consists of one chief and four assistant service dispatchers, three linemen and three assistants, two inside service men and one street-lighting inspector. The department provides 24-hour service, with at least one dispatcher, one lineman and one assistant lineman on duty. The shifts of the linemen and assistant linemen are arranged so as to have two of each on duty between 7 and 8 a.m. and 2 and 4 p.m., in order to take care of the most important times of the day. If the dispatcher needs additional help in emergencies during the day, he may draw from any of the line gangs, of whose whereabouts he is kept constantly informed, whereas at night he calls as many men as he may require.

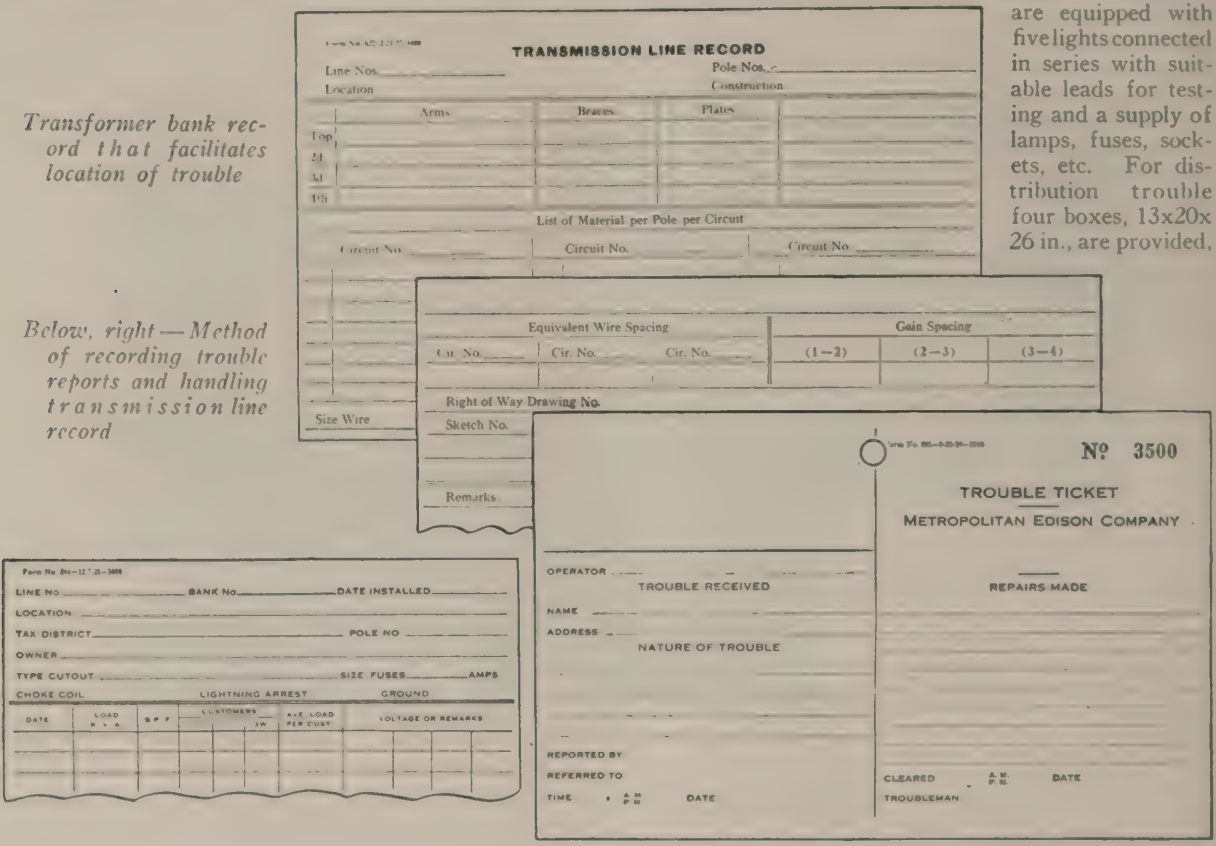
A lap in the shifts of the inside service men is also arranged so as to have two men on duty between 11 a.m. and 5 p.m., with "one-man service" during the remainder of the time from 7 a.m. to 9 p.m. At times when these men are not out on trouble they are employed repairing and calibrating meters in the meter department, which forms a source from which four or five extra men can be drawn in emergencies.

These men take care of service complaints involving meter trouble or blown service fuses which are maintained by the company. Cases of such trouble occurring at night are handled by one of the service linemen. Inside trouble is the only case where only one man is sent; all other troubles must be handled by at least two men. The street lamp inspector is on duty at night and is required to keep all street lights in the city and suburbs working properly. He works in conjunction with the city police department, which receives most reports of outages, and reports hourly to the service dispatcher.

During severe storms all of these men, as well as a large number of line department employees, either report for duty or call in to inquire if their services will be needed.

Four maps, which are kept constantly up to date, are used in the office for the city; similar maps are used for suburban sections, one map shows distribution lines and locations of all transformer banks, with their numbers, different colors being used to indicate if the lines are three phase or single phase, 2,300-volt, 13,200-volt or underground cables Lines and locations of city incandescent street lights appear on another map, with similar maps for arc lamps and for street railway distribution, the latter showing locations of feeder taps, breakers, crossings, etc.

The distribution file uses 4x6-in. plain salmon-colored cards for the location, type and size of line fuses, and yellow cards for transformer banks, giving data on transformer fuses, lightning arresters, etc.; space is also provided for recording the results of load checks. A blue card is used for each unit of a transformer bank to give complete data on the unit, including test results of losses, impedance, regulation and efficiency and a chronological record of locations at which it has previously been in service. All customers, with their addresses, are listed on white cards. These cards are arranged in the file in the order given above according to line numbers, bank numbers and customers on each bank. Transformer banks are numbered consecutively on each line, with the line number preceding; for instance, No. 108-3 means Bank No. 3 on Line No. 108.



*Transformer bank record that facilitates location of trouble*

*Below, right — Method of recording trouble reports and handling transmission line record*

**TRANSMISSION LINE RECORD**

Line Nos. ____ Pole Nos. ____
Location ____ Construction ____

| | Arms | Braces | Plates | |
|---|---|---|---|---|
| Top | | | | |
| 2d | | | | |
| 3d | | | | |
| 4th | | | | |

List of Material per Pole per Circuit

| Circuit No. | Circuit No. | Circuit No. |
|---|---|---|
| | | |

Size Wire

| Equivalent Wire Spacing | | | Gain Spacing | | |
|---|---|---|---|---|---|
| Cir. No. | Cir. No. | Cir. No. | (1—2) | (2—3) | (3—4) |
| | | | | | |

Right of Way Drawing No.
Sketch No.
Remarks.

№ 3500

**TROUBLE TICKET**

**METROPOLITAN EDISON COMPANY**

OPERATOR
TROUBLE RECEIVED
NAME
ADDRESS
NATURE OF TROUBLE
REPORTED BY
REFERRED TO
TIME A.M. P.M. DATE

REPAIRS MADE
CLEARED A.M. P.M. DATE
TROUBLEMAN

LINE NO ____ BANK No. ____ DATE INSTALLED ____
LOCATION ____
TAX DISTRICT ____ POLE NO ____
OWNER ____
TYPE CUTOUT ____ SIZE FUSES ____ AMPS
CHOKE COIL LIGHTNING ARREST GROUND

| DATE | LOAD K.V.A. | S.P.F. | CUSTOMERS | | 3W | A.C. LOAD PER CUST | VOLTAGE OR REMARKS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |

Complete up-to-date information is kept on a "transmission line record" of material used on poles, size of the line wire, type construction, etc. Pole records are filed according to number, also according to location, a yellow card being used for Metropolitan Edison Company and a blue one for Reading Transit Company poles. Poles are numbered consecutively, with a distinguishing letter to designate the district if suburban distribution lines and with the line number if a transmission line pole.

Service men are provided with two Chevrolet trucks equipped with hand searchlights, switch sticks, a supply of all makes and sizes of fuses, a quantity of wire and a full set of tools required for any emergency job. One Ford truck is equipped with four portable high-powered searchlights. The inside service man uses a Chevrolet touring car which carries a complete supply of 110- and 220-volt fuses and sealing equipment, as about 40 per cent of the service switches are sealed. For emergency service, when all of the above-named equipment is in use, the service men use standard touring cars and a handbox, of which thirteen are available. Nine of these boxes, about 7x7x20 in., are used for street railway signal trouble and are equipped with five lights connected in series with suitable leads for testing and a supply of lamps, fuses, sockets, etc. For distribution trouble four boxes, 13x20x26 in., are provided, containing a supply of all types and sizes of line, transformer and secondary fuses. In the office a complete supply is also kept of all fuses and fuse holders so as to make it unnecessary to waste time going to the storeroom for such material. Nineteen additional storage battery type searchlights and sixteen two-burner gasoline lamps are always available for immediate service.

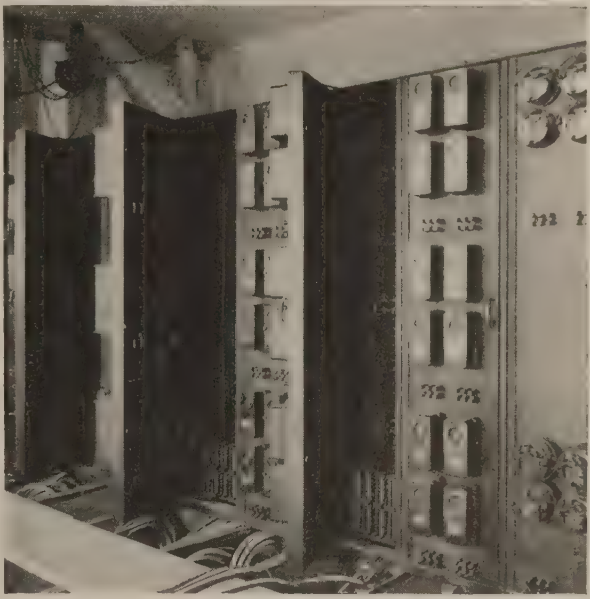
### PROCEDURE FOLLOWED

When the service dispatcher receives a large enough number of "no light" or "no power" calls to indicate that a transformer or line fuse is probably blown, he makes out a trouble ticket in duplicate, giving the name and address of the party and the nature of the trouble reported, and stamps both in the calculagraph. Referring to the distribution map, he obtains the transformer bank number. With this he can ascertain from the distribution file the exact transformer location and type and size of fuse, type, size and voltage of the transformer, and from the list of customers following he has a check on having located the proper bank. All this information, and in addition the type, size and location of line fuse, is noted on the trouble ticket and the original is then given to a service man. Upon his return to the office he notes on the trouble ticket what repairs he has made and whether they are temporary or permanent. The dispatcher again stamps both the original and the duplicate in the calculagraph, thus having a record of the exact time consumed. The original is filed in the office and the duplicate is sent to the engineering department to keep that department's records up to date as regards any changes that may have been made by the service man. In case a temporary repair was made, due to its being too large a job for the service man, the dispatcher makes out a "work order" giving all details of what remains to be done and turns it over to the general line foreman. The duplicate is held in the file as a check on uncompleted work and is given to the foreman as soon as he turns in the original properly made out.

When a report of "no light or power" is received from a customer fed from 13,200 volts, a "trouble ticket" is made as before. This is sent to the local dispatcher through a pneumatic tube connecting the two departments. The local dispatcher, if the line is energized, fills in the transformer and fuse data and returns the ticket to the service dispatcher, who checks this information and dispatches a service man, the procedure thereafter being as outlined previously. When the local dispatcher or system operator has trouble with any of the transmission lines, he makes out the "trouble ticket" and sends it to the service dispatcher, who immediately sends out four or more patrolmen in case the location of the trouble is not known. These men are told to stay clear of the lines at all times and immediately to report from the nearest telephone anything they find. The man locating the trouble is ordered to stay at that point until the repair crew arrives. The service dispatcher refers to the transmission line record file, which gives, as previously stated, complete information on material used on the various poles, and dispatches a repair crew with a sufficient amount of the proper material to make any necessary repairs.

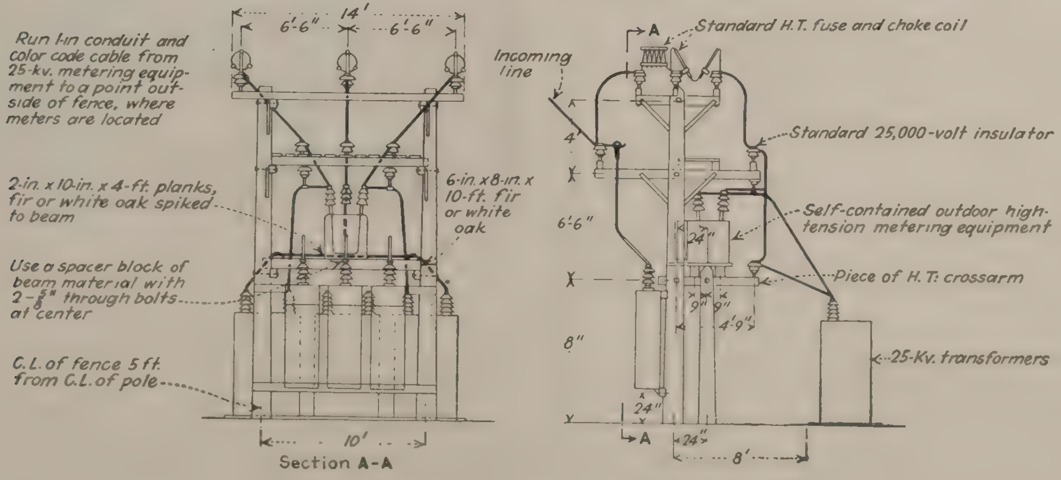
On individual "no light" calls the ticket is merely made out with the name and address and referred to the inside service man during the day and evening or to any available service lineman at night, but the disposition of the completed tickets is the same as in all cases given above.

## Hinged Panels Reduce Space Requirements



RELAY boards in the control room of the ventilating buildings of the Holland vehicular tunnel are provided with hinged panels. This construction permits full accessibility of wiring and minimizes space demands behind the boards. Fishbach & Moore, Inc., was the contractor. Service is supplied by the United Electric Light & Power Company and the Public Service Electric & Gas Company of New Jersey.

## Self-Contained 25-Kv. Metering Equipment

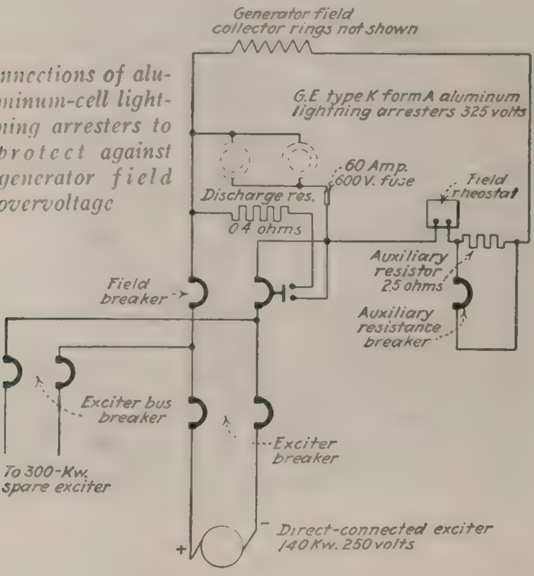

Run 1-in conduit and color code cable from 25-kv. metering equipment to a point outside of fence, where meters are located
14'
6'-6"
6'-6"
2-in. x 10-in. x 4-ft. planks, fir or white oak spiked to beam
6-in. x 8-in. x 10-ft. fir or white oak
Use a spacer block of beam material with 2-⅝" through bolts at center
C.L. of fence 5 ft. from C.L. of pole
10'
Section A-A
A
Standard H.T. fuse and choke coil
Incoming line
4'
Standard 25,000-volt insulator
6'-6"
24"
Self-contained outdoor high-tension metering equipment
Piece of H.T. crossarm
9"
9"
4'-9"
8"
25-Kv. transformers
24"
A
24"
8'

*Standards of West Penn System*

# Protecting Generator Fields Against Overvoltage

By R. B. Greenwood
*Moccasin Plant, Moccasin, Calif.*

THERE are a number of cases on record of severe trouble developing as the result of the field circuit of a large alternator becoming open-circuited. The usual cause of such an open circuit is the failure of a splice between field coils or the opening of a circuit breaker that is not provided with a discharge resistor contact. Suddenly introducing a large block of resistance into the field circuit by the opening of a circuit breaker will also result in overvoltage.


Generator field collector rings not shown
G.E. type K form A aluminum lightning arresters 325 volts
60 Amp. 600 V. fuse
Field rheostat
Discharge res.
0.4 ohms
Auxiliary resistor 2.5 ohms
Field breaker
Auxiliary resistance breaker
Exciter bus breaker
Exciter breaker
To 300-Kw. spare exciter
Direct-connected exciter 140 Kw. 250 volts
+

*Connections of aluminum-cell lightning arresters to protect against generator field overvoltage*

The increase in voltage referred to is due to self-induction. When the number of turns, amperes and area of the magnetic circuit is considered it is obvious that destructive voltages may possibly result from the decaying flux when the field current of a large machine is suddenly and completely opened. Field circuit breakers invariably are provided with extra contacts which connect a resistance of low value across the field leads somewhat in advance of the complete opening of the circuit. The energy that would appear as an arc at the breaker contacts is thus dissipated as heat. Troubles have resulted from discharge clips failing to make proper contact. These parts should be checked as part of the machine's routine monthly inspection.

Protection against excitation circuit overvoltages has been obtained in a few hydro-electric plants by the installation of aluminum cell lightning arresters. An installation of this nature was made in the Moccasin plant of the city of San Francisco a year ago and to date has proved very satisfactory. In this plant car-type aluminum cell arresters are connected across the circuit of each field of the four 20,000-kva. generators, as shown in the accompanying diagram. A 60-amp., 600-volt fuse is connected in series with each pair of arresters to protect the circuit against the possible, although remote, failure of the arresters. The two cells and the fuse are contained within a wooden box provided with hinged door and mounted on the concrete wall near the rear of each exciter breaker panel.

It will be noted from the diagram that the exciters at the Moccasin plant are direct connected. Since there is an exciter breaker and an auxiliary resistance breaker in each field circuit the opening of either breaker will result in overvoltage, and it is largely for this reason that arresters were installed. The auxiliary resistance breaker is opened by voltage relays, and relay action has occurred a few times, also exciter breakers have been opened by accident. The arresters have functioned properly during these abnormal conditions. The exciter voltage varies between the limits of 90 to 205 volts throughout the day, depending on load conditions.

Being continuously connected to circuits that are energized the greater part of each day these arresters do not require charging. As regards maintenance, the electrolyte is changed annually and the plates will be replaced as found necessary, which will probably be every three or four years.

The complete cost of each arrester installation per generator was approximately $50, which is a small sum to invest for the protection secured.

# Electric Locomotives Operated in 1 Ft. of Water

SO GREAT has been the water encountered by the contractor in driving the 7.8-mile Great Northern railway tunnel under Stevens Pass in the Cascade Mountains of Washington that it is often necessary to operate electric locomotives with 15,000 gal. of water per minute flowing through the tunnels, submerging the tracks under 6 in. to 1 ft. of water.

That the 44 six-ton locomotives used in this work are able to operate at all under such conditions seems incredible; nevertheless, comparatively little trouble has been experienced, only six armatures having been burned out in two years.

*Water is no drawback to operation of electric locomotives in tunnel work*

The locomotive shown is of the trolley and reel type. Five hundred feet of cable on a motor-driven reel is used to operate the locomotive beyond the end of the trolley where blasting would tear down the trolley. Several storage-battery locomotives are used as well.

# Opposes Contract to Regulate

Companies declare constitutional rights threatened by abolition of court appeal. Economic weakness of proposal put forth by counsel for companies

CHAIRMAN ATTWILL'S recent arguments, on behalf of the Massachusetts commission, before the legislative committee on power and light in regard to House bill 170, providing for regulation by contract, were summarized in the ELECTRICAL WORLD, March 3, page 479. Fifty-four gas and electric companies represented by Sheldon E. Wardwell, counsel for the Massachusetts Gas and Electric Association, opposed the measure, contending that it would nullify the right of court appeal, confiscate a considerable portion of accumulated assets, dry up the wells of fresh capital and stagnate development. Extracts from Mr. Wardwell's argument against the bill follow:

"During 1927 90 rate reductions by Massachusetts gas and electric companies were announced, and this year numerous others have been filed. Most of these reductions were made voluntarily. As was the case a year ago, I am not here today to attempt to justify all rates. The last few years have been a period of unparalleled business activity and electric companies have been prosperous. Possibly other electric rates should be reduced.

"In justice to the electric companies, however, it is believed that this committee will recognize that every element entering into the cost of electric service has increased in price since pre-war days. Yet in the face of this increase, out of all prices which enter into the cost of living, electric rates alone have been reduced. The electric companies have on the whole paid no excessive return to the stockholders. Most companies have neither earned nor paid an exorbitant return, nor have they charged exorbitant rates. The main reason that the impression of a large return exists is that the return is quoted in terms of an unfair level or base.

### ASPECTS OF WORCESTER CASE

"During the last year there has been a certain amount of agitation and criticism of the rates of electric companies. The department has ordered some rate reductions. Most of those ordered have been put into effect by the companies. In one case, that of the Worcester Electric Light Company, the commission ordered a cut in the lighting rate from 7 to 5 cents. The Worcester company, which was then giving the lowest lighting rate of any company in the state, sought relief from the order of the commission by proceedings in the federal court and obtained an injunction. The trial of its case is assigned to begin before a master on April 15. Three principal points appear to be involved:

"1. That in making their order of reduction the commission took as its justification the wrong rate base and refused to allow a return on the fair value of the company's property.

"2. That in estimating that a 6 per cent return is adequate, as the commission stated in that case and again in the Cambridge case recently decided, the commission assumed too low a rate of return.

"3. That in fixing a rate as low as 5 cents per kilowatt-hour the commission would force the company to serve a very large percentage of its customers at a loss.

"The commission made a flat reduction from 7 to 5 cents in the Worcester rate. The utilities believe that this flat rate method of rate making by the commission is unfortunate; that it produces inequitable results as between different classes of consumers and that establishment of a flat maximum rate at 5 cents compels the company to serve a very large percentage of its consumers at a loss and compels it to hold up rates to other consumers not only now but for the future, and that this is a very bad thing for the industry and for the community. The majority of the Worcester consumers using 15 kw.-hr. or less per month will be paying a total bill of 75 cents or less. It is less than the cost of service and produces no return to the company. It is inequitable to expect the larger consumers to make up the loss, and if the business of a community suffers a period of stagnation the power and commercial lighting customers will show a decrease in demand and the company will be unable to make up its loss.

"It is well recognized throughout the industry and by the regulating commissions elsewhere that the method of rate reduction adopted in the Worcester and other cases produces inequitable results between the consumers and that it is an antiquated and illogical method of rate making. I admit that it has been the custom of the commission for many years to adjust on a flat rate basis, but this was because the commission claimed that it was governed by a provision in our laws which allowed it to deal only with the maximum rate. Last year the commission received power to deal with all rates. I at least had hoped that in future the commission would adopt a practice which exists elsewhere and that instead of dealing with the maximum rate only, and forcing a company to sell a large part of its product at a loss, the commission would adopt the practice of determining a rate reduction by ordering a company to reduce its revenue a certain number of dollars, leaving the company to put in rates which were equitable to the different classes of consumers. I say without hesitation that if the commission adopted this practice there would be a greater probability that its rate reduction orders would be considered acceptable by the utilities, which in this respect believe that they are foresighted and looking for the good of the community as well as for the good of the industry.

### SIX PER CENT TOO LOW

"The second difference between the utilities and the commission is that the board says a 6 per cent return is adequate. 'Very attractive,' it says in the recent Cambridge decision.

"The utilities believe that a 6 per cent return is inadequate, that it will fail to attract the investors' money to the industry. For many years hardly any commission decisions have suggested that a public utility was entitled to less than 7 per cent, and a great many of them have allowed 8 per cent or even higher. If Massachusetts decides that 6 per cent is all a utility is entitled to earn, Massachusetts will cease to attract capital, and capital is essential for growth, and growth is essential if we wish to continue rate reductions, as it is only through mass production that this can be made possible.

### THE APPEAL TO THE COURTS

"Now we come to the more spectacular, though perhaps not more important, part of the controversy between the commission and the utility which produces this attempt by the commission to forestall an adverse decision by the Supreme Court of the United States, by forcing the utilities to agree to surrender all constitutional rights, and hereafter to be governed by whatever form of regulation the commission may choose to enforce.

"The decisions of the Supreme Court of the United States indicate, I believe, and evidently the commission also believes or it would not be so disturbed, that, in general, companies are entitled to a reasonable return on the fair value of their property and that the fair value cannot be determined without consideration of the reproduction cost of the property less depreciation.

"Whether or not this statement is correct will probably soon be decided by the Supreme Court of the United States in the O'Fallon case, which has now been appealed to the Supreme Court and which will soon be on the docket. Now this principle of determining value in the ordinary case by a finding of reproduction value less depreciation is no new thing. It was advocated in 1898 (a period of low prices) by William Jennings Bryan on behalf of the public. To all intents and purposes the principle has been accepted since by practically every commission in this country. The matter becomes important now and the dissent arises because there has been an increase in the general price level above the pre-war level. In other words, the index number is perhaps 40 per cent higher, so that so far as a utility has property which was installed prior to 1917 the utility would on the cost of reproduction theory have a valuation of 30 to 60 per cent in excess of cost of that part of its property. On property installed since 1919, which is the greater part of the existing investment of the utilities today, there has been no material change in the price level, and if conditions and price levels remain as they are and the growth of the utility continues, so far as the gas and electric industry is concerned this whole controversy will practically disappear in four or five years, because with the discarding of old property and the continued growth in new property investment the proportion of installation at pre-war prices is diminishing very fast.

"I will hazard an estimate that most electric companies in Massachusetts would under the reproduction theory receive credit for a rate base today of only between 10 and 30 per cent in excess of actual investment, depending on the amount of new property installed in the last ten years.

"In the opinion of some of the leading economists in the United States the reason for the so-called increases in value economically justifies reproduction cost as a rate base.

"You are familiar with the fact that prices have gone up since before the war, prices of labor and of commodities generally, and the underlying reason is the change in the purchasing power of the dollar. The laborer receives more wages, the apartment house owner receives higher rents; it does not make any difference whether the laborer was born before 1917 or whether the apartment was built before 1917. Is there any justification for saying that the investor in a public utility should have different treatment from an investor in any other form of industry? 'Prudent investment' is a very attractive phrase, but 'prudent investment' without equating to the diminished purchasing power of the dollar merely means that you are depriving the investor of some 40 per cent of his dollar, and the economist can show you that this is so.

"Men like Prof. Irving Fisher, Dr. Arthur Twining Hadley, Professor Cabot* of the Harvard Business School and other leading economists in the country believe that, in so far as property should govern rates, value should be determined on the basis of the reproduction theory, and Professor Cabot points out the dangers to the public of determination on any other theory, which can be phrased in a word, perhaps, by saying that if you pass the commission's bill, and a period of declining prices comes, the people of Massachusetts will be very regretful of this proposed contract. In other words, the commission would now attempt to transfer the risk of the enterpriser to the rate-paying public. I might just as well say tax-paying public, for the personnel are one and the same.

"The utilities believe that they are not only legally but economically justified in their position, and that to recede from this position would be submitting to confiscation of a very material part of the investment of the stockholder. The commission in its report to the Legislature refers to the greed and gluttony of the man who would introduce this principle into Massachusetts regulation, and I assume that the fellow conspirators of these 'gluttons' are the Justices of the Supreme Court of the United States who have apparently approved the reproduction doctrine, some of the leading economists of the United States who advocate it, and the utility commissioners of most other states of the Union who have adopted it.

"It is only recently that the suggestion was made that there is a different rule of rate making in Massachusetts than elsewhere; that suggestion has no foundation in law or in fact.

### PENALTY OF NON-ACCEPTANCE

"Now, passing from the crime for which the utilities are to be punished, the crime of challenging the commission's decision in the federal courts, let us turn to the penalty. If the utility does not enter into a contract by which it submits to any kind of regulation which the commission may hand out municipal competition shall be encouraged, a competition which would be suicidal to both the competing municipality and the utility. The utility shall also be deprived of the power of eminent domain. It got along without the power of eminent domain for a great many years; this power was given it in order to cheapen the cost of service, and this has resulted. It shall be deprived of the power to issue further securities for plant expansion, which of course dries up the utility, impairs service, results in its eventual demise and entire loss to the investor. The bill is intended to prevent a utility from claiming constitutional rights of any description by forcing it at the point of a pistol to agree to give up its constitutional rights. It is

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**Professor Cabot's argument will shortly appear in the* ELECTRICAL WORLD.—EDITOR.

an attempt to nullify the Constitution of the United States by indirection, and as such it is an unconstitutional attempt.

"The commission's bill confiscates part of the investment and reduces the return. After certifying that its issue price was in the public interest, should the commission take this attitude toward the stockholders? I think any one would agree that the commission never should have made an order to put out stock at a level which it was unwilling to accept as a rate base, and may I suggest that, if this bill is passed, the commissioners in their capacity of regulating issues of securities under the blue sky law ought to investigate themselves in their capacity of regulating the issue price of securities, like the Lord Chancellor in 'Iolanthe,' who was compelled to find himself in contempt of court because he was in love with his ward in chancery.

"In the case of the Fall River Gas Works vs. Gas and Electric Light Comm., 214 Mass. 529, the court said:

> As between the public and the corporation the earnings belong to the corporation.

"The commission has for years recognized the surplus when it ordered issue of stock at a premium.

"The theory now is that if a company paid 7 per cent average and earned anything more it was a robber. Is this so? Was 7 per cent compensatory in the early days, when risks were believed large; was it compensatory during the panic of 1893 and the following years; was it compensatory during the depression in the early part of this century; was it compensatory during the Roosevelt panic in 1907, and thereafter; was it compensatory from 1914 to 1923, a period during a large part of which some of the best industrials in the country were paying 8 per cent and higher for borrowed money; was it compensatory during 1926, when some of the finest public utility securities in the country were selling on an earning ratio basis of over 7 per cent?

"The surplus of the companies is not to be named in cents per kilowatt-hour. It was accumulated in small fractions of a cent per kilowatt-hour, and in every moment of the company's history there has been a commission with power to control rates.

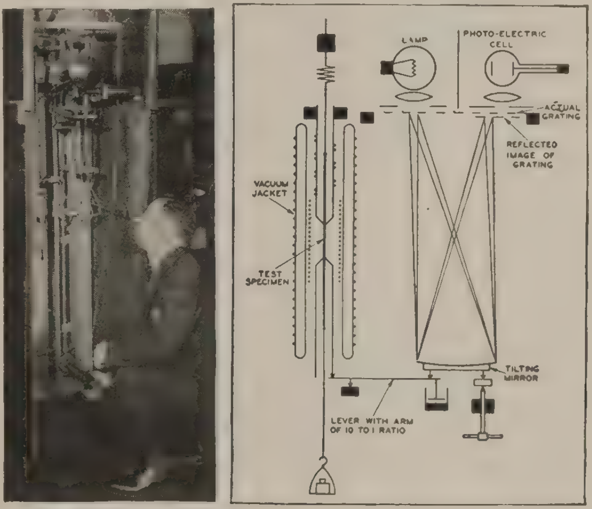
### In Times of Depression

"But even if it is assumed that the assurance of a return sufficient to maintain the market value of stock at par is practical, and if beyond this complete good faith is presupposed and a practical guarantee is maintained, what happens? In times of economic stress and depreciated security values the rate of return will have to be increased to conform to the security market. In order to provide for this return, rates will have to be increased and the financial burden will thus be transferred directly and wholly from the investor to the rate payer, and in this connection it should be remembered that in times of economic stress unemployment is at its peak and the earning power of the average consumer is restricted. Just at the time when in the interest of the larger group of citizens conditions should be maintained with the greatest degree of stability, it will be necessary under the mandate of this bill to increase the rates and thrust the burdens upon incomes which have already been depleted.

"The history of the public utility industry has never presented a condition parallel to this. Rates have always been increased with great reluctance and the investors have never claimed their pound of flesh, but through the exercise of economy and forbearance have postponed, and in most cases avoided, rate increases in times of trouble. They are still willing to do as they have always done heretofore, and the vicious character of this bill is nowhere more apparent than it is in the case of the unnatural and uneconomic condition which it would impose upon the investor and the rate payer alike when adversity threatens."

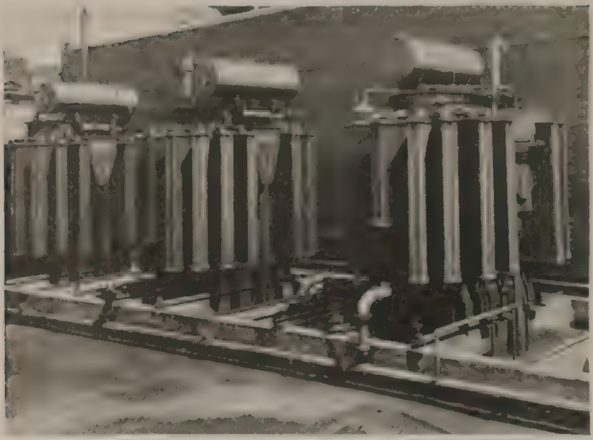
## Measuring Infinitesimal Elongation Electrically

EQUIPMENT to measure changes in length of the order of a billionth of an inch has recently been devised by P. P. Cioffi of the Bell Telephone Laboratories. The need for so refined an instrument arose in studies of magnetic materials. It was designed to measure changes of length in a piece of wire about 4 in. long. One end of the 4-in. section is fixed in position and to the other end a clamp is attached which connects to the short arm of a lever. The long arm of this lever tips a concave mirror as the wire changes its length. Light from an incandescent lamp, after passing through a suitable lens, falls on the mirror at a small angle from the perpendicular and is reflected back to a position somewhat offset from the lamp where a photo-electric cell is mounted. Between the light source and the mirror is a grating with alternate opaque and transparent lines, each $\frac{1}{2}$ mm. thick. The image of this grating falls on the mirror and is reflected back to an extension of the same grating in front of the photo-electric cell. When the images of the transparent lines are reflected back to another group of transparent lines full light will fall on the cell. When, on the other hand, they fall on the opaque lines no light will be transmitted. Only a very small movement of the mirror is required to cause this change from full light to no light. The photo-electric cell gives off a current proportional to the light falling on it, and this current is indicated by a sensitive galvanometer. The galvanometer indication thus serves to divide the width of one bar of the grating into a large number of smaller divisions.



*Arrangement and schematic plan of accurate measuring device*

## Exposed Buses Eliminated in Outdoor Substation



OUTDOOR equipment is reduced to a minimum by the Brooklyn Edison Company in this bank of 27,000/4,600, three-phase, 10,000-kva. transformer units. Three-conductor, underground, lead-covered cables for high- and low-tension connections run to oil-filled potheads on the sides of the transformers. Grounding switches are provided.

## Costs for White-Way Lighting

ACCURATE operating costs for one year's operation of a white-way lighting system were kept by the serving utility to use as a basis for contracting for operation and maintenance on future installations. The system consists of about a mile of two-light standards using modern high-intensity lamps. Like many other cities, lighting installations of this character are paid for by the property owners by establishing an assessment district. Property owners also are permitted to contract for lighting and maintenance for a period of five years.

It is evident that the matter of operating costs is quite important to the central station, since any error in calculating these costs must be carried over a period of years before there is any chance of rectifying matters. Accordingly, the accompanying costs are presented in the hope that they may be of value to other central stations that are developing this type of load:

| | |
|---|---|
| 1. Cost of lamp replacements per light unit per year, labor and cartage only | $0.90 |
| 2. Average cost of lamp replacements per lamp per year, labor and cartage only | 0.30 |
| 3. Cost of glassware replacements per light unit per year, labor and cartage only | 0.05 |
| 4. Average cost of cleaning glassware per light unit per year (material, labor and cartage, six cleanings per year) | 1.46 |
| 5. Average cost of cleaning glassware per light unit per cleaning | 0.24 |
| 6. Average cost of patrolling and inspecting the installation per light unit per year (material labor and cartage) | 0.38 |
| 7. Average cost of maintenance of posts, cut-outs and post base transformers per light unit per year (material, labor and cartage) | 1.07 |
| 8. Average number of hours system was operated per light unit per year, lamp hours (one-third burn all night) | 3,334 |
| 9. Average number of lamp renewals per light unit per year (one-third burn all night) | 2.96 |
| 10. Distribution and transformer losses expressed as percentage of rated wattage of lamps | 25 |

In studying this table it should be understood that the term "light unit" refers to the lamp and inclosing glassware. There are two such light units per post. It should be noted that in items 1, 2 and 3 the cost of lamps and glassware has purposely been omitted, since this factor varies with the lamp and glassware used, and may be accurately determined for any installation.

A very important point brought out by the cost study is the fact that the wattage assessable to each lamp as determined from the kilowatt-hours used by the system is 25 per cent greater than the rating of the lamps. This indicates that line losses and losses in the constant current transformers and series post transformers in this installation are somewhat higher than is generally assumed. This is an item of great importance where the service is sold on a predetermined value instead of on a metered basis.

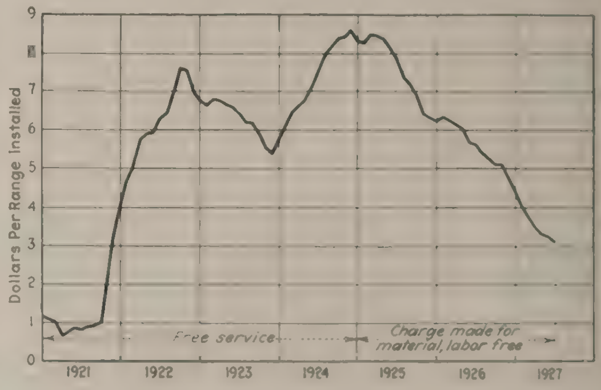
## Range-Servicing Costs Mount Under Free Maintenance

By D. F. McCurrach
*Rate Engineer Northwestern Electric Company, Portland, Ore.*

SINCE the latter part of 1921 the power companies in Portland, Ore., have engaged actively in range sales and have built a large range load. Up to 1925 no charge whatsoever was made for servicing ranges, both labor and material being supplied free indefinitely. The effect of this practice was not fully appreciated until the cost of maintenance per range mounted to a serious figure, when both companies decided upon a change of policy to relieve them of the serious burden.

Under the new policy a range user is charged for all material used in maintenance, but still receives the labor free. A new customer has free maintenance for one year, the materials being furnished by the range manufacturer and the labor by the utility; after that a charge is made for material only.

The accompanying curve shows the average cost of range maintenance of the Northwestern Electric Company over the period covered by the different range-servicing policies. The salutary effect of the present policy as compared to the old is too obvious for reference.



*Effect of range-servicing policies upon average maintenance cost per range*

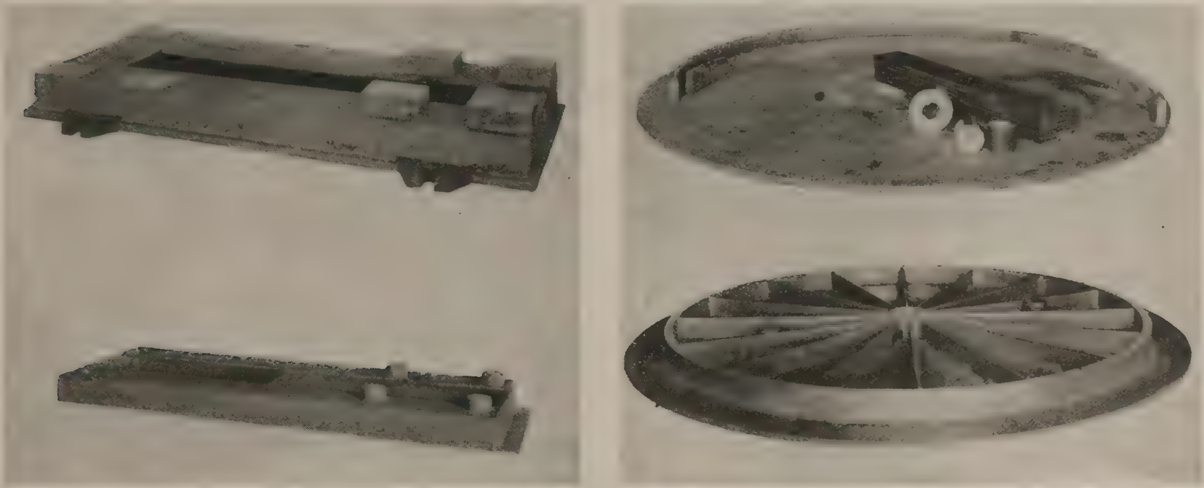
The cost of maintenance per cumulative average range installed is obtained as follows: The moving annual total range maintenance as of any particular month is divided by a figure which represents the cumulative number of ranges installed as of a year preceding the month investigated, plus one-half of the ranges installed in the current year. This method of showing the average maintenance cost has the effect each month of indicating in a general way the trend of these costs, as each calculation covers a year's operation.

# Arc Welding for Machinery

### An analysis of the underlying factors governing the use of arc welding, with some examples of cost comparison with cast iron

By A. F. Davis
*Vice-President Lincoln Electric Company*

LIKE many other industrial processes that have been sponsored by the electrical industry, arc welding has spread into industry as a whole so that its significance to the electrical industry is small as compared with its significance to industry at large. Use of the electric arc for welding purposes was once an interesting novelty; today many people believe that electric arc welding is destined to bring about sweeping changes in American industry. The prophets of the welding fraternity are numerous and frequently make extravagant claims. Examination of the underlying factors that govern the use of welding may be helpful.



*Comparison of costs between welded and cast-iron parts*

| Motor-Generator Set Base | |
|---|---|
| Cast-iron base weight | 560 lb. |
| Cost | $31.70 |
| Welded steel equivalent weight | 233 lb. |
| Cost | $7.45 |

| Machinery Turntable Base | |
|---|---|
| Weight of rough casting | 4,200 lb. |
| Cost | $336 |
| Weight of welded-steel equivalent | 1,740 lb. |
| Cost | $105 |

It is believed by many that the use of welded steel construction in place of castings is a serious threat to the foundry. It is claimed and adequately proved that a number of pieces of welded steel construction have been built that are the equivalent of castings, and cost figures are given to show that the welded steel costs only 25 to 50 per cent as much as the castings.

Does this mean that the foundries of the country are doomed? Engineers and executives who have had wide experience with welded steel construction say that the foundry is not doomed. J. H. Francis, vice-president and general manager of the Kilby Manufacturing Company, Cleveland, gives his view of the situation as follows: "We own and operate a gray-iron foundry. We also build a large amount of welded-steel construction. A considerable amount of the welded-steel construction is done on pieces which we formerly made in the foundry. The type of construction we use depends largely upon the job. Our responsibility to our customers compels us to manufacture our product as well as we can by the most economical process. Welded-steel construction has been built in our plant for thirteen years and we are doing more of it all the time. As yet, however, we see no indication that it would be a good thing for us to dispose of our foundry."

Advocates of welded-steel construction in place of castings have advanced the following as a sound basis for their claim that, where welded steel can be used, it is far less expensive than cast iron: Hot-rolled steel and gray-iron castings are both made from pig iron which costs about $20 per ton. Gray-iron castings cost, on the average, $120 per ton. The additional $100 per ton covers all the charges for molding, pouring and other foundry expense. The same ton of pig iron which cost $20 could have been made into hot-rolled steel for an additional $20 per ton, making a total cost of $40 a ton for hot-rolled steel. It costs five times as much to get a ton of pig iron into the form of a casting as it does to get it into the form of hot-rolled plates, shapes, bars, etc. The next step is to get the hot-rolled stock cut to size and welded into the equivalent of a casting. It is claimed that this cost on simple machinery bases and frames will in most cases not exceed $40 per ton. Thus the welded steel equivalent of the casting may cost $80 per ton, against $120 per ton for the casting.

*This cylinder bracket cost less than a casting exclusive of the wood pattern cost*

| | |
|---|---|
| Weight | 74 lb. |
| Material cost | $5.60 |
| Labor cost | 5.44 |
| Equivalent rough casting cost | 11.84 |
| Wood pattern | 30.00 |

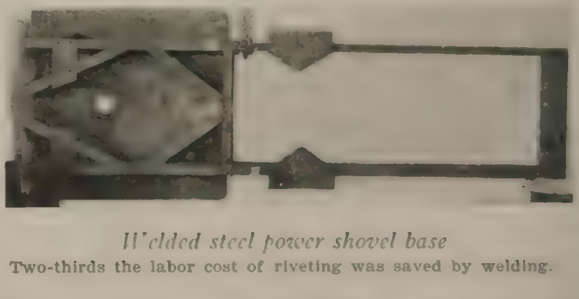
Owing to the superior physical properties of steel as compared with cast iron, it is claimed, usually less than one-half the weight of steel is required as compared with cast iron. The ratio of cost is therefore calculated to be, cast iron, $120; welded steel, $40.

It seems obvious from the preceding discussion that the importance of welded-steel construction and its effect on the foundry as well as industry in general is directly dependent on the percentage of castings that can be replaced with welded steel economically. On this point the testimony of I. T. Kahn, president of the Consolidated Iron & Steel Company of Cleveland, is interesting. The company operates the Republic Structural Iron Company, which, in addition to ordinary steel fabrication, makes welded-steel pieces in place of castings. The Consolidated Iron & Steel Company also owns and operates the Taylor & Boggis Foundry of Cleveland. Mr. Kahn sums up the situation as follows: "Operating, as we do, steel-welding equipment and a gray-iron foundry, we from time to time have to advise our customers the preferable construction for a given article and occasionally to suggest a change. It would seem that the idea of cost would be the determining factor, but this is not entirely so, and it is also true that a cost which may be favorable to welded steel, on a production of ten pieces per day, may be favorable to castings on a production of the same piece of 1,000 per day, or vice-versa. Appearance is important to American machinery manufacturers and users. Which of the two methods gives the better appearance? Generally the saving through the use of welded steel results from a reduction in weight, yet in many cases bulk or weight is essential in a certain member of the machine, which raises the question as to whether weight is essential to the design. Another question, which, however, is one of the components of cost, is the price of patterns for castings and the assembly jigs for welding. When these conditions are answered advantageously as to welded products, we recommend the change. As to the ultimate effect upon our foundry, we have no fear. Castings will not be discontinued and we believe anything that reduces the cost of machinery opens up new fields of consumption at each new level of reduced costs. Thus with a loss of such members as are changed to welded steel, the foundries will be compensated by increased production of the remaining unchanged members."

Present opinion among those who are in a position to judge the situation appears to warrant the belief that increasing use of welded-steel construction may necessitate some changes in the organization of the foundry industry. The foundry will hold the business which it can handle more efficiently than the welded steel department. But if the pieces of simple shape and in general the jobs which furnish the tonnage jobs of the foundry are to be built in welded steel, it means that the foundry will have to be organized to produce this class of work very efficiently. The tonnage jobs in the foundry are frequently looked on as the salvation of the foundry management in keeping the cost per pound of making castings down. Take these jobs out of the foundry and the cost system has to be overhauled and more efficient methods employed.

The machinery builder who operates his own foundry is in much the same position as the jobbing foundry. If he takes the tonnage jobs out of his foundry, he may find that it is more economical to buy the small castings from a foundry which is meeting the new situation with more efficient methods of producing small castings and can actually beat his own cost on the outside on this class of work. Several machinery builders who use welded-steel construction and also operate a foundry already face this situation.

The idea of welding in place of riveting does not carry with it the implication of radical changes in iron and steel business such as may occur should welded-steel construction replace gray-iron castings on a large scale. No one appears to be very much excited about the question of whether steel shall be riveted together or welded together. The novelty of welding has worn off and the matter has become, to a considerable extent, a question of which method costs the more. There are of course, a



*Welded steel power shovel base*

Two-thirds the labor cost of riveting was saved by welding.

number of cases in which the judgment of the engineering profession is against the use of welding because it is relatively new and a great deal remains to be learned about it. High-pressure steam boilers, etc., can be welded but probably will not be welded until more is known about the process. However, this is but a matter of a short time, for we are making considerable progress in our knowledge of the process.

The grounds on which the advocates of welding base their claims to recognition on work which may be either riveted or welded are that there may be a saving of both material and labor. A material saving is claimed and in many cases proved on tanks, steel pipe and similar jobs, due to the fact that the welded joint may be as strong in tension as the members joined. The strength of the joint determines the thickness of material required on work of this kind. The riveted joint, on the other hand, is always weaker than the sections joined, so that an excess of material is required. The labor cost of joining steel pieces by welding is claimed to be less than the labor cost of riveting. The fact that the welding "gang" is one man and the riveting "gang" three or four men gives weight to the argument for welding. In shop welding there is general agreement that the work per day per man is far greater with welding than with riveting.

*This guide link of welded steel costs considerably less than a casting*

| | |
|---|---|
| Weight | 90 lb. |
| Material cost | $5.08 |
| Labor cost | 0.85 |
| Equivalent rough casting cost | 18.00 |
| Wood pattern | 60.00 |

To summarize the whole situation relative to the use of welding, it may be said that in so far as welding may be used to fabricate jobs which were formerly made using castings or riveted steel, and produce an equivalent job at less cost, welding will be used. The conditions in the machinery building field which have been brought about by the application of arc welding are not unusual. The development of high-speed steel necessitated a much greater change in the design of machine tool equipment to meet the new high-speed and high-power conditions than may be expected in the case of introduction of welded-steel construction in place of castings.

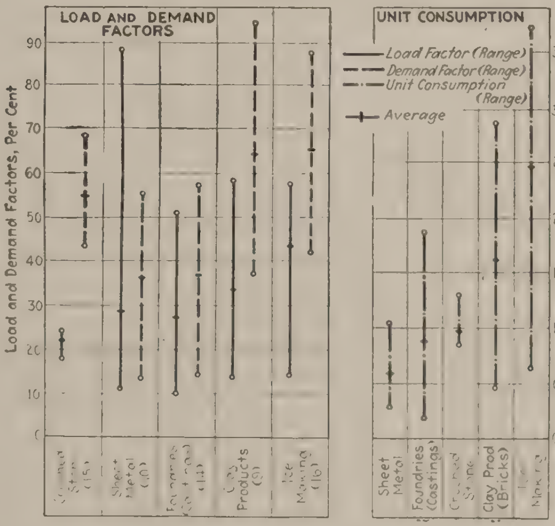
# Characteristics of Industrial Loads

### Performance of individual plants departs widely from averages. Useful data must be based on individual processes

EVERY now and then some one believes that considerable laborious investigation can be avoided in determining this or that factor if certain average electrical characteristics are obtained for different industries. For example, many commercial and engineering decisions could be made if the average load factor, demand factor or energy consumption per connected load for different industries were applied to individual plants in those industries. The question has been raised whether meter size might not be based on a certain percentage of the connected load.

While the general comment is often heard that every case must be considered by itself, it applies particularly to industrial characteristics. To show this fact 50 industrial plants representing five major classes of business were investigated to ascertain whether any average figures can be obtained for specific industries that mean anything.

Sixteen ice-making plants, fourteen foundries, ten sheet-metal factories, nine brick plants and five stone crushers were studied. The results are plotted herewith by group and relativity. Since they do not include small installations and apply to industries in one locality, the individual results should approach the averages if they will under any condition.



*Comparisons of average yearly load factors, demand factors and unit energy consumptions for different industries with departures from averages*

A glance at the charts representing the separate industries indicates how widely the individual factors vary from the average, the departure being greater with some industries than with others. The master chart comparing load and demand factors and unit consumption for these five industries appears on this page and shows the same things a little more clearly than do the charts for each industry.

For example, load factor* (yearly) variation is least for crushing stone and greatest for sheet-metal working, departures from average for foundries, brick plants and ice making being as much as +87, —70: +75, —60: +35, —65 per cent of average respectively.

Likewise, demand factor* (yearly) variations are least for crushing stone and greatest for the other industries considered. Similar remarks can be made regarding kilowatt-hour consumption per connected kilowatt per year.

If averages mean anything when the departures are so great as those observed, it can be said that ice making has the highest load factor, demand factor and energy consumption per connected kilowatt. Of the remaining industries, brickmaking, sheet-metal plants, foundries and stone crushing rank in descending order for load factor. Brickmaking, stone crushing, foundries and sheet-metal plants rank in the order named for reduction in demand factor and energy consumption per kilowatt of connected load.

The general conclusion is that average figures that mean anything cannot be derived even for specific industries.

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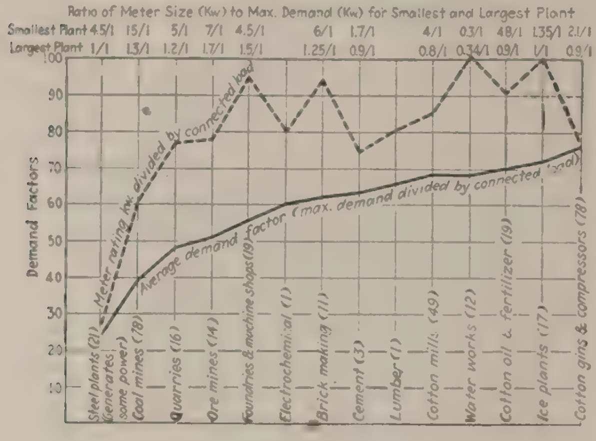
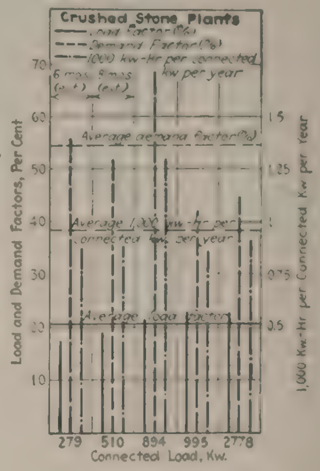
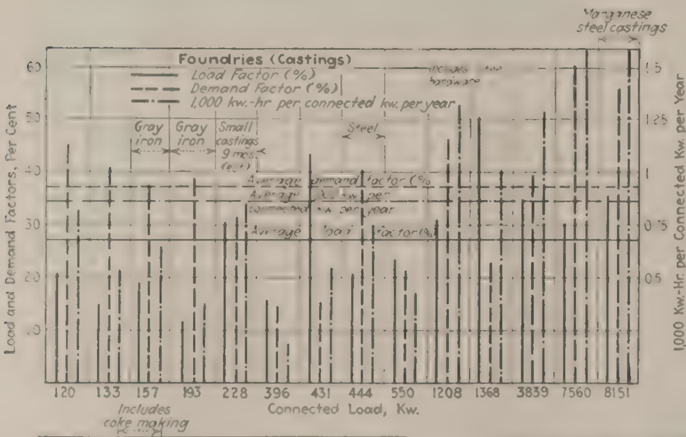
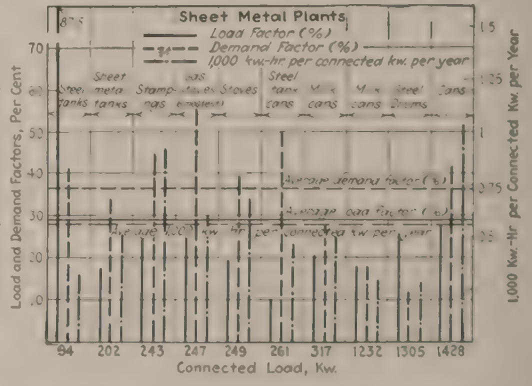
*Load factor and demand factor are loosely used frequently. They are used here with their standard meaning. For example, load factor is the ratio of average power to maximum power. Demand factor is the ratio of maximum demand to connected load.*

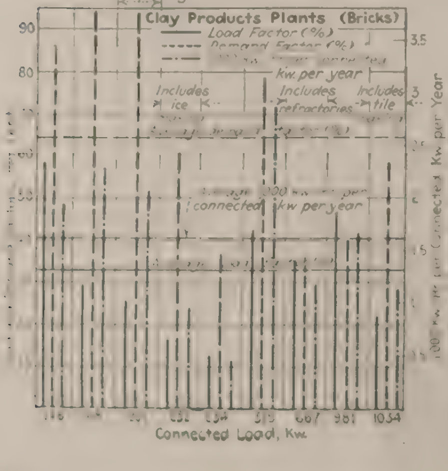


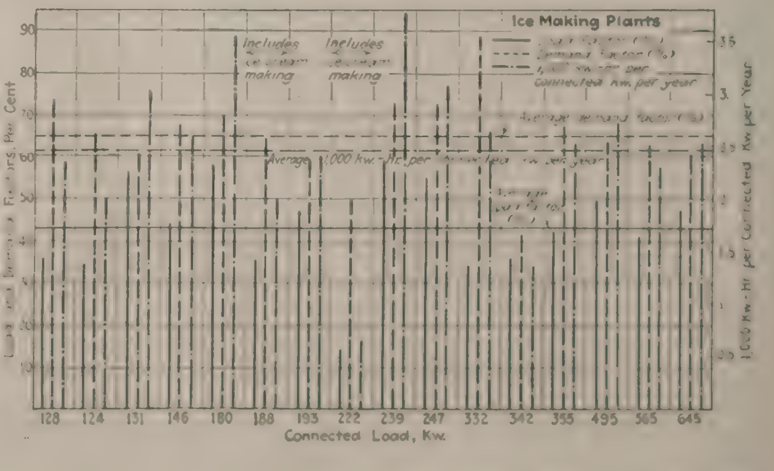


*Comparisons of yearly load factor, demand factor, unit energy consumption and relations of meter size to connected load and demand factor for different installations engaged in similar occupations*









## Unusual Street Lights for Los Angeles

AN ARTISTIC street lighting system has been designed for Wilshire Boulevard, Los Angeles, by the General Electric Company. The lighting units, or lanterns, are larger than previous designs for this type of service. They are, in general, rectangular in shape, approximately 7 ft. high and are mounted on poles to bring the light center 22 ft. above the street. Each lantern contains two incandescent lamps, one 2,500 cp. and the other 600 cp.

A double wiring circuit will make it possible to operate either lamp separately or both together. It is intended to use the brighter lamps from darkness until midnight and the smaller lamps from midnight until daylight, when traffic on the street will be so light as not to require as much illumination. Approximately 400 of the new lights have been installed 120 ft. apart on either side of the street. The poles are of bronze-sprayed cast iron and the lanterns of cast bronze. In accordance with the general popular vogue in southern California of using the Spanish renaissance design for much of its street architecture, this style has been followed in the design of the lanterns and standards.

## Utility Finds Opportunities for Economies in Many Departments

CONVINCED that continuous thinking in terms of economy and adopting a policy of undeviating vigilance will bring results, a public utility supplying a city and suburban community in the East has applied its theories in practice.

The end of the construction, or expansion, period in the territory of this company permitted the reduction in number of workmen in the construction department from 105 to 15. This eliminated a large labor item, and the maintenance work was scheduled and arranged so that a minimum number of workers are now required for this class of activity.

Passenger automobiles formerly assigned to individuals for their exclusive use have been numbered and are now used as taxis—that is, are operated when needed, by any employee privileged to car use. This resulted in a reduction in the number of vehicles needed from twenty to fifteen, with a consequent curtailment of overhead and operating expenses. Standardization of motor vehicles, both passenger and commercial, eliminated a great multiplicity of spare tire, parts and tool requirements and permitted shop storage space curtailments. The value of eliminating assigned cars was believed to be largely psychological, offering a means of inducing employees to think of their activities in terms of economy.

Combination of the functions of the underground forces of the electric and gas divisions made one supervisory organization serve for both. Working crews were consolidated so that any truck can service either class.

Record-department complexity was reduced. Where formerly seven sources of information and records on meters and customers, accounts were maintained, there will be two files for this purpose. A saving in floor space of about 10,000 sq.ft. was realized and a contemplated expenditure for expansion which would have involved $7,000 to $8,000 was avoided.

A recent survey of consumers' homes indicated that about 12 per cent of the fixture outlets were not provided with lamps. A successful campaign for the sale, at an attractive price, of packages containing six lamps resulted in placing more than one additional lamp per customer in the hands of consumers in this territory.

Sales efforts added refrigerators to the lines and the recommendations of satisfied users have led to a market out of proportion to the direct sales efforts. Similar comments can be made regarding other appliances.

Changing from arc equipment to incandescent street lamps to reduce maintainance charges and replacements has converted the net results from a loss per installation per year to a reasonable profit.

Interconnection with adjacent electric light and power systems is considered to have reduced the value, as essential operating units, of the individual power station comprising this company's generating capacity. As the necessity of the individual unit for service continuity maintenance is reduced and some of them are not required for stand-by service in the event of breakdowns, fewer small stations must be maintained. Interconnection has, in addition to reducing the capital investment required for generating purposes, resulted in better service and higher reliability. The number of operators was found to be greater than necessary, after the completion of the interconnection program, and the services of 30 men were dispensed with.

This company has found that there are opportunities in nearly every department for making the invested dollar work harder, longer and more effectively.

# Letters from Our Readers

### *Value of Purchased Power*

*To the Editor of* ELECTRICAL WORLD:

The attention of ELECTRICAL WORLD readers should be called to a miscalculation by Edgar J. Kates in the Feb. 14 issue of *Power,* where he discusses "Guessing Fixed Charges for a Proposed Power Plant."

He assumes an industrial establishment using 17,000 kw.-hr. per month with a maximum demand of 100 kw. and a Diesel engine operating cost of 1.1 cents per kw.-hr. This gives an operating cost of $187 per month. Then he proceeds to say that purchased power costs 2.28 cents per kilowatt-hour, or $476 per month. My arithmetic makes this only $387.60 per month. This is a serious error. Mr. Kates assumes an investment of $15,000 necessary to produce the above results.

If this industrial plant put the $15,000 in a safe investment at 6 per cent it would make $900 per year, or, better still, if put back into its own business probably three or four times this amount. Furthermore, ten years is a long time and this industrial plant will probably have lower power rates before that, or at least it will want to have $15,000 ready to buy a better oil engine; $900 plus $1,500 is $2,400, equaling the amount of the assumed saving. Also, the plant would probably not have maintenance and other troubles to worry about.

It looks as if Mr. Kates has made about a $20,000 error.

L. O. BUCKNER.

York, Pa.

[The rate upon which the calculations of Mr. Kates were based was 2.8 cents; the figure of 2.28 was a typographical error, according to the editor of *Power.*—EDITOR.]

# Digest of Electrical Literature

## *Generation, Control, Switching and Protection*

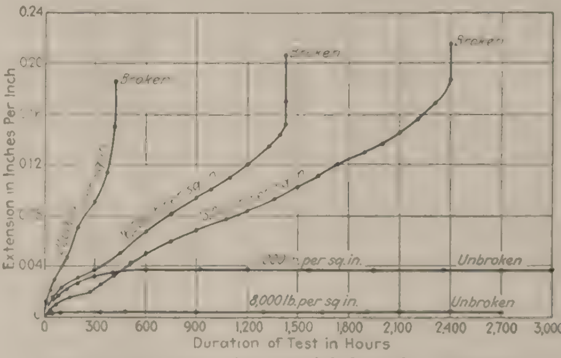
*Transformer Protection.*—V. Wiarda and E. Wilm.—An overwhelming majority of transformer faults are accompanied and preceded by abnormal heating of the oil. Over-current protection cannot function until the fault has developed to such magnitude as to cause a material increase of the normally absorbed current. A gas relay, on the other hand, fails to respond until the abnormal heating is high enough to dissociate oil or to cause an arc. A well-designed temperature relay of high thermal sensitiveness is therefore considered by the authors as superior to either of these two. Two such relays of recent design are described. Both of them utilize the bending of a bimetallic strip. The disadvantage of the slowly moving strip, combined with the uncertainty of making a reliable contact, has been avoided by causing the strip to release a lever, subjected to heavy spring pressure, thereby obtaining a positive snap-action switch. The strip, adjusting screw, spring switch and resetting lever are mounted in a 1-in. insulating tube, which can be screwed oil-tight into cover or tank of a transformer. Adjustment is provided for a range of 50 to 120 deg. C., within an accuracy of plus or minus ½ deg. This relay was adopted as standard equipment on all power transformers of the Berlin municipal power system.—*Elektrotechnische Zeitschrift,* Jan. 19, 1928.

## *Transmission, Substations and Distribution*

*Heavy Traction Substations.*—H. B. Poynder.—A practical consideration of some of the problems encountered in the design of automatic rotary convertor equipment which still await satisfactory solution. The author has considered the circuit breakers, ventilation, thermal relaying and vertical versus horizontal design for rotary convertors. The advantages of high-speed circuit breakers are stated as including the prevention of serious lightning trouble on the track equipment. It is the contention of the author that breakdowns which occur during thunderstorms are in almost all cases caused by surges set up by lightning strokes in the vicinity of the track which do not actually strike the equipment. The initial discharge amounts to only a relatively small number of coulombs, is practically harmless so long as it takes place over the surface of the insulators and does not pierce them, and this can be insured by proper design of the insulators. The damage results from the great heat generated by the power arc which follows, and the high-speed breaker, by limiting the time during which the power arc persists, prevents any damage to the insulators in the great majority of cases. The author is strongly in favor of the development of an overhung vertical machine with a central bearing and a steadying thrust bearing below, the slip-rings being between the two bearings. This is advocated as producing a compact design with magnet ring resting on the substation floor and the slip-rings in the basement. The accumulation of conducting vapor would be impossible, there being in the suggested design a free upward path for all conducting vapors.—*Electrical Review* (*England*), Feb. 10, 1928.

## *Hydro-Electric Development and Steam Equipment*

*What is the Limiting Temperature in Central-Station Operation?*—V. T. Malcolm.—As a result of investigation the author states that at each temperature of a metal under test there is a stress which if exceeded will cause fracture, though equipment may give satisfactory service operating at this temperature with loads greater than the critical stress for many years. The best conclusions indicate that the design of equipment must be based upon the strength of metals at operating temperatures over long periods of time and that other properties, such as thermal expansion, thermal conductivity, chemical stability, resistance to wear and abrasion, etc., must receive greater attention than in present engineering practice. These latter factors will probably govern actual design, but the first and basic requisite is that of physical strength and the proposed temperature. Charts for various alloys considered by the author to be safe for operation at 1,000 deg. F., and which are also satisfactory for such service as requires wear resistance, chemical stability and coefficient of expansion, are given. The physical properties of metal suitable for high temperature service have been reviewed in connection with creep values, chemical stability, thermal expansion and wear and abrasion factors.—*Mechanical Engineering,* February 1928.



*Creep tests on cast chrome-nickel steel, at constant temperature (1,000 deg. F.) and load*

## *Units, Measurements and Instruments*

*Absolute Measurement of Capacitance by Maxwell's Method.*—Harvey L. Curtis and Charles Moon.—The absolute measurement of capacitance by Maxwell's method is based on the assumption that certain conditions are fulfilled by the experimental apparatus. While there are at least seven of these conditions, the most important is that the galvanometer correctly integrates the current. When large capacitances are measured, a galvanometer is required in which the current through the coil does not affect the magnetism of the permanent magnet. By placing the coil in a symmetrical position with respect to the magnet this condition can be fulfilled in most galvanometers. This adjustment is, however, greatly simplified by a proper design of the galvanometers. The method used by the present investigators requires that a condenser shall be charged and discharged at a known rate. This is accomplished by platinum contacts dipping in mercury cups which have been placed on the prongs of a tuning fork driven by an electron tube. This permits the Maxwell bridge to be balanced with the same ease and accuracy as a Wheatstone bridge. It is necessary to determine the frequency of the fork at the time of measurement. The possibility of introducing systematic errors has been guarded against by employing two independent bridges in which the factors have been varied as much as possible.—No. 564 *Scientific Papers of the Bureau of Standards.*

## *Illumination*

*An Investigation of Electric Lighting in the Engineering Industries.*—J. L. H. Cooper.—The modern trend toward standardization in industry has resulted in attaining a degree of workshop efficiency not hitherto available and it is now realized that the prosperity of all industrial establishments depends to a large extent on the adoption of standardized systems for lighting in workshops, and in contrast to the earlier lighting systems much more attention is now given to illumination and the arrangement of lighting units. The author has reviewed the general attitude of employers in Great Britain in regard to lighting, the activities in connection with more progressive lighting policies. The average hours of artificial lighting are tabulated in connection with significant factors of wall conditions and window conditions, and work requirements, the servicing and maintenance of lamps and equipment, the types of lamps employed, glare factors, types of buildings, lighting of machine tools, tabulated values for tool point intensities and general intensity values have been given. The author states that it is not generally appreciated that the cost of lighting in the average workshop represents a very small percentage of other charges when one considers the payroll and capital charges. In general, the cost of good lighting, both in large and small workshops does not exceed 0.86 per cent of the wages bill. The cost, therefore, of good lighting cannot be considered as a burden on industry, but on the contrary is economically sound and efficient.—*Journal of Good Lighting (England)*, January, 1928.

## Motors and Control

*Accurate Control of Rolling Speeds.*—The electrically driven 10-in. merchant bar mill recently installed in an Ohio plant has unusual provisions for close regulation of rolling speeds. As a result, less frequent roll changes are necessary. It is unnecessary to maintain close supervision of roll diameters, as is required with constant-speed drives, because the speed of the stand may be increased to compensate for alteration of the roll diameter. Roll changes are unnecessary for sizes from $\frac{7}{32}$ in. to $\frac{5}{8}$ in. in round bars or equivalent sections in squares and flats, according to this article. Each mill motor has an individual magnetic control panel so that any stand can be started or stopped. When each of the stands is driven at the proper speed the bar passing through it is kept under tension but not stretched or looped. Because of the close centers, speed is controlled by a synchronous tie between the motors, which in reality takes the place of interlocking gears. This control is obtained by individual balance-type vibrating speed regulators which not only maintain a synchronous tie among the four motors but also maintain a correct speed set for each motor within close limits. This speed-regulating equipment may be taken out of service by the operation of a transfer switch and the motor placed under hand control.—*Iron Age*, Feb. 2, 1928.

*Electrically Driven Woodworking Machinery.*—Various aspects of the direct electric drive, with particular reference to high-speed equipment made possible by the application of high-frequency alternating-current motors, have been considered in this discussion. Tabulated recommendations of countershaft speeds and motor sizes and ratings for use in connection with the more common types of woodworking machinery have been included. The use of portable electric tools in certain jobs has also received consideration, with particular reference to the speeds found desirable for standardized specifications.—*Electrical Review (England)*, Feb. 3, 1928.

## Electrophysics, Electrochemistry and Batteries

*Electric Puncture of Two Dielectrics in Series.*—E. Marx.—If two insulating media of greatly different electric strength are placed in series, and are subjected to a puncture test, it will be found that the failure of the weaker material reduces materially the strength of the other, stronger, material. The partial breakdown acts like a sharp point, concentrating the electric field and causing a premature failure of the other insulator. The tests were made first between electrodes immersed in distilled water, with a sheet of Cellon half way between the electrodes. It was found that the polarity is considerably influenced by direct-current tests. Similar characteristics were found with porcelain or glass in oil. For example, a certain oil-porcelain-oil combination failed at 77 kv., while the porcelain piece alone did not puncture until 136 kv. Since such combinations of dielectrics are commonly used in oil switches, transformers and other oil-immersed high-voltage apparatus this phenomenon should be of considerable value to designers. — *Elektrotechnische Zeitschrift*, Jan. 12, 1928.

## Traction

*The Post Office Railway*—A discussion of the underground electric railway for the conveyance of letter and parcel mails between the principal post offices and railway stations in London. This system has recently been opened for traffic and a description of the electrical layout and equipment is included in this article. The total length of the railway as at present constructed is 6½ miles. Operation of the trains is entirely independent of any accompanying motorman and control is obtained through switch cabins at each station. The rolling stock consists of steel cars which are made up into trains of two or three units. Each car is capable of carrying a load of 1,120 lb. The electrical equipment is relatively simple and consists principally of two 22-hp., 440-volt direct-current series motors connected in parallel. A resistance in series with each motor and a set of electrically operated braking equipment and reverse gear are mounted on each car. The motors are energized in the usual way from the conductor rail, which is divided into sections, each section being controlled either by an automatic track circuit on the sections between the stations or by levers working under track circuit control in the station areas. These levers are concentrated in the various switch cabins. The train is started on a falling track gradient under a pressure of 440 volts and attains a maximum speed of 35 m.p.h. When a station is approached and a rising gradient is encountered the conductor rail is dead and the train is brought to rest by the automatic operation of the brakes. After a short interval the conductor rail in this section is energized at 440 volts and remains energized at that voltage for a predetermined time, which is sufficiently long to give the train a good start. At the end of this period the voltage is reduced to 150 and the train runs into the station under these conditions. Here it either enters a dead berth section and is brought to rest by the brakes alongside the appropriate platform or it passes on to a through section if it is not to stop at the station.—*Electrician (England)*, Feb. 10, 1928.

## Miscellaneous

*Physical and Optical Societies' Exhibition.*—Electrical instruments were a feature of the eighteenth annual exhibition of the physical and optical societies recently held in London. Several types of unusual interest were included. An improved oscillograph outfit suitable for potentials up to 75,000 volts includes two electromagnetic vibrators and one electrostatic vibrator, which may be used to obtain voltage records at very high pressures through variation of equipment characteristics. This device requires but one camera and one source of light to which an abnormal voltage is applied for a fraction of a second during the time of exposure. The intense light thus obtained passes through an optical system, which insures that a separate beam is focussed on each vibrating mirror. The reflected beams pass through a cylindrical lens, thereby reducing the images to bright spots of film, which is moved in a vertical plane at right angles to the plane of the vibrating beams. Another exhibit was a low-tension Schering bridge of improved design, which provides a simple and accurate means of measuring the power factor and dielectric constant of insulating materials at audio-frequency. Provision is said to have been made for measuring power factors from 0.001 to 0.5 with test capacities varying from 60 to 1,000 micro-microfarads. The electrodes and leads are screened so that samples may be tested at a controlled temperature and humidity. The bridge is direct reading and easy to operate. A heat-loss gage, which may be carried in the hand and used at the desired point, has been devised for measuring the heat loss from a surface of boiler settings and other hot bodies. The surface of a capsule is exposed to the heat emanating from the surface under test, either by making direct contact with the surface or by holding the instrument at a distance, when the radiant heat is measured. The instrument's heat receiving surface is surrounded by a guard ring.— *Engineer (England)*, Jan. 12, 1928.

# Book Reviews

## *English for Engineers*

By S. A. Harbarger, assistant professor of English Ohio State University. New York: McGraw-Hill Book Company, Inc. Second edition. 300 pages. Price, $2.

"English for engineers, or 'engineering English' as it is popularly called, should mean the presentation of ideas from the engineer's angle, the interpretation of ideas as he sees them with his interest, his training, his ambition and his vision." With this definition, the author, in a manner at once succinct and comprehensive, gives many practical hints concerning the way in which the engineer should approach writing of every description—sales matter, business letters, letters of inquiry and instructions, technical explanations, abstracts, summaries, reports, book reviews, editorials and articles for engineering societies and publications. A chapter is also included on "English for Non-Technical Uses." College students and young engineers should find in the book an incentive to care and pains whenever they put pen to paper. Practice is nine-tenths of style; but great engineering writers are few, and it is doubtless as unreasonable to expect an accomplished engineer to be also a brilliant author as it would be to expect a master of composition to excel as a technician. Every engineer, however, can shun the errors of the illiterate and the jargon of the marketplace. Professor Harbarger's effort is rightly and well directed.

## *Anleitung zur Entwicklung Elektrischer Starkstromschaltungen*

By Dr.-Ing. Georg I. Meyer. Berlin: Julius Springer. 159 pages, 167 illustrations.

The usefulness of this book lies in its affording a basis for building up switching schemes to fit various conditions as they may confront the engineer. It does not offer ready-made solutions, and it is confined to power circuits. As might be expected, the major portion is devoted to polyphase control, with its diversity of possible connections, relays and protective devices. Liberal use is made of schematic diagrams. Bold lines and separate figures to focus attention on one item at a time contribute to the clarity of treatment, which is essentially descriptive, dealing with methods, rather than devices.

## *Der Transformator im Betrieb*

By Dr. Milan Vidmar. Berlin: Julius Springer. 310 pages, 126 illustrations.

The author's avowed object is to reconcile the viewpoints of operating engineer and designer by discussing the economics and the functioning of transformer installations under unusual as well as under normal conditions. Thus, he points out that under pressure of price competition the effect of technical progress is inevitably and progressively to decrease the efficiency. The inclusion of analyses of the functioning of protective devices—e.g., fuses, circuit breakers, lightning arresters and choke coils—in their bearing on thermal and mechanical phenomena within the transformer is commendable. The treatise sums up transformer performance in a readable and authoritative way, somewhat off the beaten path and avoiding excessive use of mathematical language.

## *Wissenschaftliche Abhandlungen der Physikalisch-Technischen Reichsanstalt*

Berlin: Julius Springer. Vol. X, Parts 1 and 2, 363 pages; Vol. XI, Part 1, 336 pages.

The general quality of these reprints of contributions from the Reichsanstalt to various scientific and technical journals is too well known to call for comment. They are not confined to any one branch of physics. Space unfortunately does not permit even a catalog of titles of those relating to electricity or using interesting electrical methods. Photometric and optical studies appear in considerable number; others deal with high-frequency or high-intensity electrical and magnetic measurements, including mention of an oscillograph serviceable up to 50,000 cycles p.s., low-temperature conductivity of metals and crystals and platinum resistance thermometric calibrations, measurement of low thermal conductivities, color methods for temperatures of small coils, a condenser method for measuring bearing lubrication and a unit for Roentgen ray dosage. There is a lengthy report on the calibration of mercury standards of the ohm.

## *Landeselektrizitätswerke*

By S. Schönberg and E. Glunk. Munich and Berlin: R. Oldenbourg. 398 pages, 144 illustrations.

This comprehensive treatise by former associates of the late Oskar Miller deals with superpower systems in general, although the illustrations are largely drawn from the great Bayernwerk. The authors take up in considerable detail various stages in the development of a large regional undertaking, giving due attention to economic as well as engineering considerations. The units are necessarily the local systems, which must be co-ordinated into a single entity. Among the topics discussed are the estimation of the probable demand, the obtaining of data by means of suitable questionnaires, the predetermination of the future lighting, industrial and transportation loads, determination of the sites and magnitudes of hydro-electric and steam stations to be constructed, the securing of an economic balance between the two sources of energy, and finally the working out of the major engineering features. The book contains a profusion of tables, charts and diagrams.

## *Die elektrischen Einrichtungen für den Eigenbedarf grosser Kraftwerke*

By Friedrich Litze. Berlin: Julius Springer. 160 pages, 89 illustrations.

Power plants, both steam and hydraulic, have grown to such magnitudes and in modern practice make use of so many automatic features that a great deal of electrical apparatus is necessary to the plants' own functioning, as distinguished from the main equipment for the generation and control of the outgoing energy. The author states that no unified treatment of this auxiliary equipment has heretofore been published. The book undertakes to make up the deficiency in a descriptive way. While useful as a summary of modern practice, its value would be greatly enhanced by the inclusion of quantitative information.

## *Die Grundlagen der Hochfrequenztechnik*

Br. Dr.-Ing. F. Ollendorff. Berlin: Julius Springer. 639 pages, 379 illustrations, three insert charts.

The author has successfully put into a single volume enough of the underlying theory of high-frequency engineering to serve as an adequate introduction to practice, if combined with a reasonable amount of suitable laboratory work, or if the reader is already familiar with the devices and fundamental circuits. The book was developed for a course in a German technical school of recognized standing. That will suggest the scope and grade of difficulty. The treatment is necessarily mathematical, though not obtrusively so, and the physical significance of the conclusions is pointed out. In general, it follows established lines: the first third devoted to the characteristics of static and dynamic fields and of the parts constituting the usual high-frequency circuit, the next part to circuit characteristics, forced and free oscillations, coupled circuits and related topics, and the final quarter to electromagnetic radiations. To the teacher or advanced student, especially in the field of communication engineering, it should prove useful for both the text and for the copious bibliography. Even so, the latter is not exhaustive, at least in so far as American titles are concerned.

# Books Received

*Hockspannungs freileitungen.* By Dr.-Ing. K. Draeger. Berlin: Julius Springer. 40 pages, illustrated.

*Die Gleichstrommachine.* By Dr.-Ing. e. h. J. L. la Cour. Berlin: Julius Springer. 714 pages, illustrated. Price, 30 marks.

*Radio Engineering Principles.* New second edition. By H. Lauer and H. L. Brown. New York: McGraw-Hill Book Company, 301 pages, illustrated. Price, $3.50.

# News of the Industry

## Senators Chatter, Chatter as Words Flow

### And Muscle Shoals Debate Goes on Forever—House in a Snarl on the Same Subject—Trade Commission Questionnaire—Boulder Dam "Facts"

By Paul Wooton

*Washington Correspondent of* Electrical World

DESPITE all that has been said in Congress in the past ten years about Muscle Shoals, that subject continues to stimulate protracted debate. A vote on the Norris resolution has been expected in the Senate for more than a week. As this is written, there are indications that the debate may continue for another week. It is very apparent, however, that the Norris resolution, modified by the Harrison amendment, stands a good chance of passage. In the Lower House, Muscle Shoals is in a worse snarl than ever, with the prospects against any legislation.

The Harrison amendment puts the government in the fertilizer business on an experimental basis only. While there is objection to even a small commercial production, it comes apparently from a minority. On the other hand, there is some objection from those who want to see the government become a large producer of commercial fertilizers. The majority, however, seems to think the Harrison amendment does everything for fertilizer that reasonably can be expected. The strength of the amendment lies in the fact that it removes the undesirable feature of government operation from the disposition of the power output. Under it the power must be distributed under state regulation, without discrimination among states and municipalities. Moreover, it prevents municipalities from securing power under conditions that would permit discrimination against the users of power who make their purchases through ordinary commercial channels.

The Federal Trade Commission is making its final arrangements for its hearings in the investigation of the electric and gas industries. It is stated at the offices of the commission that the utilities are co-operating to make the investigation a thoroughly efficient one. So as to obtain certain fundamental data which will aid in the conduct of the hearings, it is understood that the commission is about to send out a carefully prepared questionnaire to the industry. All the subpœnas now have been issued to take care of the initial hearings.

Instead of the private conference at first planned, preliminary hearings were held by the commission on Thursday morning of this week to examine certain officers and representatives of the National Electric Light Association and the American Gas Association. Testimony was to be taken with a view to identifying and putting in the record certain documents of the two associations relating to their organization and personnel. No announcement was made as to when other public hearings in the investigation will begin.

### Boulder Dam "Facts"

A detailed examination of the Swing-Johnson Boulder Dam bill, with suggested changes, is made by the Secretary of the Interior, Hubert Work, in a letter to Senator Phipps, chairman of the committee on irrigation and reclamation. It concludes:

> To sum the matter up, it is my opinion that the entire $125,000,000 proposed to be authorized to be appropriated from the Treasury for this project should be reimbursed, with interest. The information available to the department seems conclusive that the entire expenditure can be paid out of power and other receipts without imposing any undue burden on any feature of the project or those to be benefited thereby. Apparently, the only effect of any donation of a part of such principal or interest would be to increase the suggested contributions to the States of Arizona and Nevada. The plan set out in Section 16 for the construction of a so-called retainer dam for flood control with foundations sufficient to permit the later construction of a dam 550 ft. in height, I do not regard as feasible. In my judgment, the sum mentioned would not be sufficient to construct a dam sufficient to afford flood protection of material value.

The eleven members of the California delegation in the House of Representatives have issued and signed a "statement of facts" regarding the Boulder Dam project. It is as follows:

> 1. There is a serious and ever-increasing flood menace existing along the lower reaches of the Colorado River, both in Arizona and California, threatening the destruction of lower basin communities, the largest and most important being the fertile and productive Imperial Valley, with its 65,000 inhabitants, all below sea level.
>
> 2. A high dam at Boulder Canyon will hold back the floodwaters of the Colorado River and prevent a recurrence of the disasters of the past. This remedy has been worked out by the government engineers after thorough, exhaustive investigations and studies and has been favorably recommended to Congress by the Secretary of the Interior. Eminent engineers outside of the Interior Department have concurred in and approved the works, plans and cost estimates of the Reclamation Service engineers.
>
> 3. As an incident to this development sufficient hydro-electric power can be generated at the dam to repay the government all money advanced in the construction of the project, together with interest, well within a period of 50 years. Secretary Work in his report on the project estimates that the repayment can be made in 25 years.
>
> 4. Under the provisions of the pending bill, before a dollar of federal money can be appropriated or expended the local interests to be benefited must put up with the Secretary of the Interior valid and binding contracts, agreeing to take water and power at the rates to be fixed by the Secretary, which in the aggregate will guarantee the return to the United States government of the entire cost of the project, estimated by government engineers at $104,000,000, together with 4 per cent interest. Through the taxing powers possessed by the interested municipalities, irrigation and water districts, more than $4,000,000,000 worth of property will be placed back of these contracts.
>
> 5. An unfortunate international complication exists, due to the fact that the entire water supply for 65,000 American citizens in the Imperial Valley, after being diverted from the Colorado River in the United States, flows for approximately 60 miles through Mexico, where the water is subject to diversion and use. It is necessary for the protection of American water rights in all the basin states against the initiation of new rights by water users in Mexico, by an enlarged beneficial use there, that the All-American Canal be authorized to take the place of the present canal.
>
> 6. The magnitude of the project, the fact that the Colorado River is an international as well as interstate navigable stream, the urgent necessity for flood-control works beyond the means of local communities to build, the necessity for an impartial agency to make an equitable distribution of the benefits of the project to meet the legitimate demands of the interested states for water and power, all make the federal government the logical agency to construct this project.
>
> 7. The Swing-Johnson bill now pending before Congress embodies the matured plan of the government engineers.

### Tennessee Valley Report

In connection with the exhaustive survey being made of the Tennessee Valley the Chief of Engineers has submitted to Congress the final report on the Tennessee, Clinch and Powell Rivers and a progress report on the remaining portions of the study. The cost of the Cove Creek dam is estimated at $37,540,000. If it is built, it should be tied in with the Clinton, Melton Hill, and Kingston dams, the report says, which will cost an additional $24,900,000. When property damages are added, the entire project would cost $86,016,000. To develop the maximum power resources of the river, the report continues, nine dams should be built between Knoxville and Colbert Shoals. Dam No. 3 at Muscle Shoals being one. All this would cost a billion dollars.

## Conowingo Goes on Lines

*Power from Two of the Seven Hydro-Electric Generating Units Which Will Form the Initial Installation Is Transmitted to Philadelphia*

ONE minute after midnight on Thursday morning, March 1, power was transmitted to Philadelphia from Conowingo over the 65 miles of wire that already connect the great hydro-electric plant on the Susquehanna River, just across the Maryland boundary, with the system of the Philadelphia Electric Company. The energy thus received was put to use to supply its fraction of the demand. At 12:10 a.m. the recorder showed that 30,000 kw. was coming into Philadelphia from Conowingo. Simultaneously there was a sharp dropping off in the production of two of the company's main steam stations, the Delaware, in northeastern Philadelphia, and Chester station, at Chester, Pa. Operations of the generators at these plants were gradually reduced as the Conowingo turbines came into service.

There was no formal ceremony. Roger Taylor, superintendent of the Conowingo plant, directed the operation, and the flowing of the energy into the Philadelphia system was recorded in the load dispatcher's office at the headquarters of the Philadelphia Electric Company, at Tenth and Chestnut Streets. William H. Taylor, president of the Philadelphia Electric Company, issued a statement, in part as follows:

"The great Conowingo hydro-electric project of the Philadelphia Electric Company is virtually completed, three months ahead of schedule. Thus is inaugurated an engineering project of major importance in the electrical industry, a project that was completed in record time—a hydro-electric project which is the second in importance in the United States and one which will be of the greatest value to the Philadelphia district."

Work on the Conowingo plant was started March 8, 1926. It is expected that its initial installation of seven 54,000-hp. waterwheels will provide about 1,150,000 kw.-hr. of electricity annually from water power. When the transmission system is completed the power will be sent to Philadelphia over two 220,000-volt, three-phase lines. The total cost of the project will be around $52,000,000.

Stone & Webster constructed the plant at Conowingo, subletting part of the work to the Arundel Corporation of Baltimore. The hydraulic machinery now in place was manufactured by the Allis-Chalmers Manufacturing Company (see ELECTRICAL WORLD for March 3, page 475) and the generating units by the General Electric Company. These two firms will each furnish four of the generators and the waterwheels respectively, and three are to be supplied by the Westinghouse Electric & Manufacturing Company and the I. P. Morris Company respectively.

Full-page advertisements announcing the operation of the plant were printed in Philadelphia and New York newspapers by the Philadelphia Electric Company, the General Electric Company and Stone & Webster.

## Excitement Over Radio Legislation at Washington

Geographic equalization of radio zones without regard to great centers of population, the principle embodied in the Watson amendment to the 1927 law, has aroused great opposition in territories threatened with the loss of much of their "air" power, and prophecies are made that passage of such a bill will kill the broadcasting industry. The Radio Corporation of America, the American Telephone & Telegraph Company, Commissioner O. H. Caldwell of the Eastern district and others have come in for attacks from Senator Dill of Washington, Representative Davis of Tennessee and other congressional critics. The House was to consider legislation on Thursday. Last year's provisions expire on March 15, and unless new legislation is enacted or the term of the commissioners, two of whom have not yet been confirmed, is extended, chaos will return.

## Cleveland Electric to Have 59 More Miles of 132-Kv. Line

Announcement comes from the Cleveland Electric Illuminating Company that it will on April 1 begin the construction of a 132-kv. steel-tower transmission line, 59 miles in length, to supply additional electric power in northeastern Ohio. Within the past two years the company has rehabilitated various properties acquired in Lake, Geauga and Ashtabula Counties and has made many improvements and extensions, including 125 miles of 33-kv. lines connecting with Lake Shore and Avon stations. It recently began construction of a second 28-mile 132-kv. line connecting Avon station with the Clinton Road substation, which distributes power to the westerly portion of the Greater Cleveland area. This line will be finished about Aug. 1, at the same time that a new unit will go into operation at Avon station increasing the company's total generating capacity to more than 400,000 kw.

The new northeastern Ohio line will connect with the present 132-kv. system south of Cleveland and will follow a route across Lake County to a substation to be erected in Saybrook Township. There it will be connected with the present 33-kv. system. The line will consist of approximately 450 steel towers, supporting six copper wires strung in spans averaging 700 ft. The right-of-way will be about 100 ft. wide. With its completion the company will have 137 miles of 132-kv. transmission.

The new transmission project brings the company's 1928 budget for improvements and extensions up to $11,600,000. The new line will take several months to complete and will call for an investment of approximately $1,800,000.

## Truck Users Relate Experiences at Conference

An unusually good program was carried out at an electric truck conference in New York City, March 6, 7 and 8, held under the auspices of National Electric Light Association committees and in conjunction with the eighth annual electric truck exhibit in the New York Edison-United Companies building. Talks by users of electric truck fleets were the feature of the conference. The speakers were Matthew J. Gory, United Dressed Beef Company; George Ford, American Railway Express Company; F. P. McDaniels, Western Electric Company; Joseph Husson, Electo Company (Lord & Taylor and McCreery & Company, department stores); Charles S. Morris, Metropolitan Fireproof Warehouse Corporation; H. A. Currie, New York Central Railroad; Charles F. Wark, Pilgrim Steam Laundry, and Henry Fallerius, Bloomingdale Brothers (department store).

Utility representatives from New York, Newark, Boston, Cleveland, Chicago, Indianapolis and Pittsburgh outlined their electric truck sales programs. J. C. Boyers, Ward Motor Vehicle Company, and C. B. Cook, Industrial Truck Manufacturing Company, presented addresses from the manufacturer's angle. At a session of the truck-operating committee of the Metropolitan Section, N.E.L.A., reports of experience in the maintenance and servicing of trucks in New York, Baltimore, Chicago, Detroit and New Jersey were presented.

## New York Assembly Rejects Smith's Power Bills

The New York State Assembly last Monday, after a sharp debate, rejected, by a vote of 85 to 60 motions to bring both Governor Smith's water-power measures out of committee. One of the Governor's measures would create a state Power Authority to bring to the next Legislature a comprehensive plan for the development by the state of its hydro-electric resources. The other bill would submit the question of power development to the voters of the state this fall through a referendum. The Republican leaders now are planning to rush through their own water-power proposal, providing for a commission to investigate and report back to the 1929 Legislature. Governor Smith intends to veto the measure.

## "Inverted Speech" by Telephone Demonstrated

Before the New York Electrical Society on Wednesday evening of this week, Sergius P. Grace, general commercial engineer of the Bell Telephone Laboratories, demonstrated a process for "inverting" or "scrambling" words or sentences spoken over the telephone so that they are incomprehensible to any "listener in" and then reconverting them to their ordinary sound for the intended recipient. This is accomplished by the manipulation of sound frequencies at the transmitting end and their retranslation at the receiving end. Mr. Grace worked the device also in the reverse way, enunciating meaningless or imaginary words which the loud speaker used gave forth as proper ones. Possibilities of a commercial use for this process, where secrecy is desired, suggest themselves, but these have apparently not yet been worked out. Any intention to apply the method, which can, of course, be used with music as well as words, to radio transmission to enforce the purchase of patent "unscramblers" is emphatically denied by telephone officials.

## Quebec Authorizes Beauharnois Power Project

The private bills committee of the Quebec Legislature has placed the seal of approval on a bill whereby the Beauharnois Light, Heat & Power Company is authorized to build a power canal between Lake St. Francis and Lake St. Louis, developing 500,000 hp., half of which may be exported to the Province of Ontario on conditions fixed by the provincial government. A feature of the vote on the bill was that all the ministers of the government voted for it, a fact which in itself meant the success of the measure, though it was not a government bill. Premier Taschereau had previously pronounced himself in favor of the project as being one for the general benefit of the province, and particularly beneficial to the district of Montreal, which would have 500,000 hp. developed at its very doors. The federal government must also give its sanction. Doubt exists whether this sanction will be given until the courts decide the question of federal and provincial jurisdiction of water powers developed on navigable waterways.

When the engineers who investigated the St. Lawrence scheme submitted their report, they favored a route on the north side for the waterway in the district in question, although also commending the southern route where the proposed Beauharnois canal is to be located. With the interests behind this concern the names of prominent financiers like Frank P. Jones and E. R. Wood are associated. They are understood to have offered to build the canal and present it free for navigation as part of the St. Lawrence waterway if they receive compensation in the form of the power rights incidentally developed. Opponents of the bill contend that it means drying up the St. Lawrence River between Lake St. Francis and Lake St. Louis and thereby putting an end to existing power plants on the St. Lawrence, including those of the Canadian Light, Heat & Power Company and the Cedars Rapids development of the Montreal Light, Heat & Power Company. The first-named company has a development of 30,000 hp. at St. Timothée, having used the old Beauharnois canal under lease.

## Voltage Up to 3,600,000

*New Record Set in the Production of Artificial Lightning at Pittsfield Is Reported by F. W. Peek at St. Louis Regional Meeting of A.I.E.E.*

ARTIFICIAL lightning of 3,600,000 volts, the highest ever obtained and about seventeen times greater than that of any transmission line in this country, has been produced in the high-voltage engineering laboratory of the General Electric Company at Pittsfield, Mass. F. W. Peek, Jr., in charge of this work, announced the achievement March 7 in speaking before the regional convention of the American Institute of Electrical Engineers in St. Louis. The new generator is unique in operation. The electricity is gradually stored in artificial clouds just as electricity is stored in real thunder clouds, Mr. Peek said, and is then discharged in a blinding flash.

*A 3,600,000-volt artificial flash*

"Lightning sparks produced by these voltages, lasting but one ten-millionth of a second, can be seen as a blinding flash. However, as light travels about 100 ft. in that time, the phenomenon is all over when a person standing but 100 ft. away sees it or when the light reach him, Mr. Peek explained.

The Pittsfield laboratory has pioneered in the development of power transmission and high voltages since it supervised the construction of the first 15,000-volt line in 1891. Seven years ago this laboratory was first to announce 1,000,000 volts, four years later 2,000,000 volts was announced, and now come voltages almost twice as great. Although these voltages frequently have a duration of less than a millionth of a second, their rate of rise and fall or wave shape has been accurately measured by the cathode-ray oscillograph developed by the general engineering laboratory of the General Electric Company at Schenectady.

"The object of the study is to secure scientific information on the nature of electricity and to obtain further engineering information on the protection of life and property against lightning, to build transmission lines, transformers and other electrical apparatus to resist lightning voltages," Mr. Peek said.

From direct voltages of 3,000,000 voltages of more than 5,000,000 of very short duration were observed by reflection from the open end of a line in the experiments, Mr. Peek said. Mr. Peek and his associates have been experimenting with these voltages for many months, and he laid emphasis on the fact that his success was in a large measure due to the assistance of his associates.

A report of the St. Louis meeting of the Institute will be printed in next week's ELECTRICAL WORLD.

## Seattle Lighting Department Records Progress

In its report for 1927, just available, the Seattle Lighting Department chronicles the beginning of the work on Diablo Dam designed to give the Gorge plant a dependable peak capacity of 40,000 kw., says that machinery for Cedar Falls unit No. 6 has been ordered and may be in operation for next winter's peak, and urges the immediate construction of a second Skagit transmission line at a cost of $2,218,000 and the immediate installation of a third unit at the Gorge, to develop 25,000 hp. and operate in 1928, and of the first two 40,000-hp. units of the Diablo plant, to operate in 1929. This 105,000 additional horsepower is to cost $3,620,000—$600,000 for the Gorge and $3,020,000 for Diablo—or only $34.48 per horsepower. Later on another 40,000 hp. at Diablo is to cost $760,000. The report condemns the proposed Hanging Rock dam as uneconomical—"a financial and engineering blunder."

The report, after recording a substantial gain in earnings and output, makes the following reply to the argument for taxation of municipal plants:

> The average rate throughout the country for electric current for lighting during 1927 was 6.6 cents per kilowatt-hour as against 2.73 cents per kilowatt-hour for city light. The electric company sells approximately $3,400,000 worth of current in Seattle per year and the city $4,300,000 worth, making a total in the neighborhood of $7,700,000 per year in Seattle and vicinity. If this current were sold at the average rate prevailing throughout the country, it would cost the consumer $17,000,000, which indicates a saving from municipal competition of $9,300,000 per year. When we consider that the total amount of taxes for the city of Seattle for 1927 was $8,500,000, the argument that the city is losing a great deal of revenue because city light is not taxed entirely loses its force. As a matter of fact, the tax paid by our competitor for the year 1926 amounted to only 0.82 mill per kilowatt-hour of current sold.

The City Council has passed a bill appropriating $625,000 for the third unit and other equipment of the power plant and system at Gorge Creek. It is designed for completion in the winter of 1928-29.

## Political Echoes Resound in Public Utility Field

Charles M. Hay of St. Louis, a Democratic candidate for United States Senator from Missouri, in opening his campaign condemned public utility holding corporations that apparently are outside the regulation of the state public service commissions, indorsing the investigation proposed by United States Senator Walsh of Montana. Mr. Hay advocated rigid regulation of the sale of securities of such holding corporations and declared that Congress should conduct an honest and thorough investigation into the operations of the holding companies and then act promptly if remedial action can be taken.

Attorney-General O. S. Spillman of Nebraska is a candidate for the Republican nomination for United States Senator, contesting with Senator R. B. Howell, who won the place six years ago with a record as a municipal ownership man. In his statement to voters asking for support, Mr. Spillman makes much of what he terms his successful effort to curb "the power trust" by the injunction secured in Cedar County restraining the Interstate Power Company from cutting rates below cost to destroy a plant erected by the Hord company under a contract to sell the same to the city. He claims that it was an important victory because it established that in law electrical energy is a commodity, thus making it possible to prevent discrimination in prices as between communities.

Olin R. Holt, an attorney of Kokomo, Ind., has announced he will seek the Democratic nomination for Governor of Indiana on a platform pledging himself if elected to work for the abolition of the Indiana Public Service Commission. The law creating the Indiana commission was passed at the 1913 session of the Legislature.

Ex-Senator Frederick W. Hinckley, South Portland, Me., who is a candidate for the Republican nomination for Governor, is sponsor for a plan to bring electric light service to more rural sections of Maine. He declares: "I believe the time has come for the State of Maine to give financial aid toward the construction of transmission lines into these localities, and at the next Legislature this matter should have most serious consideration, with a view of putting it into practical effect. I know of no greater service the Legislature can render than this."

## Power Commission Interested in Herminghaus Decision

The Federal Power Commission has asked the Railroad Commission of California to defer its decision on the application of the East Side Canal & Irrigation Company for approval of the transfer of riparian lands and rights owned by that company on the San Joaquin River to the Southern California Edison Company. The Federal Power Commission's plea is based on the fact that the East Side company case is the outcome of the California Supreme Court's decision in the suit brought by the Herminghaus estate against the Southern California Edison over the matter of riparian rights in connection with the California Edison company's development of water power. The Federal Power Commission says that the United States, not having been a party to the suit, did not have its rights adjudicated and is not bound by the decision and that the Attorney-General is now considering a suit to establish the rights of the United States.

# "Electrical World's" London Letter

### Electrical Service in England Under Flood Conditions—Submarine Cables Versus "Beam" Radio—Electrical Contractors as Retailers—Rural Supply of Energy

By Bernard C. Holding
Editor of *The Electrician*

London, March 1, 1928.

When the Mississippi River so disastrously stepped out of its course a year ago very few people in this country could visualize what appalling disaster such an event can create. In January Londoners experienced for themselves, though on a very much smaller scale, its baneful effect. In that month the overflowing Thames burst through an embankment into a congested city area and within a few minutes drowned numbers of sleeping residents. The inundation took place in the night, but although a number of the power stations in the affected area were partly flooded, there was no single case of a failure to supply electricity, though one badly affected station had to requisition a supply from an interconnected plant. In many cases a supply was maintained only by the unremitting efforts of the power-station staffs, and in one instance an assistant charge engineer, at great risk to himself, remained waist-deep in water for five hours regulating the steam-driven rotary boiler-feed pumps, as the governor by which they were normally regulated had been put out of action by the flood. Although the damage done to the generating stations was comparatively slight, damage to substations, feeder pillars and other parts of the systems was considerable. A good deal of damage was done to consumers' installations, and one plant in an industrial area reported a drop of 100,000 kw.-hr. in its weekly demand.

The submarine-cable communication companies, which have long professed indifference to the growing competition of the "beam" radio system, have suddenly changed their views, and the government has been asked whether it will take steps to bring about co-operation between the two methods of communication. The chief obstacle in the way of the realization of such a proposal lies in the fact that it would be very difficult to formulate a scheme which would give the cable companies what they want without entailing considerable sacrifices on the part of the wireless interests. Meanwhile two eminent chartered accountants, one representing the cable companies and the other Marconi's Wireless Telegraph Company, are preparing a joint report on the whole situation. Pending the issue of this report, it would be unwise to anticipate any closer relation between the rivals.

The electrical contractors, who have not as a class shown particular interest in the retailing of electrical goods through a shop, are now beginning to pay attention to this side of the business. Many of them hold that an electric shop, unless supported by a flourishing installation business, is not a paying proposition, in view of the present state of domestic electrification in this country. Be this as it may, many hardware men, druggists, garage keepers, musical-instrument dealers and other retail traders have been quick to see the possibilities for the extensive sale of domestic electrical appliances and are planning to develop this trade. As an instance of the extent to which retailing has got away from the electrical trade, it has been stated by the sales manager of a company selling electric tools that only 2 per cent of his total sales of these appliances goes through the electrical trade. Realizing the coming competition, the electrical contractors are now actively discussing the potentialities of electrical shopkeeping.

The doubts that have long been expressed as to the ability of the national electricity scheme to give supplies to the "truly rural" areas, which now depend on oil and other primitive methods of illumination, were strengthened by a recent statement by the Minister of Transport, in which he said that after long and careful consideration he had evolved a plan for submission to the government whereby in certain rural areas electricity would be available for all who wanted it. Those who remember the promises—made while the new electricity act was before Parliament—that the scheme would "save British agriculture" are beginning to wonder whether they heard aright!

On the personal side, January saw the bestowal of a knighthood upon J. R. Brooke, the secretary of the Central Electricity Board, while W. T. Leech, director of telegraphs and telephones at the General Post Office, has been made a C.B. (civil division). As you have very likely already noted, the seventh award of the Faraday medal has been made to Prof. J. A. Fleming, F.R.S. Death has removed several important members of the electrical community. Among those whose loss will be widely felt are Leon Gaster, the founder of the Illuminating Engineering Society; Charles Vernier, probably the most prominent of our mains engineers, who was responsible for the laying down in County Durham of the first large 20,000-volt cable system in the world; Charles Day, a well-known lift engineer and a director of Waygood-Otis, Ltd., and James A. Harris, who at one time occupied important positions with the Westinghouse Electric & Manufacturing Company, Pittsburgh, and at the British Westinghouse Company's Manchester works.

## Louisville's 100,000-Kw. Automatic Hydro Station

WHAT the manufacturer calls by far the largest automatically controlled hydro-electric station in the world will soon be in regular operation on the Ohio River at Shipping Port, just below Louisville. This station was recently completed for the Louisville Hydro-Electric Company and will generate 100,000 kw. In design, construction and operation it represents a complete departure from conventional practice. The present installation consists of eight 12,550-kva. vertical-shaft generators operating on a terminal voltage of 14,000. Space is provided on the dam for two more generators in the future, which will bring the ultimate capacity of the station up to 125,500 kva. All generating and control equipment was manufactured by the General Electric Company.

*Shipping Port automatic station has unusual features*

The principal unique feature of the station resides in the electrical layout. The conventional switchboard has been entirely eliminated and has been replaced by individual control panels installed in cabinets or "cubicles" alongside of each generator. Each cubicle contains relay mechanisms for starting, running and stopping its generator, together with protective equipment for emergency conditions. A synchronism and voltage checking device makes it possible to connect a generator to its bus until electrical conditions are correct. In normal service the station is under the management of a supervisor centrally placed at his controlling cabinet. When the load demand increases the supervisor indicates by means of a signal light on a generator cubicle that this machine is needed on the line. The floor attendant immediately operates the starting button on this cubicle, and the gate-operating mechanism is put in motion, bringing the generator up to speed. As soon as the machine is in rotation the automatic control devices come into play and the incoming machine is placed on the bus as soon as its electrical conditions are correct.

The extremely erratic behavior of the Ohio river produces a head of water on the station varying from zero to 37 ft. The high-water low-head season lasts about three months of the year, and during this time the station will be shut down. When the effective head has reached 9 ft. it is possible to carry a light load on the generators, and this load is increased until a maximum head of 37 ft. permits the station to generate its full capacity. A peculiarity of the station is that there are no windows within 25 ft. of the generating room floor, as the station is virtually half under water during the flood season.

The dam and building, of which a bird's-eye view is shown above, were designed and constructed by the Byllesby Engineering & Management Corporation. The power generated is sold to the Louisville Electric Light Company, after transmission at 66,000 volts over two miles of line to the steam station of the company in the city of Louisville.

## Purchases and Mergers

*Stone & Webster Announce Another Group Organization of Large New England Companies — New Holding Company Has Plants in Five States*

STONE & WEBSTER have announced the formation of a voluntary Massachusetts association to be known as the Eastern Utilities Associates for the merging of New England public utilities which have gross earnings of $8,500,000. The companies immediately involved are the Blackstone Valley Gas & Electric Company, the Edison Electric Illuminating Company of Brockton and the Electric Light & Power Company of Abington and Rockland. They are already physically connected.

A new holding company to be known as the Atlantic Public Service Corporation will, besides water and ice concerns, take over six companies giving electric service and formerly controlled by the Atlantic Public Utilities, Inc. They comprise the Caribou (Me.) Water, Light & Power Company; the Shenandoah River Power Company of Meyer's Falls, Va.; the Potomac Valley Power Corporation of Petersburg, W. Va.; the Indiana Light & Power Company of Defiance, Ohio; the Ohio Northern Public Service Company of Bowling Green, Ohio, and the Provincetown (Mass.) Light & Power Company.

All necessary preliminaries having been complied with, the Delaware Electric Power Company (formerly the Wilmington & Philadelphia Traction Company) became a part of the United Gas Improvement Company system on the first of the month, in accordance with announcement.

The Dowagiac (Mich.) Light & Power Company has been taken over by the Middle West Utilities Company. The properties, consisting of the electric and gas distribution systems serving the city of Dowagiac and the village of Cassopolis, will be operated by the Michigan Gas & Electric Company.

The Central Power Company has purchased the distribution system from the municipality of Brock, Neb. The Village Board of Palmer, Neb., has agreed to sell its municipal distribution system and electric light plant to the Central Power Company, provided the voters approve in April.

The Wisconsin Power & Light Company has purchased a number of small electric lines in the vicinity of Prairie du Sac. These purchases embrace the Sauk-Prairie Light & Power Company, Sauk County Utilities Company and part of the lines of the Prairie Electric Company.

The Missouri Public Service Commission has authorized the Central States Edison Company of Delaware to purchase the common stock of the Gasconade Power Company, operating in Gasconade, St. Aubert, Bonnet's Mill, Osage City and other towns in east central Missouri. The company will pay $186,200 for the stock, which has a book value of $173,779.

Ownership of the electric light plants of Mansfield, Ava, Seymour, Norwood and Mountain Grove, Mo., has been transferred to the Interstate Power & Light Corporation of Chicago, which has purchased the systems from the Central States Power & Light Corporation of Davenport, Iowa.

The Indiana Public Service Commission has approved the purchase by the Interstate

Public Service Company of the Midway Electric Company of Shipshewana for $20,000.

The Suburban Power Company has been authorized by the Ohio Public Utilities Commission to sell its property in Erie, Sandusky, Wood and Lake Counties to the Erie Power & Light Company for $75,000.

Three Iowa towns sold their electric distribution systems in February—Jolley to the Iowa Public Service Company, Waukee to the Iowa Power & Light Company, and Halbur to the Iowa Public Service Company.

Stafford, Kan., has lost its fight before the Kansas Public Service Commission to prevent the sale to a private company of the municipal distribution system of Sylvia, an adjacent town which has been served for a number of years from Stafford's municipal power plant.

The M. B. Light & Power Company, operating in Morrisville, N. Y., and near by, has made application to the Public Service Commission for authority to transfer its franchises and system to the New York State Electric Corporation.

Eight million dollars is announced as the price paid by the Oklahoma Power & Light Company for the Charles Page utilities at Sand Springs (Electrical World, Feb. 25, page 423).

## Missouri Has 600,000 Hp. in Undeveloped Water Power

A survey of the undeveloped water resources of Missouri completed in 1927 by H. A. Buehler, State Geologist, showed approximately 600,000 hp. susceptible of profitable commercial development. Virtually all of the sites included in the list are now under permit, various corporations and individuals having obtained rights from the Federal Power Commission, and many of these permits are now being offered to public utility companies. The chief sites listed in the Buehler survey are:

White and James Rivers in Barry, Stone and Taney Counties, 220,000 hp.; under permit to the Empire District Electric Company of Joplin.

Black River, near Piedmont, in Reynolds and Wayne Counties, 30,000 hp.; under permit to W. H. Meridith of Poplar Bluff. The Black River Hydro-Electric Company took bids on construction of this project on June 24, 1927, but no further action has been taken, pending financing and arranging contracts for sale of energy.

Current River, in Carter, Ripley and Shannon Counties, 100,000 hp.; permit held by the Missouri Hydro-Electric Company of Kansas City.

Osage River, 6 miles above Bagnell, in Miller County, 100,000 hp.; permit held by the Missouri Hydro-Electric Company under option to Stone & Webster of Boston; Union Electric Light & Power Company of St. Louis considering taking over this project.

Gasconade River, in Pulaski and Phelps Counties, 100,000 hp.; permit held by the Central Missouri Power & Water Company.

The White River Power Company, through Hugh L. Cooper and the North American Company, has applied for a federal permit for the use of White River in Taney County, while the Gasconade River Power Company has applied for a permit to use Gasconade River in Osage, Maries and Phelps Counties.

## Briefer News

**Texas City Plant Will Generate 6,000 Kw.**—Construction of the Texas City electric power plant announced by the Texas Gulf Power Company will be started soon, according to P. J. Hayes of Galveston, district manager. The plant will cost approximately $350,000 and will have a capacity of 6,000 kw. From it there will be constructed a system of wooden-pole transmission lines to towns of the Gulf Coast section.

**North Carolina Town to Build Hydro Plant in Agreement with Mill Company.**—The town of Marshall, N. C., and the Marshall Mill & Power Company have entered into a contract whereby, on the approval of the voters, the town is to take over the company's water-power site on the French Broad River and rebuild and enlarge the mill plant. The mill will purchase power at $5,000 a year. The new plant will be rated at about 1,800 hp. and will, it is estimated, cost $175,000 besides $90,000 for the site.

### Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

Northwest Electric Light and Power Association — Accounting Section, Portland, Ore., March 12. Berkeley Snow, 1208 Spaulding Building, Portland, Ore.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 13-15. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Illinois State Electric Association—Hotel Abraham Lincoln, March 14-15. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

National Electrical Manufacturers' Association—Policies Division, Edgewater Beach Hotel, Chicago, March 14-16. S. N. Clarkson, 420 Lexington Ave., New York.

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N. E. L. A.—Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Institute of Electrical Engineers — Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

**European Tour for Engineers.**—Engineers associated in the Midwest Power Conference are planning to go abroad on an "international power tour," sailing from New York on Aug. 18. While in Europe they will visit large power plants and new developments in various countries. The tour will last six weeks and there will be time for sightseeing and scenery. Headquarters for the tour have been established at Suite 656, 25 Broadway, New York.

**A. W. Burchard's Aid to Arbitration to Be Theme of Memorial Luncheon.**—The American Arbitration Association is to hold a luncheon on March 15, at the Astor Hotel, New York, to signalize its appreciation of the contribution to arbitration made by the late Anson W. Burchard of the General Electric Company, first president of the association. The speakers at the luncheon will be Owen D. Young, Lucius R. Eastman and Julius H. Barnes.

**Philadelphia-Suburban Counties Gas & Electric Cuts Rates.**—A rate reduction to consumers of electricity in Philadelphia suburbs embracing a territory of about 1,400 square miles, with a population of more than 600,000, is announced by the United Gas Improvement Company, which says that the cut will result in a large saving to customers of its subsidiary the Philadelphia-Suburban Counties Gas & Electric Company. Under the new schedule the rate will be 10 cents a kilowatt-hour for the first 50 hours instead of 11 cents.

**About $2,500,000 Asked from Legislature for Ontario Hydro This Year.**—Hydro requirements bulk large in the Ontario government estimates for the year 1928, which were tabled in the Legislature on March 1. The total requisition for hydro purposes is $2,470,000. Of this, $400,000 is for transmission and distribution lines and rural distribution in connection with the Niagara system. The largest single item is for the St. Lawrence and Ottawa Hydro system, $1,250,000 being set aside for transmission lines and $350,000 for transformer stations on this system.

**Modesto-Don Pedro Transmission Line Ready in Spring.**—Construction work on the Modesto Irrigation District's direct transmission line from Modesto to Don Pedro, under way for ninety days against adverse conditions, is progressing rapidly, and completion in the spring is assured, according to B. W. Creim, chief electrical engineer of the district. This line, on the north side of the Tuolumne River, is to be 40 miles in length. It will insure the district against interruption in service, according to Mr. Creim, who further believes that it will pay for itself in from five to six years through reduced cost of transmission, even though the rate of consumption does not increase.

Missouri Commission to Inquire Into St. Louis Energy Rates.—The Union Electric Light & Power Company of St. Louis having shown in its annual report a net income above all expenses and interest charges of $5,214,479 for 1927, an increase of $927,142 over 1926, certain newspapers are agitating for a decrease in rates, and the Missouri Public Service Commission, with this object in view, has requested the company for additional data. The residential rate is the one where a cut is thought particularly desirable by the commission if it proves feasible.

Specifications for Mackenzie River Plant at Eugene, Ore.—Bids have been advertised for a portion of the equipment to compose the first 9,000-hp. unit of the 18,000-hp. Leaburg development of the city of Eugene, Ore., known as hydro-electric power plant No. 2 of that city. The Leaburg development requires a diversion dam on the Mackenzie River, 20 ft. high, with three 100-ft. gates and a 30-ft. sluicegate. Tie-in with the present system will be effected by 10 miles of 44,000-volt transmission line from Leaburg to plant No. 1 at Waterville.

Birmingham's Street - Lighting System to Be Tripled in Two Years.—It is the ambition of James Jones, Jr., president of the City Commission of Birmingham, to make that city the best-lighted in the South. He announces that the city is about to complete two new "white ways," one on Fourth Avenue North and the other in the West End on Tuscaloosa Avenue. The first "white way" includes about 100 new lamps and the second 126. In December, 1926, Birmingham had just 501 street lamps; in December, 1927, it had 927, and it plans to have 1,527 by December, 1928, Mr. Jones states.

Permits Sought for Arizona Sites on Colorado River.—Application has been filed with the Federal Power Commission by the Arizona State Board of State Institutions for the development of a hydro-electric project at Grand Wash on the Colorado River. It is stated that 400,000 hp. may be obtained at this point by the construction of a 383-foot gravity dam. The board will also file similar applications for hydro-electric plants at Pearce's Ferry, Flowersack Rapids, Devil's Slide and Bridge Canyon. Applications for hydro-electric plants at these places have also been filed by the Arizona High Line Canal Association.

Oswego, N. Y., to Negotiate for Further Water-Power Rights on Canal.—Oswego, N. Y., wishes to acquire the riparian rights at the east end of Dam No. 6 in the Oswego River so that the city may use the full flow of the river at the dam. Both the Battle Island Power Company and the State of New York claim ownership of these rights, and the city will probably open negotiations with both while awaiting a judicial decision on ownership. The Battle Island company, it is stated, has asked on previous occasions $100,000 for its rights. The municipal power plant at the west end of Dam No. 6, now nearing completion, contains two extra wheel pits for use if the city obtains the rights to the power at the east end.

Indianapolis Church Adopts Floodlighting as Permanent Attraction.—So pleased were the members of the Broadway Methodist Episcopal Church in Indianapolis with the result attained by floodlighting their new building during the week set aside for dedication exercises that they decided on a permanent installation which is now in operation. The Robbins Electric Company placed four 1,000-watt floodlamps on the four sides of the tower, and the Indianapolis Power & Light Company supplies the electrical energy.

Gould Street, Baltimore, Will Soon Raise Consolidated Company's Rating to 260,000 Kw.—The increase in the Consolidated Gas, Electric Light & Power Company's generating capacity provided by the completion of the first unit of the new Gould Street power station and the rapidly approaching completion of the second unit is noted in the company's annual report, just issued. Completion of the new unit will bring the company's total rating to approximately 260,000 kw., to which is added an available hydro-electric supply from the Pennsylvania Water & Power Company's Holtwood plant amounting to 80,000 kw. With the close of the year a new agreement was made with the Pennsylvania Water & Power Company covering a period of 43 years, making it co-extensive in time with the 50-year contract between the Consolidated and the United Railways & Electric Company of Baltimore for the supply of power to the last named.

Maine's 66,000-Volt Line Nearly Completed.—The Central Maine Power Company is finishing its high-voltage transmission line from Gulf Island to Maxcey's, a distributing center. An interesting feature of this line is the crossing over the Kennebec River at Brown's Island. In order to maintain the clearance for shipping required by the United States government it was necessary to erect five steel towers, the two largest of which are 190 ft. high. They provide for jumping the river in two spans of 825 ft. and 95 ft. each. At Gulf Island an addition to the present substation has been built of 15,000 kva. capacity, stepping up the current from 33,000 volts to 66,000 volts, which can be raised later to 110,000.

Convention of American Oil Burner Association.—Plans for co-operation between oil producers and electric light and power companies in serving the users of oil-heating apparatus will be an important topic at the annual convention of the American Oil Burner Association, to be held at the Hotel Stevens in Chicago on April 3-5. A representative of one of the large electrical companies will speak on the relation of the central station to the oil-heating industry, and the interest of the oil producers in the utilization of oil fuel by owners of homes and commercial buildings will be discussed by an official of one of the large oil companies.

Zilwaukee Plant Extension on the Saginaw Three-quarters Completed.—Work started by the Consumers Power Company last May at its Zilwaukee steam plant on the Saginaw River, near Saginaw, Mich., is more than three-quarters finished. The extension consisted of a 30,000-kw. Allis-Chalmers turbo-generator, four 1,234-hp. boilers, a 3,500-kw. General Electric house turbine and 45,000 kva. in additional transformer capacity. The original installation at Zilwaukee was 40,000 kw. in two units. In addition, the greater part of the 41,500 kw. generated on the Au Sable River and the 13,000-kw. output of the plants of the Wolverine Power Company on the Tittabawassee feed into the outdoor substation. When the new unit is on the line there will be about 125,000 kw. concentrated at the Saginaw River plant.

Radio Standardization Furthered by the A. E. S. C.—An effort to stabilize the radio industry through the establishment of national standards of construction and quality of radio apparatus is being made by the American Engineering Standards Committee, which announces the election of Dr. Alfred N. Goldsmith, president of the Institute of Radio Engineers, to the chairmanship of its committee on radio standardization. The radio committee includes in its membership representatives of the departments of War, Navy and Commerce as well as of the radio industry and interested national associations and groups. Other radio committee members just elected are Dr. Clayton H. Sharp of the Electrical Testing Laboratories, vice-chairman, and C. B. Jolliffe of the United States Bureau of Standards, secretary.

Quebec's Revenue from Water-Power Rights.—A report presented to the Legislative Assembly of the Province of Quebec by the Minister of Lands and Forests shows that revenue from water powers in that province is growing large. For the year ended June 30, 1927, it totaled $802,010. The still incomplete development of the Duke-Price Power Company at Ile Maligne has just come into the revenue-paying class, paying the province $9,775. Of the $802,010 mentioned, $468,103 came from the five big dams constructed by the Quebec Streams Commission, which can furnish a flow for many additional developments.

Mr. Blackwell Talks on Prevention of Accidents.—Plans for the prevention of accidents to workers in the public utility companies of Ohio, West Virginia and Kentucky were discussed at Cincinnati last week as part of an open conference of the accident prevention committee of the East Central Division, N.E.L.A. H. C. Blackwell, president of the Union Gas & Electric Company, Cincinnati, asserted that accidents are nearly always due to carelessness on the part of the men injured and their disregard of the instructions laid down by the management. "We have found that the only remedy for carelessness is either to discharge or to lay off," he said. "All work should be done under predetermined specifications couched in the language of the men who are to obey them." He urged that responsibility in the case of a large utility organization be centered in one man, but that that man have committees of the various departments working under him.

Interconnection in Minnesota.—Speaking before the annual convention of the Minnesota Federation of Architectural and Engineering Societies, held at Minneapolis Feb. 17 and 18, on "Local Electric Power Stations Versus Interconnection," Oscar Gaarden, sales engineer Northern States Power Company, reported: "As nearly as can be determined, there are in Minnesota today 860 communities receiving central-station electric service. Of these, 746 receive service from interconnected systems and 114 have isolated plants. Of the 860 communities, 230 are served on the retail basis by the largest system, 155 by the second largest, 83 by the third largest, 44 by the fourth largest, 35 by the fifth largest, 114 by small transmission networks and 43 by isolated private plants. Of the 156 communities served by municipal distribution systems in the state, 85 purchase energy from transmission lines and 71 have isolated plants. Of the total number of communities served, 18 per cent are owned by the municipality and 82 per cent by private companies."

Oregon Officials Oppose Further Permits for Hydro Plants on Intrastate Streams.—Oregon's fish and game authorities have announced a definite stand against the further construction of any hydro-electric plant along any state stream or river with exception of locations in the vicinity of headwaters. The fish commission assumed this attitude following a hearing before the State Engineer which involved applications filed by the city of Eugene for authority to establish additional hydro facilities on the Mackenzie River. State Engineer Luper has taken the Mackenzie River dispute under advisement.

# Commission Rulings

Public Notice of Consolidation in Nebraska a Condition Precedent.—The Nebraska Railway Commission, by a two-to-one decision in a telephone merger, has determined that a constitutional provision regarding the giving of public notice covering at least 60 days to stockholders of the contemplated consolidation of competing public utilities is mandatory, not directory, and is a condition precedent to its approval of the consolidation. The minority of the commission held that since that body has no authority to settle disputes between stockholders and no power of management, its duty in the matter of approving consolidations ends when it finds that the proposal is in the public interest. It will assume that the officers of the corporation will obey the constitutional mandate and is without power to make such obedience a condition of approval.

Utility May Be Compelled to Serve Below Cost.—In refusing the Lincoln Telephone & Telegraph Company permission to raise rates at its Endicott exchange to a level where a return on the investment would be insured, the Nebraska Railway Commission held that public utilities may on occasion be required to continue the operation of portions of their property which may be unprofitable, and even though such operation involves a loss, it is not confiscation of property. The commission held that the proposed rates in the case under notice were greater than the service was worth, would result in depriving a number of patrons of telephone service and enable the company to do indirectly what it has not been able to do directly, bring about the abandonment of the exchange. The law requires a 60 per cent petition of patrons for abandonment, and this the company was unable to obtain. The commission maintained that the test of whether the service is worth the rates is what subscribers on adjoining exchanges pay without protest. It pointed out that, while charged with the responsibility of authorizing rates which are not confiscatory to the utility, it must also provide a rate which is fair to the rate-paying public and not in excess of the value of the service.

# Recent Court Decisions

Right and Wrong Charges to Jury on Negligence of Company.—A judgment for the defendant in Iron City Grain Company vs. City of Birmingham—a suit for damages for destruction of plaintiff's place of business by fire because of alleged negligence by the city in furnishing electricity and maintaining equipment—has been reversed by the Supreme Court of Alabama. This court found erroneous a charge that if the jury could reconcile the evidence with a theory that the defendant was not negligent, it was the jury's duty to do so, and a charge that before the jury could find for the plaintiff it must be satisfied that the facts were inconsistent with the theory that defendant was not negligent was declared confusing and misleading. There was, however, no error in charging that the law did not presume the defendant negligent or that defendant had no duty to maintain wires inside plaintiff's building, there being evidence that the city installed the wires without compensation. A charge that proof which showed only that a thing could have happened in a given way did not warrant the conclusion that it did happen that way was not a reversible error, though it might have been refused. (115 So. 99.)*

"In the Public Interest" Means "Not Detrimental to the Public."—In remanding the case of the Electric Public Utilities Company vs. West to the Maryland Public Service Commission (Electrical World, Feb. 25, page 422), the Court of Appeals of Maryland defined "the public interest" as conceived by it. The commission, as before chronicled, had refused to permit the Electric Public Utilities Company to purchase from Thomas O'Hara the stock of the Home Electric Light Company of Lonaconing, the Emmitsburg Electric Company, the Antietam Electric Light & Power Company and the Midland Electric Light Company, four Maryland corporations, because it could not "see wherein the public will be benefited in the slightest degree." The Court of Appeals on this point said: "In the case of an owner of the stock of such a company is it within the rule of reason to hold that he may not sell his stock to a corporation unless it can be shown that the public will be benefited by the sale? Or may permission be refused merely because the only consideration moving the parties is one of financial investment which the parties believe to be for their mutual advantage? We think not. If public utilities could be owned only by people whose primary purpose is to benefit the public, few of them would be privately owned. Until human nature changes, enlightened self-interest as the moving cause of enterprise is about the best that can be expected. To prevent injury to the public in the clashing of private interest with the public good in the operation of public utilities is one of the most important functions of public service commissions. It is not their province to insist that the public shall be benefited as a condition to change of ownership, but their duty is to see that no such change shall be made as would work to the public detriment. 'In the public interest,' in such cases, can reasonably mean no more than 'not detrimental to the public.'"

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

**Rufus E. Lee**, formerly president of the Continental Gas & Electric Company and at the present time an investment banker with headquarters in Omaha, has been made head of the Tax Research Association of Nebraska. This association concerns itself with the task of scientific study of taxation with the idea of making recommendations to the Legislature for reforms. Mr. Lee was a pioneer in Nebraska's electrical development.

**Carroll G. Bennett**, formerly chief engineer of the Illinois Commerce Commission, has been appointed chief engineer for the Public Service Company of Northern Illinois. Mr. Bennett's early experience was with the Allis-Chalmers Manufacturing Company and with L. B. Stillwell, consulting engineer, New York. He spent some time with the department of water supply of New York City before removing to Springfield, Ill., in 1921, as assistant chief engineer of the Illinois commission.

**William W. Trench**, assistant secretary of the General Electric Company, has been elected secretary of the company to succeed Myron F. Westover, who retired March 1. Mr. Trench has been associated with the General Electric organization since 1915, when he was appointed assistant to Owen D. Young, who at that time was a vice-president. One year later he was named assistant secretary. Mr. Trench is a graduate of St. Lawrence University and the Brooklyn Law School and was admitted to the bar in 1916.

**Abel Reynolds** has been elected treasurer and general manager of the New England Water, Light & Power Associates, with headquarters in the Hospital Trust Building, Providence, R. I. This organization was recently formed under the presidency of Arthur B. Lisle to operate and control the Central Connecticut Power & Light Company and various water companies in eastern New England. Mr. Reynolds was in the employ of the Narragansett Electric Lighting Company, Providence, for 29 years and was not long since appointed superintendent of the Bristol County Gas & Electric Company, Rhode Island.

**Myron F. Westover**, who for almost 40 years has been actively identified with the electrical industry, retired March 1 as secretary of the General Electric Company, the office he had held for 34 years. In 1888 Mr. Westover became secretary to Charles A. Coffin, who at that time was treasurer and manager of the Thomson-Houston Electric Company. Thus began a close friendship and business association which lasted nearly 40 years and was brought to a close by the death of Mr. Coffin less than two years ago. In 1893 Mr. Westover was elected assistant secretary of the General Electric Company, which had been organized only the year before. The following year he was elected secretary, the office he had since that time held.

## *F. D. Mahoney Now with Electric Bond & Share*

F. D. Mahoney, whose resignation as vice-president of the West Penn Power Company was announced in the Feb. 11 issue of the Electrical World, has assumed his new duties with the Electric Bond & Share Company with headquarters in New York, where he will engage in the expansion of that company's interests in foreign countries. Mr. Mahoney's resignation as vice-president of the West Penn Power Company brought to a close an affiliation which dates back to June, 1922. From that time until 1927 he was commercial manager in charge of the department that developed new business, formed the distribution engineering department, stressed the merchandising of appliances and in other fields made itself an active part of the organization. In 1927 he was named vice-president.

*F. D. Mahoney*

A graduate of the University of Wisconsin, Mr. Mahoney began his engineering career as lineman's helper, and after serving in various capacities with central stations in the Middle West he joined forces with the electrical engineering department of the American Gas Company at Philadelphia. Here he secured a wide and varied experience in the construction and operation of public utilities. After the war Mr. Mahoney joined the Alabama Power Company as commercial manager, where he remained until his connection with the West Penn system.

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**J. E. Aldred**, president of the International Power Securities Corporation, and J. A. Walls, vice-president and chief engineer, sailed for Europe March 3, aboard the *Leviathan*. They will visit the properties of the companies in Italy and France in which the International is interested.

**T. F. Manville, Jr.**, a director of the Johns-Manville Company, has been elected a director of the Morison Electrical Supply Company, New York.

# Obituary

**George McQuaid**, director of public relations for the Central & Southwest Utilities Company, an Insull property, died suddenly March 5 at his home in Dallas, Tex. Mr. McQuade was one of the best-known newspaper men in Texas and Oklahoma, having been identified with various newspapers in those states for 30 years. He was a native of Alexandria, Va., and a lawyer by profession, but soon after opening an office at San Antonio he relinquished his legal practice to enter upon a journalistic career. He served on the staff of such papers as the Kansas City *Journal*, the Guthrie (Okla.) *Capital*, the *Daily Oklahoman*, the Galveston *News*, the Dallas *News*, etc., in capacities that ranged from reporter to managing editor and editor. In 1922 he took charge of the Texas Public Service Information Bureau, which issues weekly news regarding the utilties operating in Texas and about public utilities in general. Subsequently he affiliated himself with the Insull interests.

**Alexander Siemens**, who for many years was associated with the famous engineer and inventor Sir William Siemens and until the World War was the chief representative in Great Britain of the great Siemens electrical interests, died Feb. 16 at Milford-on-Sea, England. The deceased, who was 81 years of age, was a Hanoverian, but became a naturalized British subject in 1878. Settling in England in 1867, he entered the shops of the telegraph factory then recently established by Siemens Brothers at Woolwich, and in the two following years he was engaged in the erection of the Indo-European telegraph line in Persia and in laying cables in the Black Sea. Later he spent seven or eight years in assisting Sir William Siemens with the design and application of the latter's regenerative furnaces. After the death of Sir William, in 1883, he assumed a more important position in the firm of Siemens Brothers, and ultimately he became its chief permanent director resident in England. Alexander Siemens was twice president of the Institution of Electrical Engineers, in 1894 and 1904, and in 1910-11 he was president of the Institution of Civil Engineers.

# Financial and Statistical News

## *Utility Stocks Move Up*
## *Bond Redemptions Heavy*

IN THE face of general market weakness power and light stocks have recovered substantially and many have established new high points. American Gas & Electric has touched a new high of 142½ after a run up of twenty points. Public Service of New Jersey common is up four points to 133. Gains are recorded also by Electric Power & Light, Brooklyn Edison, Commonwealth Edison, Pacific Gas & Electric, etc. The average of fifteen representative power and light common stocks is again at 130, which is the high point for all time for this group of stocks.

Bond redemptions continue at a high rate. Nearly $195,000,000 of bonds and notes were called this month for payment in advance of maturity. Although figures are not yet complete, it is understood that utilities are responsible for a large proportion of the total. Obviously, this means a big reduction in interest charges through the substitution of lower coupon obligations and, in some cases, stocks.

## Record Monthly and Yearly Energy Output

As has been usual in the past, electrical energy output of public utility plants in January almost equaled that of December, when all records were broken and production for the first time exceeded 7,000,000,000 kw.-hr., according to data collected by the U. S. Geological Survey.

January production was 7,179,000,000 kw.-hr.; for December it was 7,218,000,000 kw.-hr. In each of those months the output was greater than in the entire year 1903. These figures are an indication of the tremendous increase in the use of electricity in recent years.

The average daily output in January was 232,100,000 kw.-hr., a trifle less than the revised figure for December of 232,800,000 kw.-hr., but 6.5 per cent greater than in January, 1927. The total production of electricity by the use of water power amounted to 2,719,952,000 kw.-hr. and closely approached the December figure, the highest ever attained. It constituted 38 per cent of the total in each month.

The total production of electricity in 1927 by public-utility power plants was 79,723,000,000 kw.-hr., an increase of about 8 per cent over the total output for 1926. The accompanying table gives the monthly figures of output for 1926 and 1927, including street railways and other utilities as well as electric light and power companies.

| | 1926 | 1927 | A | B | C |
|---|---|---|---|---|---|
| January | 6,159 | 6,730 | 9 | 32 | 35 |
| February | 5,629 | 6,080 | [illegible] | 34 | 36 |
| March | 6,178 | 6,717 | 9 | 37 | 38 |
| April | 5,812 | 6,416 | 10 | 40 | 40 |
| May | 5,849 | 6,582 | 12 | 40 | 41 |
| June | 5,920 | 6,475 | 9 | 38 | 39 |
| July | 5,955 | 6,455 | [illegible] | 34 | 38 |
| August | 6,175 | 6,684 | 8 | 34 | 36 |
| September | 6,221 | 6,607 | 6 | 33 | 33 |
| October | 6,594 | 6,929 | 5 | 33 | 34 |
| November | 6,482 | 6,874 | 6 | 35 | 36 |
| December | 6,817 | 7,218 | 6 | 35 | 38 |
| Total | 73,791 | 79,767 | 8 | 35 | 37 |

Column A shows percentage of increase in 1927; column B shows percentage of output produced by water power in 1926; column C the percentage so produced in 1927.

New York Central Electric Changes Set-Up.—The New York Central Electric Corporation has filed a certificate in the office of the Secretary of State increasing its number of shares from 50,000 preferred stock, $100 par value, and 200,000 common, non-par value, to 100,000 preferred stock, $100 par value, and 200,000 common, non-par.

## Associated Gas & Electric to Create $50,000,000 Issue

Stockholders of the Associated Gas & Electric Company at a meeting to be held March 12 will vote on the creation of a fifty-million-dollar issue in the form of 4½ per cent debentures dated March 1, 1928, and maturing March 1, 1948. The company wishes to provide funds for the retirement of certain of its 5½ per cent and 6 per cent convertible debentures, for the acquisition of property and for other corporate purposes. The directors of the company voted on the plan at a meeting held Feb. 16.

# Attwill Replies to Critics

### Massachusetts Commission Chairman Defends Contract Plan of Regulation—Reproduction Base Assailed

A DEFENSE of the so-called regulation by contract bill (House 170) before the legislative committee on power and light in Massachusetts was recently presented by Chairman Henry C. Attwill of the Department of Public Utilities in rebuttal to arguments against this measure by Sheldon E. Wardwell, representing the Massachusetts Gas and Electric Lighting Association, and by others. The opening argument of Mr. Attwill on behalf of the bill was abstracted in the ELECTRICAL WORLD March 3, 1928, page 479, and the gist of Mr. Wardwell's address is printed on page 509 of this issue. In his rebuttal the chairman of the Massachusetts board maintained that the bill's chief objective is to insure a continuance of past standards of regulation in the Bay State, declaring that the credit of the companies would not be impaired by its acceptance and defending the measure's constitutionality. He spoke in part as follows:

The attitude of the Department on this bill is a sincere desire to advance the interests of the public utilities and the public alike. The suggestion, I think, was made first about 1922 in a report to the Legislature, in relation to the so-called premium law. Since then we have discussed it more fully, and we believe that it is in the interest of the public utilities; that is, those who desire to do real public service to the Commonwealth, and of course it is hostile to those who do not desire to do real public service for the state.

The reproduction theory involves the value of the property by adding absurd factors of cost. We concede that probably in dealing with the situation in the West, the Supreme Court at Washington, after it had once determined that the fixation of rates in any way was a judicial question, found that there was not much of anything that it could have done because no one knew the real investment in the utilities in the West, on account of the tremendous inflation of capital there.

The trouble with the reproduction theory is that it is extremely difficult to operate it, so difficult that it practically negatives regulation. Under that theory of regulation the department cannot hope to treat with more than two or three rate cases in a year, and so it is obvious that the whole power of regulation of rates is paralyzed.

Moreover, these gigantic holding companies and associations, buying up our local companies, owned and controlled by gentlemen living out of the state, who have no interest in Massachusetts traditions or ideals, cannot be expected to do anything but to get every dollar that it is possible for them to get out of the utilities, because they have no interest in Massachusetts other than the amount of money that they can make out of the state. It is to their interest to continue this method of regulation, because they usually furnish the management of the companies and usually have another company that furnishes the management of the local company under contract agreement. Furthermore, in every rate case it appears that they furnish the experts, the accountants, all the paraphernalia, to make the reproduction study and cost, and furnish the witnesses to testify.

Now, we believe this bill is constitutional; if it is not, very likely the present railroad act is not constitutional, because if a state cannot make a contract except a contract which ceases to be good, except so long as the corporation can make a return upon the property, 8 per cent on the reproduction value of the property, it is obvious that the state never can enter into any contract except that it guarantee to pay the other fellow, but the other fellow is never bound to pay it.

I do not believe that can ever be the law in the United States of America. If it is, then it is time that the people of the United States had a constitutional amendment to take care of that situation. Now, the savings institutions of Massachusetts are the wonders of the world. They have attracted capital into them far more readily and far more quickly than these public utilities have ever attracted capital, and yet back of them is nothing to guarantee the investor except the integrity of the officials of the institution and the examinations by the Commonwealth from time to time to see that their investments are proper. Despite this, in the past century, I doubt if the interest charges in relation to the savings banks of Massachusetts have varied 1½ per cent. There is enough money in the savings banks today on deposit to buy practically every public utility in the state and not disturb a mortgage.

What I would like to do is to so operate the public utilities that I could divorce banking control from the utilities, and I would attract the money of these savings bank depositors readily into these public utilities and give them a better rate of interest than the savings banks do, and equally safe security.

If we can attract money readily into the state treasury on public loans at 4 per cent, with people relying upon the good faith of the Commonwealth of Massachusetts, do you have any misgivings that the public utilities, regulated under Massachusetts traditions and under Massachusetts ideals as they have been for a century, cannot attract capital enough to carry them on at low rates of interest? Why, how absurd!

Our opponents seem to think that our proposition commits the state to guaranteeing a return sufficient to make the stock stay at par. No, it does not do that, but it restrains the state from doing anything which would prevent it earning the dividends which would sustain it at par, and, on the other hand, it in no way commits the state to any hard and fast standard or rule upon which it can earn its dividends and its interest.

Efficiency has not come usually from the stockholders. They are efficient in shouting for dividends, not a doubt about that; but the ones who are entitled to praise for efficiency are usually the operating officials of the utilities, and there are many instances which have come to my attention where the operating officials were efficient in their duties, but were denied adequate compensation by these hungry stockholders.

All this bill does is to seek to insure the regulation of the past, regulation built up on the ideals and traditions of Massachusetts, and not borrowed from the wild and woolly West. And let me say to you that I doubt if there are any utilities in the country whose credit stands better than those in Massachusetts, who heretofore have been content and satisfied to operate under the rules and under the views and under the ideals and traditions that have obtained here in Massachusetts.

The companies have the temerity to come up here and say, if we continue the policy and the system that has pertained in the past we will ruin all the utilities, and that they will not be able to get any cash to finance their undertakings.

It has been my feeling for years that one of the greatest drawbacks to this so-called United States doctrine is that it creates hostile camps between the consumer on the one hand and the stockholder of the corporation on the other hand, where, as a matter of fact, if the corporation is fair, their interests are identical. The consumer gives the surplus; he donates to these gentlemen his streets; he gives them a monopoly. He ought therefore to have in return rates as reasonably cheap as they reasonably can furnish them.

Now, if the corporation is reasonable upon its part, his interest and the stockholders' interest are identical because he needs the service. He knows that there can be no extensions and additions to the capital plant unless he is willing to put the corporation in position to get a fair return upon the stock, which will make the stock attractive as an investment to the investor. Both their interests are conserved. Consequently, when we limit their operations to a fair and reasonable dividend, we assure any additional earnings being held in the treasury and employed in the public service. And by that operation we relieve them from being in hostile camps and we march them side by side, together in that interest of the Commonwealth and the welfare of its people.

I do not believe that we have got to such a stage in Massachusetts that we no longer have public-spirited citizens who are willing to work, and willing to work in the interests of the general public, at fair and generous compensation. This bill in no way contemplates a fixed return. It fixes the minimum return, but it permits the commission to allow any return above that which may be required to protect the financial integrity of the company and allow it to perform its public functions in the interest of the public.

We never will sustain the doctrines, traditions and ideals of men by sitting supinely in a chair and allowing these foreign interests that are coming into Massachusetts and gobbling up our utilities to ride roughshod over us.

If these gentlemen are right, this bill, if passed, will do them no harm. Moreover, it will put the Commonwealth in no worse position than it is now. Consequently, in my judgment, there is no sound reason why it should not be passed, and we will see what the result of its passage is.

## December Customer-Ownership Sales Exceed $16,600,000

December sales of stock directly to customers consisted of 290,300 shares, valued at $16,603,000 and involving about 18,130 transactions.

The total value is somewhat below the monthly average for the year, but exceeds that of February, July, August and September and is less than 10 per cent below November sales. But it falls short, by more than 40 per cent, of the figures for the peak months, March and October.

The average value of the transactions was unusually high, being nearly $920. Three companies reported sales exceeding $1,000,000 for the month, the actual amounts being, respectively, $1,560,500, $1,544,300 and $1,400,000, and in addition one company had sales exceeding $3,800,000 in value.

The preceding estimates are based on returns from companies serving somewhat over 12,000,000 customers at the end of the year and thus accounting for about 87 per cent of all customers served by companies in the United States making it a practice to sell securities locally.

WINNIPEG ELECTRIC REPORTS UNUSUAL INCREASE IN OUTPUT.—During the year 1927 the combined output of the Winnipeg Electric and its associate, the Manitoba Power Company, amounted to 511,103,200 kw.-hr. and the peak load for the system was 112,000 kw. These figures mark an increase in output of 80 per cent over the previous year, and an increase in the peak load of 70 per cent over the previous year.

## Industrial Development by New England Companies

The power committee of the New England Council recently reported on its survey of the activities of New England electric service companies in attracting industries to their respective territories. These companies were asked what they had done to attract industries to New England, what concrete results had been obtained and what plans were entertained for the future.

Of 53 New England companies reporting, only eleven claimed to have done any industrial development. None claimed to have obtained new industries solely through their own efforts. Their parts in industrial development included co-operation with chambers of commerce or railroads, advertising in newspapers, advertising in trade papers and magazines, listing available sites, issuing booklets, lending financial assistance and purchasing stock, purchasing and remodeling of buildings for industrial uses, solicitation by letter and in person of concerns interested in a particular territory, maintenance of exhibits at the various fairs and expositions, assignment of an industrial engineer or a sales department executive to industrial development activities, co-operation with industrial real estate brokers, and assisting communities in developing industrial survey programs. All of the reporting companies plan to continue such industrial development as they now conduct; all believe the work beneficial, but few have definite plans for additional efforts in the future.

## Capital Set-Up of New Stone & Webster Group Announced

The new association formed by Stone & Webster, Inc., known as the Eastern Utilities Association, as announced elsewhere in this issue, will be capitalized at 2,000,000 no-par common shares and 2,000,000 no-par convertible shares. The companies immediately involved are the Blackstone Valley Gas & Electric Company, Edison Electric Illuminating Company of Brockton and Electric Light & Power Company of Abington & Rockland.

One share of Blackstone Valley $50 par common stock will be exchanged for 2½ shares of common stock in the association and 3¾ convertible shares. One share of Edison Electric $25 capital stock will be exchanged for one common share of the association and 1¾ convertible shares.

The association's common shares are entitled to dividends of $2 annually before any dividend is paid on convertible shares. When $2 common dividends have been paid the convertible shares will be entitled to annual dividends of $1. Thereafter each convertible share will receive one-half the amount received by each common share. When net earnings for two consecutive years have been not less than $2.40 a share on common and $1.20 on convertible shares, the latter may be converted into common at the rate of two convertible shares for one common share.

## Undeveloped Water Powers in North Carolina

It is evident from the rate at which the production of electrical energy in North Carolina has increased during the past decade that new power sources must constantly be developed for many years in the future. In the past ten years the installed water power in North Carolina has increased from 325,000 hp. in 1918 to nearly 610,000 hp. at the end of 1927.

The Department of Conservation and Development estimates that undeveloped sites now controlled by public utility companies in North Carolina total about 400,000 hp., in addition to the 295,000 hp. which they now have under construction. In addition, sites are known to the department which have been the subjects of engineering examination sufficient to indicate that some 505,000 hp. of undeveloped water power is available from them. If this be added to the preceding 695,000 hp. estimated as controlled by the public utilities, there is at least a total of 1,200,000 hp. in undeveloped water power available in North Carolina. In this estimate numerous undeveloped powers known to exist have not been included because they are at present not economical to develop.

Portland Electric Pays Special Dividend.—Directors of the Portland Electric Power Company have declared a special dividend of $10.80 a share on the second preferred stock, payable 80 cents in cash and $10 in second preferred stock.

Illinois Power & Light to Issue Debentures.—To raise funds for the acquisition of certain properties the Illinois Power & Light Corporation will issue, subject to the approval of the Illinois Commerce Commission, $2,000,000 principal amount of notes or debentures, maturing in twenty years and bearing interest at the rate of 5 per cent per annum. The officers and directors have also arranged to bring $5,000,000 of new money into the fixed capital of the company by the sale of additional common stock.

## Company Reports

| | Gross Earnings Twelve Months Ended Jan. 31 | |
|---|---|---|
| Name of Company | 1928 | 1927 |
| Associated Gas & Electric | *$34,939,706 | *$29,284,246 |
| Bangor-Hydro-Electric | 1,878,797 | 1,745,799 |
| Baton Rouge Electric | 1,032,755 | 973,374 |
| Blackstone Valley Gas & Electric | 5,914,838 | 5,566,986 |
| Cape Breton Electric | 654,265 | 622,033 |
| Central Illinois Light | 4,416,395 | 4,221,519 |
| Cities Service | 32,850,841 | 26,682,395 |
| Columbia Gas & Electric & subs | *96,851,668 | *92,119,614 |
| Columbus Elec. & Power | 4,250,142 | 3,788,729 |
| Commonwealth Power | 53,550,307 | 49,473,699 |
| Consumers Power | 26,913,469 | 24,305,770 |
| Eastern Texas Electric & subs | 7,278,115 | 5,768,124 |
| Edison Electric Illg. Co of Rochester | 1,930,290 | 1,784,213 |
| Elec. Light & Pwr. Co. of Abington & Rockland | 627,537 | 579,233 |
| El Paso Electric | 3,008,357 | 2,863,182 |
| Federal Light & Traction | *7,010,040 | *6,623,587 |
| Galveston & Houston Electric & subs | 5,066,762 | 4,671,420 |
| Illinois Power | 2,635,727 | 2,589,739 |
| Lowell Electric Light | 1,801,769 | 1,729,669 |
| Northern Ohio Power | 12,655,030 | 12,048,922 |
| No. Texas Elec. & subs | 2,745,995 | 2,525,289 |
| Ohio Edison | 1,924,543 | 1,834,708 |
| Portland Electric Power | 12,103,187 | 11,817,801 |
| Public Service Co. of New Hampshire & subs | *3,536,711 | *3,389,120 |
| Puget Sound Power & Light & subs | 14,940,655 | 13,615,677 |
| Savannah Elec. & Pwr. | 2,223,012 | 2,240,597 |
| Sierra Pacific Elec. & subs. | 1,248,006 | 1,266,230 |
| So. California Edison | *30,600,637 | *27,846,518 |
| So. California Edison | 30,822,709 | 28,188,831 |
| So. Indiana Gas & Elec. | 3,036,886 | 2,902,501 |
| Tampa Electric & subs | 4,705,593 | 4,882,944 |
| Tennessee Electric Power | 12,585,890 | 11,885,410 |
| Virginia Elec. & Power | 15,540,606 | 14,510,921 |

## Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday March 6 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new—no par | 76¼ | 72 | 1 |
| Ala. Pwr., $7 com. pf.—no par | 114¼ | 114¼ | 115¼ |
| Allis Chalmers Mfg., 6% com | 121½ | 115½ | 125 |
| Aluminum Co. of Amer., com | 125 | 120 | 136 |
| Aluminum Co. of Amer., 6% pf | k107½ | 105 | 107½ |
| Amer. & Foreign Pwr., 7% pf.—no par | 107½ | 105½ | 108½ |
| Amer. & Foreign Pwr., com.—no par | 28¾ | 22½ | 27½ |
| Amer. Bosch Magneto, com.—no par | 20½ | 15½ | 22½ |
| Amer. Brown Boveri Elec.† | 15½ | 14½ | 18 |
| Amer. Brown Boveri Elec., pf. $7 | 58 | 55 | 63 |
| Amer. Gas & Elec., 6% pf.—no par | 107¼ | 106½ | 109 |
| Amer. Gas & Elec., com.†—no par | 143½ | 117½ | 143¾ |
| Amer. Lt. & Trac., 6% pf | 115 | 116 | 120 |
| Amer. Lt. & Trac., new com | 191 | 170 | 191½ |
| Amer. Pwr. & Lt., 6% pf | 107¼ | 104 | 109½ |
| Amer. Pwr. & Lt., com.†—no par | 69 | 62 | 70 |
| Amer. Pub. Serv., 7% pf | a100 | 99 | 100 |
| Amer. Pub. Serv., com.† | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf | a 96 | 87¼ | 96 |
| Amer. Pub. Utilities, 7% pr. pf | 100 | 98 | 100 |
| Amer. Pub. Utilities, com | k 60 | 60 | 65 |
| Amer. States Sec., A | a 5¼ | 4 | 5¼ |
| Amer. States Sec., B | a 6 | 4½ | 6 |
| Amer. Superpwr., 6% ptc. pf.—25 | 30 | 28¼ | 30 |
| Amer. Superpwr., 6% 1st pf | l 103½ | .... | .... |
| Amer. Sup'pwr., Class A†—no par, ex rts | 38¼ | 37 | 41¼ |
| Amer. Sup'pwr., Class B†—no par, ex. rts. | 39 | 37½ | 43 |
| Amer. Wtr. Wks. & Elec., 6% pf | k104½ | 101½ | 105 |
| Amer. W.W. & E., com. new—no par | 56 | 52½ | 61 |
| Anaconda Copper cap. $3 | 55¼ | 53¼ | 59¼ |
| Appalachian Electric Pwr., 7% pf | 109 | 108½ | 109½ |
| Arkansas Pwr., & Lt. 7% pf | 107½ | 108 | 109½ |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec. pf. $6—no par | 95 | 96 | 98 |
| Assoc. G. & E., Class A, 10—no par. | 47¼ | 47 | 51¼ |
| BABCOCK & WILCOX, 7% com | 118 | .... | .... |
| Binghamton L., H. & P., $6 pf | 105½ | 102 | 105½ |
| Birmingham Elec. pf. $7—no par | 110 | 109 | 111 |
| Blackstone Valley G. & E., 6% pf | k106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | 156 | 132 | 160½ |
| Blaw-Knox, com.† | i103 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com | f203½ | . | |
| Brazilian Trac., Lt. & Pwr., com., new | f 52½ | .... | .... |
| Broad River Pwr., 7% pf | 105½ | 105 | 107½ |
| Brooklyn Edison 8% com | 228 | 206½ | 235½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26¼ | . | |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 37½ | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf | k 98 | 98 | 101 |
| California Ry. & Pwr., 7% pf | k135 | | |
| Carolina Pwr. & Lt. pf. $7—no par | f110 | 109 | 110 |
| Central & S. W. Util., $7 pf.—no par | a102¼ | 99 | 105 |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a104½ | 103½ | 108 |
| Central Ark. Ry. & Lt., 7% pf | 104 | 105 | 107 |
| Central Ill. Pub. Serv., $6 pf | a 99 | 97½ | 99 |
| Central Ind. Pwr., 7% pf | a 98 | 94 | 98 |
| Central Maine Power, 6% pf | 95 | .... | .... |
| Central Maine Power, 7% | 109 | 109 | 112 |
| Central Pwr. & Lt., 7% pf | 104½ | 104½ | 105½ |
| Central States Elec., 7% pf | 111 | 104 | 112 |
| Century Elec., 6% com | b143 | 140 | 145 |
| Chicago Fuse Mfg., com.—$2.50 no par | m 30 | 30 | 33 |
| Cincinnati Gas & Elec., 5% com | g 99¼ | 97½ | 100 |
| Cities Service, $6 pf.—no par | l 96¼ | 94½ | 96¼ |
| Cities Service, pf. B—no par | k 8½ | 8½ | 9½ |
| Cities Service, pf. BB—no par | k 90½ | 88½ | 90½ |
| Cities Service, com.—20 | l 56½ | 54 | 56½ |
| Cities Service, Bks. Shrs.—10 | m 27½ | 22½ | 27 |
| Cities Service Pwr. & Lt., 7% pf | 106½ | 105½ | 107 |
| Cities Service Pwr. & Lt., 6% pf | 100 | 95½ | 100 |
| Cleveland Elec. Illg., 6% pf | 113 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com | 360 | 350 | 370 |
| Columbia Gas & Elec., 6% pf | 108 | 107¼ | 110¼ |
| Columbia G. & E. com. $5—no par | 91 | 89¼ | 97½ |
| Columbus Elec. & Pwr., $2 com.—no par | k 70 | 66 | 71 |
| Columbus Elec. & Pwr., 7% pf | 113 | | |
| Columbus Ry., Pwr. & Lt., 7% pf | 107½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 107 | | |
| Columbus Ry., P. & Lt. com.—no par | 105 | | |
| Commonwealth Edison, 8% com | 175 | 165 | 189 |
| Commonwealth Pwr., 6% pf | 102¼ | 102¼ | 104¼ |
| Commonw'th Pwr., $2, com.—no par | 69 | 62½ | 69 |
| Conn. Lt. & Pwr., 8% pf | 119 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf | 112 | 118 | 121 |
| Cons. Gas of N. Y., pf | 102½ | 101½ | 102½ |
| Cons. Gas of N. Y., com. $5—no par. | 136 | 119½ | 139½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf | m112½ | 110½ | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf | e111½ | 110½ | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf | e110¼ | 110¼ | 115 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf | m125½ | 125½ | 128½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 69½ | 67½ | 72½ |
| Consolidated Pwr. & Lt., 7% pf | 105 | | |
| Consumers Pwr., 6% pf | 104¼ | 105½ | 106 |
| Consumers Pwr., 6.6% pf | 106 | 106 | 107 |
| Continental Gas & Elec. 7% pr. pf | 111 | 108 | 111 |
| Contl. G. & E. com. $4.40—no par | k235 | 240 | 265 |
| Crocker Wheeler, com.† | 30 | 24 | 27 |
| Crocker Wheeler, 7% pf | 90 | 77 | 82 |
| DALLAS PWR. & LT., 7% pf | 110½ | 110 | 111 |
| Dayton Pwr. & Lt. 6% pf | 108½ | 108 | 109 |
| Derby Gas & Elec., 7% pf | 98 | 96 | 98 |
| Detroit Edison, 8% com | 178 | 166½ | 194½ |
| Dubilier Condenser, com.—no par | k 3¼ | 2¼ | 3½ |
| Duke Pwr., cap | k135 | 130 | 145 |
| Duquesne Lt., 7% pf | k116½ | 115½ | 116½ |
| EASTERN NEW YORK UTIL., $7 pf | k110½ | 111 | 112½ |
| Eastern New York Util. com | k 65 | ... | ... |
| Eastern States Pwr. $7, com | k 12 | 12 | 14½ |
| Eastern States Pwr. pf | k 97 | 98 | 99 |
| East. Tex. Elec. 7% pf | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com | d257 | 252 | 268 |
| El Paso Elec. 7% pf | 113 | 110 | 112½ |
| Elec. Bond & Share, 6% pf | l109¼ | 109½ | 111¼ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 92 | 76 | 94½ |
| Electric Household Util.† | a 17¼ | 13½ | 15½ |
| Elec. Investors, 6% pf.—no par | 102½ | 101 | 102½ |
| Elec. Investors, com.†—no par | 44½ | 40½ | 45½ |
| Elec. Pwr. & Lt., ctfs. pf | 110 | 106½ | 110 |
| Elec. Pwr. & Lt., ctfs., 40% pd | k124½ | 120½ | 125½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 36½ | 28½ | 36½ |
| Elec. Refrig. cap.† | 14½ | 11½ | 15½ |
| Elec. Ry. Securities, com.—no par | 6½ | ... | ... |
| Elec. St. Battery com. $5.25—no par | 77½ | 69 | 77½ |
| Elmira Wtr., Lt. & R.R., 7% pf | k106 | 104 | 107 |
| Empire Pwr., ptc.† | k 32½ | 27½ | 35½ |
| Engr. Pub. Serv. $7. pf.—no par | k109 | 107 | 110 |
| Engr. Pub. Serv., com.—no par | 35¼ | 33 | 36¼ |
| Eureka Vacuum Cleaner com. $4—no par | 74½ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf | k108 | 104 | 106½ |
| F.-M., com.—$3—no par | k 39½ | 32½ | 40¼ |
| Federal Lt. & Trac., com. $1.40 | 51½ | 42 | 55 |
| Federal Lt. & Trac., $6 pf.—no par | 102½ | 98 | 105 |
| Florida Pwr. & Lt., 7% pf | 107 | 105 | 107¼ |
| Ft. Worth Pwr. & Lt., 7% pf | l114 | 113 | 114¼ |
| GALVESTON-HOUSTON ELEC. 6% pf | 77 | 75 | 78 |
| Galveston-Houston Elec., com | 32 | 31 | 34 |
| General Cable, Cl. A | 63½ | | |
| Gen. Elec. $3 com.—no par | 132½ | 124 | 138½ |
| Gen. Elec., special—6% | 11½ | 11½ | 11½ |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 40¼ | 35¼ | 40¼ |
| Gen. G. & E. (Del.) pf. A $8—no par | k123 | 122½ | 126½ |
| Gen. G. & E. (Del.) pf. A $7—no par. | k113½ | 108½ | 113½ |
| Gen. G. & E. (Del.) pf. B $7 | 108 | 105½ | 108 |
| Gen. Pub. Serv., $7 cum. pf., no par. | k117 | 110 | 110 |
| Gen. Pub. Serv., com., no par | 19 | 16½ | 20½ |
| General Public Utilities, $7 pf | 98½ | 98 | 99 |
| Ga. Lt., Pwr. & Rys. com | k 58 | 55 | 65 |
| Ga. Ry. & Pwr., 8% pf | k125 | | |
| Ga. Ry. & Pwr., 7% pf | k113½ | | |
| Gt. Western Pwr., 7% pf | h106½ | .... | .... |
| IDAHO PWR., 7% pf | 109 | 109 | 110 |
| Ill. No. Utilities 6% pf | k 96 | 96 | 98 |
| Ill. Pwr. & Lt. 7% pf | 106 | 103 | 105½ |
| Indianapolis Pwr. & Lt., 6½% pf | 104¼ | 102 | 107 |
| Indianapolis Pwr. & Lt. $7 pf | 103 | 100 | 105 |
| Ingersoll Rand com | 90½ | 90 | 94 |
| Int. Combus. Engr., com. $2—no par | 48½ | 45 | 55½ |
| Int. Combustion Engr. 7% pf | k103½ | 103½ | 105 |
| Int. Util., Class A—$3.50—no par | k 45 | 45 | 51 |
| Int. Utilities, Class B—no par | k 7 | 3½ | 10 |
| Interstate Pwr. pf.—$7—no par | 101½ | 100 | 102 |
| Interstate Pub. Serv., 7% pf | 103 | 103 | 106 |
| Iowa Ry. & Lt., 7% pf | k100 | 02 | 103 |
| JERSEY CENTRAL PWR. & LT. CO. 7% pf | 108 | 105 | 107 |
| Johns-Manville com.†—no par | 116½ | 114 | 126½ |
| Johns-Manville, 7% pf | m119½ | 119½ | 120 |

Stock Exchange: aChicago; bSt Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 3. lBid price Wednesday, March 7. mLatest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

**(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)**

| Companies | Bid Price Tuesday March 6 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | k116½ | 115 | 116½ |
| Kansas Gas & Elec., 7% pf. | l109½ | 107 | 109 |
| Kentucky Hydro-Elec., 7% pf | k103 | 100 | 104 |
| Kentucky Sec., 6% pf. | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | k102 | 100 | 103 |
| LACLEDE GAS LT., 10% com. | k200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 25⅛ | 19½ | 27⅜ |
| Long Island Ltg., 7% pf. | 112 | 110½ | 112½ |
| Long Island Ltg., 6% pf. | 106¼ | .... | .... |
| Long Island Ltg., com.†—no par | k178 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | 108 | 105 | 109 |
| Louisville Gas & Elec., cl. A. $1.75 | 28¾ | 28 | 29¾ |
| MAN. ELEC. SUPPLY, cap. $5—no par | 52½ | 50 | 54⅛ |
| Manila Elec., com.†—no par | k 47 | 45½ | 50 |
| Maytag Mfg., com 50—no par | 32⅜ | 30½ | 34½ |
| Memphis P. & L., pf.—$7—no par | k109¼ | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 106½ | 103 | 107½ |
| Metropolitan Ed., pf.—$7—no par | 109 | 109 | 111 |
| Metropolitan Ed., com. $5—no par | k140 | .... | .... |
| Middle West Utilities, 7% pf | a122 | 116½ | 124½ |
| Middle West Util., 7% pr. lien | a125⅜ | 125 | 129¼ |
| Middle West Util., com. $6—no par | a129⅞ | 123¼ | 135 |
| Midland Utilities, pr. ln. 6% pf. | a 95⅛ | 94½ | 96½ |
| Midland Utilities, 7% pf. A | a 91 | 90½ | 91½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k 99 | 98 | 101½ |
| Minn. Pwr. & Lt., 7% pf. | l109 | 107 | 109 |
| Miss. River Pwr., 6% pf. | 108 | 94 | 108 |
| Miss. River Pwr., 3% com. | m 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k107 | 100 | 109 |
| Mohawk Hudson Pwr., 2d pf.—$7 no par | k104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 30 | 29½ | 31½ |
| Montana Pwr., 5% com | 165½ | 102¼ | 167¼ |
| Montreal Pwr., 7½% com. | f 90½ | .... | .... |
| Mountain States Pwr., 7% pf. | k103 | 97 | 103 |
| Mountain States Pwr., com.† | 17 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109½ | 98 | 110 |
| National Carbon, 8% pf. | m138½ | 138 | 139 |
| National Elec. Pwr., A† | a 31¼ | 27½ | 32¾ |
| National Lt., Ht. & Pwr., con. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | k109¼ | 101 | 111 |
| National Pwr. & Lt., com †—no par. | 25⅜ | 21⅞ | 27⅜ |
| National Pub. Serv., 7% pf. | 102¼ | 99 | 103 |
| National Pub. Serv., 7% ptc., pf | 114 | 108 | 115 |
| National Pub. Serv., A com. $1.60—no par | 25⅜ | 22 | 27½ |
| National Pub. Serv., B com.—no par | k 27½ | 24¼ | 30 |
| Nebraska Pwr., 7% pf. | l110½ | 110 | 111½ |
| Nevada-Calif. Elec., com. | k 35 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | k 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k110 | 98½ | 104 |
| New Eng. Pub. Serv., pf. $7 | 108 | 95 | 100 |
| New Orleans Pub. Serv.—7% pf. | 108¼ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | k103 | 101 | 104 |
| New York Power & Light 7% pf | 114½ | .... | ... |
| New York Power & Light, 8% pf. | m114 | .... | ... |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | 109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | 109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25. | 28 | 28 | 28¾ |
| No. Amer., 6% pf.—50. | k 55 | 53½ | 55 |
| No. Amer., com.—10 | 60½ | 58⅜ | 62¾ |
| No. Amer. Edison, $6 pf.—no par | 103 | 102½ | 105⅜ |
| No. Caro. Pub. Serv., pf.—$7—no par | 109 | 93 | 105 |
| Northeastern Pwr., com. | 20⅜ | 19¾ | 23 |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 24⅛ | 18 | 24⅛ |
| No. Ont. Lt. & Pwr., 6% pf. | k 98½ | 94 | 99½ |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf | k108 | 101 | 110 |
| No. States Pwr. (Del.), 8% com | 134⅜ | 123 | 136⅜ |
| No. Texas Elec., 6% pf | 58 | 45 | 70 |
| No. Texas Elec., com. | 18 | 5 | 36 |
| OHIO BRASS, com. B $4—no par. | 99 | 89 | 99¼ |
| Ohio Brass, 6% pf. | k107 | 106 | 111 |
| Ohio Pwr., 6% pf | 106½ | 104 | 107½ |
| Ohio Pub. Serv., $6 pf | k102½ | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | 111 | 107 | 111 |
| Ohio River Edison, 7% pf. | 109 | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 112¾ | .... | .... |
| PACIFIC Gas & ELEC., 6% pf. | 27 | 26⅜ | 28⅜ |
| Pacific Gas & Elec., 8% new com. | 45⅝ | 43½ | 49⅝ |
| Pacific Pwr. & Lt., 7% pf. | l109 | 106 | 109 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 80 | 79⅜ | 80 |
| Penn-Ohio Edison, 6% pf. no par | 94⅛ | 93½ | 96 |
| Penn-Ohio Edison, 7% pf. | 106⅝ | 106½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l110½ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 69 | 68 | 72½ |
| Phila. Co., 5% pf.—50 | k 46¼ | 46½ | 48⅛ |
| Phila. Co., 6% pf.—50 | 53¾ | 52 | 53⅞ |
| Phila. Co., com.—50 | 159¾ | 149½ | 163 |
| Phila. Elec., 8% com.—25 | c 57⅞ | 55⅜ | 59 |
| Portland Elec. Pwr., 7% pf. | 103 | 100 | 103¼ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 84 |
| Portland Elec. Pwr., 6% 2d pf. | 85 | 55 | 70 |
| Portland Elec. Pwr., com. | 50 | .... | .... |
| Potomac Elec. Power, 6% pf. | j111 | .... | .... |
| Pwr. Sec., pf.—no par | k 58 | 50 | 60 |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | 105 | .... | .... |
| Pub. Serv. of N. J., 6% pf | 105½ | 103⅜ | 106½ |
| Pub. Serv. of N. J., 7% pf. | 119⅞ | 118 | 120⅛ |
| Pub. Serv. of N. J., $2 com.—no par | 44⅜ | 41½ | 45 |
| Pub. Serv. of No. Ill., 6% pf. | a111⅛ | 110 | 113½ |
| Pub. Serv. of No. Ill., 7% pf. | a119 | 119 | 121 |
| P. S. of No. Ill., com. $8—no par | a170 | 159¼ | 180 |
| Pub. Serv. of No. Ill., $8 com. | a169 | 159⅜ | 180 |
| Pub. Serv. of Okla., 7% pr. ln. | k105 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | k109⅝ | 109 | 110¼ |
| Puget Sound Pwr. & Lt., 7% pf. | k110 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | k 98 | 92 | 98½ |
| Puget Sound Pwr. & Lt., com. | k 43 | 34⅜ | 50 |
| RADIO COPR. OF AMER., $3.50 pf.—50 | 55½ | 54½ | 57⅞ |
| Radio Corp. of Amer., com.—no par. | 100¼ | 85¼ | 104¼ |
| Rhode Island Public Service, pf. $2—no par | m 31⅜ | 30⅜ | 31⅜ |
| Rochester Gas & Elec. 6% pf. D. | k105 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B. | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105 | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | k114 | 110 | 115½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | 7 | 4¼ | 7⅜ |
| Sierra Pacific Elec., 2% com. | k 36 | 29 | 38¾ |
| Sioux City Gas & Elec., 7% pf. | 107 | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 108¼ | .. | .. |
| Southeastern Pwr. & Lt., ptc. pf. | l 89 | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 42⅞ | 40⅜ | 44⅞ |
| So. Calif. Edison, 8% pf. | k 45½ | 38½ | 41 |
| So. Calif. Edison, 7% pf. | k 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | k 26½ | 25½ | 28 |
| So. Calif. Edison, 8% com. | 47¼ | 43½ | 47½ |
| Southern Cities Utilities, 7% pf. | k 75 | 75 | 78 |
| Southwestern Lt. & Pwr., A $3 | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf | 91¾ | 88 | 92 |
| Southwestern Pwr. & Lt., 7% pf | k111½ | 103 | 113 |
| Standard Gas & Elec., 8% pf | k 66 | 65 | 68 |
| Standard Gas & Elec., 7% pr. pf | 111½ | 108 | 113 |
| Standard G. & E., com $3.50 | 62⅜ | 57⅞ | 65 |
| Standard Power & Light, com. | 44 | 29¾ | 45 |
| Standard Pwr. & Lt., 7% pf. | k105 | 98 | 105 |
| Staten Island Edison, pf. $6—no par | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | 167 | 162 | 175 |
| Syracuse Lighting, 7% pf. | k110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 62 | 62 | 64 |
| Tenn. Elec. Pwr., 6% pf. | 103¾ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109¾ | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 10 | .... | ... |
| Terre Haute, Ind. & East. Trac., com | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf | l114 | 113½ | 115 |
| Tide Water Pwr., 8% pf | 111 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 117¾ | 112⅜ | 134 |
| Toledo Edison, 7% pf. | 109½ | 108 | 111 |
| Toledo Edison, 6% pf. | k103½ | 95 | 105 |
| Toledo Edison, 6% com. | k100 | 93 | 102 |
| Tri-City Ry. & Lt., 6% pf. | k100 | 96 | 99 |
| UNITED GAS & ELEC., 6% pf | 100 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c115⅛ | 111½ | 117⅞ |
| United Lt. & Pwr., pf.—$4—no par | a 56½ | 53 | 56½ |
| United Lt. & Pwr., pf.—$6.50—no par | a 99 | 95 | 100 |
| United L. & P., com. A .48—no par | a 17 | 14 | 17¾ |
| United L. & P., com. B .48—no par | k 24⅛ | 20 | 24⅜ |
| Utah Pwr. & Lt., 7% pf. | i 111 | 109½ | 111½ |
| Utica Gas & Elec., 7% pf | 105 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf | 100½ | 98 | 101½ |
| Utilities Pwr. & Lt., com. A $2 | 32 | 28½ | 32 |
| Utilities Pwr. & Lt., com. B $1—no par | 26 | 18½ | 26 |
| VERMONT HYDRO-ELEC., 7% pf. | k100 | 95 | 100 |
| Virginia Elec. & Pwr., 7% pf. | k111½ | 108 | 111 |
| WAGNER ELEC., 7% pf. | b 99½ | 96⅜ | 99½ |
| Wagner Elec., com.—no par | b 41 | 37 | 41 |
| Washington Ry. & Elec., 5% com. | j485 | .... | .. |
| Washington Ry. & Elec., 7% pf. | j103½ | ... | |
| Washington Wtr. Pwr., 8% com. | k225 | 175 | 235 |
| West Penn Elec., 7% pf. | 112⅜ | 109½ | 114½ |
| West Penn Elec., Cl. A $7 | 109 | 106¼ | 110¼ |
| West Penn Pwr., 7% pf. | 115½ | 114⅜ | 116⅜ |
| West Penn Pwr., 6% pf. | 110½ | 109½ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf. | k102 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 104 | 101 | 106 |
| Western States Gas & Elec., com | 38 | .... | ... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 94¾ | 88⅜ | 100⅜ |
| Weston Elec. Instrument, Cl. A $2—no par | 33 | 30½ | 34 |
| Weston Elec. Instrument, com.—no par | k 12½ | 12½ | 14½ |
| Wheeling Elec., 6% pf | k104 | 95 | 104 |
| Worthington Pump, 7% pf. A | k 50 | 46½ | 55 |
| Worthington Pump, 6% B | k 44½ | 41 | 49½ |
| Worthington Pump, com | 30 | 28 | 34⅜ |
| YALE & TOWNE com. $5—25. | k 74½ | 71½ | 75 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, March 3. *l*Bid price Wednesday, March 7. *m*Latest quotations available. †Dividend rate variable.

## New Capital Issues

First mortgage and refunding 4½ per cent gold bonds, series F, of the Interstate Public Service Company to the amount of $12,554,000 were offered during the past week at 94½ and interest, yielding about 4.85 per cent. These securities, dated March 1, 1928, are a direct obligation of the company, and are secured by a mortgage covering as a direct lien all fixed property now owned or acquired in the future. Proceeds will be used toward reimbursing the company for refunding bonds bearing higher coupon rates and for other corporate purposes.

The Oklahoma Power & Water Company issued first mortgage 5 per cent twenty-year gold bonds, series A, at 96½ and interest, yielding about 5.30 per cent, a piece of financing involving $4,500,000.

Six-dollar cumulative preferred stock was issued by the National Power & Light Company at $102 per share and accrued dividend, 101,126 shares being offered. Another offering of six-dollar cumulative preferred stock (no par value) was made by the West Texas Utilties Company at 96 per share and accrued dividend to yield 6.25 per cent.

Iowa Power & Light Company this week sold an issue of $6,000,000 first mortgage 4½ per cent bonds, series A, due 1958, at 95¼ and interest to yield 4.80 per cent. Proceeds will be used to retire $5,000,000 of 5½s and 6s due May 1, 1928, as well as for additions and extensions.

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American Gas & Electric Increases Capital.—The American Gas & Electric Company, New York City, has filed a certificate in the office of the Secretary of State increasing its number of shares from 2,850,000, non-par value, to 4,600,000, non-par value.

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Massachusetts Utility Increases Capital.—Greenfield (Mass.) Electric Light & Power Company at its recent annual meeting voted to increase preferred stock from $300,000 to $375,000, the new stock to consist of 3,000 shares of par value of $25 each. Proceeds from this issue will be used to reduce the company's floating indebtedness.

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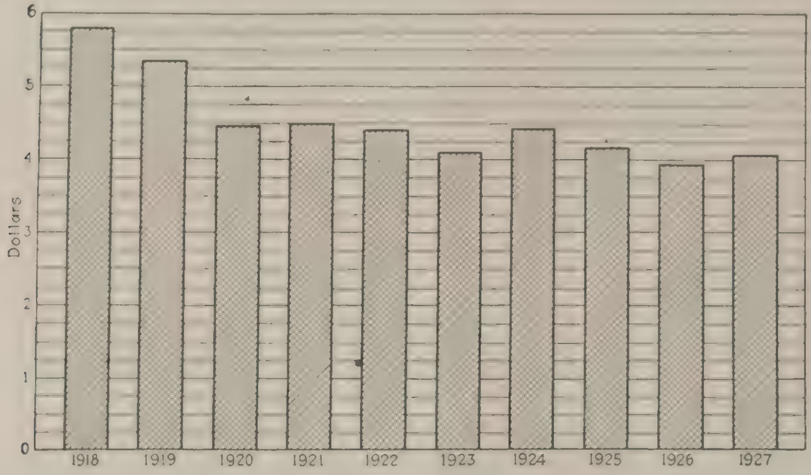
Lynn Gas & Electric Petition Approved.—The Massachusetts Department of Public Utilities has approved the petition of the Lynn Gas & Electric Company for the issuance of 19,500 shares of additional stock at $25 per value to be offered to stockholders at $75 per share.

# Western Massachusetts Companies Gain 10 Per Cent in Kilowatt-Hour Sales

ANTICIPATION of an excellent showing by the Western Massachusetts Companies and constituent properties during 1927 have been realized in the first annual report of this organization. This voluntary association came into being Jan. 15, 1927, and the properties embraced in the report consist of the Turners Falls Power & Electric, Greenfield Electric Light & Power, Lee Electric, Agawam Electric, Ludlow Electric Light, Amherst Gas, Easthampton Gas, Pittsfield Electric and United Electric Light (Springfield) companies. On Jan. 1, 1928, there were 940,528½ shares of common stock without par value in the association, or 96.4 per cent of the total outstanding shares of common stock in the constituent companies. The common shares were held by 4,781 stockholders and the present dividend rate is on the basis of $2 per share annually. There are no bonds or other evidences of indebtedness outstanding. The operating utilities controlled have combined assets of $36,082,403 and did a gross business in 1927, eliminating intercompany sales, of $8,189,877. They serve a population of about 400,000 and supply many diversified power requirements. Total energy sales after intercompany transactions were 403,814,360 kw.-hr., an increase of about 10 per cent over 1926. The total generating capacity of the plants of this group is 64,000 kw. in hydro and 71,500 kw. in steam power. During the past decade the business of these companies has increased 147 per cent.

The consolidated earnings statement of the operating companies for 1927 shows operating expenses of $3,270,926 and taxes of $1,295,757, net of $3,623,194 and total earnings (including other income of $136,694) of $3,759,889. Interest deductions were $256,977, leaving a balance of $3,502,911. The retirement reserve was $1,002,274, set aside by constituent companies in 1927 to meet the cost of plant and equipment replacements. Dividends of constituent companies totaled $2,829,415, leaving after balance $673,496. Other charges deducted were $182,070, leaving as addition to surpluses of constituent companies $491,425. The statement of the voluntary association itself showed total income, $1,036,160; dividends paid, $1,022,164, and balance to surplus, $13,996.

Since 1918 the investment in the combined constituent companies per dollar of gross income has fallen from about $5.80 to $4 and the total investment has increased from about $18,000,000 to $33,000,000. Gross income has risen from about $3,250,000 to $8,189,877 and accumulated reserves and surplus from $1,800,000 to $9,950,000 in round numbers. Sales of permanent power have increased from about 125,000,000 to 295,000,000 kw.-hr. The number of employees has increased from approximately 550 to 720. During the past year the affiliated companies expended $2,355,700 for additional electrical equipment and other plant items, and at present the United company, Springfield, is building a $900,000 main receiving substation in West Springfield and is increasing the capacity of its Indian Orchard hydro plant by 2,600 kw. at a cost of about $260,000.



*Investment per dollar of gross income*

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## Norway Enters American Market

Oslo Gas & Electricity Works (Oslo Gas og Elektricitetsverker), Norway, made an offering during the first week of March of 5 per cent external sinking fund gold bonds, totaling $6,000,000, at 95½ and interest to yield 5.30 per cent. The Oslo Gas & Electricity Works was organized in 1920 by resolution of the Municipal Council of the city of Oslo for the purpose of combining under one management the gas and electric producing and distributing systems formerly operated by municipal government. The issue was oversubscribed.

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## Continued Improvement in Utilization of Fuel

Revised statistics of the total annual production of electricity by public-utility power plants in the United States, compiled by the U. S. Geological Survey, indicate an output of 79,767,000,000 kw.-hr. in 1927, an increase of 8 per cent over the output for 1926. Of this quantity 37 per cent was produced by the use of water power, an increase of 1.6 per cent over the proportion for 1926. In kilowatt-hours the electricity produced by the use of fuel increased about 5½ per cent, and the electricity produced by water power increased about 13 per cent. It would have required about 27,000,000 tons of coal to generate the electricity which was produced by the use of water power. These figures cover not only energy for light and power, but include the output of other public utility plants as well.

The improvement in the average utilization of fuels that has been brought about by improvements in plant design and operation during the last few years continued in 1927. The operators of public-utility power plants performed the remarkable feat of generating about 2,500,000,000 more kilowatt-hours of electricity by the use of fuel in 1927 than in 1926 by the consumption of about 150,000 tons of fuel less than was used in 1926.

From 1919 to 1927 the average quantity of coal required to produce a kilowatt-hour of electricity has decreased from about 3.2 to about 1.8 lb. This is a notable performance, not only in the total amount of the reduction during the eight-year period—1.4 lb., or a reduction nearly as great as the present average rate of consumption per kilowatt-hour, but especially in the continuation of the improvement during recent years, when the limit of achievement in utilization of fuel under present conditions of generation of electricity has almost been reached. The reduction in the average fuel rate from 1926 to 1927 was about 0.12 lb., or almost 2 oz., per kilowatt-hour generated. With coal costing $4 a ton, it would require the savings on the generation of about 4,000 kw.-hr. of electricity to amount to $1 in fuel. The total consumption of electricity by ten average domestic customers in 1927 about equaled 4,000 kw.-hr. The apparently insignificant saving of 0.12 lb. of coal per kilowatt-hour amounted to about 3,000,000 tons of coal for the year, or, at $4 a ton, $12,000,000.

Tables accompanying the Geological Survey statement show the output and fuel consumption for 1927 for the United States and its main divisions, with the annual figures of output and fuel consumption and the average rates of fuel consumption per kilowatt-hour from 1919 to 1927.

# Business News and Market Conditions

## Industrial, Agricultural and General Employment Prospects

### Survey of Year's Business Indicates Steady Sales—New High Levels Expected in 1928—Situation Generally Promising Throughout the Country

SOME of the high points in a bulletin issued by the United States Department of Labor entitled "Industrial, Agricultural and General Employment Prospects for 1928" are summarized by states as follows:

*Alabama*—Outlook promising; increase expected in iron, steel and coal; textiles stationary; much public work and commercial building planned; farmers optimistic.

*Arizona*—Increased employment predicted in the major industries; agricultural activities to increase; several large construction projects.

*Arkansas*—Outlook very favorable, except for coal mines, textiles and lumber mills; activity in highway construction and building.

*California*—Industrial activity expected to reach normal first half of 1928; several large industrial plants starting; activity in highway and heavy construction, but no increase in building trades.

*Colorado*—Increase expected in several major industries and agriculture.

*Connecticut*—Metal-working and silverware to continue at capacity; improvement in textiles; increase in leather, paper and hat industries; $11,000,000 for highway work.

*Delaware*—Activity expected in machinery, shipbuilding and leather; less bright outlook in fiber industry; large building and public works program previously begun to continue.

*District of Columbia*—Large government departmental buildings started.

*Florida*—Major industries expect normal operating schedules; much road construction.

*Georgia*—Establishment of new industrial plants to continue; $35,000,000 for roads and municipal improvements.

*Idaho*—Major industrial plants report a satisfactory outlook.

*Illinois*—Increase in industrial employment anticipated; metal industries more optimistic; automobiles and railroads demand increased steel; much building.

*Indiana*—Gradual expansion in industrial employment anticipated; large increase in automobile production and in demand for steel.

*Iowa*—Improvement in industrial conditions; $28,300,000 in road construction; satisfactory building program.

*Kansas*—Employment to equal or surpass 1927; employment by public utilities will continue at same rate; building operations slightly under 1927.

*Kentucky*—Textiles expect increased business; coal mining curtailed; lumber stationary; building prospects fair; activity in highway and other construction.

*Louisiana*—Major industries predict better year than 1927 except lumber, textile and oil; increase in public work and farm acreage.

*Maine*—Textile outlook uncertain some places, operating to capacity elsewhere; increase in iron and shoes, but not in paper or lumber; farmers gloomy.

*Maryland*—Major industry prospects fairly satisfactory.

*Massachusetts*—Rubber, footwear, fabrics, printing, wire, leather, and paper to continue at capacity; cotton mill situation improved; normal increase anticipated in other industries.

*Michigan*—General industrial increase expected, particularly automobiles; 350 miles of concrete highway; slight decrease in building.

*Minnesota*—Outlook distinctly favorable; iron production to continue; highway construction, city improvements, lumbering and agriculture good; heavy business expected by flour mills and farm machinery manufacturers.

> *Contrary to precedent established in former Presidential election years, when the business world stood by awaiting results before charting programs, the opposite is true at this time. . . . Industry and business will mark new high levels in 1928. . . . All signs point to the biggest year in the history of the automotive industry. Iron and steel point to marked increases over 1927. . . . Building construction will compare favorably with the previous year. The position of agriculture shows improvement. Railroads will undoubtedly enjoy normal business. . . .*
>
> FRANCIS I. JONES,
> *Director-General U. S. Employment Service, U. S. Department of Labor.*

*Mississippi*—Outlook good except lumber and textiles.

*Missouri*—Outlook improves over 1927; automobile assembling plants to resume; iron and steel operations to increase; mineral shipments higher; building activity good.

*Montana*—Industrial prospects encouraging; industries, excepting lumber manufacturing, expect a slight increase; mining and oil development work anticipated; large construction projects planned; agriculture in good shape.

*Nebraska*—Rubber tire concerns working overtime; other assembling plants to resume; meat packing gains; large building and public works program contemplated.

*Nevada*—Industrial plants optimistic; 50 per cent increase in sugar beet acreage; decrease in building; extensive highway program.

*New Hampshire*—Shoe, textile and paper industries coming back to normal; others continue at maximum; normal building program; $3,000,000 for highway work.

*New Jersey*—Industrial conditions compare favorably with 1927; several industries continue on curtailed schedules; bright outlook in automobile lines; increase in iron and steel; textiles continue improving; large building program; $30,000,000 worth of bonds voted for state highway construction program.

*New Mexico*—Normal operations in major industrial plants and mining; building and other construction to increase; increase in highway construction.

*New York*—Prospect not particularly great; agricultural machinery, cameras, optical supplies, textile and shoe industries continue satisfactory; automobile industry to increase; part-capacity operations in locomotive, railroad equipment and electrical manufacturing plants; building program to continue.

*North Carolina*—Considerable construction work, including power plants and lines; major industries satisfactory.

*North Dakota*—Public works, power lines and railway construction in prospect; beet sugar production increasing.

*Ohio*—Outlook not altogether favorable; less building; $20,000,000 for highways; iron and steel, rubber goods and tires to show increase.

*Oklahoma*—Outlook, except coal mining, encouraging; industries expect improvement; textile and lumber companies are less optimistic.

*Oregon*—No increase anticipated; depression in lumbering continues and affects other industries.

*Pennsylvania*—Metal industries increase from curtailed to schedule; textile outlook favorable; less decrease in building, but much public work.

*Rhode Island*—High activity in metal and building trades to continue; increase in textiles; machinery to continue at maximum production; gradual pick-up in general.

*South Carolina*—New textile plants, satisfactory industry schedules; heavy construction and building activity.

*South Dakota*—Road and building construction active; prospects favorable.

*Tennessee*—Steady increase in textiles; building outlook good.

*Texas*—Much building and public work planned; textiles and lumber not particularly bright, but improving; farmers optimistic; increase in acreage.

*Utah*—Outlook fairly satisfactory; some increase in agriculture, live stock, highway construction and some lines of manufacturing.

*Vermont*—Optimistic, especially regarding marble, granite, talc and textiles; much reconstruction.

*Virginia*—New industrial plants near completion; prospects in nitrogen manufacture and artificial silk knitting; large highway work.

*Washington*—Optimistic; large pulp and paper mills and chemical plants to be erected; 150 new factories; building and heavy construction schedules big.

*West Virginia*—Continued increase in factory employment; airplane factories; increased public improvements; building to increase.

*Wisconsin*—Major industries expect fairly satisfactory schedules; fair prospects in building construction.

*Wyoming*—Slight increase in major industrial plants, oil refineries and sugar factories; material increase in agriculture and livestock; considerable construction.

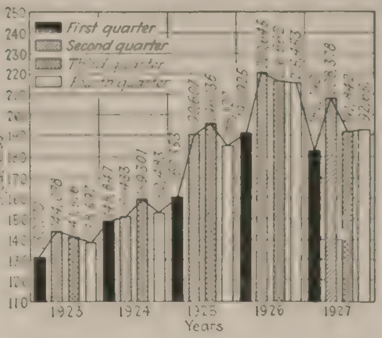
*Sales of Washing Machines by Quarters 1923-1927 (Except Electrics)*

Electric Washing Machine Sales Shown Separately
(Data Supplied by American Washing Machine Manufacturers' Association)

| Quarter | Hand-Power Machines | | | | | Gas and Power Machines | | | | | Water-Power Machines | | | | | Total (Including Electrics) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1923 | 1924 | 1925 | 1926 | 1927 | 1923 | 1924 | 1925 | 1926 | 1927 | 1923 | 1924 | 1925 | 1926 | 1927 | 1923 | 1924 | 1925 | 1926 | 1927 |
| First | 35,317 | 22,079 | 25,174 | 26,854 | 21,050 | 5,934 | 3,803 | 6,762 | 13,742 | 14,676 | 7,352 | 4,732 | 5,475 | 7,228 | 4,783 | 178,773 | 179,461 | 197,764 | 238,749 | 223,299 |
| Second | 30,811 | 20,470 | 25,314 | 24,516 | 16,655 | 6,319 | 4,310 | 9,034 | 19,103 | 24,091 | 7,758 | 4,023 | 5,844 | 8,226 | 5,584 | 188,966 | 180,236 | 230,799 | 272,496 | 254,708 |
| Third | 30,212 | 19,036 | 22,348 | 20,293 | 14,544 | 4,289 | 3,987 | 10,431 | 19,039 | 19,467 | 6,947 | 5,078 | 5,665 | 8,518 | 4,357 | 182,964 | 187,402 | 234,580 | 264,512 | 230,210 |
| Fourth | 19,063 | 20,748 | 20,922 | 17,905 | 13,721 | 3,568 | 4,842 | 9,518 | 14,645 | 26,487 | 6,498 | 3,729 | 3,789 | 5,299 | 3,430 | 167,726 | 181,802 | 219,356 | 253,302 | 236,289 |
| Total | 105,403 | 82,333 | 93,758 | 89,568 | 65,970 | 20,110 | 16,933 | 35,745 | 66,529 | 84,721 | 28,555 | 17,562 | 20,773 | 29,271 | 18,154 | 718,429 | 728,901 | 882,499 | 1,029,053 | 944,506 |

## Washing Machine Sales Decrease in 1927

Sales of all types of washing machines in 1927 amounted to 944,506, with a retail value of $127,750,000. This compares with 1,029,053 machines in 1926, with a total retail value of $137,525,000. Electric washing machines showed a decrease of about 8 per cent in 1927 as compared with 1926, the total number of washing machines sold in 1927 being 775,661. In April, 1927, 78,993 electric washing machines were sold, the largest number in any one month during that year. Lowest monthly sales were recorded in January and were 55,319. The difference between the best and the poorest month was 23,674 machines, or 36 per cent of the monthly average, 64,638. The five months having sales above the monthly average were March, April, June, September and October. The accompanying table gives sales by quarters from 1923 to 1927 for all types of washing machines and the accompanying graph records the sales of electric washing machines for the same period.



*Sales of electric washing machines by quarters, 1923 to 1927*

# Market Conditions

INDUSTRIAL equipment buying is active in the New England district. Orders amounted to about $275,000 and included a 6,000-kw. turbo-generator unit. Small motor sales are increasing and are up in volume to those of last year. An increase in appropriations for street lighting is noted throughout the district. Utility orders show an increase in the Eastern district, with substation equipment a feature of the demand. A New York company bought $320,000 worth of high-tension cable. The industrial demand continues active.

A satisfactory volume of small orders characterizes the business in the Southeast. Industrial plant orders and prospects are especially good. In the St. Louis district sales are at about a normal level and jobbers have been doing a slightly better business since March 1. Business is gradually increasing in the Middle West, though not to a marked extent. During February a large utility company bought at an average rate of $140,000 per day. On the Pacific Coast industrial business is especially active. A pulp mill in Gray's Harbor, Wash., ordered $12,000 worth of motors. A 10-ton pulp mill is to be built in South Bend, Wash., and a mining company in Tuolumne County will build a 3,294-hp. plant next July. Several sales of pumps and motors were reported for the irrigation and orchard districts in eastern Washington and Oregon.

### *Metal Markets Active—Some Price Improvement Noted*

Copper and lead sales have been active. The tone of the copper market is improved and the 14.125 cents price (Connecticut delivery basis) of the leading producers, which has been more or less nominal for many weeks, has been realized on large tonnages. Lead has been particularly active, though the price in New York is virtually unchanged. Zinc has been quiet, but sellers have not pressed their offerings, and business has been done at somewhat higher levels than last week. Moderate consumer buying of tin, with little change in price, is reported. Copper can hardly be said to be firmly established at 14.125 cents delivered in Connecticut, even though an unusually good tonnage was sold on that basis. On Tuesday all prices between 14 cents and 14.125 cents, Connecticut, were realized and a fair quantity for Middle West delivery was placed at 14.25 cents. In some instances it is probable that special brands or special shapes were a factor in the sales at the high end of the range. One or two sellers were willing to shade 14.125 cents on Wednesday, but the rest are firm at that figure and most of the business has been done at 14.125 cents.

NEW YORK METAL MARKET PRICES

| | Feb. 29, 1928 Cents per Pound | March 7, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 13.95 | 14.125 |
| Lead, Am. S. & R. price | 6 | 6 |
| Antimony | 10½ | 10½ |
| Nickel, ingot | 35 | 35 |
| Zinc spots | 5.825 | 5.875 |
| Tin, Straits | 51⅛ | 51⅛ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper price March 7, 1928, 15¼ cents.

### *Good Volume of Small Orders Reported in Southeast*

A reasonably satisfactory volume of small orders characterizes the electrical business in the Southeast. Virtually no orders for large equipment are being placed, though there is a satisfactory amount of that business in more or less immediate prospect. The largest central-station orders cover distribution and small power transformers for one company, totaling $17,000. The next order in point of size was for $7,300 worth of house-type meters. Another central-station order called for $4,500 worth of creosoted pine poles and bushings amounting to $1,700. The demand for meters and small transformers is generally good. One company in south Georgia ordered electric ranges, costing approximately $11,000, for use in a special sales campaign.

An order was placed last week by a new industrial plant in Georgia for inside wiring materials approximating $30,000, while an industrial plant in Tennessee ordered two electric welders costing $2,000. Bids have been asked on a textile mill project in Alabama for motors, transformers and regulators which will cost from $100,000 to $125,000. There is a considerable amount of industrial business, particularly in textile plants, now pending which should be announced within the next 30 to 60 days and contracts let at that time. One of these pending jobs is a silk mill to be constructed in Tennessee at a cost of $750,000. The improvement in construction lines is reflected in jobbers' sales. One of the most prominent jobbers states that his business for February was 25 per cent ahead of the same month last year. Municipalities are buying in good volume, though the individual orders are generally small. One Georgia town ordered $2,000 worth of line construction materials, while another municipality purchased street lighting equipment amounting to $1,100.

Construction projects are as follows: The Uriah Ice & Gin Company, Pensacola, Fla., plans an ice and cold storage plant to cost $100,000. The Plainville Brick Company, Plainville, Ga., plans a power station to cost $25,000. The F. S. Royster Guano Company, Norfolk, Va., plans a new fertilizer plant at Wilmington, N. C., to cost $125,000. The Willys-Overland Company, Toledo, Ohio, plans a new assembling plant at Columbia, S. C., to cost $600,000. The Gillette Grain Company, Nashville, Tenn., plans a new grain elevator to cost $115,000. Huntsville, Ala., Milledgeville, Ga., and Richmond, Va., plan ornamental lighting systems.

## *Utility Orders Increase in Eastern District*

Light and power companies are prominent in the market in the Eastern district and such business is showing marked improvement. Substation equipment continues as a feature of current commitments and inquiries are increasing. A central-station company in Brooklyn has placed an order for substation apparatus, including underground network protectors, totaling about $35,000. Wire and cable is more prominent in demand, following several weeks of dullness. A New York utility has contracted for a quantity of high-tension cable amounting to $320,000. A leading manufacturer of generating equipment reports a better volume of inquiries than at any time this year, with orders trending upward. A western Pennsylvania municipality has purchased a 500-kw. generator set and a New York central-station company will soon be in the market for a direct-current set of like capacity. A manufacturer of turbo-generators reports an order for a large unit for central-station service at San Francisco. Business in control apparatus is holding up well and out-door switching equipment is operating under more active call. High-tension line insulators are experiencing a sluggish market, with little change expected for several weeks.

Industrial demand shows little change. The call for motors and other apparatus is active. A manufacturer reports orders for 20-hp. motors for automobile plant service. Several paper mills in Michigan and Wisconsin are expected to place orders at an early date, and a rayon mill at Lewistown, Pa., is scheduled for heavy purchases for a plant addition to cost more than $1,000,000. Fractional-horsepower motors are in better demand and makers of smaller electrical appliances are receiving sizable orders. A manufacturer of electric refrigerators says that business has shown considerable improvement within the last few weeks as compared with earlier in the year.

The electrical market at Philadelphia is becoming more active. Central-station companies are making inquiries for substation and line equipment and good prospects appear ahead in these lines. Prime mover sales are slow. Industrial account shows betterment, particularly in connection with the iron and metal-working industries, which have been purchasing motors in larger-sized units. The local textile industries are showing expansion in their call for requirements for new installations.

Current construction activities are as follows: The Otis Elevator Company plans an addition to its plant at Yonkers, N. Y., to cost $200,000. Huschle Brothers, Inc., will add to its paper box plant at Long Island City to cost $125,000. The Public Service Electric & Gas Company will soon begin work on a two-story substation at Rahway, N. J. The Vacuum Oil Company plans an addition to its refinery at Paulsboro, N. J., to cost $100,000. Haverford College, Haverford, Pa., plans an engineering laboratory to cost $100,000. The Pennsylvania Power & Light Company will build a 66,000-volt transmission line from Berwick, Pa., to the Hanlock Creek plant of the Luzerne County Gas & Electric Company; surveys are also in progress for transmission lines in Hollenback, Dorrance and Dennison Townships. The Columbia Steel Company will make extensions in mill at Butler, Pa., to cost $1,000,000. The United States Engineer, Pittsburgh, will receive bids until March 28, for a hydro-electric plant at Lock 6, Allegheny River, near Clinton, Pa. The Allegheny Steam Heating Company, operated by the Duquesne Light Company, Pittsburgh, plans a new central power plant to cost $1,000,000. The Eastern Shore Public Service Company will build a transmission line from Salisbury to Vienna, Md.

## *Sales at About Normal Level in St. Louis District*

No marked change is noted in the St. Louis district. An order was placed by a railway company for machine tool motors amounting to $5,000. Another for substation control and switching equipment amounted to $35,000 and a lot of oil switches and circuit breakers was purchased by another central-station company for $22,000. One manufacturing company reports $150,000 worth of miscellaneous business in the southwestern part of the district for the first week in March. Indications of a slowing down of business in the Illinois coal mining region is probably owing to labor uncertainty after April 1. Jobbers are doing a slightly better volume of business since March 1.

Construction projects are as follows: The Camden Ice & Coal Company, Camden, Ark., plans an ice and cold storage plant to cost $90,000. The Arkansas Power & Light Company plans extensions in transmission lines at Tellville and Cotter, Ark. The Arkansas Cold Storage Company, Little Rock, plans an ice and cold storage plant to cost $100,000. The Bayou State Refining Corporation, Losston, La., will extend its oil refining plant to cost $200,000. Armour & Company, Chicago, plans a branch packing plant at Elk City, Okla., to cost $150,000. The Texas Ice & Fuel Company, Houston, plans a 40-ton ice plant on Canal Street, to cost about $60,000. The Texas-Louisiana Power Company, Pecos, Tex., has approved plans for addition to its power plant Muskogee, Okla., and San Antonio, Tex., plan ornamental lighting systems.

## *Business Gradually Increasing in Middle West*

The volume of business in the Middle West is gradually increasing, although not to a marked extent. Spring activity in industrial plants is becoming more noticeable and optimism is strongly evident. February production figures in the automotive industry are encouraging and considerable buying is reported in the agricultural districts. The coal situation in southern Illinois does not show any immediate signs of improvement, but the building situation has improved considerably. The various utility companies continue to be an important factor in general business, their purchases adding materially to the volume of business transacted. While the conservative policy of hand-to-mouth buying is still generally in effect, a somewhat less restricted attitude is being assumed toward future committments. General purchases during February were larger, one utility company averaging $140,000 per day. Among the interesting items placed this week were a motor order valued at $20,000 and an order for 400 assorted distribution transformers, 25, 37½ and 50 kva. Considerable construction work is under way. Small orders placed for such work are in excess of $50,000. Jobbers' sales are generally satisfactory. Municipal and railroad business is quite large. Appliances are moving in fair volume and the campaign last month on waffle irons resulted in volume sales of this appliance.

Construction projects are as follows: Columbia Mills, Inc., Chicago, plans a mill at West Pullman, Ill., to cost $200,000. The Reliance Dye & Stamping Company, Chicago, Ill., plans a three-story addition to cost $250,000. The Chicago, Burlington & Quincy Railroad Company plans a power plant to cost $50,000. The Caterpillar Tractor Company, East Peoria, Ill., will erect an addition to cost $200,000. The University of Illinois, Urbana, plans a testing laboratory to cost $400,000. The Interstate Public Service Company, Indianapolis, Ind., plans purchase of lines in Johnson, Bartholomew and Shelby counties. The Rollins Hosiery Company, Des Moines, Iowa, plans an addition to cost $100,000. Emmetsburg, Iowa, plans a municipal power plant. The Western States Public Utilities company will add to its power plant at Sheldon, Iowa, at a cost of $80,000. The Iowa Railway & Light Company will erect a power plant at Webster City, Iowa, to cost $38,000. Royal Oak, Mich., plans a new pumping plant for waterworks service, to cost $80,000. The Detroit Edison Company plans a one-story substation at Royal Oak, Mich., to cost $140,000. The St. Joseph Paper Board & Box Company, St. Joseph, Mich., plans a new mill to cost about $300,000. Earl Dickason, Chillicothe, Ohio, plans a baking plant to cost $125,000. The Vermont Marble Company, Cleveland, has filed plans for a plant on Harvard Avenue, to cost $100,000. Dayton, Ohio, will take bids for a central station for fire alarm and police signal systems, to cost about $50,000. The Defiance Dairy Products Company, Defiance, Ohio, plans a plant to cost $275,000. E. I. du Pont de Nemours & Company, Wilmington, Del., will extend its powder mills at Barksdale, Wis., to cost $400,000. The Wisconsin Power & Light Company plans a two-story storage and distributing plant addition at Berlin, Wis., to cost $25,000; also a similar plant at Portage, Wis. Evanston, Ill., Niles Center, Ill., and Cedar Rapids, Iowa, plan ornamental lighting systems.

## *Industrial Business Active on Pacific Coast*

Some excellent industrial business is reported on the Pacific Coast. A pulp mill in Gray's Harbor, Wash., bought $12,000 worth of motors. A 10-ton pulp mill is to be built in South Bend, Wash. A mining company also will build a 3,294-hp. plant next July in Tuolumne County. A Mexican mining company is in the market for motors and supplies for Mazatlan shipment. Ten elevator equipments and a distribution switchboard with a total value of $60,000 have been sold by the Westinghouse Electric Manufacturing Company for San Francisco installation. Other interesting orders include two motor-generator sets, valued at $5,000, for motion-picture service and two 200-hp. motors for a Honolulu sewage disposal plant. Another Honolulu order covers transformers, watt-hour meters, etc., valued at $8,000. Power company orders include one carload insulators for $7,500, 200 assorted 7,500-volt line switches and 10,000 assorted steel pins. The city of Anaheim is in the market for transformers and meters and the city of Los Angeles for meters, instruments and a carload of line switches.

Sales of motors and heavier apparatus in Seattle are reported from fair to good. The majority of sales cover pumps and motors for irrigation and orchard districts in eastern Washington and Oregon and small motors for replacements and minor additions to lumber mills and woodworking plants in northwest Washington and Gray's Harbor. The sale of four motor-driven pumps for a pump mill in Whatcom County is reported. Buying for pulp and paper mills, including one new plant and additions to two or more is expected this spring. The Great Northern Railway Company has awarded a contract for approximately $100,000 worth of insulators and line materials in connection with the completion of electrification of its main line from Wenatchee to the Cascade tunnel.

Construction projects are as follows: The Belmont Copper Company, Superior, Ariz., plans a flotation plant to cost $200,000. The Pacific Gas & Electric Company plans improvements at Lodi, Calif., to cost $75,000; also in vicinity of Yuba City, to cost $80,000. Riverside, Calif., is planning a 5,000-kw. municipal power plant. The National Ice & Cold Storage Company, San Francisco, plans an ice plant at Hollister, to cost $80,000. The Monolith Portland Cement Company will make extensions in its mill at Tehachapi, Calif., to cost $250,000. Walter H. Wheeler, Minneapolis, Minn., is preparing plans for a power plant at Polson, Mont., to cost $75,000. The California Petroleum Company, Sunburst, Mont., will extend its refining plant to cost $200,000. The Doernbecker Manufacturing Company, Portland, Ore., will add its furniture plant at a cost of $400,000. The San Juan Pulp Manufacturing Company, Bellingham, Wash., plans an addition to cost $100,000. Los Angeles and Santa Maria, Calif.; Great Falls, Mont.; Aubuquerque, N. M.; Oregon City, Ore., and Wenatchee, Wash., plan ornamental lighting systems.

## *Industrial Equipment Buying Active in New England*

An encouraging increase in buying is reported in the New England district. New installations and replacements of power equipment are being considered and a number of interesting purchases amounting to about $275,000 were noted. Orders included a 6,000-kw. turbo-generator unit with control apparatus, costing about $160,000; switchboard and power control equipment, amounting to about $25,000, for mill expansion, and an order for power control, consisting of switchboards, regulators and accessories, amounting to $75,000. Small motor sales are increasing and are up in volume to those of last year. Transformer inquiries are active. Central-station requirements are receiving more attention and orders are steady, with line hardware, wire and poles in good demand.

An increase in appropriations for street lighting is noted throughout the district, appliance sales are steady and wiring contracts for mercantile type construction and institutions are in good volume. Charles H. Tenney & Company, Boston, Mass., plan a power plant on the waterfront at Salem, Mass., to cost in excess of $1,000,000.

# Activities of the Trade

## Jefferson Electric Combines With Chicago Fuse Company

Announcement was recently made of the consolidation of the Jefferson Electric Manufacturing Company and the Chicago Fuse Manufacturing Company. The new organization will be known as the Chicago-Jefferson Fuse & Electric Company, with offices at Laflin and Fifteenth Streets, Chicago. The following are officers of the new organization: President, J. A. Brennan, formerly president of the Jefferson Electric Manufacturing Company; vice-president, A. R. Johnson, formerly secretary of the Jefferson Electric Manufacturing Company; vice-president, A. E. Tregenza, formerly vice-president of the Chicago Fuse Manufacturing Company; treasurer, J. C. Daley, formerly treasurer of the Jefferson Electric Manufacturing Company.

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## Lincoln Opens New School for Instruction on Arc Welding

For many years a school of welding has been conducted by the Lincoln Electric Company, Cleveland, manufacturer of "Stable-Arc" welders, at its shop. The company recently entirely reorganized and re-equipped this school. Its purpose is the training of electric arc welders, no tuition or fees being charged. The course in the school occupies 30 days and is given in 12 lessons.

The pupils in the school work under the direction of a trained instructor, who teaches them both as a class and as individuals. All the educational work comes under the general direction of A. F. Davis, vice-president of the company. With 30 days intensive training, men are able to acquire a sound working knowledge of the fundamentals of electric arc welding and are fitted to engage competently in the trade. The company does not maintain an employment bureau for graduates of the course, but it does, if possible, fill such applications for men as are made to it from the school.

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THE PETTINGELL-ANDREWS COMPANY, Boston, electrical jobber, announces that its name has been changed to the General Electric Supply Corporation. Frank S. Price, president, states that no change in ownership, organization or policy is involved.

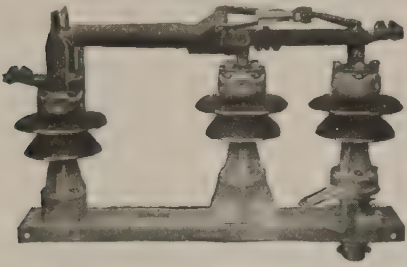
THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order for the complete electrical equipment of the shipping board freighters "Defiance" and "Triumph" which will be converted to Diesel-electric drive.

THE GENERAL ELECTRIC COMPANY, refrigeration department, has appointed J. J. Donovan as apartment house specialist. Mr. Donovan was formerly territorial representative with headquarters at Pittsburgh, Pa.

# New Equipment Available

## Disconnecting Switch

The 37-kv., 2,000 amp., type TTR gang-operated "Hi-Pressure" contact disconnecting switch placed on the market by the Railway & Industrial Engineering Company, Greensburg, Pa., has the operating parts above the insulator of non-ferrous metals and is fitted with monel metal bolts and pins at the vital points. The contact is made by rotating the blade into chrome steel reinforced jaws under pressure after the blade is operated into closed position. The rotating movement cleans the contact surface of corrosion and dirt. The pressure contact is released before the blade lifts, which the manufacturer claims makes its operation easy. The bearing on the rotating insulator column is equipped with Alemite lubrication.



*37-kv., 2,000-amp. gang-operated "hi-pressure" contact disconnecting switch*

## Manual A.-C. Motor Starter

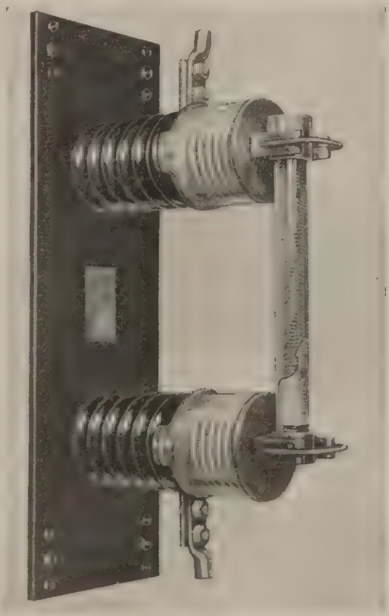
A manually operated starter for alternating-current motors up to 7½ hp., known as the C-H 9115, has been placed on the market by the Cutler-Hammer Manufacturing Company, Milwaukee. The switch mechanism incorporates the new C-H double-break roller contacts and wide-faced figures of heavy copper, cadmium plated. Thermal overload inverse time limit protection is provided. The mechanism of the starter is mounted on a "Thermoplax" panel, and knockouts are arranged on five sides of the box. The device has a two-part safety cover such that the lower part only can be opened for quick replacement of the fusible links in the overload cutouts, the upper part being arranged so that it can be locked if desired.

## Inclosed Circuit Breaker Potheads

The "U-Re-Lite" manufactured by the Cutter Electric & Manufacturing Company, Nineteenth and Hamilton Streets, Philadelphia, is now available in increased capacities for 440-volt and 550-volt alternating-current service as follows: The "Junior" three-pole unit up to 80 amp., the "Senior" three-pole unit up to 200 amp., the type "W" three-pole unit up to 400 amp., and the type "LL" three-pole unit up to 1,000 amp. The company states that, interpreted in dollars, this means that many circuits formerly requiring a "Senior U-Re-Lite" can now be protected by a "Junior U-Re-Lite" and similarly in the cases of the other breakers mentioned above, at no sacrifice in positive protection, but at a saving in cost. The capacities given for the various types are load-carrying capacities. For interrupting capacities the company refers to tests made by two utility companies.

## Potential Transformer Protective Combination

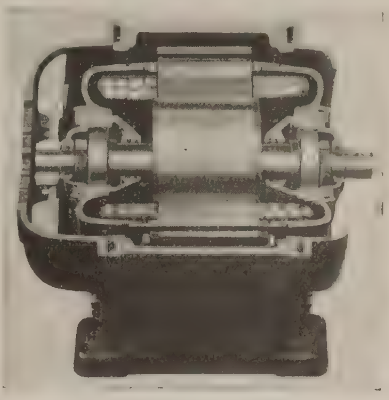
The type RR potential transformer protective combination has been placed on the market by Schweitzer & Conrad, Inc., Chicago. The equipment, as shown in the illustration, consists of combinations of a new current-limiting resistor and the type DLC ½-amp. fuse. The resistor has the S&C wire wound form of construction and is for indoor use only. The essential differences between this type of resistor and other S&C resistors are that the type RR unit occupies a minimum of space and it may be applied, without alterations, to any existing indoor fuse mounting. This new design thus makes it possible to add a current-limiting resistor to any indoor fuse mounting now installed in a potential transformer application.



*A protective combination for potential transformers*

## Totally Inclosed Motor

A new type of completely inclosed ventilated motor with a 40-deg. rating has been placed on the market by the American Electric Motor Company, Cedarburg, Wis., which recently became a subsidiary of the Splitdorf-Bethlehem Electrical Company of Newark, N. J. In describing this motor the company cites an unusual test to demonstrate how effectively dust is excluded from the windings. A glass case was filled with a mixture of sand, iron fillings and sawdust until the motor was half covered. An external fan on the motor churned this mixture, filling the air with it and completely surrounding the motor with thick dust. For two weeks the motor was run under these extremely adverse conditions. When the motor was opened the windings were so clean that a permanent magnet brushed over them showed no trace of filings. Nor had any sand or sawdust penetrated the cover. The inclosed hoods hermetically seal the winding. The hoods are telescoped into a ring fastened to the stator laminations, the surfaces of which are machined.



*Cooling is accomplished by driving the air through as well as over the stator laminations*

The cooling of this type P-K motor is such that air is driven through as well as over the stator laminations. The stator core is perforated. Air in the inclosed portion is agitated by malleable cast fans shrunk on the motor shaft. The ball bearings are of the cage type. The inclosing hood of the motor can be removed without disturbing the bearing, which remains on its shaft inclosed in its cage. The stator is removable. Should it be damaged it can be replaced in a few minutes. The rotor has the end rings electrically welded to the bars.

Polyphase Switches.—A line of polyphase switches built in sizes ranging from 60 amp. to 400 amp. with test connections and from 60 amp. to 600 amp. without test connections. These can be furnished with fuses sealable or accessible when the switch is in the "off" position. The switch is of slate base construction and the contacts are mounted on the top where they can be inspected in the "on" position.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Feb. 14, 1928)

1,659,293. Electrical Device; W. Hermann, Chicago, Ill. App. filed Jan. 5, 1924. Electric igniters of the type employing a spring actuated drum and a cable which winds on the drum.

1,659,295. Lath Support and Loom Fastener; P. P. Kaufman, Appleton, Wis. App. filed July 23, 1925.

1,659,303. Connecting Block for Electric Wiring; L. H. Rovere, Richmond, N. Y. App. filed May 23, 1924.

1,659,312. Multiple Connecter; R. C. Colwell, Morgantown, W. Va. App. filed Dec. 11, 1924. For connecting a plurality of electric wires to a battery terminal or the like.

1,659,400. Electric Heater; J. M. Frank, Chicago, Ill. App. filed Jan. 21, 1924. Known as a grid heater.

1,659,421. Electrical Cigar and Pipe Lighter; C. D. Anderson, Ojus, Fla. App. filed March 29, 1927.

1,659,422. Clock; J. Bachtold, New York, N. Y. App. filed Nov. 23, 1926. Electromagnetic secondary clock.

1,659,429. Induction Electricity Meter; J. Harris, La Fayette, Ind. App. filed June 15, 1925.

1,659,447. Electrical Attachment Plug; C. F. Smith, New Britain, Conn. App. filed March 18, 1926.

1,659,463. Electrical Connecter; T. B. Entz, Brooklyn, N. Y. App. filed Jan. 24, 1924. For connecting the terminals of storage batteries.

1,659,464. Current Connecter; M. F. Fitzgerald, Winsted, Conn. App. filed July 24, 1924. For portable electrical devices such as flat irons, etc.

1,659,469. Transformer for Electric Arc Cutting and Welding Apparatus; F. C. Owen, Fayetteville, N. C. App. filed Nov. 14, 1925.

1,659,479. Electric Heating Unit or Element; A. Brown, Gore, N. Z. App. filed March 23, 1923. For heating or boiling water in kettles, etc.

1,659,502. Burglar Alarm Lock; W. J. Tyson, New York, N. Y. App. filed Dec. 4, 1925.

1,659,513. Electrical Steam Generator; C. B. Baughn, Visalia, Cal. App. filed Oct. 20, 1926.

1,659,515. Metal Clad Electric Switch Gear; H. W. Clothier, Wallsend-on-Tyne, and A. Allan, North Shields, England. App. filed April 21, 1925.

1,659,548. Transformer; S. E. Johannesen, Pittsfield, Mass. App. filed Sept. 8, 1926. A magnetic core and winding arrangement for transformers wherein those parts subjected to large differences of voltage are well separated and insulated.

1,659,549. Electrical Measuring Instrument; I. F. Kinnard, Lynnfield, and W. H. Pratt, Lynn, Mass. App. filed July 12, 1926. Of the induction type for measuring characteristics of alternating current circuits such, for example, as the conductance.

1,659,550. Method of and Furnace for Uniting Metal Parts by Fusion; C. Steenstrup, Schenectady, N. Y. App. filed May 29, 1926.

1,659,551. Electric Coupler; H. E. Van Dorn, Chicago, Ill. App. filed May 9, 1921. For automatically coupling together a large number of train circuits on one railway car with those on an adjacent car.

(Issued Feb. 21, 1928)

1,659,561. Electric Percolator; W. S. Bremer, St. Louis, Mo. App. filed June 4, 1926.

1,659,576. Carbon Holder; G. D. Brady, Detroit, Mich. App. filed April 17, 1922. Adaptable for projection apparatus.

1,659,582. Automatic Electric Control Device; J. F. Wiggert, Lead, South Dakota. App. filed April 12, 1927. For automatically regulating pressure or the like.

1,659,606. Synchronoscope; K. H. May, Berlin, Germany. App. filed July 15, 1927. Employing an induction disc and induction field elements co-operating with the disc such that the apparatus may be largely constructed from standard meter parts.

1,659,614. Wall Circuit Breaker; F. W. Roller, East Orange, N. J. App. filed Sept. 25, 1924. Applicable to the formation of control panels for lighting and other circuits of rooms, offices, residences and the like.

1,659,619. Protective Arrangement; O. C. Traver, Schenectady, N. Y. App. filed March 18, 1926. For systems comprising two parallel lines, especially when these are provided with a differential system of protection involving current transformers which are connected in series for normally circulating current, whereby further protection, such that either line alone may carry as much current as the two together, is provided.

1,659,623. Dynamo-Electric-Machine Stator; J. M. Barr, Milwaukee, Wis. App. filed Dec. 12, 1923.

1,659,646. Circuit-Testing Device; F. R. Weiss, Chicago, Ill. App. filed April 9, 1925.

1,659,648. Electrical Fitting; H. A. Douglas, Bronson, Mich. App. filed Jan. 27, 1926. For miniature lamp.

1,659,698. Massage Vibrator; N. E. Norstrom, Chicago, Ill. App. filed June 22, 1922.

1,659,706. Means for Suppressing Harmonics of the Transmitting Line Frequency; R. Rudenberg, Berlin-Grunewald, Germany. App. filed Aug. 25, 1926.

1,659,719. Blanket Warmer; G. E. Blake, Fort William, Ontario, Can. App. filed April 18, 1927.

1,659,729. Constant-Voltage Alternator; D. K. Gannett, Jackson Heights, N. Y. App. filed Nov. 24, 1923. In which the output voltage will be substantially constant regardless of variations in the exciting voltage.

1,659,731. Insulator; E. I. Green, East Orange, N. J. App. filed July 1, 1925. Adapted to stabilize the leakage loss under different weather conditions.

1,659,749. Electric Incandescent Lamp and Method of Manufacturing Its Illuminating Body; F. Skaupy, Berlin, Germany. App. filed Dec. 2, 1921.

1,659,759. Motor Controller; T. E. Barnum, Milwaukee, Wis. App. filed May 17, 1920. Combined starting and low-current cutout controller for alternating current motors having different circuit connections for starting and running.

1,659,774. Electric Heating Device; W. W. Hicks, San Francisco, Calif. App. filed Jan. 5, 1925. Hot plate.

1,659,779. Current-Controlling Device; T. J. Madigan, Brooklyn, N. Y. App. filed May 12, 1926. Automatic switch for electric heating devices such as flat irons.

1,659,862. Thermally-Controlled Electric Snap Switch; O. Dodge, Colorado Springs, Colo. App. filed Aug. 10, 1922. Cut-off mechanism for heated utensils.

1,659,864. Switch for Electric Flash Lights; R. M. Eaton, Niagara Falls, N. Y. App. filed Sept. 23, 1926.

1,659,897. Reflector for Radiant Heaters; J. Schoenfeld, Alameda, Calif. App. filed April 6, 1925.

1,659,904. Means for Regulating Traffic; F. E. Woodford, Chicago, Ill. App. filed Sept. 14, 1922.

1,659,911. Apparatus for Performing Soldering Operations; J. W. Fay, Villa Park, Ill. App. filed June 13, 1924.

1,659,914. Stop Action for Organs; W. E. Haskell, Brattleboro, Vt. App. filed Feb. 7, 1923.

1,659,920. Electric Welding Process; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Dec. 18, 1924. In which a steel tube is provided with a fin or flange of copper for use in boiler walls.

1,659,921. Clamping Device; J. C. Nichols, Chicago, Ill. App. filed March 10, 1923. Which may be included in an electrical circuit and conduct current from the circuit to an article held by the device.

1,659,936. Molding Composition; H. F. Albright, Jr., Oak Park, Ill. App. filed Dec. 27, 1923. Comprising a compound composed of 8 per cent shellac, 21 per cent kauri gum, 55 per cent mica, and 16 per cent vermilion, and in addition a small quantity of rubber.

1,659,946. Apparatus for Heat Treating Articles; J. W. Fay, Villa Park, Ill. App. filed March 12, 1926.

1,659,951. Lamp Socket; J. Hohl, Newark, N. J. App. filed Dec. 5, 1922. Of cold moldable insulating material.

1,659,986. Electric Stove; O. F. Baughman and L. W. Cady, Lakewood, Ohio. App. filed April 2, 1925.

1,660,017. Switch Plug; J. Schoenfeld, Alameda, Calif. App. filed April 13, 1925.

1,660,041. Facial Treatment Method and Means; W. Meyer, Chicago, Ill. App. filed June 12, 1925.

1,660,052. Electric Heater; G. W. Shepherd, Terre Haute, Ind. App. filed Dec. 7, 1926.

1,660,070. Floor Switch; H. W. Crane, Chicago, Ill. App. filed Dec. 27, 1920.

1,660,080. Relay for High-Tension Fuses; P. C. McKendrick, St. Paul, Minn. App. filed May 25, 1925.

# New Trade Literature

MOTORS AND FIELD COILS.—Bulletins GEA-712A, GEA-918, GEA-919 and GEA-920 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its type BTA adjustable speed, alternating-current, brush-shifting motors, the improved brush-holders for GE-73 and GE-240 railway motors and field coils with spring pads for GE-265 railway motors.

AUXILIARY EQUIPMENT.—The Cochrane Corporation, Seventeenth Street below Allegheny Avenue, Philadelphia, is distributing bulletin No. 676 covering apparatus for heating systems and industrial plants, including combined heaters and hot wells or storage tanks, deaerting heaters, steam and oil separators, traps, back pressure valves, filters and flow meters.

INCLOSED CIRCUIT BREAKER.—The Cutter Company, Nineteenth & Hamilton Streets, Philadelphia, has issued a supplement to its hand book of the "U-Re-Lite" covering larger capacity units of different types. Attention is also called to the multi coil U-Re-Lite, the separable contact U-Re-Lite and the extra long time-delay U-Re-Lite Included is data on short circuit tests made at the Hermitage Avenue station of the Commonwealth Edison Company of Chicago.

ELECTRIC APPLIANCES.—Catalog No. 3 issued by the Central Flatiron Manufacturing Company, Johnson City, N. Y., describes and illustrates the various "Betsy Ross" electric aids for the household and also includes a price list.

PROTECTIVE COMBINATIONS.—Bulletin AD1004 issued by Schweitzer & Conrad, Inc., 4421 Ravenswood Avenue, Chicago, describes and illustrates its type RR protective combinations for potential transformer applications in indoor locations.

STOKER.—A new publication issued by the American Engineering Company, Philadelphia, describes the Taylor coal-burning unit. A large drawing shows the Taylor unit driven by the Hele-Shaw rotary hydraulic motor.

OUTDOOR STATION EQUIPMENT, SWITCHES AND ELECTRIC FURNACES.—Bulletins GEA-505A, GEA-857, GEA-915, GEA-928, GEA-929 and GEA-930 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its type TD-328 expulsion fusible cutout and disconnecting switch for short circuit protection and type EF-1 combined expulsion fuse and disconnecting switch for outdoor station equipment, the type E, form C expulsion type fusible primary cutout and disconnecting switch, the type LP-3 air break starting switches with round studs for synchronous converters, type LD-22 knife (lever) switches with laminated studs and the GE pot-type electric furnaces for lead hardening.

METAL AND NICKEL PRODUCTS.—The International Nickel Company, Inc., 67 Wall Street, New York City, has issued a fall 1927 buyers' guide on monel metal and pure nickel products.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Singapore, Straits Settlements (No. 29,908), for storage batteries for automobiles.

Purchase is desired in Barcelona, Spain (No. 29,978), of battery chargers and molds and separators for batteries.

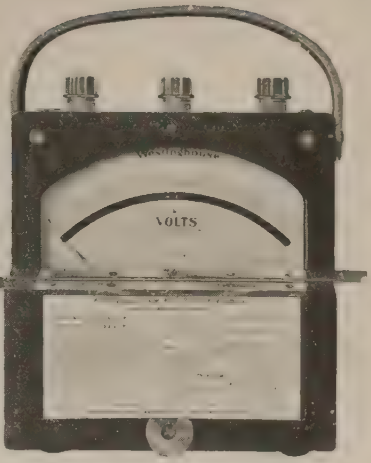
An agency is desired in Turin, Italy (No. 29,981), for electrical apparatus.

An agency is desired in Caracas, Venezuela (No. 29,942), for household electrical appliances.

Purchase and agency are desired in Rome, Italy (No. 29,925), for high-voltage insulators, radio, telegraph and telephone apparatus and wiring supplies.

Purchase and agency are desired in Goteborg, Sweden (No. 29,926), for household electric refrigerators.

# Positive Accuracy



PORTABLE instruments attain maximum usefulness only when they are accurate.

Westinghouse PY-5 instruments are recognized standards of instrument accuracy. Not only are these instruments particularly applicable for general testing and laboratory work, but they are also useful in calibrating and checking other instruments.

Remarkable compactness has been achieved in the PY-5 line—with no sacrifice of dependability. Maximum accuracy in reading is assured by a scale of full length for instruments of this class.

An outstanding feature of the PY-5 instrument is that the control resistors and shunts are mounted on the end plate with the terminals. The end plate can be quickly removed—a design which greatly facilitates the making of adjustments to the resistances, in case the user desires to recalibrate the instruments.

Each instrument is mounted in a sturdy case, the cover of which folds back, exposing the dial for reading when in use, and protecting the glass and scale from injury when not in use.

Type PY-5 instruments include a complete line of voltmeters, ammeters, and single-phase wattmeters.

W
WESTINGHOUSE ELECTRIC

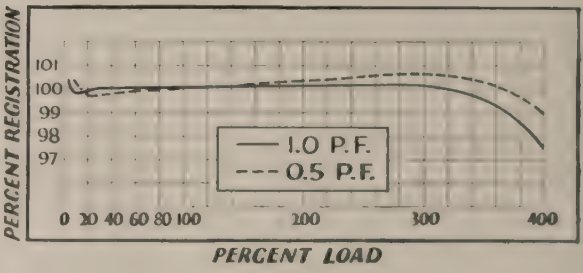
## Type PY-5 Portable Instruments *for* Alternating Current

Westinghouse Electric & Manufacturing Company
Newark Works Newark, N. J.
Sales Offices in All Principal Cities of
the United States and Foreign Countries

# Westinghouse

X9712

# The new SANGAMO
## TYPE H.C.
# METER



## STRAIGHT LINE ACCURACY TO 300 PER CENT—FULLY TEMPERATURE COMPENSATED

Since 1914 the fundamental design of Sangamo Type H Meter has not been changed. Proof of its dependability and performance is the fact that over four million have been placed in service.

Now, a few simple changes have produced a meter correct under all service conditions of load and temperature...the Type HC. However, the original design is so closely followed that many parts of the Type HC are interchangeable with corresponding parts in the Type H.

The load curve tells the story of HC super-accuracy...a straight line to 300 per cent. Temperature compensated means compensated at all power-factors, from 20 deg. to 120 deg. Fahrenheit. As with other good modern meters, voltage and frequency variation errors are negligible.

Mechanical improvements include a reinforced metal cover and positive location and locking of the permanent magnets. Compared with the Type H, the weight of the moving system is the same, the torque the same, the speed reduced. Direction of disk rotation has been reversed. In short the HC Meter has been standardized and modernized in every detail.

The Type HC is fully described in an addenda to Bulletin 67, which will be sent on request.

SANGAMO ELECTRIC COMPANY, SPRINGFIELD, ILLINOIS

“Megger” Ground Resistance Tester

# A direct-reading Instrument for testing the resistance to Earth —of Ground Connections

**BIDDLE SPECIALTIES**

- **“Megger,” “Meg” and “Super-Meg” Insulation Testing Instruments**
- **“Megger” Ground Resistance Tester**
- **Frahm Frequency Meters**
- **Frahm Tachometers**
- **Jagabi Speed Measuring Instruments**
- **Jagabi Rheostats**
- **Dionic Water Tester**
- **Siemens & Halske Precision Electrical Instruments**
- **Precision Potentiometers**
- **Scientific Apparatus**

THIS new “Megger” Instrument tests “grounds” merely by making one set of connections, turning the crank and reading the scale. No adjustments, no “balancing” and no calculations,—it reads like a voltmeter.

It offers definite advantage over other methods; and is of especial value not only because it is direct-reading —*“like a voltmeter”*—but because it is not affected by *severe* stray alternating or direct current in the earth —or by polarization or electrolysis.

“Megger” Ground Resistance Testers are now available with ranges as low as 0 to 3 ohms and as high as 0 to 3000 ohms; with 2 or 3 ranges in the same instrument. Already they are performing for “ground-testing” the equivalent of what “Megger” Testing Sets have done—for 25 years—for testing insulation resistance.

Write today for
New Bulletin
No. 1165-W.

James G. Biddle
*Electrical Instruments*
1211-13 Arch St., Philadelphia

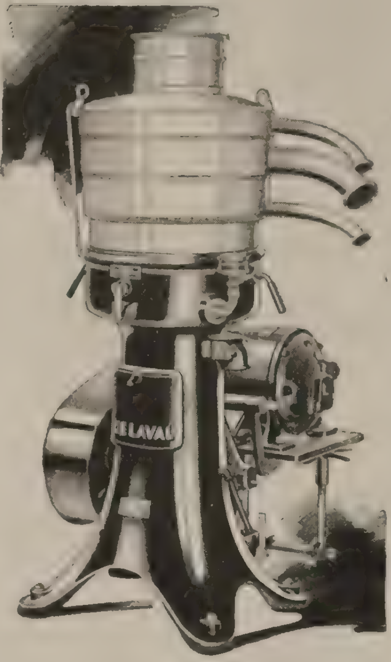
**“MEGGER”**
TRADE MARK REGISTERED U.S. PAT. OFF.

# Leadership

## ~ *among the leaders*

SINCE 1878, when De Laval invented the first continuously operated centrifugal separator, no one has thought of such a machine without thinking "De Laval." This year, as we observe our Golden Anniversary, De Laval leadership in centrifugally separating, purifying or clarifying various liquids is just as pronounced as it was 50 years ago.

De Laval's leadership is proved by the number and character of the organizations which are today adding more De Laval Centrifugals to their plant equipment. It is the result of rigid adherence to the De Laval policy of building the finest centrifugal machines that can be designed and selling them at the lowest prices made possible by its modern mass production methods; making no concessions in design, quality or price to offset the claims made for other machines.



THE list below shows a few of the nationally known organizations from which *repeat* orders for De Laval Centrifugals have been received during the past few months:

- American Gas & Electric Co.
- American Steel & Wire Co.
- Brooklyn Edison Co.
- Carnegie Steel Co.
- Devoe & Raynolds Co.
- The Ford Motor Co.
- General Electric Co.
- The Glen Alden Coal Co.
- Humble Pipe Line Co.
- Jones & Laughlin Steel Corp.
- The Lehigh Portland Cement Co.
- Nash Motors Co.
- Public Service Production Co.
- Reo Motor Car Co.
- Southern California Edison Co.
- Stone & Webster, Inc.
- U.G.I. Contracting Co.
- Union Electric Lt. & Power Co.

*In writing for information as to how De Lavals can best work for you, please ask for Bulletin 106-W on lubricating oil or Bulletin 107-W on insulating oil.*

*Three De Laval Oil Purifiers in the Hudson Avenue Station of Brooklyn Edison Company*

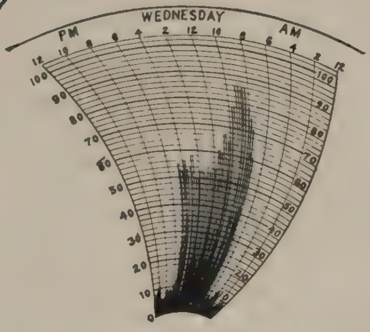
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 600 Jackson Blvd., Chicago
DE LAVAL PACIFIC COMPANY, 61 Beale St., San Francisco
ALFA-LAVAL CO., Ltd., 34 Grosvenor Road, London, S. W. 1

# DE LAVAL OIL PURIFIERS

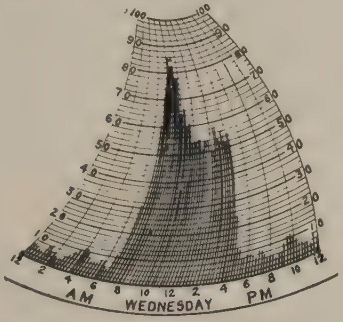
*Types for Lubricating Oil and Insulating Oil*

# *Improved* Demand Meters

## *Types G-9 and GS-9*



*Section of standard 7-day chart, as used to show accurately the time of maximum demand as well as the value.*



*Record of same all-day load as above but on inverted chart, which is advantageous for reading the time and the value of the smaller demands.*

The G type demand meters can be used with any type or make of watthour meter—they are flexible. They give a complete record for a week or longer on one circular 8-in. wax-coated chart that is easily filed. They produce a well-defined record that can be accurately read.

*Send for Bulletin GEA-903*

While these new meters adhere to the same fundamental principles of operation as the G-8 and GS-8, which they supersede, they embody several changes in design. These minor modifications, which are directed toward a general improvement of the line, are as follows:

1. The clocks are equipped with temperature-compensated balance wheels together with improved winding key and arbor.
2. The thermostat and its mounting also are improved.
3. Bronze bearing bushings have been added to important bearings in the mechanism and clock, and the stylus arm has been stiffened.
4. The general appearance has been made much more attractive; the meters are now finished in nickel and black throughout.

620-5

# GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

# TWO WEEKS FROM TO-DAY

GENERAL ELECTRIC will introduce a new, complete line of porcelain-housed primary cutouts, the culmination of several years' development.

This line will establish new standards of value by reason of mechanical and electrical improvements, and especially because of greatly increased insulation strength which will place cutouts on a basis comparable with modern practice in line insulation.

The new G-E line will permit the economical use of high-grade cutouts on the lower-voltage distribution systems; it will also make available at reasonable cost unique and superior cutouts for higher-voltage systems.

GENERAL ELECTRIC

420-11

Electrical World

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W. H. ONKEN, JR.
*Editor*

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## *Water Power Not in the Discard*

WHILE steam is and will be the mainstay of the electric light and power industry, water power is by no means in the discard. True, there have been wonderful improvements in steam-plant equipment which have added perceptibly to steam-station economy, and there are possibilities for still greater improvements; but that does not mean that water-power development will necessarily cease or that steam-plant production will totally eclipse water-power production. So far as hydro-electric possibilities are concerned, there are as good fish in the sea as ever were caught, nor has water-power development received the setback that many suppose. The Federal Power Commission is receiving applications for water-power development at the rate of one hundred a year. Construction has been definitely authorized for six million horsepower, of which two million is completed and in operation. Five and a half million more is under investigation by preliminary permittees, and fifteen million horsepower is covered by applications not yet acted on. Approximately one-third of the total electrical energy generated is produced from water power.

Unfortunately, the development of many large power sites is being held up temporarily for political reasons. For example, there are five projects on the St. Lawrence River, involving approximately five million horsepower of installed generating equipment, which cannot be acted on until Canada and the United States agree on an acceptable scheme of development. Thirty-four projects, representing nearly six million horsepower, are held up pending the ratification of the Colorado River compact. There are also awaiting action applications for sites on the Tennessee involving more than three-quarters of a million horsepower. Hydro-electric development has nevertheless been progressing at a fair rate, but it will not, because of the nature of the business and the location of the water power, grow as rapidly as steam-station development. However, there are many millions of horsepower awaiting development which economically cannot be touched, so far as price of output is concerned, by any steam station, and it would be unfortunate if the general improvements being made in steam-station design should blind operators to these hydro-electric possibilities.

* * * *

## *Stock Dividends and Public Relations*

THE flame of public criticism which is frequently turned upon the public utilities usually springs from misunderstanding or willful misrepresentation of some policy or practice pursued by them. The method of distributing earnings not infrequently has been the occasion, and the payment of stock dividends has sometimes been the center of attack. This has been represented as a means of obscuring unduly large earnings—of passing on to the stockholders the returns from exorbitant rates to consumers. Such arguments, although decidedly transparent, provide excellent fuel for unscrupulous politicians and others. Much or all of the misunderstanding would be avoided if those utilities concerned would point out to the public that through the stock dividend they have been able to obtain new capital cheaply; that, rather than pay out cash, they have issued stock-dividend certificates as evidence that a portion of earnings otherwise available for cash dividends has been transferred from surplus to capital account and permanently invested in the business. And this, incidentally, should answer the charge that the sole purpose of such dividends is evasion of income taxes.

Among others who should benefit from such explanation are certain writers of financial articles for newspapers who for the sake of arresting attention and providing striking headlines indulge in the use of such thoroughly misleading terms as "melon," "handout" and "Christmas gift." While the irrelevance of such expressions to the utility field is obvious to those familiar with financial practice, it may not be so evident to the general public. The use of such terms and the general misconception which exists involve the germ of much mischief to the utilities. It is much easier to eradicate the germ than to correct the mischief.

* * * *

## *Time Lag of Spark Gaps*

ADVANCE in the electrical art has almost invariably been accomplished through empirical and cut-and-try methods. Discovery of a new phenomenon has always been followed by efforts in the shop and factory to make use of it, and generally the resulting product is only a first step which is soon outdistanced as the result of competent scientific investigation looking always toward improvement. Early devices yielded more promptly to the study of underlying principles because of their relative simplicity. However, with increasing values of power and voltage, with increasing demand for refinement of measurements and with the use of higher frequencies, many more involved relations have appeared, requiring longer and longer and more and more careful study.

One class of phenomena has been particularly obstinate and difficult to analyze—namely, the behavior of the high-voltage spark gap. The importance of the spark gap in all forms of protective equipment, and the consequent importance of knowledge as to its time lag in relation to the protection afforded, are well known. The matter has been studied for years, and many more or less conflicting explanations, none of them entirely convincing, have been offered in explanation of the time lag of the various types of spark gap. Early experimenters showed the influence of ultra-violet light and other evidence that the phenomenon of breakdown in gaps is related to the condition of the intermediate gas as regards ionization. In a general way it has been recognized that the final rupture of a gap occurs through ionization by collision, but no certain laws under which the behavior of a gap may be predicted have been proposed.

At the recent winter convention of the American Institute of Electrical Engineers a further contribution to this important and interesting field was made in the paper of J. J. Torok. Using a form of impulse generator different in form from that proposed by Peek some years ago, Mr. Torok has succeeded by reflection methods in cutting off the value of a voltage impulse on a gap at any point on the curve representing the rise of the surge. In this way and with the aid of photographic methods he has studied the successive stages of the initial discharge leading finally to sparkover. Contrary to accepted opinion, a large sphere gap is found to have a definite period of preliminary discharge. Further experiments revealed the important influence of the initial state of ionization in the gap both on the preliminary form and on breakdown value of the gap. The result indicated that it will probably be difficult to control these factors, thus suggesting that the sphere gap will always require very great care and can probably never be an instrument of precision.

An important application of this suppressed-discharge method is in the opportunity it affords for studying the distribution of high-voltage electrostatic fields, as, for example, the fields around suspension insulators with arcing horns, rings and similar equipment. The suppressed discharge method constitutes an important new instrument in the fields both of scientific research and practical engineering developments.

* * * *

## High-Pressure Steam Winning Many Victories

PLENTY of expectation has been current that operating troubles would increase faster than a straight-line ratio using steam above 400 pounds pressure and 700 degrees total temperature. Through the eyes of ultra-conservatives apparatus for these heavy duties has been skeptically regarded in not a few installations. However, evidence has been growing that the art has been permanently advanced by raising pressures and temperatures, although the industry is still too much in the dark as to the economic justification of these new developments.

George A. Orrok gave the recent Midwest Power Conference at Chicago a valuable paper upon operating experience with high-pressure and high-temperature steam, and his conclusions that there now appear to be no serious difficulties up to at least 2,000 pounds are indeed significant with respect to the solution of the important physical and metallurgical problems concerned. Reports from a representative number of high-pressure installations declare that most of the anticipated troubles with equipment have been absent and that operating difficulties are on the whole no greater than with the ordinary 200-pound stations. Most of the troubles reported pertain to minor though essential equipment, like gage glasses, fittings, glands, gaskets, and so forth, and have been well taken in hand. The boilermakers state their readiness to guarantee service up to 900 degrees Fahrenheit when specified, and alloy steels for tubes, shells and castings are now available for more difficult operating conditions than have prevailed in the past. Operators report both thermal and commercial economy in the use of higher pressure, and this is borne out by repeat orders for similar apparatus, probably the best of all indications of success.

The favorable results which have been coming to light in regard to the operation of high-pressure and high-temperature plants should be supplemented in the near future by the release of more over-all cost data and analyses. When these become more generally available, engineers will be in a still better position to determine the most economical pressure and temperature to use in a particular case. Unless the economic factors in plant experience are liberally exposed to the analytical fire of the profession, progress will be slower than the splendid achievements of physical and chemical engineering in this field deserve.

* * * *

## Commercial Section Turning to Broader Objectives

PRACTICAL possibilities for constructive work by the commercial men of the power industry were never better indicated than at the meeting of the N.E.L.A. Commercial Section executive committee in Chicago last week. It was not that so much was accomplished. Rather, the time set apart for the meeting was more adequate and there ensued an unhurried discussion that went further afield and to more purpose than has been usual in the past.

For the last year or so undoubtedly the pressing problems of the residence market have held chief attention. This was well, for the great need has been to awaken the utilities to the passing of the old era of growth by the accumulation of customers, to confront them with the need for large-scale selling if expansion in this vast market is to continue. This work must go on until universal acceptance and action are realized. But undoubtedly a movement has been started. It has been reflected in many ways—the reorganization of the Society for Electrical Development, the holding of the intertrade merchandising conferences, the calling of the Industry Sales Conference, now at work; the appointment of a commercial director at N.E.L.A. headquarters, and the general quickening of executive interest. Meanwhile other committees have been at work, but the limelight has been on the domestic market.

Last week attention was also very definitely directed toward the field of power and industrial heating. Power has been more or less taken for granted in recent years, yet connected industrial customers are said to average only a 50 per cent utilization of electricity, and the use of steam, oil engines and private electric plants within easy reach of power lines still bulks very large. The difference in the extent to which power has been sold in different cities attests how great a factor good selling has been. And so it is with industrial heating. A tremendous volume of profitable factory load only waits upon an intensive study of local possibilities and the skilled man power needed to do the selling, not by talking power but by its intelligent application to the production problems of factories.

The meeting recognized that this work must now have energetic leadership—also that power men must take a more constructive part in the development of the wiring code. Such objectives can be facilitated by the new commercial director. Clearly, there is urgent need in all this work for a more effective procedure in the organization itself, that the work of committees can have more continuity, with less time and effort lost in meetings and between them.

* * * *

## *Standardize High-Voltage Tests*

SUCH a variety of tests are being conducted in high-voltage laboratories that the data produced are frequently contradictory and sometimes very unsatisfactory. Yet the relative and absolute performance of insulators, arresters and cables is of fundamental importance to development and practical application of high-voltage equipment. In order that data obtained in different high-voltage laboratories may be compared, it would be advisable to specify the steepness of impulse waves, the frequency for oscillatory tests and other details. An "impact" test is meaningless unless the wave is defined and the regulation of the test equipment measured. To determine these quantities precision instruments could be incorporated in each laboratory. Temperature, humidity and wind conditions are other essential elements that must be definitely specified to make test data comparable.

Whatever may be the opinions regarding the phenomena which actually occur on lines or the relative merits of different tests for duplicating operating conditions, it would be logical to make tests that are comparable. The proper instruments are expensive, but they are available, and high-voltage test technique has proved fully adequate to obtain reliable results if conducted under specifications. By studying the possibilties of such procedure engineering groups can devise test methods which will avoid the confusion now prevalent.

* * * *

## *Selling Only Part of Load Building*

UTILITY load-building programs do not end with contracts for power or for household appliances. The contract is merely a starting point for the formation of a seller-and-customer relationship which demands a great deal in cost and service from the seller. In large measure this fact is recognized by utility executives in building up a power sales program, because industrial specialists are carried on utility payrolls to serve as counselors to power customers. Funds are provided for advertising and sales agents to bring new industries into a territory, and in some cases the utility becomes a stockholder in the industrial enterprises. The utility accountants do not set up balance sheets per customer which embody all such indirect costs as part of the revenues and costs involved in kilowatt-hour billings.

The same principles hold good in load building with domestic customers. No utility should embark on an aggressive household load-building program without making provision for proper accounting and servicing. In the ultimate electrical home it will be profitable and necessary for the utility to provide a home-service counselor or service man. Load building in homes can stand on its feet as a merchandising business only when some degree of saturation is had in the use of electric appliances. In several cases, however, utility executives put all home load-building costs into an account called merchandising and expect a profit to show at the end of each year. For this reason some regulatory commissions point to red figures for merchandising and believe the utility is wasting money in an unprofitable business, and some utility executives wear long faces and think they have gone into an illusory business because of the same red figures.

In the initial stages of home load building it should be known that only small and well-introduced appliances can be sold on a profit-making merchandising basis. The range, refrigerator, water heater and other heavy-duty appliances must be pioneered and pushed into homes at a loss when they are considered as a merchandising enterprise and when they are new in a territory. They must be serviced often and promptly by the utility until other service agencies know how to do the work. Yet the only hope for ultimate development of business in the homes on an adequate and profitable basis lies in the sale of these pioneering appliances. Pioneering load-building costs are legitimate and should be met, but it is questionable practice to place all these costs in one account called merchandising and then have commissions and utility executives look askance at the red figures on the balance sheet because they do not understand the complete story of the costs involved in doing pioneering work in home load building. It would be well to divorce strictly store merchandising from home servicing and home appliance pioneering when computing costs for load building in homes.

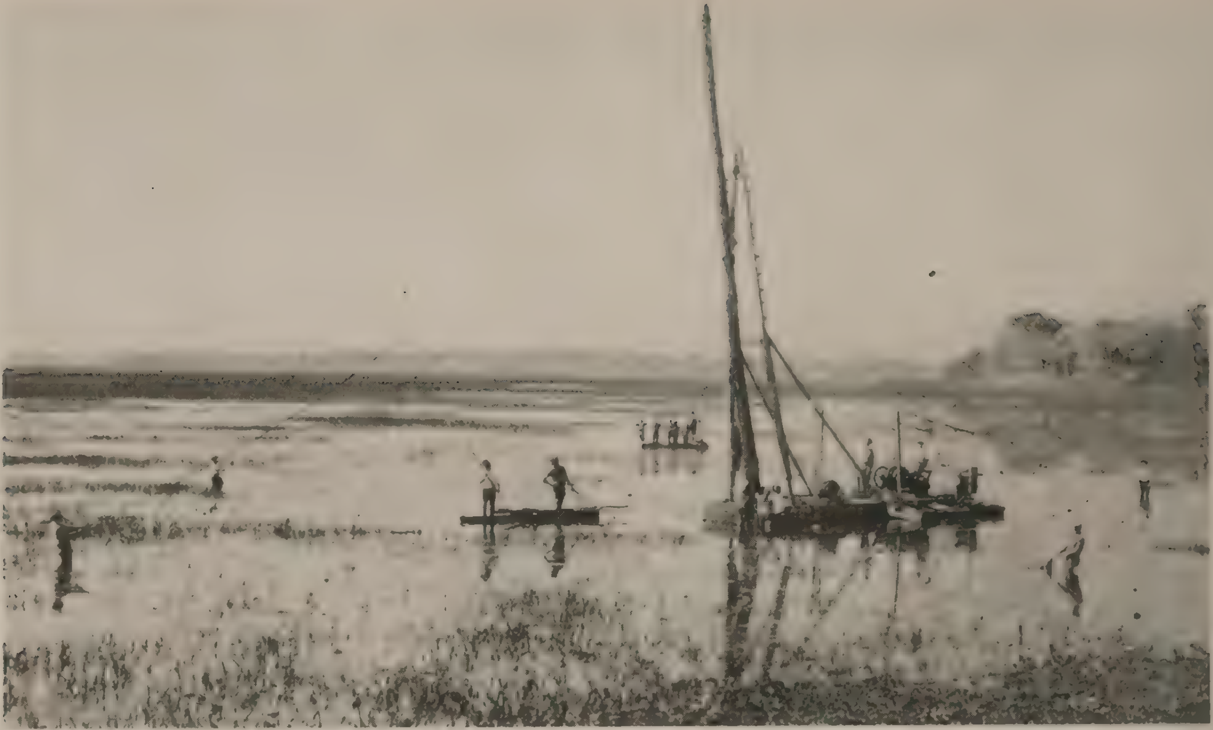
* * * *

## *Cable for High-Voltage Transmission*

OVERHEAD transmission lines are exposed to mechanical and electrical hazards that make continuous electric service difficult and expensive. Multiple lines and circuits from multiple generating sources are required to give metropolitan service to a community. In some areas it has been suggested that high-voltage underground cables might be used to replace overhead transmission circuits and thereby render more continuous service because these cables would be immune from lightning and from the hazards of accidental mechanical contact. But great care must be exercised before drawing such a conclusion if the present service rendered by even low-voltage underground cables is under consideration.

Figures compiled over several years show about seven service failures per 100 miles of cable per year for low-voltage cables now in operation. This percentage of failure, translated in terms of high-voltage, single-conductor cable, gives a service continuity per 100 miles per year much inferior to that now rendered by a modern single-circuit 220-kv. overhead line. Many of these failures are not the fault of the cable manufacture, but the installed service is the only proper measure of service value. If cost values be also placed in the equation, it may be seen that any large use of high-voltage cable for transmission faces a very decided service and economic handicap.

The present state of the cable art is, however, no guarantee of future developments. There are no inherent technical handicaps to making reliable high-voltage cables, and, if available, their use would eliminate the hazard of mechanical contact inherent in exposed overhead lines. It is encouraging, therefore, to find high-voltage cables introduced and used in Chicago and New York to bring large blocks of power at minimum cost to areas of heavy load, because ultimate developments in the art point to possibilities of underground transmission which will give better service than can be expected from overhead lines. In the interim it is advisable to measure service values in terms of actual experiences.



# *Right-of-Way Difficulties Encountered Along Florida-Georgia Line*

*Rig for erecting poles in swampy sections and nature of timber land cleared*

# Line Construction Methods

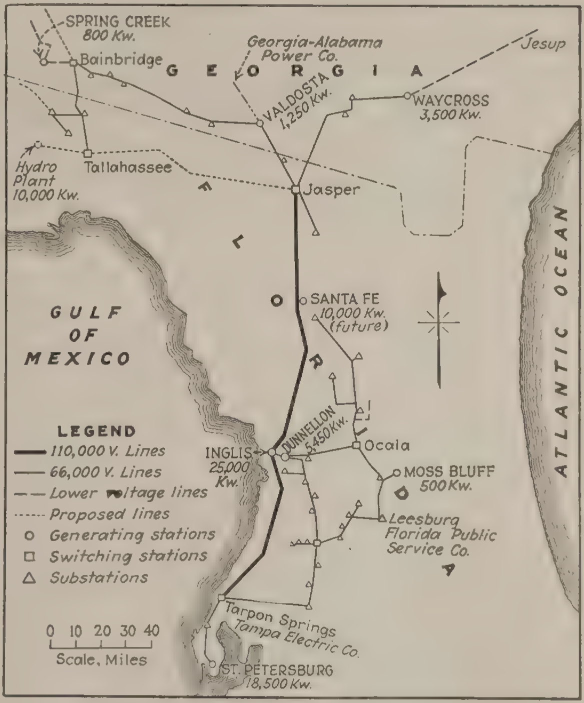
## *Used in Florida-Georgia Work*

Organization and handling of forces to speed completion of transmission lines and substations involved in expansion of National Public Service Corporation's system

By M. J. Idail* and C. E. Bland†

In the spring of 1926 the General Engineering & Management Corporation, operator and manager of the National Public Service System, entered upon a very extensive building program to meet the needs of the territory in Florida and Georgia. It had been decided that, in order to keep the standard of service in step with the increased importance of load, certain of the existing lines and substations were to be reinforced and revamped. There was additional available load in parts of the territory already served, as well as load to be had by line extensions. The company had also acquired a number of isolated, inadequate and expensively operated properties in South Georgia which had to be interconnected by a distributing transmission system, and this system in turn connected to the base power station then under construction in Florida. All of the requirements of this situation made speed of construction a paramount consideration. The demands for electric power were urgent at half a dozen places and it was necessary to start construction simultaneously at a number of widely scattered points.

Much of the line construction was through undeveloped and sparsely inhabited country. Right-of-way clearing was heavy and costly. The undeveloped nature of the country permitted the lines to be located on long tangents; there is one pole line tangent 30 miles long, and a number in excess of 10 miles, while the tower line has one tangent of 36 miles, one of 32 miles and several of 20 miles. The Tarpon Springs-Inglis section of tower line was located as close to the margin of the Gulf of Mexico as the swamp hammock would permit. Of necessity the line had to pass through a considerable amount of heavy cypress swamp. However, for a distance of 50 miles a high sandy ridge ideally suited to transmission line construction was found to parallel the coast just inside the hammock. Much of the hauling was done over the right-of-way.



*Transmission system of Florida Power Corporation, West Florida Power Company and Georgia Power & Light Company*

**The general transmission voltage is 66,000 volts. To connect the Florida and Georgia 66,000-volt system to the Inglis station the Inglis-Tarpon Springs and Inglis-Jasper 110,000-volt trunk lines were built. The company has prepared preliminary plans for a hydro-electric development on the Santa Fe River; this development will feed into the trunk line also. Contrary to general impression, the central and western part of Florida is not all flat and low; there are hills and bluffs, giving rise to possibilities of water-power development. It is interesting to note that the only water powers so far developed, or in contemplation in Florida, are a part of this system.**

The lines on the northern end of the system are for the most part built through dense turpentine woods. Florida is divided by section and range lines into sections nominally one mile square. Parts of Georgia are divided into land lots. In order satisfactorily to describe properties in the easements it was required that the lines be tied in to the section quarters and lot quarters. The labor and worry involved in making these tie-ins will be appreciated when it is realized that the original government surveys were made under the much-abused contract system around 1840 and that the pine stakes used as hubs have practically all become lost. To complicate matters further, most of the sections vary somewhat from the correct mile square.

At the start of the job a field office was opened in Ocala, Fla. A few weeks later, when both pole line and tower line work began to take on some momentum, a sub-office was opened in Thomasville, Ga. This arrangement held until the later stages, when the Ocala office was closed and the field office moved to Valdosta, Ga.

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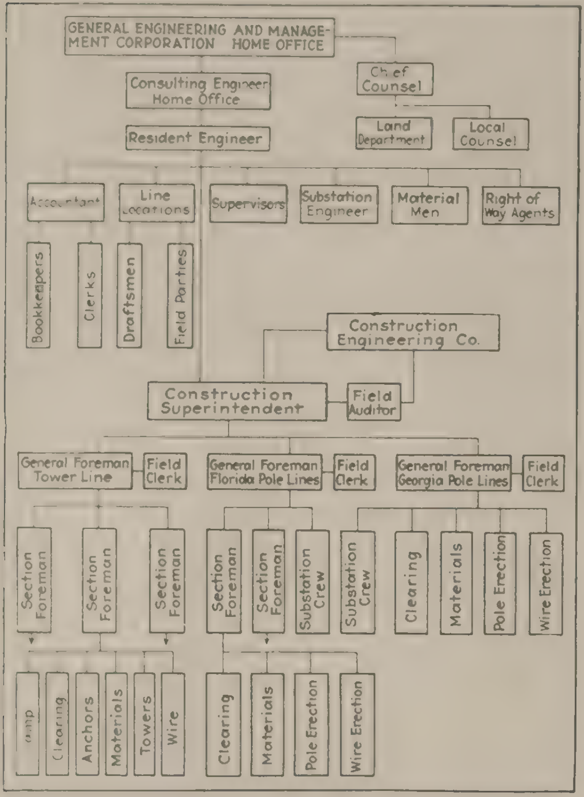
**Engineer with Francis R. Weller, consulting engineer, Washington, D. C.*

*†Construction manager Hoosier Engineering Company, Chicago, Ill.*

Although the operations in Georgia were several hundred miles distant from the Ocala office, the direction of all work was placed under one resident engineer and all accounting and disbursements were handled from the Ocala office. As the work progressed the wisdom of this arrangement was demonstrated; right-of-way and legal policies were kept uniform and details of accounting and engineering practice were standardized throughout the whole project.

While all right-of-way agents were directly responsible to the resident engineer in regard to progress, methods, payment, etc., the chief local counsel of the company formulated policies and passed on decisions in all matters appertaining to legalities, titles, rights, etc. In each county where work was done the chief counsel retained a local attorney to advise the right-of-way department and to handle legal processes, such as condemnation suits, etc. Fifteen attorneys were so retained.



*Engineering and construction organization chart*

The county records of title in Florida in general are in poor shape due to the many transfers and subdivisions which have taken place during the past few years. It was found necessary for the chief counsel to form a land department to clear up titles in the easements after the right-of-way department had obtained easements sufficiently good to warrant proceeding with construction. It was entirely out of the question to delay construction until titles to properties involved were completed. The land department will not have completed its work for a year or more after construction has been completed. Even making these concessions the right-of-way situation, as it always does in such rush projects, controlled and limited construction rates.

The surveys and plotting of tower line and central Florida pole lines were handled under the direction of the locating engineer from the Ocala office; similar North Florida and Georgia work was handled under the direction of the assistant locating engineer from Valdosta. The Florida and Georgia right-of-way groups were entirely independent of each other.

Three chief inspectors, or supervisors, and a substation engineer formed the contact between the resident engineer and the four construction groups; i.e., tower lines, Florida pole lines, Georgia pole lines and substations, and relieved him of all details of construction. The resident engineer had no assistant; his contact with his department heads was direct and constant. The material men were charged with the receipt, inspection and check-out of all material. The actual construction organization will be described later. Designs and specifications were prepared in the office of the consulting engineer and that office initiated purchases of equipment and material and supervised field operations and methods in considerable detail. The general scheme of the program was determined at the outset by the General Engineering & Management Corporation and the clients' staff kept in touch on all matters of importance.

### CONSTRUCTION ORGANIZATION

The field supervisory organization included: A resident engineer; one accountant and five clerks; one locating engineer, one assistant, nine field parties, two chief draftsmen and five draftsmen; two right-of-way agents and nine men; three inspectors; one substation engineer and two assistants; two material men and two warehouse men.

The project as a whole was divided into 42 jobs, each authorized by an improvement estimate. Costs of each job were kept separately and in detail. Funds were advanced to the resident engineer upon his requisition, and all except unusually large invoices were paid by the resident engineer. At the close of each job a physical inventory of the line or substation was made, the material charges on the books checked against this inventory and necessary journal entries made to cause the books to show correctly the cost of each job. When the project was nearing the close an audit was made of the freight invoices; this audit resulted in substantial refunds because of overcharges.

Unit costs are satisfactorily low on all items except the right-of-way account. The high cost of right-of-way was due to the fact that the rush basis of the project allowed but little time for "dickering," and, further, timber damage cost was high because of valuable timber tracts passed through. Right-of-way clearing cost was also rather high since very little open country was encountered. Freight charges affected costs more than is usually the case; in terms of f.o.b. factory cost, freight varied from 10 per cent of material cost, in the case of insulators and conductor, to 30 per cent in the case of poles and crossarms.

The extent of the program and the time allowed for execution, if carried out entirely by the General Engineering & Management Corporation's own forces, would have necessitated a very large expansion of engineering, supervision and construction forces and equipment for a short period. On the transmission line and substation program the corporation retained Francis R. Weller as consulting engineer in charge of engineering, designs, surveys, rights-of-way and general supervision of construction, and contracted with the Hoosier Engineering

Company for the complete erection of lines and substations. The client placed a contact engineer on the job to act as its personal representative, to expedite decisions, etc.

The accompanying chart shows the form of the construction organization. A progress schedule was prepared for each job and sizes and number of gangs were determined by the requirements of these schedules.

*Pulling logs from right-of-way with tractor (A), reel wagon that aided stringing of conductors (B) and placing anchor in hole (C)*

These schedules were altered from time to time as the relative importance of certain of the jobs changed, or as caused by right-of-way hold-ups or other difficulties. Weekly progress reports were submitted to the client; each progress report showed the work of the past week and to date and contained a statement of work laid out for the coming week.

Right-of-way clearing crews were built up from native labor, largely colored. A great many of these men were found to be skilled woodsmen. The usual clearing crew consisted of about 40 men, with a sub-foreman for about every fifteen men. The crews were organized into units, one unit clearing out underbrush, another using axes for small timber, another using crosscut saws for larger timber and a fourth crew trimming and burning brush. In the section of country where commercial timber was grown it was necessary to fell trees in a manner that would not damage other growing timber. It was also necessary in these sections to clean up brush piles thoroughly, as it is claimed insects which damage the growing timber breed in such piles.

Considerable hazard existed in burning brush, due to the possibility of fire spreading into the heavy woods; for this reason special attention was exercised by crew foremen in watching these fires. When necessary to keep a fire burning after working hours, sufficient men were left to watch it. During exceptionally dry seasons brush burning was stopped entirely.

On the high ground pine timber predominated. In Florida the pine woods had largely been cut over. In Georgia, however, many tracts of large timber were encountered. In low sections of both Georgia and Florida very heavy timber growth was encountered. These dense woods consisted of live oak, gum, palm and pine, all tied together by a dense undergrowth.

For tower line construction a standard width of clearing of 100 ft. was decided upon and for pole line construction 50 ft. was standard. All tall timber outside of this width, allowing for a five-year growth, which in falling would touch the line, was also cut. In a few instances large, substantial timber which appeared to be able to withstand high winds was left intact. All large pine timber, regardless of size, if tapped for turpentine, was cut, since experience has proved turpentined trees to be a hazard. Due to the long spans on tower line and consequent side swing of conductor in high wind additional clearing near the center of span was often necessary.

The standard type of tower anchor was the four-legged grillage. These anchors have a comparatively large bearing area to take care of poor soil compressive qualities in the swamps. The general character of the soil was a sand overburden with occasional clay outcrop. In numerous places limerock was encountered. At least 30 per cent of the anchors were installed in wet holes.

TABLE I—GENERAL FEATURES OF STANDARD 66,000-VOLT LINE CONSTRUCTION

It is quite general practice throughout Florida to use pin-type construction on 66,000-volt lines. This is no doubt due to the fact that the load density per mile of line is rather low and the economics of the problem require the cheaper pin-type construction rather than the more desirable (and more expensive) suspension design. The absence of the necessity to design for ice loading makes the comparatively long standard span quite safe. The standard span is shortened to 300-350 ft. when the line is constructed along a road, or carries two circuits. Carrier-current communication is used for load dispatching and system operation.

Cypress poles, untreated; standard length, 40 ft.
Triangular spacing of conductors, 6-ft. spacing, using pole top pin arrangement.
Creosoted pine cross-arms, 8 lb. open cell, long-leaf yellow pine.
Pin-type insulators, four-piece, cemented thimbles.
No. 1/0 A.C.S.R. conductor.
Standard span, 400 ft.
Safety Code clearances to ground.
Design loading, 11 lb. wind, no ice, 32 deg. F.
No dispatching telephone circuit.

In the sandy soil, even though dry, it was necessary to crib the sides of the excavation with planks. In wet soil it was necessary to drive sheet piling and pump the excavation. For locations with a small amount of water hand-operated diaphragm pumps were used. For anchors set in extremely wet places power-driven diaphragm pumps were used. Numerous places were encountered where eight power pumps could not keep the water down. A few instances were encountered where soil would not support the load imposed. In such cases piling was driven to firm bearing and the top of piling capped with a concrete mat, upon which the grillage anchors were installed.

Limerock in the presence of water constituted the most difficult footing condition encountered. The average limerock could be broken up with a stone sledge and small charges of dynamite. However, for a section of line just north of Inglis, Fla., a harder grade of rock was encountered. This was handled by means of an air compressor, jackhammer and dynamite.

For approximately 20 miles north of the Inglis steam plant the tower line passed through a section of the densely timbered swamp land bordering the Gulf of Mexico. Operations were started in this section in December. Due to the fear of the spring rainy season tieing up operations entirely, all hands were concentrated on this section in the endeavor to have anchors installed and material delivered by the following April. As the rainy season was late the work was well ahead by the time the heavy rains arrived.

The lower 10-ft. section of the tower was designed for use as a template in lining up and leveling the footings. The use of this arrangement prevents the anchor from sinking in toward the center of the tower and thus causing delay in erecting the superstructure. The use of the tower section as an anchor template eliminates transporting a heavy template from tower to tower; this item alone contributes a considerable saving in cost. Objection to this method is made by those who favor erecting the tower from the prone position. This objection, however, was discounted because of previous successful experience with the built-up or piece-by-piece method of tower erection. A foreman and ten men with a 1-ton truck comprised the average anchor crew.

### Tower Erection

As previously mentioned, the built-up method of tower erection was used. One great advantage of the built-up method is the small amount of equipment needed. This method limits the equipment required per crew to four handlines, six end wrenches, six socket wrenches with handle drawn out to a drift, one light gin pole with guide iron, chain, pulley and rope. The crew consists of four climbers, four groundmen, one assembler and one foreman. A truck was furnished for each two crews.

To speed up the erection of towers, a bonus system was devised whereby each member of the tower crew received an additional hour's pay for each tower erected above the minimum required. In this way excellent cooperation was obtained. Erection was facilitated by the fact that all tower pieces were well fabricated and marked. Some of the tower shipments were made by rail and water and some slight confusion was caused thereby.

The 4/0 A.C.S.R. conductor was strung out by means of a reel wagon pulled by a caterpillar tractor. The three reels were loaded on the wagon and as each tower was passed the conductor was raised to roller bearing snatch blocks suspended from the crossarms. As ends of the conductor were reached other reels were loaded on the wagon and the two ends spliced with a double sleeve joint. This method of laying out the conductor reduced the chances for abrasion to the minimum, since the conductor was not pulled over any rocks or barbed wire fences.

TABLE II—GENERAL FEATURES OF 110,000-VOLT CONSTRUCTION

It might be thought that since the lines are not designed for ice loads, comparatively small conductor sags and low towers would suffice for the desired long spans. This is not true, however, because of fear that a high day-after-day tension in the conductor would lead to vibration troubles; the sags adopted are but slightly less than those which would have been used in designing for Class B loading.

| | |
|---|---|
| Double-circuit, galvanized steel towers. | |
| One No. 4/0 A.C.S.R. circuit present with provision for second circuit and ground wire. | |
| Height from ground to low crossarm | 65 ft. |
| Vertical spacing between crossarms | 10 ft. |
| Height to top of tower | 90 ft. |
| Horizontal clearance between circuits | 20 ft. |
| Insulation { Eight units in suspension and semi-anchor.<br>Nine units in dead-end position. | |
| Standard span | 1,300 ft |
| Average span | 1,230 ft |
| Longest span | 1,500 ft |
| Design load, 11 lb. wind, no ice, 32 deg. F. | |
| Tower specification: Towers required to withstand test loads 50 per cent greater than loads corresponding to 11-lb. wind, no ice, on 1,300-ft. span Type A tower designed for 5-deg. line angle; type B tower, 45-deg. line angle. | |
| Type of anchor, square earth grillage. | |
| Tower weights: | |
| Type A superstructure | 7,130 lb. |
| Type A anchor | 1,270 lb. |
| Total type A tower | 8,400 lb. |
| Type B superstructure | 9,600 lb. |
| Type B anchor | 4,275 lb. |
| Total type B tower | 13,875 lb. |

Two-mile sections were used in sagging in; type B towers with semi-anchor insulator assemblies were inserted at approximately 2-mile intervals, and these towers divided the line into convenient sections for sagging purposes. Dynamometers were used in giving the conductors a test pull of 3,000 lb. After the test pull the conductors were slacked off to the stringing tension of approximately 1,500 lb. The correct sag was determined by sighting in with a sag line and targets and the corresponding tension was checked by dynamometer. Specially designed Chicago grips were used to catch off the conductor. At each B tower two sets of grips were used with chain and turnbuckles to catch off between sags and to hold the test pull. After sagging was completed a small gang with a truck clamped in the insulator assemblies on the intervening suspension towers and also picked up the snatch blocks. The average wire crew comprised a foreman and twelve men with a tractor and two trucks.

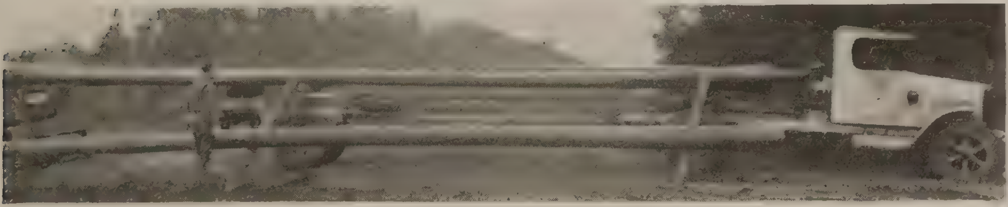
Motor trucks were used throughout the work wherever possible. In the sections not cultivated trucks often traveled the right-of-way. In low land it was necessary to use teams or tractors to place the material. In tower distribution one complete tower was hauled per trip with a 2-ton truck. For pole hauling 2-ton trucks with pneumatic-tired trailers were used. As the cypress poles were very heavy, the average load was four poles. Often poorly constructed bridges limited the loads hauled.

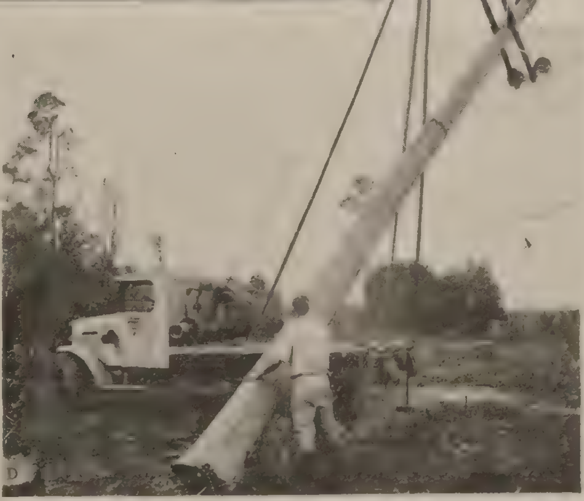
Truck depreciation was unusually high. The sandy soil was hard to pull through and was extremely hard on pneumatic tires. At the peak of the construction as many as 50 trucks, five tractors and six trailers were used on construction and material delivery. In addition, 29 passenger cars were used by the right-of-way, survey inspection and supervision forces.

On 130 miles of the tower line it was necessary to use construction camps. Each camp was designed to care for 60 men and had a camp force of one cook, two helpers and a flunky. The camps were run under the direction of the respective section foremen. Two complete camp equipments sufficed; a camp handled a section about 20 miles in length and the camps were moved as construction progressed.

Due to the presence of malarial fever it was necessary to watch sanitary conditions very closely. Each bunk tent was thoroughly screened. There was practically no sickness on the job. Each man staying in camp was charged $1.25 per day, but this fell considerably short of meeting camp operating and depreciation expenses. The camp deficit was a comparatively small portion of the total cost of the job and was cheerfully accepted as being offset by the good morale of the men.

*Pole truck and trailer (A), special transformer hauling rig (B), loading poles with truck winch (C) and pole setting equipment (D)*





The majority of the poles were set with 2-ton trucks equipped with derricks and winches. All poles were framed and cross-arms and insulators attached before raising. This method allowed the use of groundmen for this work instead of the higher priced linemen. In swampy places the poles were erected by use of a gin pole cart with team or tractor.

A large number of wet holes were encountered in the loose, sandy soil and hole digging under such conditions was quite a troublesome and expensive job. Great success was had in setting these poles with dynamite; i.e., "shooting them in." The method is as follows: First, a 2-in. pipe is driven into the ground to approximately the depth to which it is desired to set the pole. The dirt inside the pipe is then augered or bailed out, after which a charge of 40 per cent dynamite, usually about two sticks, depending on the texture of the soil, is inserted. The pipe is then pulled out, leaving the charge about 6 to 7 ft. in the ground, and the pole is erected directly over the charge and guyed with hand-lines, or if it is a light pole, the workmen can hold the pole erect with pike poles. The charge is then exploded, opening a cavity and allowing the pole to drop to position, after which the soil falls back around the pole. It is usually necessary to use some additional backfill, but not as much as might be imagined. The cavity is not much greater in diameter than that of the pole itself and the force of the explosion seems to be largely upward. Sometimes a shot that is too heavy will shatter a part of the pole. This method works to perfection in sandy soil and can be used in clay soil, although not so successfully, since preliminary shots are required to loosen up the soil.

A number of unusual and interesting problems were encountered in building the pole lines. For about 20 miles one line was built parallel to an old logging railroad and 25 ft. from its center line. A small locomotive and several flat cars were rented and a gas engine derrick was built on one of the flat cars. Poles, cross-arms, insulators and hardware were first delivered and then pole erection was started. It was necessary to shoot in most of the poles. Two crews were used; one, with the derrick, stood the poles up and guyed them, and the other gang followed, shooting and removing the guy lines. The conductor was pulled out from a reel wagon mounted on a flat car.

Another interesting job, described in the ELECTRICAL WORLD, April 30, 1927, was the erection of a 2-mile section of line across a swamp in which the water varied in depth from 2 ft. to 6 ft. The poles were set up by means of a derrick built on an old barge and then shot in. Each pole was side guyed with screw-type anchors to insure permanent stability.

The rates of progress varied considerably on the various jobs. The organization was planned and equipment mobilized in anticipation of a schedule considerably faster than that actually realized. Even though the speed of construction be considered more important than keeping costs to a minimum, practically, the limit is soon reached. Property owners will not be rushed into giving easements; to attempt to do so simply results in sending prices sky high. Legal processes take time and lots of it. The workmen were frequently reminded of the importance of avoiding unnecessary crop and fence damage and of getting on well with the people in general. Very little trouble occurred in this connection.

*Installing anchors in swamp under difficult conditions*

### SUBSTATION ERECTION

Substation gangs were organized apart from the pole-line crews, as many as six gangs being used on the project. A great many temporary installations were made to provide service during reconstruction. On the larger stations the crews were divided into units, such as foundation crew, steel and equipment erection crew and electrical crew for switchboard and wiring work.

Prior to the 1926-1927 program the transmission system comprised approximately 260 miles of 66,000-volt line and 90 miles of 44,000-volt and 22,000-volt construction. At the completion of the program the 66,000-volt lines will have increased to more than 730 miles, and 178 miles of 110,000-volt trunk line connecting the Florida and Georgia systems will have been built. The 66,000-volt substations will have increased in number from 22 to 45. Sixteen small, over-loaded, uneconomical generating plants will have been shut down. In addition to the transmission work here described, the distribution systems in St. Petersburg, Clearwater and Tarpon Springs were entirely rebuilt and a 25,000-kw. oil-burning generating station constructed at Inglis, Fla. The Inglis station was designed and constructed by the General Engineering & Management Corporation's own forces. A 10,000-kw. (ultimate capacity) hydro-electric development is under construction at Jackson's Bluff, near Tallahassee, the state capital of Florida, and will be tied in with this development.

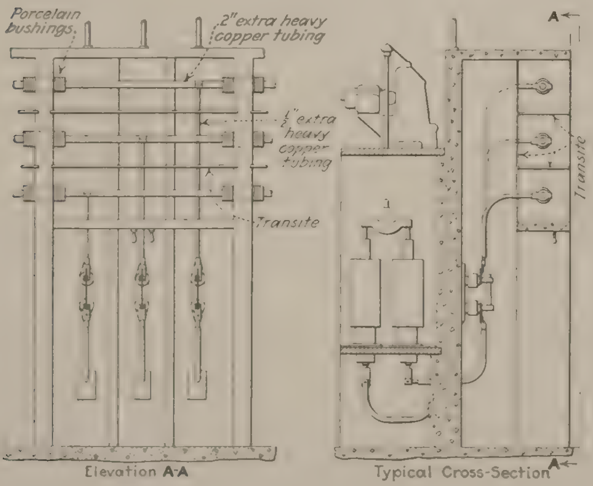
Experience on a project of this size brings out very forcibly the advantages and necessities of certain arrangements which on smaller projects are equally important but may not stand out so strongly. The accounting system must be such that money will be available for the prompt payment of invoices. There must be a sufficient number of bookkeepers and office men to keep the books properly and in detail; incorrect entries must be corrected by journal entries as soon as discovered, even though there may tend to be a multiplicity of journal entries.

Ample, if not even an excess, construction equipment is a necessity on a rush job; this is particularly true in the case of trucks. The importance of the position of chief of the party on line location is often underestimated. It pays to employ a high type of experienced man for this work.

The entire transmission project was under the direction of H. D. Panton as resident engineer for Francis R. Weller. The General Engineering & Management Corporation gave general supervision to the project. Admirable co-operation between the client's operating departments and the engineer's and contractor's forces contributed much to the satisfactory handling of the project.

## Porcelain Bushings Support Tubular Bus

IN USING tubular copper bus in several of its substations the Portland (Ore.) Electric Power Company has developed the type of support shown. Porcelain bushings, through which 2-in. extra-heavy copper tubing passes, are cemented into the cell barriers. This type of support requires a minimum number of insulators and has ample strength for taking care of very heavy short-circuit stresses. A cushion is obtained for the tubular bus by inserting packing around the tubing where it passes through the supporting insulator.



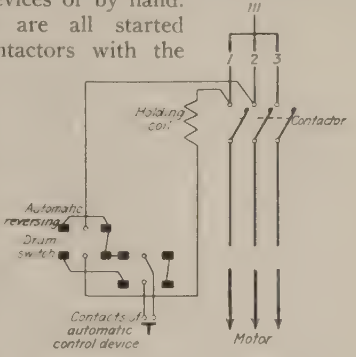
*Bus structure supported by barrier bushings in substation*

# Reversing Drum Switch Transfers Motor Control

By C. B. Carpenter
*Engineering Department, Washington Water Power Company, Spokane, Wash.*

A SIMPLE and reliable method of transferring control of motors from automatic to hand control is often desired in the case of pumps, blowers and other machines controlled by automatic devices, such as float or pressure switches. Such a device should be simple and rugged and should permit the motor to be operated independently of the control device, under control of the device or stopped and made non-automatic, as may be desired by the operator.

At the Chelan hydro-electric plant of the Washington Water Power Company there are five pumps controlled either by automatic devices or by hand. The driving motors are all started by across-the-line contactors with the control device connected in the circuit to the holding coil of the contactor. The device used for this purpose is a reversing drum switch of standard manufacture suitable for small motors on circuits up to 600 volts. Its cost is about the same as a push-button station which will perform a similar function on a 440-volt circuit. The contacts in the switch are rugged and have ample carrying capacity for any contactor coil circuit that may be utilized.


III
1
2
3
Holding coil
Contactor
Automatic reversing Drum switch
Contacts of automatic control device
Motor

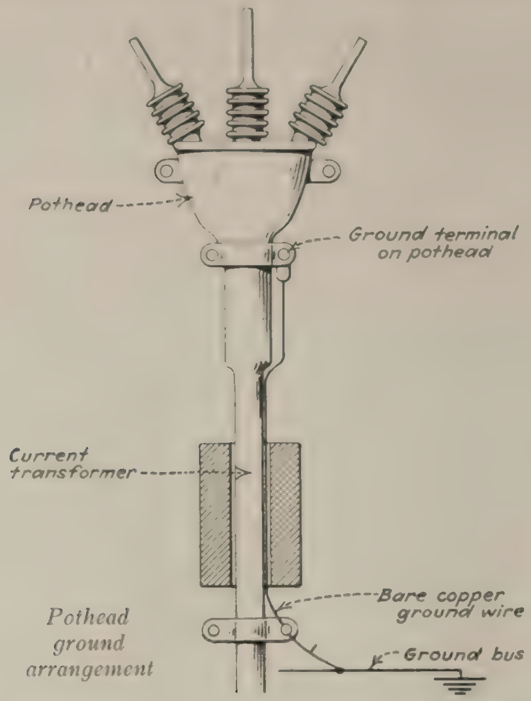
*Connections for reversing drum switch adapted to transferring motor control from hand to automatic operation*

When the reversing switch is connected as shown in the accompanying diagram and is in the off position, the control circuit is open and the motor is off. When thrown to one side the contactor coil circuit is connected in series with the contacts of the float switch or other automatic device and the motor is subject to the control of that device. If the switch is thrown to the opposite position, the contactor or control circuit is closed and the motor will run independently of the position of the contacts in the automatic control device. In the case of small direct-current motors the main line of the motor can be controlled by the drum switch. The drum switch is so small that it can be mounted at any convenient point. At Chelan the switches are mounted on the motor frames, affording unit construction.

With its positions marked "Run," "Off" and "Automatic" the operation of the switch is almost self-evident, whereas if push-button stations were used for the same service the operation would neither be so simple nor reliable. It was found in the case of a 440-volt circuit that the small reversing drum switch cost only half as much as two push-button stations that would have been required to perform the same function. Moreover, tampering with the automatic control device is avoided in case it is desired to operate the machinery irrespective of the position of the control device.

## Cable Pothead Protection

FROM F. B. Haugaard of the Electricity Department, Sydney, Australia, comes a note of comment on a short article entitled "Place to Ground Cable Sheaths" and published in the ELECTRICAL WORLD, April 23, 1927.



*Pothead ground arrangement*

Mr. Haugaard points out the desirability of a ground connection at the pothead itself, on account of the fact that "a considerable percentage of failures occur in potheads." As a means to prevent ground return currents in the cable sheath from setting up a flow in the secondary of the transformer and also to provide a ground connection at the pothead, he presents the arrangement shown in the accompanying sketch. In this, the ground wire attached to the pothead is brought back alongside the cable sheath through the current transformer opening, is clamped to the sheath below the transformer and goes to ground. The bolts supporting the potheads are insulated with fiber bushings and washers in order to assure the complete return of sheath currents along the ground wire and back through the current transformer. The ground return current in the sheath is thus balanced by the current in the ground wire and no flow is set up in the secondary of the transformer.

## Generator Rating Close to 30,000,000 Kva.

AN INSTALLED capacity of 29,629,000 kva., operated by 2,806 companies and municipalities, while 1,644 additional systems use purchased energy exclusively, constitutes the generating equipment in public utility electric light and power plants in the United States (not including Muscle Shoals) at the beginning of 1928.

Of the 4,450 systems in all, 2,477 are commercial and 1,973 municipal, though the total generator equipment in the latter is relatively small.

The figures here presented are the result of a comprehensive and critical recheck by the ELECTRICAL WORLD of data from all available sources of information, including some material not obtainable until very recently.

The revision shows a slight increase in rating, confined to no particular section of the country, over the previous determination as of the end of 1927. A few additional operating companies have also come to light.

Particular care has been taken properly to allocate the plants of companies operating in more than one state, though operations are reported from one central office.

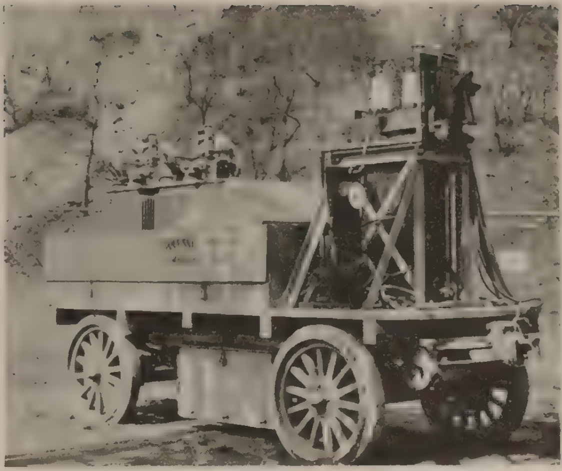
*Number of Central Station Operating Systems and Installed Generator Rating, Jan. 1, 1928*

| | Number of Operating Systems | | | | | |
|---|---|---|---|---|---|---|
| State | Total | Commercial | Municipal | Systems Generating Energy | Systems Purchasing All Energy | Generator Rating, in State, Kva. |
| **United States*** | 4,450 | 2,477 | 1,973 | 2,806 | 1,644 | 29,629,000 |
| New England | 326 | 253 | 74 | 178 | 148 | 2,396,000 |
| Middle Atlantic | 414 | 311 | 103 | 237 | 177 | 7,191,000 |
| South Atlantic | 527 | 280 | 247 | 345 | 182 | 3,746,000 |
| East North Central | 1,004 | 540 | 464 | 527 | 477 | 7,083,000 |
| West North Central | 1,108 | 437 | 671 | 679 | 429 | 2,167,000 |
| East South Central.* | 220 | 135 | 85 | 183 | 37 | 1,341,000 |
| West South Central | 386 | 207 | 179 | 341 | 45 | 1,240,000 |
| Mountain | 290 | 199 | 91 | 210 | 80 | 1,093,000 |
| Pacific | 175 | 116 | 59 | 106 | 69 | 3,372,000 |
| **New England** | | | | | | |
| Maine | 62 | 56 | 6 | 34 | 28 | 217,000 |
| New Hampshire | 38 | 34 | 4 | 25 | 13 | 107,000 |
| Vermont | 58 | 43 | 15 | 32 | 26 | 108,000 |
| Massachusetts | 123 | 81 | 42 | 60 | 63 | 1,185,000 |
| Rhode Island | 10 | 9 | 1 | 5 | 5 | 248,000 |
| Connecticut | 35 | 29 | 6 | 22 | 13 | 531,000 |
| **Middle Atlantic** | | | | | | |
| New York | 184 | 137 | 47 | 116 | 68 | 3,577,000 |
| New Jersey | 25 | 13 | 12 | 18 | 7 | 775,000 |
| Pennsylvania | 205 | 161 | 44 | 103 | 102 | 2,839,000 |
| **South Atlantic** | | | | | | |
| Delaware | 9 | 3 | 6 | 6 | 3 | 41,000 |
| Maryland | 41 | 31 | 10 | 26 | 15 | 330,000 |
| District of Columbia | 3 | 3 | 0 | 1 | 2 | 185,000 |
| Virginia | 56 | 40 | 16 | 44 | 12 | 321,000 |
| West Virginia | 48 | 42 | 6 | 27 | 21 | 819,000 |
| North Carolina | 118 | 59 | 59 | 61 | 57 | 615,000 |
| South Carolina | 66 | 35 | 31 | 45 | 21 | 585,000 |
| Georgia | 115 | 31 | 84 | 77 | 38 | 536,000 |
| Florida | 71 | 36 | 35 | 58 | 13 | 314,000 |
| **East North Central** | | | | | | |
| Ohio | 235 | 123 | 112 | 111 | 124 | 1,976,000 |
| Indiana | 165 | 89 | 76 | 82 | 83 | 724,000 |
| Illinois | 201 | 117 | 84 | 117 | 84 | 2,342,000 |
| **East North Central** *Continued* | | | | | | |
| Michigan | 181 | 77 | 104 | 119 | 62 | 1,344,000 |
| Wisconsin | 222 | 134 | 88 | 98 | 124 | 697,000 |
| **West North Central** | | | | | | |
| Minnesota | 192 | 69 | 123 | 104 | 88 | 498,000 |
| Iowa | 172 | 81 | 91 | 85 | 87 | 548,000 |
| Missouri | 152 | 95 | 57 | 105 | 47 | 516,000 |
| North Dakota | 104 | 65 | 39 | 81 | 23 | 33,000 |
| South Dakota | 80 | 33 | 47 | 55 | 25 | 65,000 |
| Nebraska | 214 | 55 | 159 | 131 | 83 | 179,000 |
| Kansas | 194 | 39 | 155 | 118 | 76 | 328,000 |
| **East South Central** | | | | | | |
| Kentucky | 68 | 58 | 10 | 56 | 12 | 259,000 |
| Tennessee | 66 | 44 | 22 | 54 | 12 | 439,000 |
| Alabama* | 32 | 15 | 17 | 21 | 11 | *568,000 |
| Mississippi | 54 | 18 | 36 | 52 | 2 | 75,000 |
| **West South Central** | | | | | | |
| Arkansas | 51 | 36 | 15 | 47 | 4 | 118,000 |
| Louisiana | 58 | 16 | 42 | 54 | 4 | 217,000 |
| Oklahoma | 107 | 35 | 72 | 88 | 19 | 211,000 |
| Texas | 170 | 120 | 50 | 152 | 18 | 694,000 |
| **Mountain** | | | | | | |
| Montana | 34 | 31 | 3 | 27 | 7 | 328,000 |
| Idaho | 39 | 22 | 17 | 22 | 17 | 228,000 |
| Wyoming | 34 | 25 | 9 | 25 | 9 | 31,000 |
| Colorado | 65 | 32 | 33 | 51 | 14 | 257,000 |
| New Mexico | 25 | 22 | 3 | 23 | 2 | 19,000 |
| Arizona | 43 | 34 | 9 | 32 | 11 | 44,000 |
| Utah | 36 | 21 | 15 | 23 | 13 | 170,000 |
| Nevada | 14 | 12 | 2 | 7 | 7 | 16,000 |
| **Pacific** | | | | | | |
| Washington | 76 | 52 | 24 | 41 | 35 | 635,000 |
| Oregon | 36 | 24 | 12 | 30 | 6 | 300,000 |
| California | 63 | 40 | 23 | 35 | 28 | 2,437,000 |

*Figures for Alabama do not include Muscle Shoals plant, in Alabama, 230,000 kva.

# Field Testing of Relays

By W. M. Evans and R. J. Salsbury
*Duquesne Light Company, Pittsburgh, Pa.*



*Outfit for 22-kv. tests, mounted on a trailer*

IN April and May, 1927, 443 grounds were applied to the Duquesne Light Company system, in order to check relay operation. There was one failure of service at 2 a.m., no failures of equipment and no injury to personnel.

The relay protection of a pure radial transmission system is comparatively simple. As the transmission layout becomes more complicated and grows into a network, the relay problem also grows with a degree of complexity which is much more rapid.

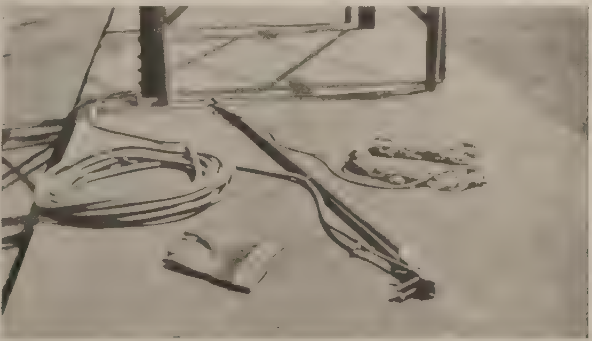
The testing of these relays and the wiring check-up in the field is very complicated, due to the location of many customers on the loops, to the power factor of the current on many lines, and to the regulation. It was not possible, except in a very few cases, to obtain the flow of power whose direction and stability are sufficiently determined to make an accurate phantom and polarity check. Some of the wiring combinations were quite involved, so that it was possible that wrong connections had crept in. Therefore, it was determined to make absolutely certain as to the performance of the relays by actually putting a ground on the system and permitting it to be cleared as under service conditions. This procedure has several advantages:

1. The mechanical and electrical operation of the breakers, otherwise dormant, is secured.
2. There is no doubt as to where the fault occurred when the breaker operations are analyzed in connection with these tests.
3. Observers at related points can secure reliable information that is otherwise lost under service conditions.
4. Knowing where the ground is placed permits the making of breakers non-automatic where imperfect conditions are suspected, and the relay operation can be observed without actually trying the circuit breakers.
5. Positive information as to the correctness of installation is secured.
6. Information as to the operation of oil circuit-breakers under service conditions is obtained.
7. The time selection between the various customers' loops can be observed. It should be noted that this time selection check included all the factors concerned in obtaining selection between stations.
8. Training in complicated switching operations is secured.

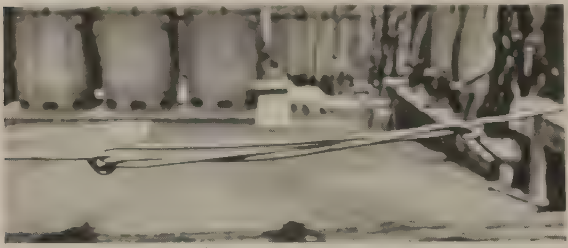
### High-Voltage Tests Simpler

The experience obtained during these tests proved invaluable. The tests made on the 66-kv. lines differ somewhat from those conducted on the 22-kv. lines, being much simpler on the higher voltage. A piece of rubber-covered wire with clamps, hook stick and ground rod and the necessary measuring instruments and the observers were all that were required.

The ground lead is connected by a clamp on the end of the live line connector. The lead is taped part way out on the stick to make it swing free of the circuit breaker. The end of the stick is strained to a steel tower with a rope. This also assists in keeping the lead free of the circuit breaker. The station ground is used as a ground point. When the circuit breaker illustrated is closed, it will apply a ground to the line which will be cleared at the adjacent station, since the ground



*Equipment used for 66-kv. line relay tests and close-up view of 66-kv. grounding material utilized in these determinations* is connected to the bus side of the circuit breaker. In order successfully to apply ground to a 22-kv. network an old circuit breaker was necessary. Had it not been used, it would have been necessary to remove equipment from service and open customers' loops so that service conditions would not have been properly simulated. Hence, this breaker, together with the control battery and the miscellaneous tools and wiring, was mounted on a trailer and transported from place to place, where it was desired to install the ground connections. In this manner 293 grounds were applied to the 22-kv. system and all 22-kv. breakers checked for relay operation. Where it was not possible to permit the breaker to open because of service requirements, a lamp was placed in series with the trip coil and its operation observed.



*Method of taking up slack in a grounding lead to keep it free of the ground*

In the 22-kv. tests it will be noted that there are two low-voltage regulators used for high-current tests on current transformers. In the center of the trailer is a tool box which contains the necessary insulators, rope and miscellaneous auxiliary test equipment. On the other end of the trailer the 22-kv. circuit breaker is mounted. The storage battery is mounted under the trailer in a compartment.

### VALUABLE RESULTS OBTAINED

Valuable operating data were secured from these tests. After the tests were concluded, it was definitely known that the polarity of all ground relays and phase relays was correct. The mechanical and electrical features of the oil circuit breakers were given a thorough trial and it was definitely determined that they had been given adequate maintenance. In addition to the operating data obtained, certain inherent characteristics of design both in transmission layout and relay scheme applications were discovered. These characteristics were of sufficient importance to cause a change in the future plans for high-tension transmission rearrangements.

The greatest amount of satisfaction was secured from the ease with which these tests had been performed, particularly on the higher voltage. It was discovered to be a simple matter to apply the ground wire on the oil circuit breaker between the bushings and open disconnect, then to close the breaker and take readings. In view of the ease of testing relays and relay schemes, and in view of the benefit derived from this method, it is planned in future to check all new installations before they are cut into service. Also, a periodic check will be made on the entire system probably once every two years, and all questionable operations will be investigated by applying actual grounds to the assumed fault which caused the doubtful operation.

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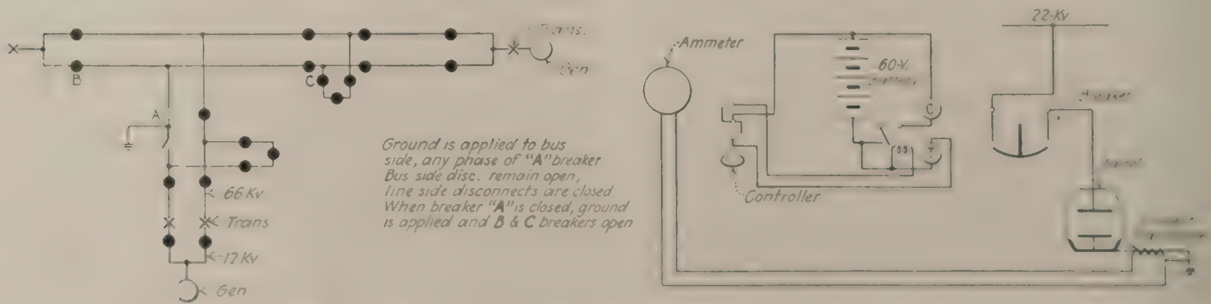
## Illumination from Invisible Sources of Ultra-Violet Light

SOME unusual illuminating effects have been produced by using ultra-violet light to cause luminescence of objects and surfaces. For example, at the last convention of the Associated Edison Illuminating Companies figures of animals, balloons, dishes, fish, flowers and water in large pools were made to glow red, pink, yellow, green and blue in apparent darkness by the ultra-violet stimulation of chemical coatings. In addition experiments have been reported in which attempts have been made to produce subdued lighting effects, such as are needed in auditoriums, theaters, etc., to permit seating or exit without disturbing performances.

The popular demonstration of this interesting application of ultra-violet light was made under the supervision of L. C. Porter of the Edison Lamp Works. He reports that powerful searchlamps were used for the purpose, equipped with quartz-tube mercury-arc lamps. These sources of invisible radiation were used because they generate a much higher percentage of ultra-violet light than do ordinary forms of illuminants. Aluminum reflectors were employed because the ordinary silvered surface reflector, which reflects about 95 per cent of visible light, would reflect only about 15 per cent of ultra-violet radiation. The polished aluminum reflectors reflect about 45 per cent of the ultra-violet radiation.

To provide illumination of different colors chemical coatings of zinc sulphide, anthracene, fluorescein, rhodamine, eosin, etc., have been employed. Such chemicals absorb the short invisible ultra-violet radiations and convert them into longer visible radiations which become apparent as light. Some of the chemicals will glow only while they are being stimulated. Others will continue to glow for a little while after the ultra-violet stimulation ceases.


Trans.
Gen
B
C
A
66 Kv
Trans
12 Kv
Gen
Ground is applied to bus side, any phase of "A" breaker Bus side disc. remain open, line side disconnects are closed When breaker "A" is closed, ground is applied and B & C breakers open
Ammeter
60-V.
C
Controller
22-Kv

*Schematic diagram for a typical 66-kv. test and connections for portable equipment used in securing data regarding relay operation on 22-kv. circuits*

# Industrial Power Interchange

Economical utilization of byproduct power can be worked out jointly by power and manufacturing industries to conserve the energy that is now wasted in many manufacturing plant processes

*An Interview With*

T. O. KENNEDY

*Vice-President and General Manager Ohio Public Service Company, Cleveland, Ohio*

*T. O. Kennedy*

POWER companies in their service to industry are meeting with an important economic problem which resolves itself frequently into both the sale of electric energy to and its purchase from the same industrial customer. This condition may be found most often in highly industrialized areas, but may occur in any territory served by electric utilities. That an arrangement for the sale and exchange of power between the utility and the industrial plant can be worked out on a mutually profitable basis has been shown in the experience of T. O. Kennedy, vice-president and general manager of the Ohio Public Service Company, under whose direction this company has been exchanging power with two of its large customers for some time. As this practice opens up large possibilities for the further electrification of industry and development of the sale of power by the central-station companies, Mr. Kennedy has been asked to outline the principles of such an arrangement. The philosophy and economics of the problem as regards industrial and utility problems have been stated by Mr. Kennedy as follows:

"There is a mutuality of interest between the manufacturing industry and the public utility industry.

"The payroll of the manufacturer supports the community and a part of this payroll naturally goes to pay for utility service. The public utility companies serving the communities are, therefore, vitally interested in the continuing success of the manufacturer, even though they may not sell him service.

"The manufacturer is also directly concerned in the prosperity of the utility companies whether or not he buys their service for his manufacturing processes. His successful operations depend, in a large measure, upon the living conditions provided by the community for his employees, and these living conditions are of course largely influenced by the utility service available for their use and convenience.

"In the conduct of some manufacturing businesses byproducts are produced representing energy in some form such as waste heat, coke, wood waste, coke-oven and blast furnace gas, etc.

"In the interest of the stockholders and in the interest of the community, these byproducts must be utilized to produce the greatest economic return possible, and because of the interdependence between the manufacturer and the utilities such utilization of these by-products becomes a mutual problem.

"Assuming that the above premise is accepted by the managements of the manufacturing company and the utilities, the first step in the solution of a byproduct situation is to canvass all possible uses for the byproduct in question carefully.

"The production of power through the use of byproduct fuel is probably the most uneconomic use to which such byproducts could be put. This is true because of the many important items of power cost, aside from the bare cost of fuel and also because of the low fuel prices against which the byproduct fuel must be evaluated.

"Therefore, every effort should be made to discover a more economic use for the byproduct, such as, for instance, for industrial heat processes, especially when the byproduct is in the form of gas and where the opportunity exists for such application. Probably the most valuable use to which coke-oven gas can be put is its distribution to domestic consumers through the mains of the public utility supplying gas service to the community in which the plant is located.

"There are many instances, however, in which the only use for byproduct energy is the production of power, and it is in such instances that the importance of cooperation between the manufacturer and the electric utility is emphasized.

"In general, there are two ways in which to consider the utilization of byproduct fuel for power production: (1) The installation of equipment designed for operation only when byproduct fuel is available and to utilize all such fuel. (2) The installation of equipment in sufficient capacity and number of units, equipped with auxiliary fuel-burning apparatus, so that a reliable and adequate supply of power can be produced at all times, whether or not byproduct fuel is available.

"In the second case the investment is very much greater than is necessary for the first method and, in addition, a wastage of byproduct fuel almost always results, because power requirements are at times insufficient to utilize all the byproduct fuel available.

"Plan No. 1 can only be followed by maintaining a connection with the lines of the electric utility on a basis permitting the taking of power from, or delivering power to, the utility system, depending upon the amount of byproduct power produced being less or greater than the total power requirements of the manufacturer.

"A comparison of the two plans in any particular instance narrows down to a study of the economics of power production by the utility and by the manufacturer with purchased fuel, and then superimposing upon the result of this study the greater relative value of the power produced by byproduct fuel when a connection is maintained with the electric utility.

### Production Cost Advantages

"Most electric utilities today take advantage of many conditions contributing to lower total cost of power production which are not available to the individual manufacturer operating his own generating plant, such as:

"1. Location of plant adjacent to fuel and condensing water supply.

"2. Increased efficiency due to maximum size of units, use of high steam pressure and temperature.

"3. Decreased investment per unit of capacity by reason of interconnection of transmission systems, thus decreasing investment for reserve.

"4. Diversity of load resulting in high load factor on generating stations.

"5. Large station capacity justifies technical ability in operating force, insuring maximum efficiency of operations.

"It would indeed be a very unusual situation where a mutually advantageous interconnection contract could not be formulated between the electric utility and a manufacturer who produces byproduct fuel for which no better use could be found than power production.

"In this connection it is important that consideration be given to possible future developments in the industrial field. Due to the increasing use of electricity for power and heating processes, the manufacturer usually can anticipate a constant increase in his power requirements. On the other hand, it may reasonably be expected that the production of byproduct fuel will decrease as improved processes are developed, such as the direct production of iron from ore without the use of the blast furnace.

### Economies in Steel Industry

"Many manufacturers, particularly in the steel industry, are today utilizing their byproducts very uneconomically, because, at the time they installed their power-producing equipment, they had waste fuel largely in excess of their power requirements and little attention was given to the efficiency of its utilization. Now, with greatly increased power requirements, they are burning purchased fuel during normal operating periods and are letting byproducts go to waste several hours every day and all day on Sundays and holidays.

"In 1922 a blast furnace company in our territory completed the installation of a 600-ton blast furnace and installed one 6,000 and two 1,000-kw. turbo-generators, using steam from boilers fired with blast furnace gas as fuel. Some of the boilers are also equipped for burning coal as an auxiliary fuel. Our company entered into an agreement with the furnace company to purchase all the power so generated in excess of that required to operate the furnace and its equipment. This contract was dated March, 1922, and the rate was based on the generating cost at our nearest plant for each month during the life of the contract.

"A steel company located adjacent to the furnace company, and under joint ownership, purchases at our regular filed rates all power for the operation of its plant, having a demand of approximately 20,000 kw.

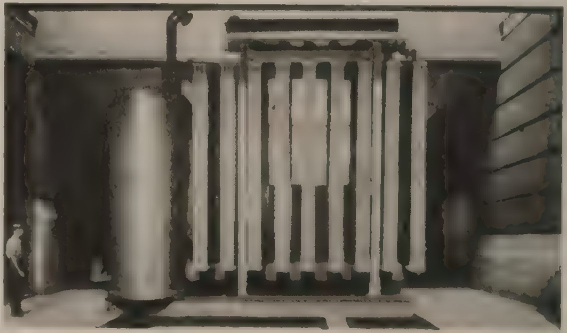
"In 1925 another steel company, at a different location, completed the installation of a 600-ton blast furnace and installed one 10,000-kw. turbo-generator, operating on steam produced from boilers fired by blast furnace gas, with auxiliary equipment for burning powdered coal. We entered into an agreement in May, 1925, to purchase all of the electric power generated by the 10,000-kw. turbine in excess of the requirements of the blast furnace and steel mill and to pay for such energy a flat rate per kilowatt-hour, which is practically equivalent to the generating cost in our system.

"The latter steel company has a total power demand of approximately 15,000 kw. and contracted to purchase at our filed rate all power required in excess of that generated by its own 10,000-kw. turbine.

"The relations between these two steel companies and our company are apparently satisfactory, and while I could not go so far as to say that the arrangements conform strictly to the ideals set up here, I believe that we have made a good start toward the working out of such an economic arrangement.

"The manufacturing industry and the utility industry have everything to gain and nothing to lose in putting all their cards on the table and working out the right solution to this problem of byproduct utilization in every instance."

## Transformer Radiator Mounting That Saves Space

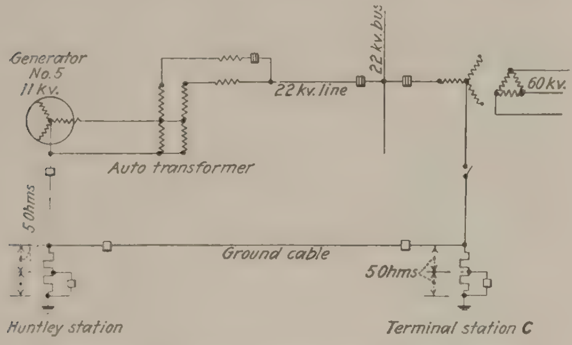


SPACE limitations in a station of the Brooklyn Edison Company required that the oil-cooling radiators for the generator auto-transformers be mounted as shown. The radiators are arranged face to face in a row, with manifolds connecting the upper and lower openings with the transformer tank. The conservator, mounted above the cooling units, is piped to the radiator furthest from the main tank. These 29,667-kva., single-phase, 13,800/27,600-volt transformers are direct connected to the generators.

# New Buffalo Unit Feeds 22-Kv. System Directly

By Cromwell MacIntosh
*Assistant Electrical Engineer Buffalo General Electric Company, Buffalo, N. Y.*

IN PLANNING the addition of a block of 60,000 kw. to the distributing system, consideration was given to the fact that the 11,000-volt system was shrinking as the 22,000-volt system enlarged. It was, therefore, determined that the new turbo-generator should feed the 22,000-volt system directly. Accordingly the generator was designed for operation in conjunction with a three-phase auto-transformer, rated 66,667 kva., 12,000 to 22,500 volts, 25 cycles. This transformer was constructed in a single unit and is one of the largest capacity transformers ever built. The low-tension winding is solidly connected to the generator terminals without switches of any kind and the high-tension windings feed directly into a 1,250,000-circ.mil line extending to terminal station "C," making connection through circuit breakers and disconnecting switches to the duplicate 22,000-volt buses of that station.



*Generator is direct-connected to 22-kv. system through auto-transformers*

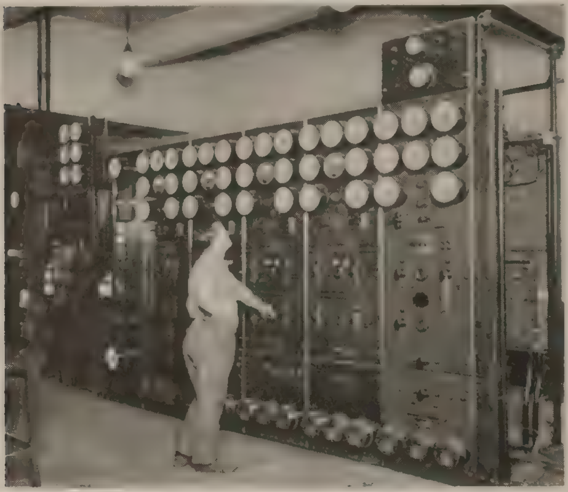
The addition of so large a unit to the sources of energy already connected to the 22,000-volt distributing system, centered at terminal station "C," very materially increased the calculated short-circuit strains upon the system, and a means had to be devised to keep these strains within short-circuit ratings of the equipment already in service. To accomplish this end the auto-transformer was designed with two parallel windings permanently connected together at the neutral and at the 12,000-volt taps. One set of 22,500-volt terminals connects through 5 per cent reactors directly to the tie line. The other set of 22,500 terminals connects through similar reactors and an oil circuit breaker to the same line. The oil circuit breaker, known as the "reactance breaker," is operated by instantaneous overload relays set to trip when the generator output exceeds 300 per cent of its rated current. With both windings connected the auto-transformer has an impedance of 3.8 per cent on 66,667 kva. When the reactance breaker trips and thereby disconnects one high-tension winding in each phase, the impedance of the auto-transformer is changed to approximately 18 per cent on the same capacity. This large increase in impedance comes into the circuit before any circuit breakers have tripped at terminal station "C," with the exception of a bus junction breaker, which has ample rupturing capacity. When the reactance breaker opens it leaves generator No. 5 synchronized with the load, and as soon as the initial disturbance has passed the operator at the Huntley generating station recloses the reactance breaker.

In the 40,000-kva. tie between the 11,000-volt system and the 22,000-volt system a similar reactance breaker has been installed, which disconnects the high-tension winding of one of the two 20,000-kva., three-phase transformers, operating in parallel. The effect of this reactance breaker, therefore, is to double the impedance of the tie from its value of 10 per cent as computed on a 40,000-kva. basis.

With respect to metering and protection, generator No. 5 is considered to include its auto-transformer, located just outside of the west wall of the station, its reactors and reactance breaker, tie line and switching equipment at terminal station "C," through which it is connected to the load bus. All of this equipment is protected by induction relays served by differentially connected current transformers installed in the neutral lines at the generator and in the conductors between circuit breakers and load bus at terminal station "C." Connected to the 12,000-volt generator terminals is a feeder for supplying house service. Since this connects within the zone protected by differential current transformers and relays, it is necessary to compensate for any current taken. Consequently, it has current transformers connected in parallel with those of the main tie line In addition to the differential protection just described, the output

*66,667-kva. auto-transformer, power-limiting reactors and 20,000-kva. transformers* of the generator is controlled by overload induction relays located at the terminal station.

The 22,000-volt distribution system is equipped throughout with induction relays of the usual kind and with ground or neutral relays arranged to trip instantaneously on ground current. Relay settings are calculated on the basis of a maximum ground current of 2,540 amp., which is the current that will flow through a 5-ohm ground resistor, connected to the neutral point of a 22,000-volt system, when one phase is dead grounded. In order to insure correct functioning of these neutral relays, the system ground must have a value of 5 ohms at all times, whether or not the generator is connected to the load. Consequently, an independent ground resistor could not be used. The scheme adopted uses two 10-ohm grounding resistors, one at the terminal station "C" and one at the Huntley station. These are independently connected to earth, and the ungrounded terminals of the two resistors, therefore, operate in parallel, having the effect of a 5-ohm resistor, connected to the system at all times.



*Generator control panels, generator-transformer unit on right*

## New Station Uses 1,350 Lb. Steam

STEAM will be generated at 1,350 lb. per square inch pressure in the new Deepwater (N. J.) station, owned jointly by the American Gas & Electric Company and the United Gas Improvement Company. The Babcock & Wilcox Company supplied the four standard and two reheat 1,350-lb. pressure boilers. The standard boilers with steaming economizer and air preheater will produce 331,000 lb. of steam per hour at 725 deg. F. The reheat boilers will deliver 290,000 lb. of steam per hour and will reheat 419,000 lb. of steam to 775 deg. F.

Generating equipment, as reported on page 476 of the ELECTRICAL WORLD for March 3, 1928, will consist of an initial capacity of 118,500 kw., the entire steam demand being supplied by the high-pressure boilers. Operating pressures will be 1,200 lb. per square inch at 725 deg. F. total temperature. This plant will also supply process steam to the adjacent plant of E. I. du Pont de Nemours & Company, Inc. The design and construction of the new plant is under the supervision of Stevens & Wood, New York.

## Seaplane Aids Line Right-of-Way Survey

IN SURVEYING the right-of-way for its 200-mile, 220,000-volt transmission line from the Ottawa River to Toronto, the Ontario Hydro-Electric Power Commission used a speedy seaplane. The aerial survey was adopted, in preference to a preliminary field survey, because it was considered cheaper and quicker, and more readily assured the best possible location of line. The eastern 120 miles of line passes through rough, undrained lake districts. A straight, short, easily constructed line avoiding villages, farms, buildings and orchards was desired for the western 80 miles.

The first procedure was to project and locate the general route. Practically the only maps available were the township maps and the standard government topographical maps. These were found to be unreliable in detail. Instances were noted, through the aerial survey, where lakes were half a mile from their map location. Many lakes were not mapped at all and roads indicated on the map did not exist. Without accurate information regarding the physical obstructions existing along the 120 miles of rough and isolated bush country the work of any survey parties put in the field would have been slow and expensive, involving general triangulation with traverses to locate obstructions and the running of trial lines.

A seaplane, equipped with pontoons, and having a flying speed of 100 miles an hour, was engaged through an aerial survey company. On the eastern section of the line, and as far west as Rice Lake, there are lakes within gliding distance of the center line, but from Rice Lake to Toronto there are few suitable landing places for a seaplane, and as the machine did not carry sufficient gasoline for a flight to the company's Ottawa River base from Toronto after a photographic flight, a base was established near the center of the route.

The survey company was provided with a copy of the government map showing the projected center line and two sets of oblique photos were taken, one from either side. These obliques were used to locate or revise the line with sufficient finality to allow vertical photographs to be taken over the final location. The latter were made at a height of approximately 6,000 ft. over what was fixed as the approximate final location of the line and were then matched into mosaic strips about 22 in. long, showing in great detail a strip of country averaging some 1¼ miles in width.

According to A. P. Goodwin of Toronto, engineer of the Hydro-Electric Power Commission transmission department, the use of these pictures has practically eliminated expensive preliminary field surveys and the work of line location has been facilitated. Small hilltops, ridges and gullies washed by rainstorms can be discerned without difficulty.

By the use of aerial maps the commission's right-of-way agents have been able to go out into the fields and secure options or easements without any preliminary field work. It has been possible to show clearly to the various owners the location of the proposed line without going out and tramping all over the fields.

The only work for the field parties, according to Mr. Goodwin, was the location of the line on the ground as indicated on the photographs, the running of a profile along the center line, noting property ties and ownership of land passed over and the staking of the tower sites.

# Five Years of Stock Dividends

Method adopted in 1923 proves beneficial both to shareholder and to the company. Comparison with issue of rights and financial results of the two policies over a period

By FRANK L. DAME
*President of the North American Company*

*Frank L. Dame*

OUR policy of paying dividends exclusively in stock during the past five years has demonstrated in a rather conclusive manner that such a policy is both practical and advantageous. That the benefits are enjoyed both by the shareholders and by the company has been proved by the experience of this company and by the indorsement of investors in every part of the country.

Many articles have been published within the last two or three years on the subject of stock dividends. Such articles usually express the academic viewpoint that the stockholder retains the same interest in a company or corporation that he had before the issue of such dividends. Sustaining this view, the United States Supreme Court has held that such dividends are exempt from the income tax. Aside entirely from the legal aspects of the question, I am greatly impressed by the facts established by actual experience with stock dividends during the period since 1923.

While there is a wide variation in practice in the payment of stock dividends, I shall refer here only to those dividends which are declared regularly and in the place of cash dividends. As already intimated, common stock dividends of the North American Company have been paid entirely in common stock since 1923. I am not familiar with any other company following this procedure, although in some cases an option is granted between the payment of cash or stock.

### ADVANTAGES OF STOCK DIVIDENDS

There are certain outstanding advantages of the policy of paying stock dividends. It provides a not too costly method of financing, which is not especially burdensome to the stockholder, to meet the demands of steady expansion, and is especially adaptable to the public utility industry. Furthermore, payment of stock dividends provides a satisfactory return to the shareholder—maintaining his proportionate interest in case he holds his dividend stock, or, in case he sells the stock, the equity in a growing and stronger concern is safeguarded. The policy also enables the shareholder to choose between cash and investment, the former by immediately cashing his stock dividend, which is readily marketable without loss except the relinquishment of potential profits, the latter by keeping his stock dividend and retaining his proportionate interest with potential profits. The second option is the retirement of dividends and interest. The stockholder can do this without the payment of additional funds, a course which so often is necessary in exercising rights to subscribe to stock. In brief, the stock dividend facilitates an increase in investment holdings without imposing additional financial burdens on the stockholder. His interests are completely protected in the interval, while he has the option of automatic reinvestment or a payment in cash.

The charge that the stock dividend is a means of tax evasion is obviously unfounded, since the company paying such dividends receives no immunity. The North American Company has adopted the stock dividend policy since it automatically makes available a fair part of the company's necessary investment funds for subsidiary development without adding an undue burden to shareholders. For taxation purposes the government recognizes original cost and stock dividends bring down the average. If the dividend is marketed, any profit over the average cost is taxable to the individual. It is essential for the holding company to increase its investments in the equity stocks of its subsidiaries in order to maintain a balanced capital set-up which will enable the parent company as well as its subsidiaries to secure money from the sale of preferred stocks and bonds at the most satisfactory rate; particularly is this the case in the public utility industry in view of its exceedingly rapid growth, doubling as it does on the average about every five years. The stock dividend of this company, namely 10 per cent, requires about seven years to double.

The strengthening of the financial set-up of the North American Company since its adoption of the stock dividend policy five years ago is evident. The dividends issued have not increased the common stock outstanding in proportion to the total consolidated capitalization. In fact, there has been an actual decrease. Furthermore, common stock during the period March 31, 1923, to Dec. 31, 1927, increased 66.6 per cent from stock dividends and 33.6 per cent from the issue of stock for cash and for properties, making a total increase of 100.2 per cent.

Meanwhile the consolidated net income, which is the amount available for common stock dividends and surplus, increased 158 per cent, or more than 1½ times the total increase in common stock.

A comparison of the stock dividend policy with the issue of rights to stockholders from time to time to subscribe for additional stock, usually at par, is interesting. The regular payment of stock dividends is virtually the equivalent of combining cash dividends with subscription rights; the former, however, gives the stockholder more frequent and convenient subscription privileges. The investor who is so situated financially that he cannot subscribe for 10, 15 or 25 per cent of his holdings, as the offering may be, sells his rights willingly and counts the proceeds of the sale in addition to his cash dividend as his yield from the investment. Investors frequently seek stocks on which rights may be expected regularly in order that they may market them immediately. Other investors buy stock with the intention of exercising rights and obtaining additional stocks so offered at a slight advantage over the market value. This is really a matter of investment rather than of taking profits, since the stockholder buys stock at less than the market price and has a potential profit at once.

Illustrating the comparison between the stock dividend and the subscription rights method is the following list of well-known public utilities which have adopted the policy of paying dividends exclusively in cash and issuing rights generally at par. The table, based on statistics in *Moody's Manual,* shows the percentage increase in stocks during the four years ended Dec. 31, 1926:

| | Stock Increase, Per Cent |
|---|---|
| American Telephone & Telegraph Company | 52.2 |
| Brooklyn Edison Company | 164.2 |
| Commonwealth Edison Company | 81.3 |
| Detroit Edison Company | 147.7 |
| Pacific Gas & Electric Company | 52.2 |
| Southern California Edison Company | 15.8 |
| Arithmetic average | 85.6 |

It is interesting to compare this average with the North American Company's stock increase, which was 100.2 per cent to the end of 1927 and 94 per cent during the four-year period used in the table, and for the purpose of a fair comparison it must be pointed out that the above table includes in some instances increases contributed to by such matters as conversions during the four-year period of bonds and debentures issued prior to the period; also, such conversions, although resembling rights, may or may not have been offered to the shareholders, and if not they decrease his proportion of interest in the company. In the case of at least two of the above companies the issue of rights is explained clearly in *Moody's Manual.* If a stockholder exercised his right 100 per cent the following would have occurred:

1. The Commonwealth Edison Company offered to its stockholders 20 per cent stock rights exercisable in February, 1923; 20 per cent in May, 1924; 12½ per cent in May, 1925, and 12½ per cent in August, 1926, which increased the stockholder's $100 interest to $120 in 1923, $144 in 1924, $162 in 1925 and $182.25 in 1926. In exercising these rights the stockholder subscribed for $82.25 additional stock. Meanwhile, he had received 8 per cent cash dividend, $32 on his original stock and $13.37 on his new stock, a total of $45.37. Thus in exercising his rights to buy $82.25 additional stock at par he had to pay $36.88 in addition to reinvesting the $45.37 received in cash dividends.

2. The Detroit Edison offered 25 per cent stock rights in June, 1923; 25 per cent in June, 1924; 10 per cent in October, 1925, and 10 per cent in December, 1926, which increased the stockholder's $100 interest to $125 in 1923, $156.25 in 1924, $171.87 in 1925 and $189.06 in 1926. In exercising these rights the stockholder subscribed for $89.06 additional stock. Meanwhile, he had received 8 per cent cash dividend, $32 on his original stock and $14.97 on his new stock, a total of $46.97. Thus in exercising his rights to buy $89.06 additional stock at par he had to pay $42.09 in addition to reinvesting the $46.97 received in cash dividends.

It is obvious that in either of these cases the additional stock purchased at par would have a market value today of more than 75 per cent above its cost. In order to maintain his proportion of interest in the company the stockholder was obliged to exercise all subscription rights offered him and to reinvest not only his cash dividend but an additional amount of cash. The stockholder of the North American Company, on the other hand, by retaining the new stock which he receives in the form of dividends maintains his proportion of interest in the company without additional investment. His new stock, of course, represents an increase in return in accordance with its enhanced market value.

### Does Not Reduce Equity

As the North American Company sees it, the problem is to provide required capital without reducing the strength of the stockholder's equity, either by offering stockholder subscription rights to new stock or by payment of dividends in stocks. The plan adopted, which makes the situation easier for the stockholder, is to issue stock quarterly for the amount of the dividends and either to send the stock to the stockholder or sell it for him, as he chooses. In our opinion it is more convenient for him to know that this will be done quarterly at the rate of 2½ per cent than to have 10 per cent or more in rights offered in one block at irregular intervals, when he would probably not be in a position to buy it.

A huge amount of new capital is required annually to take care of the normal development of the public utility industry and of a public utility company. This amount is from four to six times the increase in gross revenue during the same period. It is therefore my opinion that the policy of paying dividends on the equity in stocks is adapted admirably to the public utility industry, since its consistent and rapid growth requires so large and constant an increase in equity capital to keep the financial structure well balanced to facilitate senior financing.

## System Routine in Emergency Switching

By C. P. Hubbard
*Chief System Operator Detroit Edison Company, Detroit, Mich.*

ALL GENERATING station and substation operators in the Detroit Edison Company system are thoroughly drilled in procedures to follow in case of system emergency. These standing instructions, which are revised from time to time in the office of the system operator, include definite orders applying to the system in general and to the local plant or substation in particular and action which can be taken by operators without first notifying the load dispatcher. Notification of the load dispatcher is required at the earliest possible moment. Code signals sent simultaneously to all stations by the load dispatcher over the private telephone system assist in handling system emergencies.

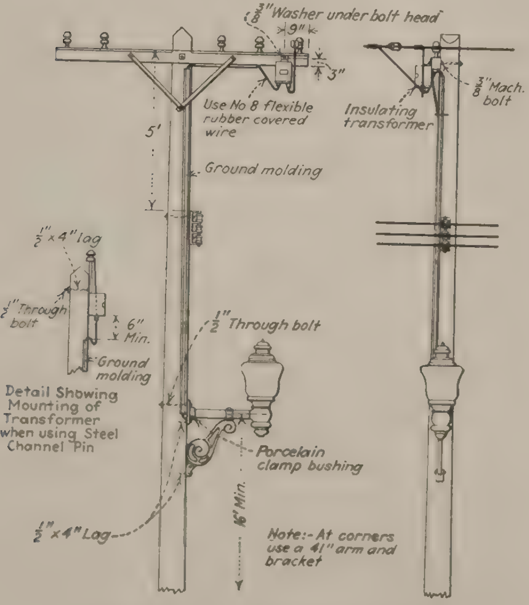
Orders which are simultaneously transmitted to all stations apply in most cases to direct-current distribution, the power-line system and street-railway supply. The code employed is indicated below:

1. Three short rings and one long ring on private telephone—close all direct-current distribution feeders and pick up load on motor-generator sets.
2. Double three rings—open emergency power lines.
3. Four short rings—lower potential to 400 volts on street-railway generators.

In case of interruption of an incoming line feeding station apparatus the operator immediately restores the apparatus to operation by putting it on another line. He does this before notifying the load dispatcher. The operator will not take this action, of course, if it is patently apparent to him that the cause of the interruption lies in the local apparatus. He does it only if he is reasonably sure that the trouble is outside of the station, which in most cases it is. It is the responsibility of the operator to be fairly sure that offending apparatus in the station is not going back on a good line and thus continuing the trouble. In view of the necessity for maintaining reliable service this practice is regarded as justifiable and safe.

In emergencies that affect supply to customers at primary and higher potentials, these customers do not get into direct communication with load dispatchers or station operators. It is a company rule that customers' calls shall be handled by the general trouble board. This board has positions occupied by experienced men who are familiar with the distribution and transmission systems and with system operation procedure. These men are more competent to deal with the customer who is affected by system trouble than is the load dispatcher who is working at high pressure in an emergency.

## White-Way Street-Lighting Fixtures on Wood Poles


3/8" Washer under bolt head
9"
3"
Use No 8 flexible rubber covered wire
Insulating transformer
3/8" Mach. bolt
5'
Ground molding
1/2"x4" lag
1/2" Through bolt
6" Min.
Ground molding
Detail Showing Mounting of Transformer when using Steel Channel Pin
1/2" Through bolt
Porcelain clamp bushing
16' Min.
1/2"x4" Lag
Note:- At corners use a 41" arm and bracket

*Standards of West Penn System*

## Automatic Furnace Permits Accurate Heat Control

By W. J. Diederichs
*Industrial Heating Engineer*
*Westinghouse Electric & Manufacturing Company*

The application of an electric rotary hearth furnace to the hardening of drop-forged wrenches has resulted in improvements in the quality of the products. These wrenches vary in size, requiring a large variation in heating time, and are treated in quantities of 1,200 lb. per hour regardless of the size. Warpage is a serious factor and individual quenching of the pieces is deemed necessary. It is also required, due to variation in size and analyses, that quenching be carried out at temperatures which vary from 1,400 to 1,575 deg. F.

*Automatic heat treating produces uniform products in this electric furnace*

The furnace provides an annular heating chamber 32 in. wide by 30 in. high, the floor of which consists of a rotating hearth covered by alloy plates elevated above the brickwork of the floor. The hearth is motor driven and is normally stationary. The control of this drive is such, however, that at regular intervals the hearth is automatically advanced the distance between the charging and discharging door and stops. The furnace has been equipped with a special charging device which, as shown in the accompanying illustration, is located in front of the charging door at the right. This device places a definite weight of work on the hearth each time it is operated. The hearth remains stationary while a new charge is entered and while a properly heated charge is individually and manually quenched at the discharging door. The time which the hearth remains stationary is adjustable, and by this means the time the work remains in the furnace, subjected to heat, can be varied through wide limits. This permits the adjustment of the heating cycle to the size of the work to be treated.

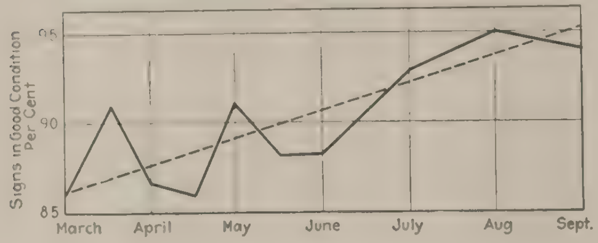
The furnace has an electrical input of 126 kw. for operation on 110-volt, three-phase power supply. This input is divided into two zones, each occupying one-half of the annular chamber. Each zone is independently controlled by a separate pyrometer and thermocouple actuating suitable contactor panels. This two-zone arrangement of input permits adjusting the temperature being maintained in the ingoing and outgoing halves of the chamber and makes it possible to vary the rate of heating the work in accordance with manufacturing and material requirements.

The furnace, when operating at a production of 1,200 lb. of work per hour at a temperature of 1,575 deg. F. successfully treats 9½ lb. of work per kilowatt-hour of energy consumed.

## Electric Sign Maintenance Plan Increases Revenue by $2,000

As A result of a nine months' experience with intensive efforts to improve the illumination of existing electric signs and floodlighted bulletins, H. L. Johnston, manager of industrial and commercial lighting Duquesne Light Company, estimates that an outlay by this utility of $300 for labor and material will have increased the revenue from this source by some $2,000 in the first year.

A survey of the electric signs in the most active sections of Pittsburgh indicated that a considerable percentage of these devices were not operating at their maximum efficiency. Many lamps were found to be inoperative, and in a number of instances signs were neither adequately cleaned nor painted to attract the desired attention. In order to maintain electrical advertising on a high level an effort was made to call the attention of the owners to the impaired effectiveness of the devices and to the desirability of restoring the equipment to a satisfactory condition. A total of 950 signs were listed in the principal business districts and inspection routes were planned, including approximately 125 installations apiece. Each route was then given to a man, who covered his assignment between 8 and 10 o'clock in the evening and who checked for burned-out lamps, inoperative equipment and other points involving poor conditions. Each route was checked twice a month until the summer months were reached, when the interval was lengthened to provide monthly inspection.



*Electric sign operation improved as a result of periodic survey*

A card with the name and location of the sign included a list of the major defects that might be involved: Part of lights out; all lights out; needs cleaning; needs painting; exterior lighted and interior lighted. Space for notation of equipment in good order was provided. Upon completion of the check, a card indicating conditions as found was sent to the owner.

At the time of the initial route coverage, only 87 per cent of the signs were estimated to be in first-class condition. Two weeks later a 91 per cent satisfactory condition was observed. Subsequent checks, while not meeting with the same effective response, indicated a general improvement until it was necessary to send cards regarding but 5 per cent of the signs surveyed.

## Cost of Electric Cold Storage in Farm Dairies

RESULTS of electric refrigeration as compared with natural ice on three retail dairy farms over a period of from two to four years each have recently been summarized by the New Hampshire Agricultural Experiment Station (of the University of New Hampshire) for the New England N.E.L.A. committee on the application of electricity to agriculture. On these farms the storage rooms ranged in size from 170 to 207 cu.ft. The refrigeration equipment was the same in each case with the exception of the motors, which were either ⅓- or ¼-hp., and the compressors were two-cylinder, reciprocating, air-cooled, gear-driven units using methyl chloride as a refrigerant. Initial investments for mechanical refrigeration equipment ranged from $350 to $766.50. The former was on a rental basis, which has been discontinued, so that from $770 to $775 is now required. For the natural ice method the initial investments varied from $135 to $775. The average for all refrigerating methods amounted to $455.

Yearly fixed charges are generally less for the natural ice method. Cash expenses for operating electric refrigerating units varied from 17 to 52 per cent less than for natural ice, but in one case were 12 per cent in favor of the electric method. The storage rooms were designed to carry an average load of 300 qt. of bottled milk per day and a maximum of 420 qt. has been stored. The maximum outdoor temperatures met were 102 to 104 deg. F. in the sun, at which time the cold storage was 50 deg. on one farm and 44 deg. on another. The average cold storage temperatures for these farms was 43 deg. for a year when the outside temperature averaged 62 deg. An average difference of about 20 deg. was maintained. The equipment operated 50 per cent of the time on two farms and 40 per cent on the third. Dairy cold storages consumed from 10 to 42 per cent of the electrical energy used on each farm for a year. The demand of the ¼- and ⅓-hp. motors under running conditions was from 320 to 360 watts and the maximum demand on starting was as high as 1,340 watts.

The energy consumption costs of the electrically operated units ranged from $37.31 to $75.60 per year on rates varying from 3¼ cents to 7 cents per kilowatt-hour. The average for all years and all farms was $48.83. When using natural ice, operating costs (labor, ice and sawdust) ranged from $196.40 to $325.92, with an average of $236.56. Due to the almost complete elimination of labor the operating costs for the electric method were consistently less than for ice, the natural ice costs averaging 383 per cent greater than the electric bills. The energy consumption varied from 772 to 1,479 kw.-hr. per year, including both nine and twelve months' operation, and the total over-all electric costs ranged from $106.71 to $135.35 per year, or an average of $118.33. The total expense ranged from 67 to 140 per cent greater with natural ice and averaged 100 per cent more than the total cost of electric refrigeration.

On a total cost basis, the average of all farms was:

| | Natural Ice | Electric Cooling |
|---|---|---|
| Cost per cubic foot of total contents | $1.19 | $0.62 |
| Cost per cubic foot of storage contents | 1.32 | 0.69 |
| Cost of 100 qt. milk per year | 0.30 | 0.15 |
| Cost per 100 qt. milk for period machine was run | 0.51 | 0.25 |
| Cost per cow per year | 6.36 | 3.17 |

# Some Experiences in Price Cutting

A close-up picture of the present tension in the market. Why the seller and the purchaser are at loggerheads

By Earl Whitehorne
*Commercial Editor* Electrical World

IN ANY discussion of the evils of price cutting, sooner or later the talk must get down to cases. It is perfectly natural and practical and proper for the purchasing agent to buy as cheaply as he can. And it is no less right for the manufacturer who sells the goods to get as profitable a price as possible. But in the evolution of business certain principles have developed and certain responsibilities. The trickery that once was the life and sparkle of horse trading is now frowned upon. Fair dealing has become the accepted standard in commerce, a live and let live policy that considers as satisfactory only a transaction that is of benefit to both contracting parties. The seller is supposed to give honest value and the buyer is expected to pay an honest price. Surely nowhere is this better understood and recognized than in this progressive, enlightened and prosperous electrical industry. Why, then, is there so much talk right now of trouble between large buyers and sellers? What has gone wrong in the market place that there is bitter talk of price cutting by manufacturers and profiteering by purchasers?

*In a recent article entitled "Who Pays the Cost of Price Cutting?" Mr. Whitehorne discussed some aspects of the present buyers' market in the electrical industry. The purchasing agent is charged with profiteering by ingenious methods of beating down price levels. The manufacturer is accused of price cowardice. The result has been demoralizing in many lines.*

*Therefore it has been recommended that secrecy be eliminated wherever bidders are called upon to reduce a price after bids are in, and that the salesman should demand a showdown and not accept the mere statement that he is the high bidder.*

*Many letters of widely varying opinion and many recitals of personal experience have been received. This article carries the discussion further, with a more intimate picture of conditions involved on both sides of the bargaining.*

Editor.

### Tricks of the Purchaser

Study it a bit and you find an interesting thing. There are some manufacturers who have the courage to establish prices and maintain them. Their price is their price and they refuse to dicker. But there are some who lack the courage or the strength. And just so there are some purchasing agents who do not haggle. They ask for bids from suppliers whose product is acceptable and the low man gets the business. But there are others who seem to consider their function one of dollar squeezing, and the length to which this gentle art is carried is astonishing. By way of illustration let's just consider a few examples:

*Case No. 1* — One very large company has a purchasing agent who seems to have complete control of the engineering department and his method is as follows:

The engineers confer with salesmen of various manufacturers and, after getting the needed information, issue specifications giving the amounts of apparatus desired, item by item. These are then turned over to the purchasing department and bids called for. The bids, when received from the manufacturers, go to the engineering department, are tabulated and analyzed. After this procedure they are handed to the purchasing department with the recommendations as to what the engineers would like. These engineers know what they want, but are required by the purchasing agent to give the names of at least three manufacturers whose apparatus would be acceptable, although the engineers, from an operating standpoint, would probably know definitely that one particular type of apparatus or one particular manufacturer would give the best results.

The purchasing agent then notifies the various bidders to appear at his office on a certain date, and the result is a flock of salesmen, the majority of whom never had a chance, but do not know it, as their names are not included in the engineers' recommendations to the purchasing agent.

The purchasing agent then retires to a large conference room and calls in his group of engineers—sometimes as many as 30. One by one the salesmen, those who have a chance and those who never had, are stood up before this imposing group. It is like a man at the bar facing a judge and jury. The purchasing agent, a very imposing individual, then holds up a bid, asking the trembling salesman if it is his. Admitting the charge, the purchasing agent barks out: "Is this your lowest bid? You have one chance to cut the price."

And so the bidding goes, until the harassed salesmen paint by telephone or telegraph to their main offices a story of the battle as they see it. Usually the story is utter defeat unless the price is reduced.

In a few hours each is called in to report again and given another last chance and somebody weakens. Then, after all this, the three representatives of the manufacturers selected by the engineers are again called in one by one. They are then given another chance to cut the price, so one by one they are worn down and one of the three eventually weakens. The net result is that some manufacturer takes a loss; the two others are sore, revengeful and swear to get even the next time with this manufacturer to whom the business was awarded, usually overlooking the fact that the purchasing agent is the one they should swear at.

When the next negotiation comes up it is usually awarded to some one other than the first successful bidder, and this goes on year after year.

*Case No. 2* — A practice more or less common in a large company is to issue calls for bids on a certain specification. After all the proposals are in, the purchasing department tabulates them, and calling in the bidders one by one, each is told or led to believe he is a little high in price. Finally one decides to meet or better the lowest bid submitted. All are in a roundabout way given an idea as to the amount of the lowest bid, told to get in touch with their factories and sharpen their pencils.

As a result, one or more of the manufacturers "bite" and come in with a still lower bid to "get in," as the salesman often says. This is especially true of some one who considers himself an outsider or has never been successful in securing business from this particular buyer.

When the purchasing agent has interviewed the entire list and held them on "hooks" for a time all the bidders are notified that the specifications have been changed by the engineers and new bids will be called for.

Practically all the time and expense of the first bids are thus lost and the merry-go-round starts all over again. Each one having spent considerable money by this time, some decide to go after the business hard in the hope of saving something out of the wreck. The net result is a free-for-all fight, but the business usually goes to the manufacturer whom the purchasing agent has had in mind all the time—at a lower price.

## To the Purchaser

*INDUSTRY needs more intelligent buying. It needs purchasing agents who know the values of the equipment they buy and make of their function something more than an adroit matching of prices. It needs frank, open recognition of the fact that what is bought must be paid for and that bids which embrace elements of engineering and of service, as well as the delivered product, cannot be compared by a mere tallying of the total cost figures.*

*Therefore, the time must come—will come—when the purchasing agent no longer shall be rated for his penny-squeezing ability, but for his engineering skill in sensing and securing the greatest values for the money spent. And one of his greatest resources will be the good will and support of his suppliers.*

The majority of the bidders never had a chance, but were systematically used to beat down the price. This method of procedure not only costs apparatus manufacturers a great deal of time and money but also wastes time and money for the purchasing and engineering organizations who award the contract.

*Case No. 3*—Some purchasing agents insist on a lump sum price on all major electrical apparatus required on a job. This lump sum might include transformers, oil circuit breakers, disconnecting switches, air-break switches, switchboards, regulators, outdoor substations and cable.

There are very few companies in this country that are in a position to offer such a complete bid. The smaller or specialized manufacturers are at a disadvantage when the engineers favor their equipment for a certain portion of the work, but the purchasing agents insist on a lump sum bid.

In order to obtain the lowest price, the purchasing agent will often ask the larger companies the amount of reduction they will make in case a certain item is eliminated from the lump sum bid. In order to protect their lump sum bid the larger companies' deduction will naturally be less than it should be when in straight competition.

The smaller manufacturers who cannot bid on the entire specification, but who may have equipment more suitable for the work desired by the engineers, are advised by the purchasing agent that they can have a certain portion of the business by taking it at a figure equal to the larger companies' deduction on that item from the lump sum bid.

By this method the smaller manufacturers are therefore offered the business at a price very much under the normal price, and if one of them takes it he is quite apt to lose money. On the other hand, if refused the business the purchasing agent will tell him that he was high in price and the business went to one company on a lump sum basis.

*Case No. 4*—One large purchaser of apparatus has a purchasing department which has successfully carried out the following plan:

Bids are called for on, say, 21 items, all of which can be supplied by one of several manufacturers. The bids specify itemized prices and a lump sum proposition.

The purchasing agent carefully picks out from all the bids the lowest price on each item. One man may be much lower on item 7. The purchasing agent then makes up his own lump sum proposition. Should any of the bidders in their proposition state that on a lump sum basis they will give a further reduction of, say, 5 or 10 per cent, the purchasing agent also takes this off his own lump sum tabulation.

The manufacturers' salesmen are then summoned and each one in one way or another learns that the purchasing agent has a lump sum figure considerably lower than that quoted by the salesman, who quickly wires the factory. In some instances the salesman actually finds out the exact lump sum figure referred to.

The net result is, the purchasing agent, by setting up this artificial lump sum figure, generally succeeds in knocking down the price of the manufacturer with whom he intended doing business from the start or whose apparatus is really specified and wanted by the engineering department.

*Case No. 5*—In a recent purchase of a large order five manufacturers bid. One was very high and was counted out. Three were low. The purchasing agent sent for the other bidder who was next below the high and told him that his equipment was desired and offered to give this firm the order at a price to be set by averaging the three low bids and adding 10 per cent. This is an inaccurate way of establishing the value of electrical machinery, to say the least, but he took the order.

*Case No. 6*—A purchasing agent asked for bids on a number of large machines involving a considerable element of design and engineering. The purchaser's engineer stressed the need for the highest efficiency obtainable. Several bids were entered involving a large expense. The high man was told that he would have to cut so many thousand dollars if he was to get the order. The purchasing agent asked the salesman: "Why should you expect to get so much more money than the X-Y-Z Company for the same size machines?" The sales engineer said: "Mr. Pricer, there are very specific reasons, based on definite engineering considerations, why our machines are worth more money to you. But there is no point in my taking your time to go all over them because you are not an engineer and will not understand the values that I am talking about. But I will be glad to go all over it with your engineer. If I can convince him that our machines are worth that much more than the X-Y-Z, will you consider this added value as a factor in our bid?" And the purchasing agent said: "No, each company must be on a par and the price decides it." And that was that.

### Typical Situations

The number and variety of these cases are without end, but certain typical situations stand out:

1. Where the purchasing agent gets the high bidder to cut on the indefinite promise of a large block of business next year.

2. Where the buyer lies, giving the bidder a false intimation as to his competitor's price, or representing the competing price on motors alone, for instance, as the complete price for motors and control, or citing a price on equipment that is not comparable, or ringing some other subtle change on the truth that deceives and tempts the manufacturer to cut.

3. Where the large buyer demands special discounts for large volume, claiming that this volume carries the manufacturer's overhead, and thus forces the big manufacturer's price down to where the small manufacturer cannot compete.

4. Where very large buyers of electrical equipment that is used as part of a manufactured product threaten to make their own motor or control or whatever it is unless the price is cut.

5. Where large utility holding companies argue that one of the savings possible through holding company operation should show up as savings in purchasing, and demand discounts over prices given to operating companies, which eliminate the small manufacturer and force the large manufacturer's price below the margin that provides for the further development of bigger and better apparatus.

6. Where purchasing agents apparently do not know how to buy because they have no facts to check bids with and no methods of evaluating bids and therefore resort to haggling.

### WHAT THE SELLER DOES

That's what they are saying about the purchasing agent—not all, of course—but many. But what is the matter with the manufacturer, you'll say, that he should admit to all this unsound and unfair treatment? Why does he fall for such methods? There is the rub. The manufacturer right now finds himself in a buyers' market. He is embarrassed in many fields by overcapacity and overproduction. He has permitted himself to become involved in a mad scramble for orders that has enmeshed him until for every story reflecting upon the purchasing agent there are fourteen about the manufacturer and his salesmen. As one man put it, "You can take a pure young man and make him a purchasing agent today and before Sunday the manufacturer's salesmen will have taught him all the dirty tricks in the business."

The utility purchasing agents say that the manufacturers are themselves the greatest culprits and are responsible for price buying. They say that first bids today are made for trading purposes only and that the bidders come to them before the ink is dry on the bids and offer to cut the prices. Therefore, they say, they too must use trading methods, because those are the methods that the manufacturers have developed and seem to understand. The purchasing agents say they are willing to pay fair prices, but that the manufacturers haven't the courage to put fair prices on their products and then stick to them.

### To the Manufacturer

*INDUSTRY needs more sincerity in selling. It needs manufacturers who consider that a bid is a word given—an honest offer of service to a friend—and not just a gesture in a sparring match. In other words, a bid from a responsible concern to a reputable customer should be a firm bid, the pledge of the house, signed with its good name. And such a bid is the equivalent of an open bid because there is no trick in it. It is not subject to revision, any more than the written word of that manufacturer is subject to question, because his honor is involved.*

*Firm bids preclude price cutting. They possess every advantage in competition. They maintain price levels by natural processes. They protect both the seller and the buyer by banishing the unseen menace of deceit.*

The small manufacturer also charges that although the large electrical manufacturers state that they desire competition and see no virtue in monopoly, yet they chafe under the competition of the small manufacturer and cut prices to get business, relying on price cutting and not on better quality, better delivery or better salesmanship to maintain their position. It is alleged that the spread of prices established by these larger manufacturers is unreasonably wide and is not justified by the savings effected in making and selling the larger quantity to the large buyer.

Again, the large manufacturer says that his responsibility to keep his plant busy gives him a natural right to price low at times on orders needed to load some department of his factory that is running short. The small manufacturers, he says, with low overhead, have ample advantage in the market place, but rely too much on price paring and too little on engineering service and quality of product.

In this competition which is being waged between the manufacturers certain practices are followed which tend to aggravate the situation:

### TRICKS OF THE MANUFACTURER

1. The large manufacturer uses the lump sum bid as a lever to lower prices on individual products to compete with the small producer who specializes in that line. It is said that at times this is so manipulated that it has the effect of a straight price cut.

2. Allowances are made on old equipment taken back that range all the way from a reasonable scrap allowance to the full original price. This is pure price cutting when the allowance is more than the seller may reasonably expect to realize from the second-hand value.

3. Some manufacturers are making extravagant contributions in preliminary engineering expense for detailed working data that are out of all reason and constitute a price consideration because they put an undue extra burden on the profit.

4. Financial affiliations between some manufacturers and the utility companies are used to bring pressure from on high to throw the order.

5. Reciprocity arrangements are drawn into competitive bids to an extent that overshadows the actual comparative values involved and works an injustice upon bidders who are invited to compete with the assumption that it is to be a fair and open contest.

6. And then there are the everyday conditions of price cutting, where the manufacturer loses his nerve and pares his price for no other purpose than to get the order and camouflages it with all manner of alibis and explanations, such as a mistake in figuring, or new information, or an unexpectedly favorable purchase of materials, or some other cock and bull story. Here are a few of the usual experiences:

*Case A*—Purchaser in the market for a 000-hp., 000-r.p.m., synchronous motor. Low bidder $8,450, with other bids materially higher. One bidder received a tip that the other really higher bidder was $7,900. He revised his bid and took the order at that figure. The other bidder held his price and checked up afterward and they found out.

*Case B*—A purchaser advised a bidder that he was getting an extra 5 per cent from another bidder on some standard listed apparatus and that he would have to meet the figure. He did, and it developed that the extra 5 was on a single order aggregating over $50,000.

*Case C*—A recent order was taken for $58,650 on specific information from the buyer that a certain manufacturer had made a price of $57,000. The original bid of the successful (?) bidder was $74,000. A later check-up disclosed that original bids ranged from $70,077 to $74,000 and no other changes were made.

*Case D*—A bid was made when it was known that there were only two companies competing. One was high and under pressure came down, but the other bidder got the order, anyway. It was finally explained that the president of the purchasing company had over-ruled price and ordered the business to be given to the other firm on "policy," for reasons unknown to his subordinates.

### The Moral Aspect

And there you are. Some men will say that all this is natural, because men are different and act differently. It has always been so, they say. But is that a reason? There are many time-honored practices that some day will give way to the onward march of principle and be changed. There are many things that men used to do that have been stopped and are not countenanced today. After all, it gets down to a very simple consideration of plain honesty. If a purchasing agent lies or otherwise deceives a bidder into cutting his price he is not dealing honestly. He is not fair. And if a manufacturer offers a bid that is not fair, either because the goods are not worth the money or because he has padded the price for trading purposes, he is not dealing honestly. It is not square when you come right down to the plain facts. It is trickery. It is an effort to take advantage of the other fellow.

Everybody will agree that it is considered wrong to slip your hand into a man's coat pocket and extract his wallet while his attention is distracted. No purchasing agent will do this to a salesman. No manufacturer will do it to a buyer. Well, the only difference is that dickering with bids and cutting prices has not yet lost its social standing. Today it involves no conspicuous degree of moral turpitude. But gradually it is going to be ostracized. The day will come when between intelligent business men price cutting will be taboo.

For with electrical men there is something more to it than just a matter of personal bartering between individuals. We have an industry involved, responsible for the maintenance of a great public service. We have a broad market to be maintained. And it is a matter of simple, inescapable truth that destructive commercial warfare between competitors or between buyers and sellers eventually demoralizes markets, wrecks the economic health of the industry and ultimately paralyzes the service upon which the public is dependent. And that is the reason why we find modern business bulwarked about with codes and standards and principles, with a highly developed system of self-imposed controls that have evolved out of experience because without co-operation and mutual good will there is no safety for investment, no stability upon which to base projects and plans.

And this responsibility for safeguarding the economics of business is an obligation that cannot be forgotten very long even in the relationships between one large buyer and his supplier. Profiteering purchasers and price-cutting sellers are forgetting this in an excess of zeal for sharp buying and for order snatching. But carried too far it brings its own defeat, for the manufacturer goes broke and the purchaser finds himself at last surrounded by enemies and he is lost.

### Two Objectives

The greatest single problem in this whole situation to my mind is the difficulty of shaking men loose from the purely negative idea that because these unintelligent buying practices are general and have existed for long, they can't be changed. But that is just foolishness. Every buyer wants to get his money's worth. Every seller wants to get a fair price. No more is wanted, no less is satisfactory. What can be done, therefore, to put an end to the haggling and the price cutting? Fundamentally, it seems to me there are two things to be done:

1. *By the Purchaser* — Industry needs more intelligent buying. It needs purchasing agents who know the values of the equipment they buy and make of their function something more than an adroit matching of prices. It needs frank, open recognition of the fact that what is bought must be paid for and that bids which embrace elements of engineering and of service, as well as the delivered product, cannot be compared by a mere tallying of the total cost figures.

Therefore, the time must come—will come—when the purchasing agent no longer shall be rated for his penny-squeezing ability, but for his engineering skill in sensing and securing the greatest values for the money spent. And one of his greatest resources will be the good will and support of his suppliers.

2. *By the Manufacturer*—Industry needs more sincerity in selling. It needs manufacturers who consider that a bid is a word given—an honest offer of service to a friend—and not just a gesture in a sparring match. In other words, a bid from a responsible concern to a reputable customer should be a firm bid, the pledge of the house, signed with its good name. And such a bid is the equivalent of an open bid because there is no trick in it. It is not subject to revision, any more than the written word of that manufacturer is subject to question, because his honor is involved.

Firm bids preclude price cutting. They possess every advantage in competition. They maintain price levels by natural processes. They protect both the seller and the buyer by banishing the unseen menace of deceit.

All this will not happen at once—not this week. I know it. But industry can work toward it—can fight for it. And the logical approach to it is for the seller to refuse longer to cut his price because the buyer tells him to. Let him at least begin to protect himself by making sure that the other bids that he is asked to beat are comparable and that the purchasing agent is not lying. If he is asked to refigure after the bids are in let him at once demand that all the bids be opened to inspection. And also, it is time the manufacturer knew a little more about the reasons why he loses orders, through regularly organized post-mortem studies of the bids on his last business.

There is no lack of engineering in production. Production is organized strictly according to facts. But production is dependent upon purchasing for continuity and quality of supply. It is time to replace wit matching and blind bartering in industrial buying by an engineering approach to truth in values.

The days of haggling and bickering are all done in retail trade. Some day price cutting will pass out of industry. And men will wonder why it was that we could have been so long blind to economic truth.

# Women Workers Used in Service Representative Plan

By W. G. Burrill
*Commercial Manager Associated Gas & Electric System, Staten Island, N. Y.*

THE home service representatives of the Associated Gas & Electric Company call on customers in their homes with the primary purpose of learning to what extent they are using electric service, checking the number and kinds of electric appliances which they own, learning what interest they have in other appliances and making minor repairs to appliances found on the premises which are out of use on account of cord or plug trouble. Women representatives are used for this home service work.

The result of this survey is posted on a card containing the customer's name and address and constitutes a record, which is brought up to date from time to time, of the customer's use of electric service in the home. When customers are found to be interested in appliances which they do not own the information is passed along to our sales organization by means of prospect cards and followed up by a salesman.

Home service representatives are not permitted to make sales. Their work is, in the last analysis, selling electric service, and is therefore more educational in character than anything else. Customers are contacted by the home service department through the mails with printed matter explaining the use and character of various appliances, together with recipes of foods to be cooked on the electric waffle iron, electric range, and frozen dainties to be prepared in the electric refrigerator. Contact is also made by means of lecture work to women's clubs, church societies, parent-teacher associations, etc. In addition to this type of activity classes are also conducted in co-operation with and in the public schools to children twelve years of age or thereabouts in the use of the electric washing machine and electric iron, how to read the meter, replace fuses, etc.

We feel that this work is doing a world of good, both to our customers and the company. Complaints of service are often adjusted by home service representatives, and when not possible of being adjusted are referred promptly to the proper department for attention, which gives us a check on the efficiency of various departments and enables changes in methods, routine and policies to be made before any great damage has been done to public relations.

In choosing home service representatives preference is given to high school graduates who have had the domestic science course or home-making course, supplemented by a background of housekeeping activities in their own homes. A course of training in company policies, rates and routine is given to the girls before they do any active field work, together with proper training in the care and operation of the various appliances. Our home service representatives are competent to demonstrate devices sold by salesmen, thus relieving the latter of this responsibility and enabling them to devote their time more intensively to sales promotion.

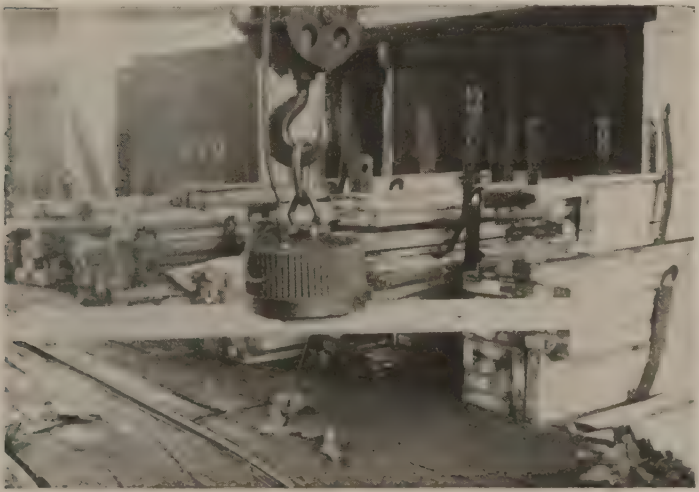
We feel that to get a coverage of our customers once a year one home service representative should be employed for each 1,000 residential customers, although we are not organized in our company at the present time on quite so extensive a scale.

# Magnets Successfully Handle Coiled and Boxed Steel

COILED strip steel is a difficult material to handle, for unless the coils are tightly bound together they will pull apart and cause confusion to the handlers and damage to the steel. A strip steel coil, even though securely bound, is a heavy, awkward thing to handle and the moving of any amount of this steel requires a gang of husky men, who must be continually cautioned against battering the finished steel strip.

The Superior Steel Corporation at Carnegie, Pa., whose product is largely cold and hot rolled strip that is shipped both in coils and boxed flat, has adopted the Electric Controller & Manufacturing Company's lifting magnets for handling the finished steel, using manual labor only where necessary to move the bundles or boxes into closed freight cars. At this plant the company recently loaded 200,000 lb. of strip steel into box cars with the magnet and four men during a ten-hour shift. Before the magnet was purchased the most that six men could load was 140,000 lb. in a ten-hour shift.

The magnets usually handle two coils at a time, and if



*Magnets handle 600 to 1,000-lb. packages of boxed strip steel. Thin sheets aid in handling of coiled strips* these two coils are not placed tightly up against each other one or both of the coils has a tendency to fall away from the magnet and be held in a vertical position. Because the steel must not be battered, it is not satisfactory for the coils to be dropped on their edge. In experimenting with the magnets on this job of handling coiled strip steel the Superior Steel Corporation discovered that a thin sheet of steel placed over the two coils to be lifted would spread the flux from the magnet sufficiently to hold both coils flat against the plate. It is a peculiar fact that this plate does not short circuit the flux, but causes the magnet to do a better job than without the plate.

## Rural Bills Collected When Meter Is Read

THE practice of making collections by the meter reader at the time he reads the meter in rural sections has been found by the Portland (Ore.) Electric Power Company to effect economy and aid in maintaining closer relations with the farmer, according to R. R. Easter, manager of the Tualatin Valley division. Moreover, a complete understanding is had as to the bill without delay; collections are greatly facilitated, and in many cases where the farmer has no checking account he is aided in making his payment.

An intelligent meter reader can be of great value to the company in such cases, as he not only creates a proper impression of the company in the customer's mind but, also, he is able to learn of his needs in so far as additional current-consuming devices are concerned and, in many cases, to obtain his partnership in the business through the sale of stock. An ordinary bill form is used. The meter reader makes out the bill at the time the meter is read from the customer's schedule for the previous month, which he has with him. In a large percentage of cases the bill is collected at the time, conveniencing not only the farmer but the company as well.

It has been found, however, that such good results do not obtain in commuting districts, where customers are more in the habit of paying by check. Quite often they are away from home or do not have the available funds except for a short period after pay day; nor is the average commuter such a willing listener in so far as purchase of additional appliances or stock is concerned.

### *Service*

The fundamental of good public relations is good service. There is no substitute for it. If we don't give good service, we won't deserve the public good will. So far as this company is concerned, it desires to have the good will of the public, but even more than this it desires to deserve it.

P. S. ARKWRIGHT,
*President Georgia Power Company*

## Letters from Our Readers

### *An Insidious Misuse of the Schools*

*To the Editor of* ELECTRICAL WORLD:

An insidious misuse of the public schools for the dissemination of government ownership propaganda is being made in New York City and probably elsewhere through the courses in "current events." For these courses weekly four-page leaflets are used, issued under the title "Loose-leaf Current Topics." These printed leaflets bear no editorial address, but those issued under the name of the "New York City Edition" are apparently published at 1123 Broadway, New York City, though there also appears to be a general publication office at 40 South Third Street, Columbus, Ohio.

The issue for the week of Feb. 27 to March 2, 1928, issued as Vol. XIII, No. 5, contains an article under the caption "Our State Water Power," beginning as follows:

> The cost of electricity to householders in New York City is 7 cents per kilowatt-hour, as charged by the New York Edison Company, a private company.
>
> This charge is "one of the cheapest rates in the United States for electricity generated from coal." In Toronto, Canada, the average cost of domestic service obtained from a public-owned water-power system was only 1.7 cents per kilowatt-hour in 1926.

Next, quoting Governor Smith, "New York State is probably the richest state in the Union in actual power resources. For years and years the resources have been allowed to run to waste." The article proceeds to ask why it is that, while other states and cities are enjoying the advantages of cheap electric power, New York State has been so slow in developing its vast sources of power in the St. Lawrence and Niagara Rivers, and answers by pointing out that "our Democratic Governor and our Republication Legislature cannot agree," and contrasts the opposing views on state development as against private development under lease.

Suggesting the precedent of the Port Authority, the article concludes that electricity generated under a similar authority would cost the consumer less than if developed by private capital, because there would be no stockholders and no profits.

The fair and impartial presentation of the elements of important economic problems affecting our national welfare has come to be recognized as a legitimate function of our public school system. We are living in an unprecedently complex civilization; we send our children to school to prepare them effectively to meet life's problems.

But an unfair and one-sided presentation of any great economic problem on which there is an honest difference of opinion is a misuse of the high privilege and duty of our educational system. The dissemination of untruths or half-truths through these leaflets, under official sanction and therefore accepted as free from any taint of propaganda, to thousands of teachers and tens of thousands of students, and through the latter again influencing tens of thousands of homes, is a thing to be vigorously combated.

GLADYS FELLOWS.
New York City.

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Heat Transmission Through Boiler Tubes.*—A discussion dealing with the rate of transmission of heat through a boiler tube from the outside inward; that is to say, a water tube boiler in contrast to the generally followed procedure of investigating the fire tube boiler has recently been completed. The information given is unusual in that the experimenter has endeavored to take into account all those variations from full-size boiler construction practice which are necessary in a small experimental installation. As a result of this investigation the following conclusions were developed: The coefficient of heat transmission of the apparatus is affected by the rate of gas flow and the temperature difference between flue gas and water as well as the pressure at which steam is generated and the temperature of the gas stream; the coefficient may be expressed in terms of the variables by means of certain derived equations; the water velocity in the tube has slight effect on the over-all coefficient of the transmission; the water velocity in the inclined tube of the apparatus varies as the steam rate and total energy input and tends to approach the practical maximum at slightly over 3 ft. per second; the water velocity is affected by the steam pressure, and the temperature gradient from the flue gas to the water in the tube varies with the flue gas temperature, the rate of gas flow and the steam pressure.—*Engineer (England)*, Feb. 10, 1928.

## *Generation, Control, Switching and Protection*

*Selective Protection.*—H. Puppikofer.—The steadily increasing unit size of generators and transformers in modern power stations ties up more and more capital per unit, causes a rising percentage of lost power when inoperative and warrants, therefore, expenditures for the best possible protection. The cost of the protective equipment may usually be considered to have been paid for when a large generator has once been saved from serious damage. Descriptions and operating characteristics are given of several modern selective protective systems, including the following: Back-flow watt relay, differential relay, self-balanced Ferranti relay, transformer relays, busbar protection, over-voltage protection, overcurrent protection, de-excitation methods and a note on internal fire protection. The necessity of an independent and absolutely dependable source of direct current which must be available at all times to provide the required control current for the protective relays in case of emergency is emphasized. A storage battery is frequently used for this purpose, although a Swiss concern advocates a small auxiliary generator on the shaft of the main machine to supply only the control current.—*Bulletin de l'Association Suisse des Electriciens*, February, 1928.

*Generating Station Bus and Switch Structure Design.*—Data as to the types of indoor bus and switch structures being used in 24 typical generating stations selected to give a great diversity of size and location from among those of more recent design in the United States are included in this report of the electrical apparatus committee of the N.E.L.A. Among the factors which have been considered in the course of the investigation and compilation of data are: Isolated phase versus adjacent phase; vertical isolation versus horizontal isolation; gasproof construction; fault bus protection; insulation of buses; bus housing construction, and cell construction. The comments of several manufacturers have been incorporated in this compilation as an expression of contemporary possibilities in this direction. Single-line wiring diagrams and simplified layouts of equipment placements have also been included.—*Serial Report National Electric Light Association*, February, 1928.

## *Units, Measurements and Instruments*

*Ground Detection.*—John Auchincloss.—The various means of detecting the impairment of resistance to ground has been considered, with particular reference to the instruments used for such determination. The various types of commercial circuits call for different schemes of ground detection and each is described in connection with the individual type of circuit for which it is adapted. In this connection the 125-volt, direct-current, two-wire ungrounded circuits, the Edison three-wire ungrounded neutral systems, the two-wire alternating-current circuit, the two-phase system, the three-phase, three-wire circuit and the specific considerations and wiring connections proved desirable by practical experience are offered.—*General Electric Review*, February, 1928.

*Electricity Meter Accuracy.*—G. L. E. Metz.—The ratio and phase-angle effects on the accuracy of watt-hour meters is developed in connection with the influences exerted by current transformers and a consideration of recent British specification standards. The author has considered the factors which influence the accuracy under operating conditions and under changes in phase angle. It is concluded that the errors cannot be reduced greatly in current transformers without increasing their size, while in the case of meters the difficulties in manufacturing procedures would be augmented if a higher degree of accuracy is required.—*Electrical Review (England)*, Feb. 17, 1928.

## *Transmission, Substations and Distribution*

*Steel-Cored Aluminum Conductors.*—E. T. Painton.—A general consideration of the application of steel-cored aluminum conductors to transmission line use, with particular reference to the results obtained in installations in Scotland. The economical and technical advantages as reflected in increased span length and resistance to corrosion have been considered by the author. As the result of severe tests, the suitability of this type of construction has been established by practical use. The methods found most desirable for erection purposes have been outlined.—*Electrician (England)*, Jan. 27, 1928.

*Mechanical and Electrical Properties of Conductors for 220-Kv. Lines.*—Avoidance of corona losses dictates that conductors to be used on 220-kv. lines shall have an outside diameter of about 1 in. Several types of conductors have been made available by wire and cable manufacturers to meet special conditions imposed by the 220-kv. conductor problem, and it is the purpose of this report of the overhead systems committee of the N.E.L.A. to present the physical, mechanical and electrical characteristics of a group of selected sizes of each type so that the designing engineer may have reliable data on a comparative basis. This report includes a discussion of corona loss and of tests for its determination. Tabulated results and characteristic curves indicating the properties investigated have been included and statements by manufacturers and research results are appended.—*Serial Report National Electric Light Association*, February, 1928.

## *Motors and Control*

*Synchronous Motor Drive With Dynamic Braking.*—C. E. Crease.—A new type of installation in which dynamic braking has been utilized to secure quick and uniform emergency or safety stopping of the synchronous motor used in a rubber mill is described in the article. The results are accomplished by disconnecting the motor stator from the alternating-current supply and connecting it across a resistance of suitable value while the rotor field circuit, by short circuiting the motor field rheostat, is increased to its maximum value. Full magnetic push-button control is utilized for this 300-hp. machine. — *Electrical News (Canada)*, Feb. 15, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*Some Experimental Difficulties With the Electro-Magnetic Theory of Radiation.*—Arthur H. Compton.—It has become increasingly evident during the past few years that the classical electromagnetic theory of radiation is incapable of accounting for certain large classes of phenomena, especially those concerned with the interaction between radiation and matter, according to the author. The more serious difficulties which present themselves in connection with the theory that radiation consists of electro-magnetic waves propagated through space in accord with the demands of Maxwell's equations have been classified as the oscillatory source of the waves; the photo-electric effect; the scattering of X-rays, and of the recoil electrons; and the individual interactions between quanta of radiation and electrons. The author has considered the problems in detail and does not negate the concept of waves of radiation. He concludes, however, that energy is not transmitted by such waves. The power of the wave concept in problems of interference, refraction, etc., is stated to be well known, but whether the waves serve to guide the photons or whether there is some other relation between photons and waves remains an open question.—*Journal of the Franklin Institute*, February, 1928.

*The Adsorption of Gases by Solids.*—H. H. Lowry and P. S. Olmstead.—While many attempts have been made to develop a theory of adsorption of gases by solids which will allow quantitative prediction of the effect of changes in temperature and pressure on the quantity of gas adsorbed by a given adsorbent, none of the theories, with the possible exception of that of Polyani, according to the authors, may be said to be satisfactory. This is due to the fact that the mathematical relationships resulting from the various theories have all contained constants which cannot be directly determined. As a result there now exist many empirical equations which fit with equal satisfaction the data obtained either at constant temperature or at constant pressure, or with constant amount adsorbed. Polyani's theory, on the other hand, assumes that the force of attraction of the solid adsorbent for the gas molecules decreases with increasing adsorption according to the characteristics of the material, but is independent of temperature and can be determined from a single isotherm. The present investigation has been undertaken in an endeavor to amplify and co-ordinate the information now available and the theories involved regarding the adsorption of gases by solids.—*Reprint B-279 Bell Telephone Laboratories, Inc.*

## *Telegraphy, Telephony, Radio and Signals*

*Grid Current Modulation.*—Eugene Peterson and Clyde R. Keith.—The term grid current modulator as used by the authors refers to those vacuum tube circuits in which modulation is initially produced in the grid circuit of a three-electrode vacuum tube due to the non-linear grid current-grid voltage relation. Comparison with a representative plate current modulator using the same tubes and the same plate potential shows that by modulating at and using the plate circuit solely for maximum efficiency in the grid circuit amplification, the maximum power output is increased about eight times, the power efficiency is increased about five times and the ratio of side-band output to signal input is increased approximately three times. This improved performance has been made possible by a detailed study of the fundamental processes involved and by a design of the tubes and associated equipment, such as transformers and filters, to permit these fundamental processes to operate to their best advantage. The article concludes with an application of the principles involved to an experimental carrier-telephone system for which the operating features of tubes, filters and transformers are discussed.—*Bell System Technical Journal*, January, 1928.

*Power Plants for Telephone Offices.*—R. L. Young.—A brief discussion of some of the more important problems connected with the supplying of power to telephone offices and developments which are being perfected to bring about economies. The author has included consideration of the factors of commercial types of charging generators and appropriate filters, power factor correction, complete power unit assemblies for small installations and the development of more nearly automatically controlled power installations with the object of reducing supervision. The subject of battery reserve is also considered and the tendency exhibited in the design and application of the equipment discussed is indicated with a view toward future developments.—*Reprint B-276 Bell Telephone Laboratories, Inc.*

*A High Efficiency Receiver for a Horn-Type Loud-speaker of Large Power Capacity.*—E. C. Wente and A. L. Thuras.—A telephone receiver of the moving coil type which is particularly adaptable to the horn type loud-speaker and which is said to represent a notable advance over similar devices at present available is described by the authors. The design is such as to permit of a continuous electrical input of 30 watts, as contrasted with the largest capacity heretofore available of about 5 watts. In addition, measurements show that the receiver has a conversion efficiency from electrical to sound energy varying between 10 and 50 per cent in the frequency range of 60 to 7,500 cycles. This contrasts with an average efficiency of about 1 per cent for other loud-speakers, either of the horn or cone type. Combining the fifty-fold increase in efficiency with a fivefold or sixfold increase in power capacity, a single loud-speaker unit of the type here described is capable of 250 to 300 times the sound output of anything heretofore available.—*Journal of the Franklin Institute*, January, 1928.

## *Traction*

*Operating Costs of Industrial Trucks.*—C. B. Crockett and H. J. Payne.—All direct costs of handling materials by industrial trucks are influenced by operating conditions. Theoretical curves are presented showing the effect on the operating costs of different types of trucks resulting from variations in length of haul, amount of material to be handled, condition of runways and number and severity of ramps. In addition there are other conditions having a decided effect upon the cost of operation but which defy analytical treatment. The author lists these as width of runways and available space, fragility of material handled, special requirements in handling, labor market conditions and range of uses for which equipment is employed. The curves presented are not offered as accurate results of tests made nor are they true graphical representations of the formulas upon which they are based. They are rather a suggested method of approach to the problem of selecting the most economical equipment operating under given conditions. — *Iron Age*, Feb. 9, 1928.

## *Miscellaneous*

*Electricity on the Farm.*—The material presented in this bulletin represents a summary of available information by the Committee on the Relation of Electricity to Agriculture regarding the rural uses for electricity. It is stated to be offered not as the last word upon the subject but rather as an elementary treatise of a development which promises to grow with astounding rapidity. The energy requirements for cooking have been tabulated for farms in various localities, with certain minimum numbers of family members, and have been reduced to average values. Appliance factors as well as those concerned in the laundry, household refrigeration, farm refrigeration, water supply, radio application and miscellaneous uses are offered. Wiring installation costs and recommendations for adequate, safe and satisfactory service are included. The recent developments of insect destroyers of various kinds, the thermal requirements for incubating and breeding purposes, and the demonstrated usefulness of ultra-violet and incandescent lighting in poultry raising receive authoritative treatment in this comprehensive summary of rural applications. — *Bulletin Vol. 4, No. 1, Committee on the Relation of Electricity to Agriculture.*

# News of the Industry

## St. Francis Dam Goes Out

### Failure of Los Angeles Municipal Structure in San Francisquito Canyon Causes Heavy Loss of Life and Property—Power House No. 2 Demolished

ANOTHER flood disaster affecting electric light and power service has been added inside a twelvemonth to those on the Mississippi and its tributaries and in the New England States. This time the scene shifted to a third geographical district, southern California, and the failure of man's handiwork rather than the uncontrolled operation of natural forces is the cause to which, in the absence of any evidence of earthquake or dynamiting, the torrent must be ascribed.

It is estimated that from 300 to 400 lives were lost and that damage to property reaching $15,000,000 was done when the St. Francis Dam on the aqueduct of the city of Los Angeles, which stood in San Francisquito Canyon, 40 miles north of the city, failed at 11:58 p.m. on March 12. Approximately 38,000 acre-feet of water was impounded by the dam, all of which escaped. The wall of water, which is said to have been fifteen feet high, swept aside every structure in the canyon and flooded Santa Clara Valley.

According to H. A. Van Norman, assistant chief engineer of the Los Angeles Water and Power Department, this is the explanation of the breaking of the dam: "Both sides of the dam gave out at the sides. The water saturated the ground deep into the hills at either side and this ground gave way first at the west side of the dam. When the ground gave way at the west side it weakened the concrete structure of the dam itself, and it sheared out completely on that side. Then the east side gave out in a similar manner. The remarkable thing is that the center arch on the dam, 75 ft. wide and 208 ft. high, is still standing."

The city had two plants in San Francisquito Canyon—No. 1, above the St. Francis Dam, with a capacity of 40,600 kw., and No. 2, immediately below it, with a capacity of 52,500 kw. Reports declare that the lower plant has been completely demolished and that all the operators and families to the total of 64 lost their lives. The Southern California Edison Company took over the load of the bureau when the city lines went out and is without difficulty meeting the demands for energy throughout the system.

It is estimated that the damage to the properties of the Bureau of Power and Light will be in excess of $5,000,000, and general property damage is estimated at $10,000,000 in addition.

A camp belonging to the Southern California Edison Company which had been established in the valley, in the path of the flood, was swept away, and it is believed that 40 or more of the 170 transmission-line workers housed there lost their lives. The roar of the breaking dam and flashes from broken power lines were the first signals of danger to the inhabitants of the valley, most of whom were asleep. By daylight the torrent had reached the Santa Clara, more than 20 miles from the dam. The river, normally a dry bed, was running fifty feet deep and two miles wide, sweeping away everything in its path. In another hour or two the stream had dissipated its force at Ventura and left a comparatively quiet flow of about six feet. Then this too trickled away, leaving only deep pools.

From Saugus on the east to near Oxnard on the west, a stretch of 40 miles, every power and telegraph wire was down, all bridges were out, highways were buried under many feet of mud or torn away by the force of the flood, and twisted snarls of railroad track lay far from the right-of-way, the sleepers still clinging at odd angles to the rails.

R. H. Ballard, vice-president and general manager Southern California Edison Company, sent the following telegram to the ELECTRICAL WORLD on Wednesday:

"We are operating normally and in addition easily carrying the full load of the municipal power system, which is completely shut down. Our only loss was a few towers standing in the path of the flood and a small switching station, and we were able to pick up the

*St. Francis dam and reservoir before the break—Finished May, 1926*

Los Angeles load of the municipal system within a few minutes after its stations shut down and to establish new connections for Santa Barbara and Ventura Counties within a few hours. One of our transmission-line construction camps was located about twenty miles below the municipal dam and in the path of the flood. We have suffered some loss of life to employees—so far about eight known casualties with a number still missing."

A later dispatch says that on Tuesday night the Edison plants carried a peak of 628,000 hp., the highest in the history of the company. On the corresponding day of last week the peak was 532,000 hp., and the highest previous peak on record was 598,000 hp. Except for local disturbances in the flooded area, there has been no interruption to the service of the Southern California Edison Company. The monetary loss to that company will be less than $100,000, represented by damage to eight high-tension-line towers, a group of small cottages and a bank of oil switches which were in the path of the flood. The Long Beach steam plant was an important factor in meeting the emergency.

### Description of the Dam

Dimensions and other details of construction of the St. Francis Dam are listed in a report by W. W. Hurlbut, office engineer of the Bureau of Water Works and Supply, Los Angeles, dated July 1, 1926. It describes the dam as follows:

"The St. Francis Dam was completed May 4 and contains 167,000 cu.yd. of concrete, of which 94,000 cu.yd. was placed during this fiscal year. The maximum height of the dam is 208 ft. The maximum width is 169 ft. and the length is 668 ft. with an additional length of dike of 613 ft. The design of the dam is the gravity type arched for additional safety."

State and local officials are at a loss to find a reason for the sudden collapse, and searching investigations are to be launched at once. Edward Hyatt Jr., State Engineer, said:

"According to our reports, the dam was in perfect condition and had been inspected regularly under state supervision. It does not seem likely that it could have been dynamited, as a tremendous quantity of explosives would have been necessary. We expect to go to the bottom of the affair."

## Dam in Kickapoo Fails

An ice jam in the Kickapoo River carried out a 60-ft. dam at La Farge, Wis., on Tuesday, interrupting the service of the local isolated electric plant, which supplies 800 inhabitants. This is the second serious interruption in recent years. Service will probably be resumed by arrangement with a nearby transmission system. As a result of the accident highways became impassable in all directions, a passenger train was marooned in the village and farms were flooded.

# Norris Bill Gets Through Senate

## By 48 to 25 It Is Passed Without the Harrison Amendment—House Expected to Disagree—First Session of Power Investigation—House Committee Is for Boulder Dam

By Paul Wooton

*Washington Correspondent of* Electrical World

BY A VOTE of 48 to 25 the Senate on Tuesday, March 13, after a debate lasting three weeks, adopted the Norris joint resolution providing for federal operation of the government's plants at Muscle Shoals. Under the resolution, the money derived from the sale of hydro-electric power will be used for experimentation in the manufacture of fertilizers.

Amendment after amendment was rejected by the Senate, the most important being the "Underwood" plan submitted by Senator Harrison of Mississippi, proposing a 50-year lease to private interests with the stipulation that 40,000 tons of fertilizer must be produced annually. This was defeated by a vote of 48 to 26.

Senator Sackett of Kentucky presented a plan to lease the plant to private interests. He said his amendment was identical with the Norris scheme except in the main issue of private versus government operation. This amendment was lost on a *viva voce* vote.

On the final vote twenty Republicans, twenty-seven Democrats and the lone Farmer-Labor member voted for the resolution, fifteen Republicans and ten Democrats casting their ballots against government operation. The resolution now goes to the House military committee, which will probably hold hearings upon it. The consensus of opinion is that no agreement between the two houses will be reached at this session of Congress.

Advocates of government ownership are acclaiming the Senate's passage of the Norris Muscle Shoals resolution as a great victory for the principles for which they stand. If the House can be influenced to follow the example of the Senate, they see the beginning of the Tennessee Hydro-Electric Commission, modeled along the lines of the Ontario Hydro-Electric Power Commission. At the beginning of the debate Senator Norris frankly announced that one of the purposes of his resolution was to demonstrate the advantages of government operation of power plants. Not only does the government by the terms of this resolution enter into the business of generating and selling power, with preferences to municipalities and farmers' organizations, but the resolution sets up the Federal Power Commission as the agency to regulate the rates to be paid for this power within the states. That particular part of the resolution, Senator Tydings of Maryland told the Senate, is unconstitutional.

It also is recognized that the passage of the Norris resolution greatly strengthens the hands of the supporters of the Swing-Johnson Boulder Canyon bill. The Senate's indorsement of government operation at Muscle Shoals is regarded as paving the way for a similar effort on the St. Lawrence and on other streams where large power resources are available. The hope of those who are opposed to government in business is that the House, which has become the conservative branch of Congress, may insist upon the elimination of the government operation feature of the resolution. The requirement to operate plant No. 2 also will be opposed strenuously in the House. Some are of the opinion that the effort on the part of the government to operate that type of plant, which many regard as obsolete, is foredoomed to failure and is likely to result in a reaction against any use of Muscle Shoals for fertilizer production.

The fact that only twenty-five Senators voted against the resolution came as a surprise, but is accounted for by the consideration that such a vote would be interpreted as an attempt to prevent the use of Muscle Shoals for fertilizer purposes. In addition, so much has been said about cheap electric rates in Ontario and at publicly operated plants that the impression was created that existing domestic rates are too high. Some of the Senators who had voted against the Walsh resolution are thought to have seized this opportunity to demonstrate that they are not always on the same side as the power companies.

### Committee Indorses Boulder Dam

A report recommending the passage of the Swing-Johnson Boulder Canyon bill was submmitted to the House of Representatives on March 15 by its committee on irrigation and reclamation. It was concurred in by all members of the committee except Representatives Douglas of Arizona, Winter of Wyoming and Leatherwood of Utah. They expect to submit minority reports, and Mr. Douglas has already seized on the St. Francis Dam disaster to ask, through a press release, whether the far greater dam in Boulder Canyon might not prove a menace instead of a protection to the Imperial Valley. Representative Davenport of New York submitted additional views, disagreeing in part with the majority. The conclusions of the majority of the members of the committee follow:

This bill should be passed because

First—Congress should no longer risk a flood catastrophe to Imperial Valley—a catastrophe which further delay only courts.

Second—Reclamation possibilities in the lower basin should be safeguarded and taken care of before it is too late. Unless something is done, the river will be acquired for power development exclusively. Mexico is constantly building up added claims to its waters.

Third—The Mexican situation must be met. It is not sound policy to allow a condition to continue by which that country may and will go on using more and more water from the river, and this at the expense of existing and future irrigation in the United States.

Fourth—The government should aid its people to secure their necessities in the way of domestic water supply, where it can do so, as here, without cost and as an incident in carrying out other federal purposes such as river regulation and reclamation.

Fifth—It will convert a natural menace into a national asset.

Sixth—A financial scheme is presented by which the development will be completely prefinanced, thus fully protecting the federal treasury and the general taxpayer.

Seventh—It settles in large part water rights between states in a sensible and practical way, substituting interstate agreements for interminable litigation and controversy. Further delay points to the latter untoward results and the disintegration of the plan of settling water rights by interstate compact.

### N.E.L.A. Men Are Witnesses

A large amount of testimony in the form of documents was introduced at the first public hearing of the Federal Trade Commission's investigation of public utilities on Thursday, March 8. Commissioner Edgar A. McCulloch presided. Representatives of the National Electric Light Association and the American Gas Association were examined. Further public hearings will, the commission informs the Senate in its first report, made on March 15, be held as fast as adequate preparation for them can be made.

To meet the situation presented on the Colorado, St. Lawrence, Columbia and Tennessee Rivers, where development plans may originate with the government, a set of principles which should govern the relationship between the government and the utilities has been proposed by J. T. Newcomb, counsel for the Joint Committee of National Utility Associations. In an address made on March 5 before members of the Cosmos Club in Washington, Mr. Newcomb said, in part:

1. No such projects should be undertaken unless they are clearly and primarily entered upon in the fulfillment of federal government purposes. This, it seems to me, must be a fundamental requirement, although it is true that in performing such functions the government will frequently find itself necessarily involved in incidental activities of a different character.

2. The right to use the water should be disposed of by the government at its fair value. It should not be sold for less than its value, because neither power users nor anybody else should be made the special beneficiaries of government expenditures by getting water or power at less than its value. On the other hand, the power users should not, through coercion or otherwise, be compelled to pay more than the fair value for the right to use the water, because to do so would make them a class specially taxed for the construction of a public improvement.

3. In addition, it seems to me that the legislation should specifically promote by definite and certain terms co-operation with the existing power producers, whose plans reach far into the future. This requires, of course, a clearly announced policy on the part of the government, firmly adhered to, which can be depended upon by the private companies.

## Savings-Bank Investment Bill Prospects Good

*Both Houses Pass It, and It Awaits Governor's Action — Governor's Water-Power Measure Gets Its Quietus in Upper House*

THE bill introduced by the committee on banks authorizing the investment by savings banks in the bonds of certain electric, gas and telephone corporations passed the New York Assembly on Thursday without debate by a vote of 130 with no opposition. This bill previously passed the Senate. It now goes to the Governor for executive approval. The Assembly also passed and sent to the Governor the bill authorizing savings banks to invest in bonds and obligations of railroad corporations. The expected opposition to the savings-bank investment bills failed to develop in the Lower House, the Republicans having approved of their passage in caucus.

In the Senate opposition was led by Minority Leader Downing. There the bill relating to utility bonds was passed by 33 to 15. All of the opposition came from Democratic Senators from New York City.

Following the example of the Assembly, the Senate by a party vote defeated the Governor's bill to set up a Water Power Authority, the Republicans offering to send to him again their bill of last year creating another committee to study development proposals. The Sargent water-power bills, protecting the interests of the state in the river regulating districts, tentatively approved by the Governor, are understood to be slated for passage.

Governor Smith has approved two minor water-power bills passed by the Legislature. One is designed to prohibit any water-power development projects in the Adirondacks where the altitude is more than 1,500 ft. This is to protect Saranac Lake, Lake Placid and other mountain resorts. The other measure would have a commission of three named to determine a fair return to the state for land flooded in connection with water-power projects along the inland streams.

## Radio Adjustment Now Awaits Conference

On motion of Senator Dill of Washington the Senate on Tuesday demanded a conference upon the "equal distribution" amendment that was attached by the House to the Senate bill extending the life of the Federal Radio Commission for one year. Although sympathetic with the purpose of the House to distribute radio stations equally upon the basis of population, Senator Dill said that the language of the amendment made it unworkable and impracticable. The conference was set for Friday, March 16. Senator Dill said that although the commission's regulatory powers would technically expire at midnight of March 15, he believed the commissioners would continue to serve until the conference reached an agreement. Nominally Secretary Hoover will again be in charge.

## Philadelphia Electric Will Speed 1928 Program

The Philadelphia Electric Company, through its president, William H. Taylor, has just announced some of the details of its twelve-million-dollar building, construction and equipment plans for 1928, following a statement by Arthur W. Thompson, president of the United Gas Improvement Company, that a construction program of $20,000,000 will be pushed by the U.G.I. and its allied companies in an effort to relieve non-employment. Mr. Taylor said:

"Our program involves such major items as the installation of huge condensers and transformers in the Plymouth Meeting substation near Norristown and the Westmoreland substation in Philadelphia, erection of an 80,000-kva. tie line between Plymouth Meeting and the generating station at Norristown of the Philadelphia-Suburban Counties Gas & Electric Company, the new Lamokin substation which will be built in Chester to supply power for the electrification of the Pennsylvania Railroad between Philadelphia and Wilmington and other important additions. The Lamokin substation will contain three 21,000-kva., single-phase, 25-cycle motor-generator sets—the largest of their kind which have been built."

## Nine Hundred at Tulsa

*Oklahoma Utilities Association Hears Industry Leaders in Its General and Group Sessions—Growth of Electric Generating Stations in State*

FORMER attendance records were shattered at the tenth annual convention of the Oklahoma Utilities Association, held at the Mayo Hotel, Tulsa, on March 13, 14 and 15. Approximately nine hundred had registered at the end of the second day. General sessions were held in the forenoons, and the various groups—electric light and power, gas, electric railway, telephone, public relations, manufacturers and suppliers, public relations and women's committee—held afternoon sessions.

E. F. McKay, manager of the association, in his annual report, revealing substantial association growth, said that the total capacity of electric generating stations in the state is now 360,000 hp. At the Wednesday morning session J. F. Owens, Oklahoma City, chairman Public Relations National Section, N.E.L.A., especially stressed the work of the committee on co-operation with educational institutions. About six hundred persons attended the banquet, where the principal speaker was Representative Charles A. Eaton of New Jersey. The election of officers was scheduled for Thursday afternoon.

## Purchases and Mergers

*Buffalo, Niagara & Eastern Subsidiaries to Be Merged—Transfers of Control of Minor Private and Public Plants in Many States Reported*

MERGER into the Buffalo, Niagara & Eastern Power Corporation of its subsidiaries, to take place in the near future, following a stock issue, was announced at Buffalo on March 13. The merger is to embrace the Buffalo General Electric Company, Niagara Electric Service Corporation, Niagara, Lockport & Ontario Power Company, Niagara Falls Power Company and the Tonawanda Power Company.

Citizens of Kinston, N. C., will determine the fate of Kinston's municipal electric light plant at a special election July 3. The Carolina Gas & Electric Company, with headquarters at Kinston, as already reported, offers to pay $1,271,000 for the power house, besides making the city a present of a "white way," and the Aldermen accepted this bid subject to ratification. Livingston & Gregory, of New York and Salisbury, N. C., have resubmitted their offer for the property—$1,357,000, including a good-faith check for $100,000 deposited with the bid.

The Appalachian Electric Power Company has bought the Montvale-Thaxton Transmission Company's line between the Virginia towns indicated, previously served by the Bedford City municipal plant.

The South Georgia Power Company has taken over and grouped under one management the municipal plants at Richland, Buena Vista and Lumpkin, Ga., all of these towns now being on a 110-volt transmission line reaching Americus and Columbus.

John F. Brewer of Mountain View, Ark., has sold a 99-year franchise for supplying power and light in that place to the Arkansas Power & Light Company.

The Bristol (Tenn.) Gas & Electric Company has purchased the franchise of the Boon Creek Electric Company at Mountain City, Tenn.

Mendenhall (Miss.) taxpayers have approved the sale of the municipal electric system to M. L. Culley for $10,000 cash.

Upon rehearing of petitions, the Illinois Commerce Commission has authorized the Illinois Power & Light Corporation to purchase the Arenzville Light & Power Company for $74,000 and the Prather & Hill Electric Light and the Elkhart Electric Light companies for $40,000. Petition for permission to purchase the municipal electric system in Dahlgren, Ill., has been filed with the commission by the Central Public Service Company.

The Interstate Power & Light Corporation is reported to have acquired the lighting plants in Mansfield, Seymour, Ava, Norwood and Mountain Grove, Mo., which will be operated as the Missouri Electric Power Company.

The Maryville Electric Light & Power Company has applied to the Missouri Public Service Commission for authority to buy the distribution plant of the Union Star (Mo.) Electric Company for $12,500. The commission has authorized the Fairfax Light, Heat & Power Company to sell its electrical distribution plant to the Tarkio Electric & Water Company for $25,000.

The Central Power Company has purchased the distribution systems in the town of Brock, as previously noted, and also in Dunbar and Farwell, Neb. The lines were formerly owned by these municipalities. All of the towns have been served wholesale by the Central Power Company.

Purchase of the municipal electric and water systems at Thomas, Okla., by the Southwestern Light & Power Company was authorized by the voters Feb. 14.

These purchases are reported from North Central states: The Otter Tail Power Company has bought the Makoti (N. D.) village lighting systems and plants at Binford, Eckelson, Dwight and Parshall, N. D.; Eastern Minnesota Power Company, the Pappenfus power system at Oak Park, Minn.; Dakota Power Company, the Custer (S. D.) Light & Power Company; Northern States Power Company, the lighting system at Ruthton, Minn.; Interstate Power Company, the Clearbrook (Minn.) plant, and Montana-Dakota Power Company, the plants at Larson, Beach, Sentinel and Butte, N. D.

The Southern Colorado Power Company, through W. N. Clark and George W. Milliken, has offered the city of Lamar, Colo., $350,000 cash for its power plant if the city will grant it a 25-year franchise.

The South American Power Company, a subsidiary of American & Foreign Power Company, has taken control of the South Brazilian Railways Company from the International Light & Power Company. The South Brazilian Railways Company owns and operates the electric power and light and street-railway systems in Curityba, in south Brazil.

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# St. Louis Institute Meeting Well Staged

### Large Attendance and Lively Interest Mark Regional Convention—System and Machine Stability, Automatic Switching, Lightning and Television Among Topics

A CRITICAL discussion that followed the presentations of two related papers—one on the influence of excitation systems on short circuits and maximum power and the other on a new development in voltage regulators—marked the high point in the regional meeting of the American Institute of Electrical Engineers held at St. Louis on March 7, 8 and 9. This convention of the Southwestern District of the Institute was successful in all ways, having to its credit an attendance of more than 400, a program of practical and interesting papers and a smoothness of organization and procedure that reflected great credit on the local St. Louis committees. A branch conference attended by students from many of the Southwestern colleges opened the three-day meeting. This was followed by a joint luncheon with the St. Louis Electrical Board of Trade, at which Bancroft Gherardi, president of the parent body, spoke on transatlantic telephony.

The first technical session was presided over by A. E. Bettis, vice-president of the Southwestern District. The development of an empirical method for determining leakage and fringing fluxes in an electromagnetic system was reported by W. L. Upson and E. L. Furth. Hans Weichsel did much to destroy the illusion that splitting the resistance rings on a squirrel-cage rotor will always result in an increase of motor starting torque. On the contrary, it will, according to the tests made by Mr. Weichsel, so increase leakage as actually to decrease that torque. The development of the various types of drives for tandem rolling mills was covered by A. F. Kenyon. Methods of calculation of power requirements were set forth.

The very worth-while results that have been obtained from consistent checking and testing of purchased material by the Kansas City Power & Light Company were enumerated at the second technical session by D. D. Clark and G. E. Meredith, whose paper was entitled "The Public Utility Laboratory and Its Relation to Service." Following this came a description, by Stanley Stokes and Leslie V. Nelson, of the metering equipment that is used to establish billing demands on the output of Cahokia station, where six sub-totalizers integrate the demands on six lines. The coincident registrations of these six are combined on the master totalizer.

#### EXCITEMENT OVER EXCITATION

Insistence by Chairman L. F. Woolston kept impatient discussers in check after R. H. Park had read R. E. Doherty's paper on excitation systems until additional material for argument had accrued from the paper on voltage regulators by R. M. Carothers and C. A. Nickle. The theme of the first of the two papers was that in the performance of alternators both static stability—that is, stability under or more or less gradual accretions of load—and transient stability—stability under violent disturbance—might be greatly improved through rapid and generous response by the excitation system to the demand for large increase of field current by the alternator. Since the need for much faster excitation systems does exist, there has been developed to fill it a modification of the long-established vibrating-contact type of field regulator. This was the subject of the second paper. The differentiation of the new regulator from preceding practice is caused by the inclusion in it of means to hold the normally vibrating contacts in the closed position while the exciter current climbs in one step to, or as near to as is possible, that higher average value demanded for stability of the alternator under its new condition of load. Since 1920, when the general subject of excitation and machine stability was reviewed at the White Sulphur Springs convention, any paper bearing on this or related matters can be confidently counted upon to stir up a keen discussion, and, as just implied, the meeting under notice proved no exception. After Messrs. Park, Carothers, Nickle, Powell, Evans, Wagner, Ashbaugh and others had shivered their lances on one another's shields, Prof. Comfort A. Adams pointed out that the logical result of investigations into machine stability is the exact determination of the "dizzy edge" of instability and, following that determination, the approach of normal operation nearer and nearer to the edge in the desire to reduce ratio of output to weight of metal in machine design.

Since the introduction of the impedance relay in 1923 certain developments have come about in its design and in its application. These were reviewed in a paper by H. A. McLaughlin and E. O. Erickson. The methods of obtaining proper potential for the restraining elements without the use of high-tension potential transformers and the use of potential from condenser-type bushings were described. To make possible the use of low-tension potential, means for compensating for the voltage drop through power transformers and for the shifting of the secondary neutral point have been developed. These were described, as were also some special applications. Deprecation of the tendency to overenthusiasm regarding the capabilities of new devices was apparent in the discussion of this paper by H. P. Sleeper, W. H. Millan and O. C. Traver. All three agreed that in the purposes for which it was intended the inductive relay performed admirably, but that these purposes did not include all power-system relay applications. A preference for the classic method of balanced protection of parallel lines was voiced, this including the inductive relay as back-up protection after the failure of one of the parallel lines.

### AUTOMATIC SWITCHING

Some of the more common forms of automatic switching of incoming lines and transformers supplying power to alternating-current substations were described in a paper by A. E. Anderson. By making a few minor modifications in the schemes described it has been possible to control automatically a complete loop or ring system. The uses and the switching requirements of balanced or parallel incoming lines and of preferred-emergency equipments were discussed in some detail. The paper concluded with a brief discussion of automatic synchronizing and transformer switching.

J. B. MacNeill presented an interesting description of the design and performance of an improved type of moderate-capacity oil circuit breaker. Relatively high-power breakers having all three poles in a single round tank have been designed, and these, in addition to increase of rating for a given space, have shown improvements in performance over types previously available.

A simple method for reducing conductor vibration on transmission lines was presented in a paper on that general subject by Theodore Varney. In a previous Institute paper Mr. Varney had discussed the action of the wind on a suspended conductor and given rules for determining the wave length and frequency of the resulting vibration. Since the date of that presentation records have been kept of the wind action upon a large number of transmission lines equipped with different kinds of conductors and installed under various conditions. Data selected from these records were presented in the paper, which also included test results from experiments indicated by the character of the recorded information. In the analysis or solution of alternating-current problems it is frequently necessary to convert vector quantities from the exponential or polar forms into complex numbers or vice versa. The paper on vector calculating devices by M. T. Weinbach described some of them and gave examples of their use.

The planning of telephone exchange plans was covered in a paper by W. B. Stephenson, and tuned radio-frequency amplifiers were treated clearly and as simply as the subject would permit by R. F. Glasgow.

### IVES, PECK AND CULLEN CONTRIBUTE

The last item on the program of the technical sessions was a lecture by Dr. H. E. Ives on television. This lecture was open to the public and drew a large attendance. On the evening of the second day a popular talk on lightning, which was illustrated with lantern slides and motion pictures, was presented by F. W. Peek, Jr. This was reported last week on page 523. At the convention dinner-dance Charles E. Cullen, professor of law and business administration of Washington University, talked on "Sanity and Sane People."

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## Business Men Inspect New East River Station

The New York Edison Company's East River station, which has now installed one-tenth of its ultimate capacity of almost 1,250,000 kw., was thrown open on March 9 to inspection by a party of representatives of civic and commercial associations, under the auspices of the Fourteenth Street Association. Vice-President Arthur Williams told the visitors of the coming addition of a 160,000-kw. machine now under manufacture by the General Electric Company, and explained some of the devices used, such as the water-filled steel tubes for furnace walls and the coal- and ash-handling towers on the river's edge.

"This new station, as planned," Mr. Williams said, "presents the greatest program for power generation that has yet been conceived. And this is only one of the several giant power plants now engaged in giving New York electric service. The plans for its construction will proceed for at least the next decade, as the station is designed to help serve increases in the utilization of electricity until 1940." The cost of the completed structure is expected to exceed $100,000,000, he said. When it finally operates at full capacity it will require for steam condensing purposes a total of 2,160,000,000 gal. of water every 24 hours. This is more than twice as much as Greater New York consumes daily. The completed station will be capable of filling the light and power needs, as of the present date, of any state in the United States with the exception of New York, Pennsylvania, California, Illinois, Ohio and Michigan, Mr. Williams observed, on the authority of United States Geological Survey statistics.

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## To Promote Power Sales

*Commercial Section, N.E.L.A., Meeting in Chicago, Turns Thought to Competitive Power Situation—Refrigeration and Merchandising Also Features*

COMMERCIAL Section men of the National Electric Light Association held a two-day meeting last week at the Edgewater Beach Hotel, Chicago. Interest centered chiefly in the work of the merchandising, power and refrigeration committees. The first day was devoted to the committees on power, industrial heating, commercial cooking, refrigeration, domestic ranges and customer relations. The executive committee was in session the second day. No more meetings are to be held before the Atlantic City convention.

The power committee, under H. W. Derry, is engaged in an analysis of the trend of industrial power for the purpose of developing a graphic comparison of the use of steam, internal-combustion engines, private electric plants and purchased power. The manufacturers of steam and oil equipment, as Mr. Derry pointed out, are fighting for existence and perfecting improvements in efficiency that are making serious competition for electric power. Central stations must study the national trends and compare them with statistics on local conditions in order intelligently to direct power sales. Power load can no longer be taken for granted, he said. There is great need for trained man power in this field. S. L. Nicholson also pointed out the need for well-classified information on load characteristics, since conditions affecting load factor in many industries have greatly changed in recent years.

C. E. Greenwood, for the merchandising committee, reported very gratifying registrations in the "residence kilowatt-hour contest," entries for which close on April 1. Indications are that at least two hundred power companies will participate. This committee is about to announce an expanded program for concurrent appliance advertising by central stations, dealers and manufacturers for the season of 1928-1929. To the work of the intertrade conference, which has developed a statement of merchandising principles for the guidance of trade relations in electrical merchandising, a vote of appreciation was given. This agreement, which has been signed by officials of the various trades, will be submitted to the N.E.L.A. executive committee the latter part of this month for approval, before publication.

Chairman G. B. Richardson announced the plan for a twelve months' campaign of personalized direct-by-mail advertising, with neutral illustrations, which the refrigeration committee has prepared for use by local companies. Under this plan special mailing lists are to be sent to Dallas, where the folders and letters will be printed by a special process, each piece bearing conspicuously the name of the recipient. The range committee is at work on a similar advertising campaign.

W. H. Sammis announced the completion of the industrial heating committee's motion picture of industrial heat applications, which is to be sold or rented to member companies. The electrical advertising committee reported by wire the successful progress of its salesman's school, then in session at the Edison Lighting Institute in Harrison, N. J., with 163 salesmen in attendance.

The trend of wiring requirements was discussed by E. W. Lloyd and S. L. Nicholson, who both called upon the power industry to take a constructive rather than a defensive interest in the development of the National Electrical Code. W. H. Hodge reported on a movement being organized by about thirty trades and industries to stimulate the modernization of homes. A committee from the N.E.L.A. Commercial Section will be appointed to co-operate.

## New York Commission for Law on Sub-Meters

The annual report of the Public Service Department of New York, State Division, for the year ended June 30, 1927, filed with the Governor recently, says that in 867 of the 921 towns of the state electric franchises are in force or their exercise has been permitted by the commission. The report says that "progressive consolidation which has been taking place for the past decade has now reached the stage where the state is served by eleven principal groups. Interconnection between groups has progressed simultaneously to the point where it is possible now for energy to flow in almost every direction within the state."

After commenting on the rapid extension of rural electric service the commission makes reference to the practice of sub-metering, by which a landlord buys energy at wholesale and makes a profit by retailing it, sometimes at rates in excess of those approved by the commission, to his tenants. Concerning this practice, which has aroused great complaint—especially in Manhattan Borough, New York City—the commission says:

> The commission has referred in its annual report to the so called sub-meter, over which it has no jurisdiction. Complaints respecting sub-meters do not decrease. While there is a disposition on the part of some engaged in rendering service through sub-meters to improve conditions and to emulate service corporations in maintaining the meters in good condition, their number is relatively small. Not until such meters are placed under proper supervision will the public be fully and adequately protected.

A recent newspaper article put the number of sub-meters in Manhattan at 115,000, an increase of 40 per cent in five years.

# Briefer News

HIGH-VOLTAGE TRANSMISSION EXTENSION IN NORTH CAROLINA. — The Carolina Power & Light Company is expected soon to begin construction on 138 miles of 110,000-volt transmission lines from Sanford to the Cape Fear station, from Norwood to connect with existing lines, from Canton to Greenville, from Canton to Asheville and from Moncure to Sanford.

HEARING THIS MONTH ON ROYAL GORGE PROJECT.—The Colorado Public Utilities Commission has set March 29 at Pueblo to hear the petition of the Public Service Company of Colorado for permission to erect a hydro-electric plant in the Royal Gorge. Although the company says it will not mar the beauty of the gorge, there are several hundred petitions asking that the grant be denied.

ENGLISH RIVER SITE APPLIED FOR.—Application has been made by George Farlinger of Sioux Lookout, Ontario, to the Lands and Forests Department for a lease of the power rights at Ear and Manitou Falls, on the English River, at the western outlet of Lac Seul, near the Manitoba border. The site for which Mr. Farlinger seeks a lease is estimated to be capable of developing about 60,000 hp.

CHESAPEAKE & OHIO RAILWAY CONTRACTS FOR 9,000,000 KW.-HR. WITH VIRGINIA PUBLIC SERVICE.—A contract recently negotiated between the Virginia Public Service Company and the Chesapeake & Ohio Railway Company for electric service at all points along that road in the utility company's territory includes 126 items and involves approximately 9,000,000 kw.-hr., bringing an annual revenue estimated at $225,000.

CENTRAL HUDSON GAS & ELECTRIC GIVES $10,000 TO ENGINEERING FOUNDATION.—A contribution of $10,000 to the Engineering Foundation endowment fund has just been made by the Central Hudson Gas & Electric Corporation of Poughkeepsie, N. Y. In making this donation T. R. Beal, president of the company, says: "This amount was in fact earned by our employees by their more efficient operation of the physical properties under their care. It represents $10,000 of return premiums paid during the past year on accident insurance as the result of the company's excellent record in preceding years."

POWER CANAL PROVES DEATH TRAP FOR DEER. — A concrete-lined power canal belonging to the California-Oregon Power Company and located in the mountainous regions of southern Oregon is proving a death trap for deer, according to the game authorities. Nine-foot sloping walls render it impossible for the animals to get out of the canal when once they try to cross it, with the result that the brutes flounder about until they become exhausted and drown. The power company will probably construct bridges over the canal at intervals so that the deer may cross in safety.

NATURAL GAS MAY BE FUEL FOR CANADIAN PRAIRIE PLANTS.—The Calgary Power Company, which controls hydro-electric development on the Bow River in the Province of Alberta and has been spreading its lines over the southern part of the province, has taken an option on approximately 10,000,000 cu.ft. of natural gas in the Turner Valley field. Whether the gas is for steam-electric generation of power the company refused to say.

HOME ECONOMICS SCHOOL MAKES AUSPICIOUS START.—The first school of home economics to be established by any division of the National Electric Light Association was held recently at the Oklahoma A. & M. College, Stillwater, under direction of Dean Nora A. Talbot, with the co-operation of Miss Florence D. Schertz and Mrs. Bess Brooks. National and geographic division officials were present, and the school was declared an unqualified success.

RATES SLASHED IN SIXTEEN IOWA CITIES.—Reductions of 20 per cent, with a maximum charge of 10 cents a kilowatt-hour and no service charge, became effective on March 1 in sixteen northwestern Iowa communities which recently came into the Iowa Public Service Company electric distribution system. Among the cities benefiting are Cherokee, Clarion, Emmetsburg, Forest City, Eagle Grove, Humboldt, Ida Grove, Le Mars, Rockwell City, Storm Lake and Sac City.

PLANS FOR WORLD ENGINEERING CONGRESS TAKING SHAPE.—The American committee of the World Engineering Congress, appointed by Herbert Hoover as honorary chairman, will meet in Washington on March 22 to formulate plans for the participation of American engineers in the congress, which will be held for the first time in Tokyo in 1929. Tsuneo Matsudaira, Imperial Japanese Ambassador to the United States, will be the host at a dinner.

UTAH ENGINEERING COUNCIL COMMITTEE REPORTS ON BOULDER DAM.—Passage of the Swing-Johnson bill, or comparable legislation, is the most effective present means of so binding California to the upper states that any rights acquired in California will be subject to the Santa Fe compact. This is one of the conclusions the special committee representing the Engineering Council of Utah and another committee appointed by the president of the Utah Bar Association, engaged for six months in a study of the Colorado River problem, present in a report recently released. "The states should own and control the public waters, provision should be made for developments on the river eventually to come under state control, and Utah should become a party to the Santa Fe compact regardless of the number of states ratifying," the report says.

**Georgia Power Reduces Rate to Large Commercial Customers.**—The Georgia Power Company has filed with the Georgia Public Service Commission a reduced rate applicable to its large commercial customers. It is a combined light and power rate embodying a service charge plus a kilowatt-hour charge and permitting the use of one totalizing meter. The rate is applicable to those commercial customers whose combined lighting and power demand exceeds 50 kw. and which use power equal to 40 per cent of the total load.

**Victoria (Tex.) Plant to Be Tripled in Rating.**—The Central Power & Light Company has adopted plans for the installation at Victoria of a 9,000-hp. turbine and two 723-hp. boilers that will triple the present generating capacity of the plant, increasing it from 4,500 hp. to 13,500 hp. This new source of electrical energy not only will provide Victoria with an ample supply of power for years to come but will be available, through existing transmission lines, to a territory extending from Luling, Eagle Lake and El Campo on the north and east to Port Lavaca, Beeville and Kenedy on the south and west.

**Ohio Power Substation Being Raised to 45,000 Kva.**—Equipment in the Ohio Power Company's substation at Newcomerstown, Ohio, is being tripled at a cost of $330,470. More than 75 men are employed in revamping the station from a 15,000-kva. bank to a 45,000-kva. bank. Five counties—Holmes, Tuscarawas, Guernsey, Coshocton and Harrison—with 2,246 square miles of territory, will be served by the new plant when it is completed in May. As part of the project two new circuits to Cambridge are being built, as well as a new circuit to Coshocton. The station at Newcomerstown is also being rebuilt.

**New Unit for Grand Rapids, Mich.**—Vice-President Charles W. Tippy of the Consumers Power Company announces that the company means to install a 20,000-kw. turbo-generator at the Wealthy Street plant of the company in Grand Rapids. Mr. Tippy explained that the growth of business in Grand Rapids and Muskegon had compelled the company to abandon all thought of water-power development on the Muskegon River since more generating capacity will be needed within a period of twelve months. The program for the Wealthy Street plant contemplates eventually a maximum capacity there of 200,000 kw. At present an addition to the present turbine room will be built, also a boiler house and 250-ft. concrete stack. Two new boilers will supply steam at a pressure of 400 lb. These will be equipped to burn pulverized fuel. The new unit will virtually double the present station capacity.

**Another Interconnection for Pennsylvania.** — Work will start within a few days on construction of a 66,000-volt transmission line from Berwick, Pa., through Salem Township, back of Shickshinny, to the Hunlock Creek power plant. The line will connect the Berwick substation of the Pennsylvania Power & Light Company with the plant of the Luzerne County Gas & Electric Company and is one of the first connections to be made in that region between large companies.

**Southwestern Gas & Electric Plans New Arkansas Plant.**—Construction by the Southwestern Gas & Electric Company of a steam generating plant on Little River, one mille south of Horatio, Ark., to cost $3,000,000 and be completed in two years' time, is announced to begin soon. Electrical energy will be furnished from it to the towns in southwestern Arkansas and eastern Oklahoma whose lighting plants were recently purchased by the Southwestern Gas & Electric Company from the Dierks company. A contract to supply a large cement plant at Foreman is said to make the new generating station necessary.

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]**

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N. E. L. A.—Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Institute of Electrical Engineers — Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities —Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association —The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

**Watertown, N. Y., Now Generates 7,500 Hp.**—With the placing in service of the third generating unit of the Watertown (N. Y.) municipal hydro-electric plant, 7,500 hp. is available, the waters of the Black River being at a high point, with prospects of a heavy flow during the next three months. The city sells all surplus power to the Northern New York Utilities and is anticipating that the amount received in the next year will be more than $100,000.

**Dallas Wires All Underground.**—The Dallas Power & Light Company, through C. W. Davis, vice-president and general manager, announces that its underground wire system, which has been in the process of construction for seven years, has been virtually completed. Construction of the underground system, which has followed the best models, has enabled the company to remove almost three hundred poles from the business district, with thousands of wires, which, with the rapid growth of the city, were becoming so numerous as actually to impede progress.

**First "School of Electrical Advertising" Is Held.**—Harrison, N. J., was last week the scene of a four-day "school of electrical advertising" held in the auditorium of the Edison Lamp Works of the General Electric Company, the Westinghouse Lamp Company co-operating. More than two hundred delegates, representing sign manufacturers, power companies and maintenance and accessory men in the East, attended. The gathering was addressed by C. J. Eaton, chairman of the electrical advertising committee of the N.E.L.A., and Earl Whitehorne, commercial editor of the Electrical World. A second school will be held at Nela Park, Cleveland, on March 19-22.

**More Rate Reductions in Kansas.**—Voluntary rate reductions of from 20 to 25 per cent have been announced for the city of Atchison by the Kansas Power & Light Company, with headquarters in Topeka. New voluntary reduced rates have also gone into effect at Salina, served by the United Power & Light Corporation of Abilene. The former rate, 9 cents for the first 50 kw. and 5 cents for all in excess, has been changed to an 8-cent top rate for the first 30 kw., 6 cents for the next 30 kw.-hr., 5 cents for the next 40 kw.-hr. and 3 cents for all over 100 kw. A revised schedule of residence and commercial lighting rates has been placed in effect at Manhattan as a result of an agreement between the City Commission and the United Power & Light Corporation. The new rates are about 10 per cent lower than those provided in the franchise that was voted down.

Patrolling Transmission Lines by Airplane. — Addressing the Electric Club of Toronto recently, A. E. Davidson, engineer of the transmission department of the Hydro-Electric Power Commission of Ontario, forecast the use of airplanes to patrol the 230-mile, 220-kv. power line from the Gatineau Power Company's developments on the Gatineau River to Toronto, when construction of the line is completed. Much of the area through which the transmission line will run is rough and inaccessible, and inspection by air would be more rapid and more thorough.

High-Power Line to Be Built from San Bernardino to Seal Beach, Cal.—The Southern Sierras Power Company, a subsidiary of the Nevada-California Electric Corporation, has authorized immediate construction of a 110-kv. power line between San Bernardino and Seal Beach, Cal., to cost $750,000. The line will extend over 58 miles and join the company's San Bernardino's substation with the Los Angeles Gas & Electric Company's Seal Beach generating station, giving the Southern Sierras company an outlet for hydro-electric power generated in the High Sierras and making possible in the opposite direction a direct supply of steam-generated power from the Los Angeles plant.

Porto Rico Railway, Light & Power Gets Franchise for Water-Power Plant.—By the signature of the Governor of Porto Rico to a franchise granted by the Public Service Commission, the Porto Rico Railway, Light & Power Company has gained "authority to utilize the waters and waterfalls of the Hicaco, Cubuy, Prieto, and Sabana Rivers and their tributaries, which form the so-called 'Blanco' River, in Naguabo, Porto Rico, and the so-called Rio Blanco development, and to construct, maintain and operate a hydro-electric plant and the necessary transmission lines." This accomplishes an object for which the company, of which Frederick Krug is general manager, has for some time been striving.

Insull Company Leases Coming Black River (Mo.) Power.—The Middle West Utilities Company has signed a twenty-year lease on the 30,000-hp. hydro-electric plant to be erected on the Black River, 3 miles southwest of Piedmont, Mo., near Poplar Bluff, by the Black River Hydro-Electric Company. The dam and power plant will cost approximately $4,500,000, according to plans prepared by the W. A. Fuller Company, St. Louis. Construction contracts will be awarded soon after federal and state licenses, now pending, are awarded. The reservoir to be created will be 21 miles long and a quarter of a mile to a mile and a half in width.

# Recent Court Decisions

Proper Division Between County and City of Tax Paid by Holder of Light and Power Franchise. — The District Court of Appeal in California has adjudged proper the division between Tulare County and the city of Dinuba (plaintiff and defendant) of a tax paid by the holder of an electric light and power franchise which caused to inure to the city a sum equal to the tax on the same proportion of gross receipts of the company from consumers in the city which the total value of all pole lines of the company's entire system bore to the total investment of the company. (263 Pac. 249.)*

Contributory Negligence of Workman Splicing Charged Wires Without Gloves Held for Jury.—The Supreme Court of New Jersey has determined, in Brice vs. Eastern New Jersey Power Company, that in the case of a workman who was killed while attempting without gloves to splice a broken fire-alarm wire on a pole supporting also the company's transmission wire the question of contributory negligence was properly submitted to the jury inasmuch as evidence showed that under normal conditions there would have been no current in the electric wire, and since it appeared that the wires came into contact because of the sagging of the electric wire at the distance of one block away (unknown to the workman), which resulted in the insulation wearing off. (139 At. 885.)

Directed Verdict Properly Elicited by Incredible Testimony.—In Simmons vs. Terrell Electric Light Company a boy testified that a hanging wire, not charged, belonging to the company struck him in the eye so hard when he came into contact with it, while walking with his mother, that he had to pull it out of the eyeball. As there was no claim that the end of the hanging wire was bent and as a physician swore that the boy's eyeball had been pierced from the side nearest the ear, the Court of Civil Appeals of Texas held this testimony incredible and to have justified an instructed verdict for the company. The court found, further, that although the electric company was charged with knowledge of the age, condition and weight of its wires, the strength of their supports and their location as regarded possible injury from limbs of trees, there was no evidence that the company knew of the hanging wire, which had apparently been broken less than an hour, or that it had been negligent in the respects just named. (1 S.W. [2d] 513.)

Right to Recover for Injury from Electric Company Furnishing Emergency Service Only.—In Rhymes vs. Eastern Texas Electric Company, the plaintiff, a workman, sued for damages because of injury received when to repair insulators he went on a pole over which the electric company furnished emergency service to his employer and came into contact with a defective switch. The electric company, claiming a breach of contract by the employer, the Texas Company, filed a cross-bill against the latter, asserting that no emergency warranting Rhymes' presence on the pole existed. The Court of Civil Appeals of Texas affirmed a judgment for the Texas Company, but reversed and remanded one for the plaintiff as against the Eastern Texas Electric Company on the ground of prejudicial errors in charges to the jury. The upper court decreed, however, that the defendant, having installed a jumper to carry energy around the switch and being under contract to keep its appliances in safe condition, could not claim reimbursement from the consumer, even though the latter had not kept a contract to install a switch on its premises and had refused the defendant permission to cut off the current in order to repair switch. (1 S.W. [2d] 688.)

# Commission Rulings

Can Earning Power of Non-Existent Hydro Plant Be Evaluated?—The Public Service Commission of Oregon is contemplating the advisability of adopting a rule affecting the valuation of utility properties which, if approved, will require the engineering department to appraise water-right holdings and find a valuation of hypothetical electric plants which may be constructed in connection with the water holdings. A serious obstacle in the path of such a program, however, is that neither the regulatory department nor the state engineering body possesses any standard by which a water right can be valued. The Oregon law governing the control of streams does not concern itself with the value of water rights, and the commission engineers express grave doubts as to their ability to pass upon the earning power of an imaginary hydro-electric utility.

Utility Company Not Compelled to Operate at Loss.—Authority has been granted by the Montana Railroad and Public Service Commission to abandon the traction system in the city of Helena because of a failure to earn a fair return. The commission said that this was the first time since its establishment that the question of granting approval to a complete abandonment and discontinuance of a street-railway system had been presented. The fact that the company had devoted its property to a public use by operating the system on and after the expiration date of the franchise did not, in the opinion of the commission, constitute, under the facts in the record, an irrevocable or absolute dedication of its property to the use of the public. The commission said: "Rather, is its devotion of its property to a public use predicated upon the assumption and condition that the public shall supply sufficient traffic on a reasonable basis to yield a fair return; and when it develops, as it is here shown to have developed, that future operations must be at a loss, then the company has the unquestioned right to discontinue operations and salvage what it can by dismantling the system. To compel petitioner to operate its system at a loss or to give up the salvage value would be to take its property without the just compensation which is a part of due process of law. The rule has been aptly stated by the Supreme Court of Montana in the city of Helena vs. Helena Light & Railway Company, thus: 'It is now well settled beyond controversy that a public utility cannot be compelled to operate its entire business, or a branch of its business, at a loss, in the absence of a statute or contract requiring it to do so.'"

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

Prof. R. C. Wallace of the University of Manitoba has been made chairman of the Manitoba Hydro-Electric Commission.

C. H. Dahl, formerly assistant general manager of the Winnipeg Electric Company, Winnipeg, Man., is now assistant general manager of the company in charge of operation.

Karl B. Norris, vice-president and general manager of the Wetmore-Savage Electrical Supply Company, Boston, has been elected president of the Saugus (Mass.) Trust Company.

E. J. McGarrell, formerly connected with Stone & Webster, Inc., Boston, has joined the meter department of the Elmira (N. Y.) Water, Light & Railroad Company in the capacity of electric meter inspector. Mr. McGarrell is a graduate of the Worcester Polytechnic Institute.

J. H. Shearer, president of the Pennsylvania Central Light & Power Company, has been elected a member of the board of directors of the Pennsylvania State Chamber of Commerce. Mr. Shearer has been active in the work of the chamber for several years.

William Noyes of Boston, well known in the hydro-electric engineering field, has been appointed operating engineer of the Public Service Company of New Hampshire with headquarters at Manchester. Mr. Noyes will make a complete study of the company's system in regard to water and load conditions.

Frank A. Rumatz, Chicago, formerly chief engineer for the Western United Gas & Electric Company, Aurora, Ill., has been made chief engineer for the Tecumseh plant of the Kansas Power & Light Company, with headquarters in Topeka. The Tecumseh plant is the company's chief generating station.

John L. Tudbury, manager of the Salem Gas Light Company, has been made manager of the Salem Electric Lighting Company as well as general manager of the Beverly Gas & Electric Company. Mr. Tudbury's first connection with the public utility business was with the Lynn Gas & Electric Company. It was in 1911 that he removed to Salem as superintendent of the Salem Gas Light Company.

Herbert S. Hinrichs, for more than two years field engineer in charge of rural electrical experiments at Larned, Kan., under the auspices of the Kansas Committee on the Relation of Electricity to Agriculture, has become agricultural engineer for the Kansas Power & Light Company, Topeka. Mr. Hinrichs, under whose direction nine electrified farm experiments have been conducted, expects to assume his new position on completion of his present work at Larned about the middle of March. A graduate of Kansas State Agricultural College, Manhattan, he combined with his technical knowledge a thorough understanding of farm problems in Kansas.

## *Dr. Davis to Head Stevens Institute*

Dr. Harvey N. Davis, professor of mechanical engineering at Harvard University and consulting engineer, has been elected president of Stevens Institute of Technology, Hoboken, N. J., succeeding the late Dr. Alexander C. Humphreys. He will assume his new duties Sept. 1. Dr. Davis was born at Providence, R. I., in 1881 and was educated at Brown and Harvard universities, receiving the degree of Ph. D. from the latter in 1906. He was an instructor at Brown in 1901-02 and has been teaching at Harvard since 1904. During 1917-18 he was engineer in the turbine department of the Lynn works of the General Electric Company and in the latter year was occupied in engineering research for the U. S. air service. He has been consulting mechanical engineer of the U. S. Bureau of Mines since 1921. He is a fellow of the American Academy of Arts and Sciences and a member of many other learned and professional societies. Dr. Davis is the author with Prof. L. S. Marks of "Steam Tables and Diagrams" and with Prof. N. Henry Black of "Practical Physics for High Schools." He is also the author of various papers dealing with thermodynamics.

*H. N. Davis*

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Louis Larsen, for 26 years with the Sundh Electric Company, Newark, N. J., has resigned. Mr. Larsen started with the company when it was originally organized by Mr. Sundh. Since November, 1922, he has been general manager and prior to that time was works manager and chief engineer. During his period of service with the company Mr. Larsen has been granted many patents on control equipment. He represented his company as executive member in the old Electric Power Club and later in the National Electrical Manufacturers' Association. Mr. Larsen as yet has made no announcement regarding his future plans.

Walter F. Hudson, director of industrial developments of the Utica Gas & Electric Company, has been appointed director of the industrial bureau of the Utica Chamber of Commerce. Mr. Hudson joined the local utilities as chief engineer in 1920. He is secretary of the Empire State Gas and Electric Association.

Walter W. Kennedy, who has been connected with the executive department of the Birmingham Electric Company, Birmingham, Ala., since 1925, has been appointed assistant to J. S. Pevear, vice-president and general manager. Mr. Kennedy was admitted to the bar and practiced law in the firm of Bradley, Baldwin, All & White until he affiliated himself with the Birmingham company.

William H. Onken, Jr., editor of the Electrical World, has been appointed by Bancroft Gherardi, president of the American Institute of Electrical Engineers, one of the representatives of the Institute at the dedication of the Louvain Memorial at Louvain University, Belgium, July 4, 1928. On that day the new memorial library at Louvain, presented by the Engineering Foundation, together with the clock and the carillon in its tower, which constitutes the memorial to engineers of the United States who gave their lives in the World War, is to be dedicated. Other representatives are Edward Dean Adams, John W. Lieb and Michael I. Pupin.

Dr. Andrew M. Soule, president of the State College of Agriculture, Athens, Ga., has been named president of the Southern Appalachian Power Conference. The selection of Dr. Soule brings to the head of that body a man who has taken an intense interest in the power and industrial development of the South, devoting his attention especially to the extension of electric power to the rural sections and farms. Through the engineering department of the college, he is carrying on extensive investigations relating to electrification of farms and electrical apparatus and equipment suitable for use on the farm.

L. L. Ellis, assistant chief construction engineer for the San Joaquin Light & Power Corporation for the past nine years, has resigned to become district sales manager at Fresno for the Yosemite Portland Cement Corporation, Merced, Calif. Mr. Ellis has been identified with construction in the Joaquin Valley since 1901, superintending construction for the Mount Whitney Power Company on the Kaweah River. He built the first concrete power house for the San Joaquin Light & Power Corporation in 1905 and has superintended the building of the Kerckhoff development, the Balch plant and other structures.

B. Green has been named superintendent of the Niagara, Lockport & Ontario Power Company at Olean.

C. F. Crowley, for seven years Cleveland representative of the Hatfield Electric Company, contracting electrical engineers with offices at Chicago, Indianapolis and Cleveland, was elected vice-president of the company at the annual meeting of its board of directors.

Allyn B. Tunis, secretary of the Public Utilities Association of Virginia, has been made director of the Virginia Committee on Public Utility Information, organized early this year, with headquarters at Richmond. Mr. Tunis has had wide experience in newspaper work in Richmond, elsewhere in the South and in New England.

R. B. Lillie, manager of the Antigo division of the Wisconsin Valley Electric Company, has been appointed manager of the Stevens Point division to succeed M. H. Montross, who has assumed new duties at Wausau. Mr. Lillie has been associated with the Wisconsin Valley utility for the past fifteen years.

H. A. Walsh has been appointed power sales engineer of the Baton Rouge Electric Company, Baton Rouge, La. Mr. Walsh was formerly connected with the Stone & Webster interests at Ponce, P. R., and more recently with the Gulf States Utilities Company at Beaumont, Tex., also a Stone & Webster property.

C. E. Blackwood, superintendent of the Southwest Power Company at Springdale, Ark., has resigned to enter business at Fayetteville, Ark. C. R. Reaser, formerly located at Prairie Grove, will succeed Mr. Blackwood. J. C. Black, superintendent at Rogers, will have supervision of the Springdale district.

Frederick Nolte, who has been connected with the Wisconsin Valley Electric Company at Antigo, has been appointed manager of that division to succeed R. B. Lillie, at the present time manager at Stevens Point. Mr. Nolte has been affiliated with the Wisconsin Valley company since 1924 and was the purchasing agent previous to his transfer to Antigo.

Robert W. Adams, formerly manager of the General Electric Company's sales office at Providence, R. I., has been appointed head of the central-station department of New England. He will be responsible for the Northeastern territory, with offices in Boston, Mass. Mr. Adams is a graduate of the electrical engineering course at Worcester Polytechnic Institute, Worcester, Mass., and has been with the General Electric Company since 1908. He was president of the Providence Engineering Society in 1917-18 and is the inventor of the Adams transmission line calculator.

Frank S. Root has joined the power sales engineering staff of the New England Power Company, with headquarters at Worcester, Mass. Mr. Root was for some years in charge of power sales activities for the Fall River (Mass.) Electric Light Company, and until coming to Worcester occupied a similar post in the organization of the Central Hudson Gas & Electric Company. He was active in the New England Association of Central Station Power Engineers from the time of its organization until leaving for New York State.

H. B. Heryford has been appointed manager of the San Joaquin division of the Pacific Gas & Electric Company to succeed the late Charles H. Northcutt. A native of California, Mr. Heryford has spent 25 years in the public utility industry. In 1903, starting with the Colusa Gas & Electric Company, he rose to the management of that company in three years. He became manager of the Chico district of the Pacific Gas & Electric Company three years later and in 1921 was appointed to the managership of the West Side division.

DeWitt Clinton, formerly treasurer of the Worcester Gas Light Company, is now secretary and assistant treasurer of the New England Gas & Electric Association, part of the Associated System. Mr. Clinton has been identified with the public utility industry since 1913, when he resigned as city treasurer and collector of taxes of Worcester to become secretary and treasurer of the Worcester Gas Light Company. Mr. Clinton's new duties include the treasurership of the Cambridge Gas Light Company, the Cambridge Electric Light Company and the Cape & Vineyard Electric Company.

## Obituary

C. H. Johnson, representative of the National Pole & Treating Company, San Francisco, died March 2. Mr. Johnson had been in ill health for some months.

Watson F. Blair, a director of the Commonwealth Edison Company, Chicago, died of bronchial pneumonia Feb. 7 at the age of 73. He had served on the directorate of the Commonwealth Edison Company for thirteen years. Previous to his retirement from active business some time ago, Mr. Blair was prominent in the Chicago banking field and as a grain commission merchant on the Board of Trade.

Jesse Lorenzo Hinds, founder and honorary president of the Crouse-Hinds Company, Syracuse, N. Y., died at his winter home in St. Petersburg, Fla., March 9. Removing to Syracuse from Binghamton, N. Y., where he was born, Mr. Hinds established the Electric Engineering & Supply Company in 1890. He had formerly been associated with business enterprises in Yonkers and Ilion, N. Y.; Alexandria, Va.; Great Bend, Pa., and Dayton, Ohio. The Crouse-Hinds organization was formed in 1897 when Mr. Hinds joined with Huntington B. Crouse of Fairville. Mr. Hinds retired from active duties in 1910.

James W. Harris, who has been connected with Alfred Wiseman, Ltd., mechanical and electrical engineers of Birmingham, England, died Jan. 14. After receiving some practical engineering training in England, his native country, Mr. Harris engaged in some work on power plants in India, China, Japan and in America on the Pacific Coast. He served the West Kootenay Power & Light Company, Bonnington Falls, B. C., and then joined the Westinghouse Electric & Manufacturing Company at East Pittsburgh, subsequently returning to Trefford Park, England. Mr. Harris was a member of the American Institute of Electrical Engineers.

Charles Vernier, chief engineer of the Macintosh Cable Company, Ltd., Liverpool, England, died Jan. 9, of pneumonia, following a nervous breakdown. At the time of his death Mr. Vernier held a position of prominence in engineering circles in England. He was in the course of his engineering career affiliated with the Brockie Pell Arc-Lamp Company, the Cork Electric Tramways & Lighting Company and the Newcastle-on-Tyne Electric Supply & Associated Companies. Mr. Vernier was active in the affairs of the Institution of Electrical Engineers, having held many of its important executive offices. He was elected a fellow of the American Institute of Electrical Engineers last June.

William J. Meyers, secretary of the United Electric Light & Power Company, New York, who had been absent from his office for many months owing to a lingering illness, passed away suddenly at his home in Westfield, N. J., Tuesday, March 13. Mr. Meyers, who was in his 59th year, was born in Caledonia, Mich., and was graduated from the Michigan Agricultural College in 1890 and obtained the degree of bachelor of laws from the University of Michigan in 1900. He was statistician of the second district Public Service Commission of New York from 1907 to 1910 and held a like position with the Interstate Commerce Commission until July, 1917. He then became secretary of the United Electric Light & Power Company. He was a very active member of the National Electric Light Association, having served as chairman of an important national committee, and was also a member of the American Gas Association.

# Financial and Statistical News

## *Utility Stocks in New Lead Bond Prices Tend Upward*

RECOVERING from the heavy selling movement of two weeks ago which brought market averages down several points in almost all groups, power and light stocks have not only reached previous levels but are taking a new lead. Common stocks of a group of companies representing more than one-third of the industry, in total assets, showed a gain of one point this week over last and of nine points since the beginning of the year. Prominent in the upward movement are Middle West Utilities, Detroit Edison, Commonwealth Edison, etc.

Preferred stocks have remained relatively quiet, with a steady trend toward marginally higher prices. Demand for the better class preferred issues is reported to be consistently good.

Power and light bond prices are also tending upward if less rapidly than a few months ago. The number of new bond issues is considerably below that of last year at this time. The volume of building and construction is lower in most parts of the country than the 1927 program.

## Hydro-Electric Power in Norway

Norway has more potential water power than any other European country. According to official statements, about 12,500,000 hp. could be developed continuously. This does not include waterfalls of less than 1,000 hp., which are estimated to amount to about 1,000,000 hp. Through regulation of the flow by damming the lakes, the total could easily be brought as high as 15,000,000 hp., of which about 2,000,000 hp., or 15 per cent, has been developed. Most of the developed power is owned by industrial concerns and utilized for manufacturing purposes, such as the fixation of atmospheric nitrogen and the production of aluminum, ferro-alloys and other substances.

## Allis-Chalmers Earns $10.02 on Common

Although sales billed by the Allis-Chalmers Manufacturing Company during 1927 were 8.7 per cent larger than the 1926 total, being $33,352,252, net income carried to surplus decreased from $3,596,891 to $3,182,472, a drop of over 11.5 per cent. Expenses increased almost 10 per cent. Earnings per share, however, showed an increase from $9.48 on common stock in 1926 to $10.02 per share during the calendar year 1927.

In accordance with a fairly general industrial contraction, unfilled orders at the end of 1927 were $10,013,114, as against $11,634,711 a year previous. The bookings of new business during 1927 totaled $30,651,807, contrasted with $32,170,181 in 1926, which was a 4.7 per cent decrease.

The working capital of the Allis-Chalmers Manufacturing Company at the end of 1927 was $21,241,058, as against $27,289,820 a year previous, the shrinkage being due to retirement of the preferred stock and acquisition of the Pittsburg Transformer Company. Total assets on Dec. 31 last amounted to $62,114,321.

Sales billed and net income for the past two years were as shown in the accompanying table.

| | 1926 | 1927 |
|---|---|---|
| Sales .......... | $30,682,542 | $33,352 252 |
| Net ............ | 3,596,891 | 3,182,472 |

## Westinghouse Electric Dividend

The payment of the regular dividend was voted by the board of the Westinghouse Electric & Manufacturing Corporation at its meeting deferred from Feb. 29 and held March 14. The next meeting will be March 28.

## Middle West Utilities Earns $15.12 on Common Stock

CONTINUING its steady, consistent increase in earnings, maintained over a long period of years, Middle West Utilities shows a gain of 15.7 per cent in parent company earnings, of 11.9 per cent in gross earnings of subsidiaries and of 16.1 per cent in net earnings of subsidiary companies. In keeping with most of the companies, this increase, although attractive, is much smaller than the 1926 record of growth in so far as subsidiary companies are concerned, but the earnings of the parent company showed a larger growth last year. In 1926 parent company earnings expanded 12.1 per cent, subsidiaries' gross 42.7 per cent and subsidiaries' net 55.9 per cent.

Surplus earnings, after payment of preferred and prior lien dividends, interest and administration expenses, were $6,988,401 in the case of the parent company, or the equivalent of $15.12 per share on the 462,079 shares of common stock issued and outstanding Dec. 31 last. This compares with $14.44 per share earned on 435,736 shares a year previous.

Customers served by subsidiaries at the end of 1927 were 1,062,773, as compared with 984,786 in 1926, an increase of 7.9 per cent. The output of electricity was 2,354,241,551 kw.-hr., against 2,054,497,637 the previous year, a gain of 14.6 per cent. Subsidiary companies spent $6,502,343 for maintenance of their properties and appropriated from income $4,120,359 for retirements, the total for depreciation and maintenance being 12.7 per cent of gross operating earnings.

The dividend on the company's common stock was increased from $6 to $7 per share, to be effective with dividend payable May 15, 1928. This payment, in accordance with charter provisions, will entitle 7 per cent cumulative preferred stock of $100 par to a dividend of 7 per cent and 1 per cent additional.

The common stock of the Middle West Utilities is today quoted around 133, which compares with 124 at the beginning of the year, 110 a year ago and 119 two years ago. It has not appreciated in relation to the growth in earnings, nor in relation to the stock increase of many less advantageously situated companies.

Considerable improvement was shown in operating conditions during 1927. Fuel consumption per kilowatt-hour generated decreased by one-third of a pound of coal. Steam generation increased 20.3 per cent during the year and hydro generation 17.3 per cent, making a total increase of 18.9 per cent. In face of this, fuel used increased only slightly over 5 per cent. Cost of residence and commercial service to customers of subsidiaries has dipped sharply below the pre-war level and consequently revenue per kilowatt-hour is now considerably below that level.

## Georgia Power Seeks Funds for Improvements

The Georgia Power Company has asked permission of the state public service commission to issue 70,000 additional shares of $6 preferred stock similar to the issue of 30,500 shares recently sold. In submitting a statement to the commission showing that the original issue of stock had been exhausted, Preston S. Arkwright, president of the company, declared that the distribution had been made with the idea of gaining for the company the interest and support of the general public. The sale was made to citizens in 110 Georgia counties, he stated. No person had been allowed to buy more than 25 shares and the sale had been at an average price of $97.52 per share. The present market price of the stock is $105. Employees are allowed $1 per share for stock distribution. The new issue will be sold at not less than $95 per share without par value, and the proceeds will be distributed over the state in improvements and the rehabilitation of plants already purchased and owned by the power company.

## Electrification in Russia

The progress of electrification in Russia is shown by statistics published in a recent issue of the *Economic Review* of the Soviet Union. While the general industrial development of the Union has surpassed by a small margin the pre-war level, the production of electrical energy by regional and local public utility stations is about three times the pre-war figure. The number of electric power installations in industrial enterprises has also greatly increased.

Production of electric energy by public utility stations and the capacity in operation during the past five years were:

| Fiscal Year | Kilowatt-Hours | Kilowatts |
|---|---|---|
| 1922–23 | 905,000,000 | 478,000 |
| 1923–24 | 897,000,000 | 498,185 |
| 1924–25 | 1,132,000,000 | 538,026 |
| 1925–26 | 1,470,000,000 | 618,862 |
| 1926–27 | 2,100,000,000 | 733,635 |

In 1913 the output was 690,000,000 kw.-hr. and the capacity 328,000 kw.

The program of the State Planning Committee calls for the following output by public utility stations during the next few years:

| Fiscal Year | Kilowatt-Hours |
|---|---|
| 1927–28 | 3,050,000,000 |
| 1928–29 | 4,100,000,000 |
| 1929–30 | 5,550,000,000 |
| 1930–31 | 6,950,000,000 |

The output of electric energy by all power stations in the U. S. S. R. last year was 4,112,000,000 kw.-hr., an increase of 27.7 per cent over 1925-26. Of this amount, factory power plants produced 1,950,000,000, railway and others the remaining 62,000,000 kw.-hr. The total is expected to increase on the average about 25 per cent during each of the next few years and to attain 10,000,000,000 kw.-hr. in 1930-31.

The capacity of public utility stations in operation last year was divided among 640 local stations with an aggregate capacity of 235,000 kw. and eighteen large urban and regional stations totaling 498,635 kw.

**METROPOLITAN EDISON INCREASES COMMON DIVIDEND.**—Directors of the Metropolitan Edison Company have declared a quarterly dividend of $2 per share on the common stock, no par value, payable March 24 to holders of record March 15. This places the common stock on an $8 annual dividend basis, compared with $7 per annum previously.

**CINCINNATI GAS & ELECTRIC ANNOUNCES REFINANCING PLAN.**—A refinancing plan, which calls for the redemption of the outstanding bond issues of the Cincinnati Gas & Electric Company and their replacement with new 5 per cent bonds, has just been decided upon by the directors of the company. Among the issues outstanding are: First mortgage 5 per cent bonds which total $11,469,000; sinking fund, series "B," bonds amounting to $5,818,000 and sinking fund, series "C," bonds totaling $5,401,500. These will be redeemed as of April 1 at their individual call prices, according to an announcement made by Charles D. Jones, president. The better money conditions make possible the replacement of the bonds with other issues at a lower rate of interest, the officials pointed out.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday March 13 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 75¾ | 72 | 81 |
| Ala. Pwr., $7 com. pf.—no par | 115 | 114½ | 115½ |
| Allis Chalmers Mfg., 6% com. | 121¾ | 115½ | 125 |
| Aluminum Co. of Amer., com. | 125½ | 120 | 136 |
| Aluminum Co. of Amer., 6% pf | 108 | 105¼ | 108 |
| Amer. & Foreign Pwr., 7% pf.—no par | 108¼ | 105½ | 108½ |
| Amer. & Foreign Pwr., com.—no par | 24 | 22⅞ | 27½ |
| Amer. Bosch Magneto, com.—no par | 23 | 15⅞ | 23 |
| Amer. Brown Boveri Elec.† | 12¼ | 11 | 18 |
| Amer. Brown Boveri Elec., pf. $7 | 50¾ | 47 | 63 |
| Amer. Gas & Elec., 6% pf.—no par | 107 | 106¼ | 109 |
| Amer. Gas & Elec., com. †—no par | 141 | 117½ | 145 |
| Amer. Lt. & Trac., 6% pf. | 115 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 187½ | 170 | 191½ |
| Amer. Pwr. & Lt., 6% pf. | 105 | 104 | 109¾ |
| Amer. Pwr. & Lt., com. †—no par | 72¾ | 62½ | 75 |
| Amer. Pub. Serv., 7% pf. | a100¾ | 99 | 101 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | k 96½ | 90 | 95 |
| Amer. Pub. Utilities, 7% pr. pf. | 100 | 94 | 101 |
| Amer. Pub. Utilities, com. | k 60 | 60 | 65 |
| Amer. States Sec., A | a 5¾ | 4 | 5¾ |
| Amer. States Sec., B | a 5½ | 4¾ | 6 |
| Amer. Superpwr., 6% ptc pf.—25 | k 30¾ | 28¾ | 30¾ |
| Amer. Superpwr., 6% 1st pf. | l103¾ | .... | .... |
| Amer. Sup'pwr., Class A†—no par | 38½ | 37 | 41¾ |
| Amer. Sup'pwr., Class B†—no par | 41 | 37½ | 43 |
| Amer. Wtr. Wks. & Elec., 6% pf. | 101½ | 101¼ | 105 |
| Amer. W.W. & E., com. new—no par | 54¾ | 52¼ | 61 |
| Anaconda Copper cap. $3 | 54½ | 53¾ | 59¾ |
| Appalachian Electric Pwr., 7% pf. | 109½ | 108¼ | 110 |
| Arkansas Pwr., & Lt. 7% pf | 107½ | 108 | 109½ |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 95 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par | 49 | 47 | 51½ |
| BABCOCK & WILCOX, 7% com. | 117 | .... | .... |
| Binghamton L., H. & P., $6 pf. | 106 | 102 | 105½ |
| Birmingham Elec., pf.—$7—no par | 110¼ | 109½ | 111 |
| Blackstone Valley G. & E., 6% pf. | k106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | 161 | 132 | 161 |
| Blaw-Knox, com.† | i104 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f207½ | .... | .... |
| Brazilian Trac., Lt. & Pwr., com., new | f 53 | .... | .... |
| Broad River Pwr., 7% pf | 106 | 105 | 107½ |
| Brooklyn Edison, 8% com | 228½ | 206¾ | 235¾ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26¾ | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 36¾ | .... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf | k 99 | 98 | 101 |
| California Ry. & Pwr., 7% pf | k135 | .... | .... |
| Carolina Pwr. & Lt., pf.—$7—no par | l110½ | 109 | 110½ |
| Central & S. W. Util., $7 pf.—no par | a102½ | 99½ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a104½ | 103½ | 105 |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 105 | 107 |
| Central Ill. Pub. Serv., $6 pf | a 99 | 97½ | 99½ |
| Central Ind. Pwr., 7% pf | a 99½ | 95 | 99½ |
| Central Maine Power, 6% pf | 96½ | 96 | 98 |
| Central Maine Power, 7% | 109 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 104½ | 104½ | 105½ |
| Central States Elec., 7% pf | 110¾ | 104½ | 112½ |
| Century Elec., 6% com. | b143 | 140 | 145 |
| Cincinnati Gas & Elec., 5% com. | g 99 | 97½ | 100 |
| Cities Service, $6 pf.—no par | l 99¾ | 87 | 94½ |
| Cities Service, pf. B—no par | l 9½ | 8 | 8¾ |
| Cities Service, pf. BB—no par | l 95 | 80½ | 86 |
| Cities Service, com.—20 | l 58½ | 40½ | 58½ |
| Cities Service, Bks. Shrs.—10 | l 29 | 22½ | 27 |
| Cities Service Pwr. & Lt., 7% pf | 107½ | 105¼ | 107½ |
| Cities Service Pwr. & Lt., 6% pf. | 99 | 95½ | 100 |
| Cleveland Elec. Illg., 6% pf. | 112 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com | 390 | 350 | 410 |
| Columbia Gas & Elec., 6% pf. | k108 | 107½ | 110¾ |
| Columbia G. & E. com. $5—no par | 90½ | 89¾ | 97¾ |
| Columbus Elec. & Pwr., $2 com.—no par | k 69¾ | 66 | 71 |
| Columbus Elec. & Pwr., 7% pf | 113 | .... | ... |
| Columbus Ry., Pwr. & Lt., 7% pf. | 108 | .... | ... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 107 | .... | ... |
| Columbus Ry., P. & Lt. com.—no par | 115 | .... | ... |
| Commonwealth Edison, 8% com | 180½ | 165 | 189 |
| Commonwealth Pwr., 6% pf. | k102 | 102 | 103 |
| Commonw'th Pwr., $2, com.—no par | 68½ | 62½ | 70 |
| Conn. Lt. & Pwr., 8% pf. | 119 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 116 | 118 | 121 |
| Cons. Gas of N. Y., pf. | 102 | 101¾ | 102½ |
| Cons. Gas of N. Y., com. $5—no par. | 135½ | 119¾ | 139¾ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111½ | 110¾ | 113½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf | e111½ | 110½ | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | e111 | 110¾ | 115 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e101 | 100½ | 101½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 70 | 67½ | 72½ |
| Consolidated Pwr. & Lt., 7% pf | 105 | | |
| Consumers Pwr., 6% pf. | 105 | 105¼ | 106½ |
| Consumers Pwr., 6.6% pf. | 106 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 106½ | 106½ | 108 |
| Contl. G. & E. com. $4.40—no par | k230 | 240 | 265 |
| Crocker Wheeler, com.† | 32 | 24 | 27 |
| Crocker Wheeler, 7% pf. | 90 | 77 | 82 |
| DALLAS PWR. & LT., 7% pf. | 110½ | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108 | 108½ | 109 |
| Derby Gas & Elec. 7% pf | 98 | 96 | 99 |
| Detroit Edison, 8% com | 181 | 166 | 191½ |
| Dubilier Condenser, com.—no par | k 3½ | 2½ | 3½ |
| Duke Pwr., cap | k135 | 130 | 147 |
| Duquesne Lt., 7% pf | k116½ | 115¼ | 116¾ |
| EASTERN NEW YORK UTIL., $7 pf | k110½ | 111 | 112¼ |
| Eastern New York Util. com | m 65 | | |
| Eastern States Pwr. $7 com | k 12 | 12 | 14 |
| Eastern States Pwr. pf | k 97 | 98 | 99 |
| East. Tex. Elec., 7% pf | 107 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d257½ | 252 | 268 |
| El Paso Elec. 7% pf. | 113 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l109¼ | 109¼ | 111¼ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 91 | 76 | 94½ |
| Electric Household Util.† | a 21 | 13½ | 21 |
| Elec. Investors, 6% pf.—no par | 102¼ | 101 | 103¼ |
| Elec. Investors, com.†—no par | 45¾ | 40¾ | 46½ |
| Elec. Pwr. & Lt., ctfs. pf. | 108 | 106½ | 110¼ |
| Elec. Pwr. & Lt., ctfs., 40% pd. | k126 | 120½ | 125½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 36½ | 28½ | 38½ |
| Elec. Refrig. cap.† | 6¾ | 11½ | 15½ |
| Elec. Ry. Securities, com.—no par | 13¾ | ... | ... |
| Elec. St. Battery com. $5.25—no par | 72½ | 69 | 77½ |
| Elmira Wtr., Lt. & R.R., 7% pf. | k106½ | 104 | 107 |
| Empire Pwr., ptc.† | k 34 | 27½ | 35½ |
| Engr. Pub. Serv. $7 pf.—no par | k109½ | 107 | 110 |
| Engr. Pub. Serv., com.—no par | 35½ | 33 | 37½ |
| Eureka Vacuum Cleaner, com. $4—no par | 70½ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | k108½ | 104 | 108½ |
| F.-M., com.—$3—no par | k 38½ | 32½ | 40½ |
| Federal Lt. & Trac., com $1.40ex.div. | 52½ | 42 | 55 |
| Federal Lt. & Trac., $6 pf.—no par | 103 | 98 | 105 |
| Florida Pwr. & Lt., 7% pf. | 107 | 105 | 107½ |
| Ft. Worth Pwr. & Lt., 7% pf. | l114½ | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf | 78 | 75 | 78 |
| Galveston-Houston Elec., com | 32 | 31 | 34 |
| General Cable, Cl. A | 73 | 56 | 73 |
| Gen. Elec. $3 com.—no par | 144½ | 124 | 144½ |
| Gen. Elec., special 6% | 11¼ | 11⅛ | 11¼ |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 42½ | 35½ | 43 |
| Gen. G. & E. (Del.) pf. A $8—no par | k124 | 122½ | 126½ |
| Gen. G. & E. (Del.) pf. A $7—no par | k112 | 108 | 115 |
| Gen. G. & E. (Del.) pf. B $7 | 107½ | 105½ | 108 |
| Gen. Pub. Serv. $7 cum. pf.—no par | k117 | 110 | 120 |
| Gen. Pub. Serv., com., no par | 19½ | 16½ | 20 |
| General Public Utilities, $7 pf | 98½ | 98 | 99 |
| Ga. Lt., Pwr. & Rys. com | k 58 | 55 | 65 |
| Ga. Ry. & Pwr., 8% pf | m125 | | |
| Ga. Ry. & Pwr., 7% pf | m113½ | ... | |
| Gt. Western Pwr., 7% pf | m105 | | |
| IDAHO PWR., 7% pf. | 104½ | 109 | 110½ |
| Ill. No. Utilities, 6% pf. | a100 | 98½ | 100 |
| Ill. Pwr. & Lt., 7% pf. | 104½ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 104 | 102 | 107½ |
| Indianapolis Pwr. & Lt. $7 pf | 104 | 100 | 105 |
| Ingersoll Rand com | 91 | 90 | 94 |
| Int. Combus. Engr., com. $2—no par | 53¾ | 45 | 55½ |
| Int. Combustion Engr. 7% pf | 104½ | 103½ | 105½ |
| Int. Ut., Class A, $3.50—no par | 46½ | 45 | 51½ |
| Int. Ut., Class B—no par | 7¼ | 6½ | 10½ |
| Interstate Pwr., pf.—$7—no par | 101 | 99 | 103 |
| Interstate Pub. Serv., 7% pf. | 104 | 103 | 106 |
| Iowa Ry. & Lt., 7% pf. | k 99 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 107 | 105 | 107 |
| Johns-Manville com.†—no par | 120½ | 111½ | 125 |
| Johns-Manville, 7% pf | 121½ | 119½ | 121½ |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 10. lBid price Wednesday, March 14. mLatest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

**(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)**

| Companies | Bid Price Tuesday March 13 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | k116¼ | 115 | 116¼ |
| Kansas Gas & Elec., 7% pf. | l109¾ | 107 | 109 |
| Kentucky Hydro-Elec., 7% pf | a104¼ | .... | .... |
| Kentucky Sec., 6% pf | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| **Kentucky Utilities, 6% pf.** | k102 | 100 | 103 |
| LACLEDE GAS LT., 10% com. | k200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 26 | 19¾ | 27½ |
| Long Island Ltg., 7% pf | 112 | 110½ | 112½ |
| **Long Island Ltg., 6% pf** | 107½ | 107 | 108½ |
| Long Island Ltg., com.†—no par | k178 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | h108½ | 105½ | 109½ |
| Louisville Gas & Elec., cl. A. $1.75 | 29 | 28 | 29⅞ |
| MAN ELEC. SUPPLY, cap. $5—no par | 53¾ | 50 | 54⅝ |
| Manila Elec., com.†—no par | 46 | 46 | 50 |
| Maytag Mfg., com. 50—no par | 31⅞ | 30 | 34¾ |
| Memphis P. & L., pf.—$7—no par | k109 | 109 | 111 |
| **Metropolitan Ed., pf.—$6—no par** | 106¼ | 103 | 107½ |
| Metropolitan Ed., pf.—$7—no par | 109½ | 109 | 111 |
| Metropolitan Ed., com. $5—no par. | k140 | 125 | 155 |
| Middle West Utilities, 7% pf. | a122¾ | 116½ | 124¾ |
| **Middle West Util., 7% pr. lien** | a126 | 125 | 129½ |
| Middle West Util., com. $7—no par | a134¾ | 123¾ | 135 |
| **Midland Utilities, pr. ln. 6% pf.** | a 96⅝ | 94⅝ | 96½ |
| Midland Utilities, 6% pf. A | a 91¾ | 90¾ | 91½ |
| **Milwaukee Elec. Ry. & Lt., 7% pf.** | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k100 | 98 | 101¾ |
| Minn. Pwr. & Lt., 7% pf. | l109 | 107 | 109 |
| Miss. River Pwr., 6% pf. | 108½ | 94 | 109½ |
| **Miss. River Pwr., 3% com.** | m 62 | .... | .... |
| **Mohawk Hudson Pwr., 1st pf.—$7—no par** | k107 | 100 | 110 |
| **Mohawk Hudson Pwr., 2d pf.—$7—no par** | k104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 31 | 29½ | 31½ |
| Montana Pwr., 5% com. ex.div. | 163 | 102½ | 167½ |
| Montreal Pwr., 7½% com. | f 90 | .... | .... |
| Mountain States Pwr., 7% pf. | k104 | 97 | 105 |
| Mountain States Pwr., com.† | 17 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110 | 98 | 110½ |
| National Carbon, 8% pf. | m138½ | 138 | 139 |
| National Elec. Pwr., A† | a 31⅜ | 27½ | 32⅜ |
| National Lt., Ht. & Pwr., com. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | k109½ | 108½ | 111 |
| National Pwr. & Lt., com.†—no par. | 25⅜ | 21⅞ | 27⅞ |
| National Pub. Serv., 7% pf. | 102½ | 99 | 103 |
| National Pub. Serv., 7% ptc. pf. | 114 | 108 | 115 |
| **National Pub. Serv., A com. $1.60—no par** | 25½ | 22 | 27½ |
| National Pub. Serv., B com.—no par | k 28 | 24½ | 30 |
| Nebraska Pwr., 7% pf. | l111 | 110 | 111½ |
| Nevada-Calif. Elec., com. | 38 | 33½ | 42 |
| **New Brunswick Pwr., 4% pf.** | k 61 | 60 | 70 |
| **New Eng. Pub. Serv., pr. ln. pf. $7** | k108½ | 98½ | 109½ |
| New Eng. Pub. Serv., pf. $7 | k106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108¾ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf | k103 | 101 | 104 |
| New York Power & Light 7% pf. | 116 | .... | .... |
| New York Power & Light, 8% pf. | m114 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com | m109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf | m109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28¾ | 28 | 28¾ |
| No. Amer., 6% pf.—50 | 53¾ | 53½ | 55 |
| No. Amer., com.—10 | 61⅞ | 58⅞ | 62⅞ |
| No. Amer. Edison, $6 pf.—no par | k102¾ | 102½ | 105⅞ |
| No. Caro. Pub. Serv., pf.—$7—no par | m109 | 93 | 105 |
| Northeastern Pwr., com. | 20¾ | 19¾ | 23 |
| **No. N. Y. Utilities, 7% pf.** | 107 | 103 | 109 |
| **No. Ohio Pwr., com.—no par** | 24⅞ | 18 | 25¾ |
| **No. Ont. Lt. & Pwr., 6% pf.** | k 99 | 94 | 100 |
| **No. Ont. Lt. & Pwr., 4% com.** | 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf | 109 | 108¾ | 109½ |
| No. States Pwr. (Del.), 8% com. | 133 | 123 | 136⅞ |
| No. Texas Elec., 6% pf | 55 | 45 | 70 |
| No. Texas Elec., com. | 16 | 5 | 36 |
| OHIO BRASS, com. B $4—no par. | 100 | 89 | 100 |
| Ohio Brass, 6% pf | k107 | 106 | 111 |
| Ohio Pwr., 6% pf | 106½ | 104 | 107 |
| Ohio Pub. Serv., $6 pf | k102¼ | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | 111½ | 107 | 112 |
| **Ohio River Edison, 7% pf.** | 109 | 106 | 109¾ |
| **Oklahoma Gas & Elec., 7% pf.** | 112½ | 106 | 114 |
| PACIFIC Gas & ELEC., 6% pf. | 27⅜ | 26⅜ | 28⅜ |
| Pacific Gas & Elec., 8% new com. | 44¾ | 43½ | 49¾ |
| Pacific Pwr. & Lt., 7% pf | l109½ | 106 | 109 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 81 | 79⅞ | 81 |
| Penn-Ohio Edison, 6% pf. no par | 94⅛ | 93 | 96 |
| **Penn-Ohio Edison, 7% pf.** | 107 | 106½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l110½ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 70 | 68 | 72½ |
| **Phila. Co., 5% pf.-50** | c 46 | 46 | 48⅜ |
| Phila. Co., 6% pf.—50 | 54¾ | 52 | 54½ |
| **Phila. Co., com.—50** | 159 | 149½ | 163 |
| Phila. Elec., 8% com.—25 | c 59 | 55½ | 59 |
| **Portland Elec. Pwr., 7% pf.** | 103½ | 100 | 104½ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 87 | 55 | 88 |
| Portland Elec. Pwr., com. | 51⅛ | 42¼ | 52 |
| **Potomac Elec. Power, 6% pf.** | f111 | .... | .... |
| **Pwr. Sec., pf.—no par** | 64¾ | 60½ | 64¾ |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf., | k105 | 99 | 103 |
| **Pub. Serv. of N. J., 6% pf.** | 105½ | 103⅝ | 106⅜ |
| **Pub. Serv. of N. J., 7% pf.** | 118¼ | 118 | 120½ |
| **Pub. Serv. of N. J., $2 com.—no par** | 44 | 41½ | 45¾ |
| **Pub. Serv. of No. Ill., 6% pf.** | a111½ | 110 | 113½ |
| **Pub. Serv. of No. Ill., 7% pf.** | a119 | 119 | 121 |
| **P. S. of No. Ill., com. $8—no par.** | a170 | 159½ | 180 |
| **Pub. Serv. of No. Ill., $8 com.** | a172 | 159⅞ | 180 |
| **Pub. Serv. of Okla., 7% pr. ln.** | k105 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109¼ | 108 | 110⅜ |
| **Puget Sound Pwr. & Lt., 7% pf.** | 111 | 109 | 113 |
| **Puget Sound Pwr. & Lt., $6 pf.—no par** | 98½ | 92 | 99½ |
| **Puget Sound Pwr. & Lt., com.** | 48 | 34⅛ | 50 |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 56 | 54½ | 57⅞ |
| **Radio Corp. of Amer., com.—no par.** | 160 | 85¼ | 160 |
| Rhode Island Public Service, pf. $2—no par | k 31½ | 30⅛ | 31½ |
| Rochester Gas & Elec. 6% pf. D | 106¼ | 105 | 106¼ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| **Rochester Gas & Elec., 6% pf. C** | 105 | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf | k116 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc | 7¼ | 4½ | 7⅞ |
| Sierra Pacific Elec., 2% com. | 37 | 29 | 38⅞ |
| Sioux City Gas & Elec., 7% pf. | 107 | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7—no par | l 108½ | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf | l 87 | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 43½ | 40⅛ | 44⅞ |
| So. Calif. Edison, 8% pf. | k 45½ | 38½ | 41 |
| So. Calif. Edison, 7% pf. | k 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 26¾ | 25¾ | 27½ |
| So. Calif. Edison, 8% com. | 46¼ | 43½ | 47½ |
| **Southern Cities Utilities, 7% pf.** | k 79 | 75 | 78 |
| **Southwestern Lt. & Pwr., A $3** | 75 | 60 | 80 |
| **Southwestern Lt. & Pwr., B** | 65 | 60 | 65 |
| **Southwestern Lt. & Pwr., $6 pf** | 91½ | 88 | 92 |
| Southwestern Pwr. & Lt., 7% pf | l111½ | 103 | 113 |
| Standard Gas & Elec., 8% pf | 66 | 65 | 68 |
| Standard Gas & Elec., 7% pr. pf | 112½ | 108 | 113 |
| Standard G. & E., com. $3.50 | 62¼ | 57¾ | 65 |
| **Standard Power & Light, com.** | 42 | 29½ | 45 |
| **Standard Pwr. & Lt., 7% pf.** | 106½ | 103⅜ | 106½ |
| Staten Island Edison, pf.—$6—no par | 103 | 99 | 103½ |
| Superheater, $6 com.—no par | 167 | 162 | 175 |
| Syracuse Lighting, 7% pf. | k110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | k 62½ | 62 | 64 |
| Tenn. Elec. Pwr., 6% pf. | 103⅜ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109½ | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf | k 10 | .... | .... |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf | l114¾ | 113½ | 115 |
| Tide Water Pwr., 8% pf | 111 | 108 | 112 |
| **Timken Roller Bear., com.—$4 no par** | 122½ | 112⅞ | 134 |
| Toledo Edison, 7% pf. | 109 | 102 | 107 |
| Toledo Edison, 6% pf. | k104 | 95 | 105 |
| Toledo Edison, 6% com. | k145 | 120 | 150 |
| **Tri-City Ry. & Lt., 6% pf.** | k100 | 96 | 102 |
| UNITED GAS & ELEC., 7% pf. | 98 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c118¾ | 111¼ | 118⅞ |
| **United Lt. & Pwr., pf.—$4—no par** | a 57 | 53 | 57 |
| **United Lt. & Pwr., pf.—$6.50—no par** | a100 | 95 | 100 |
| United L. & P., com. A .48—no par. | a 17½ | 14 | 17¾ |
| **United L. & P., com. B .48—no par. ex div** | k 24⅜ | 20 | 25 |
| **Utah Pwr. & Lt., 7% pf.** | i 111½ | 109½ | 111½ |
| **Utica Gas & Elec., 7% pf.** | 105 | 105 | 106½ |
| **Utica Gas & Elec., 8% com.** | k200 | 215 | 225 |
| **Utilities Pwr. & Lt., 7% pf.** | 101 | 98 | 103 |
| **Utilities Pwr. & Lt., com. A $2** | 32½ | 28½ | 34½ |
| **Utilities Pwr. & Lt., com. B $1—no par** | 24⅞ | 18½ | 26⅞ |
| VERMONT HYDRO-ELEC., 7% pf. | k 98 | 95 | 102 |
| **Virginia Elec. & Pwr., 7% pf.** | k110 | 108 | 111 |
| WAGNER ELEC., 7% pf. | 101 | 96½ | 102 |
| Wagner Elec., com.—no par | b 48 | 37 | 48 |
| Washington Ry. & Elec., 5% com. | j485 | .... | .. |
| Washington Ry. & Elec., 7% pf. | j104 | . | . |
| Washington Wtr. Pwr., 8% com. | k227 | 175 | 235 |
| **West Penn Elec., 7% pf.** | 113 | 109½ | 114¾ |
| **West Penn Elec., Cl. A $7** | k109½ | 106½ | 110⅞ |
| West Penn Pwr., 7% pf. | 115¼ | 114⅛ | 116⅛ |
| West Penn Pwr., 6% pf. | 110½ | 109¼ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf | k102 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 100 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .. |
| Westinghouse Elec. & Mfg., 8% com.—50 | 105⅞ | 88⅞ | 105½ |
| **Weston Elec. Instrument, Cl. A $2—no par** | 33 | 30⅞ | 34½ |
| Weston Elec. Instrument, com.—no par | k 13½ | 12½ | 14½ |
| Wheeling Elec., 6% pf | k104 | 95 | 104 |
| **Worthington Pump, 7% pf. A** | k 50 | 46½ | 55 |
| **Worthington Pump, 6% B** | k 45 | 41 | 49½ |
| **Worthington Pump, com.** | 29 | 28 | 34½ |
| YALE & TOWNE com. $5—25. | 74 | 72½ | 75 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Bid price Saturday, March 10. *l*Bid price Wednesday, March 14. *m*Latest quotations available. †Dividend rate variable.

## New Utility Financing Active

Electric light and power financing during the past week has been unusually active, a total of $41,925,000 having been recorded. Six individual issues contributed to this substantial sum. The largest offering was made by the Metropolitan Edison Company in the form of first mortgage gold bonds, priced at 99½ and interest, to yield about 4.52 per cent, a piece of financing involving a total of $23,000,000. Proceeds will be used to retire $20,545,500 bonds bearing higher rates of interest and for additions and betterments.

First mortgage and refunding gold bonds of the San Antonio Public Service Company were offered to the amount of $7,500,000, the price being 97½ and accrued interest to yield about 5.16 per cent.

The Memphis Power & Light Company made an offering of first and refunding mortgage gold bonds, series C, at 96½ and accrued interest, to yield about 4.70 per cent.

First lien and general mortgage gold bonds of the Utah Power & Light Company were offered to the amount of $5,500,000 at 96¾ and interest, yielding 4.79 per cent. These bonds, dated Feb. 1, 1928, and maturing Feb. 1, 1944, will be secured by a general mortgage on the entire physical property, franchises and rights of the company.

The West Texas Utilities Company issued 25,000 shares of $6 cumulative preferred stock (no par value) at $96 per share and accrued dividend to yield 6.25 per cent.

The Orange & Rockland Electric Company issued first mortgage gold bonds at 99½ and accrued interest, to yield over 5 per cent, the offering involving a total of $1,250,000.

An electrical manufacturing company was also represented in the week's new offerings, the Cutler-Hammer Manufacturing Company having issued 75,000 shares of common stock. The price of this stock was $47.50 per share. Proceeds will be used toward the retirement of all of the outstanding preferred stock of the company, which will be called for redemption May 1, 1928.

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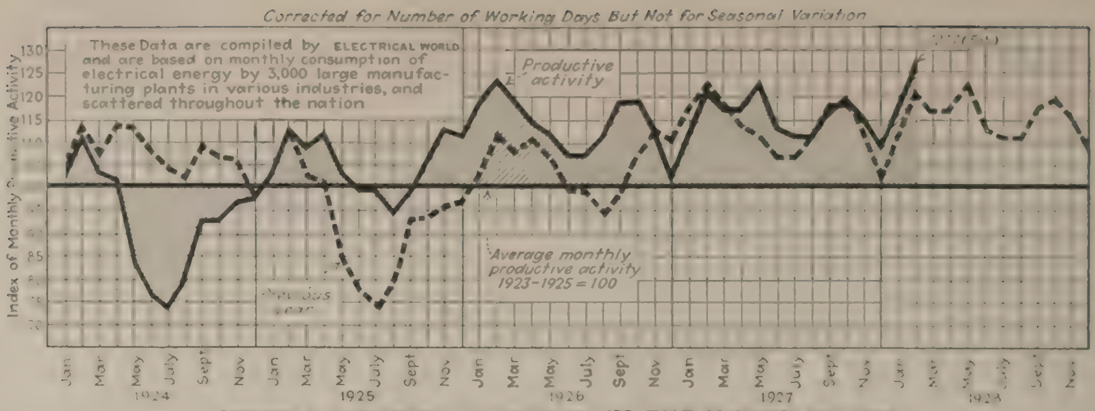
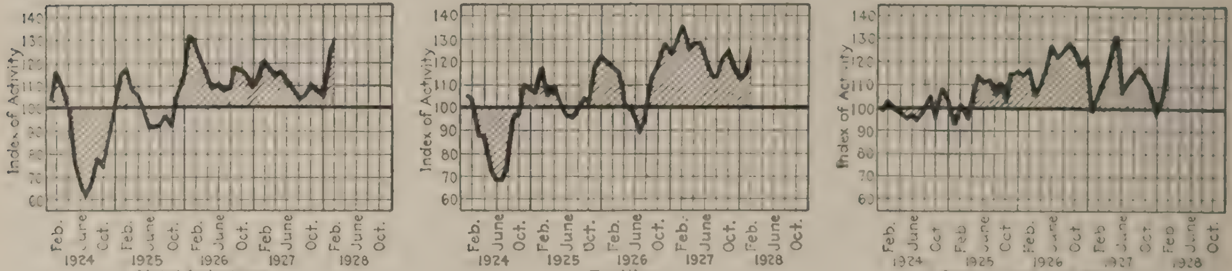
COMMUNITY POWER & LIGHT CALLS STOCKS.—The board of directors of the Community Power & Light Company has voted to call for redemption all of the company's outstanding first preferred stock, $7 dividend series, and participating preferred stock, $8 dividend series, at the redemption price of $110 per share and dividends.



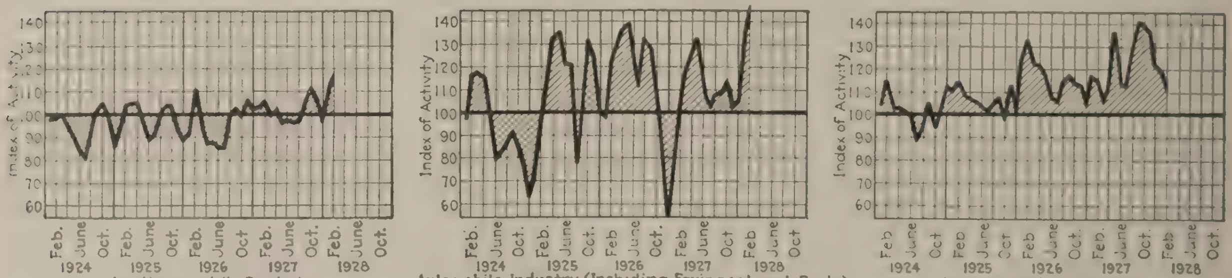
GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES



Metal Industries

Textiles

Stone, Clay, and Glass



Leather and its Products

Automobile Industry (Including Equipment and Parts)

Lumber and its Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

# Industrial Production Increased 16 Per Cent

## More Than Normal Seasonal Increase in Productive Operations Since the Opening of the Year—All Groups Report Increases Over January

CONSUMPTION of electrical energy by the manufacturing plants of the nation as reported to the ELECTRICAL WORLD indicates that the rate of general industrial production has been materially increased since the opening of the year. The February rate of general production was 16.2 per cent over December and 7.8 per cent over January, a rate of increase comparable with that recorded for the same period in 1927, but materially exceeding that recorded in 1924, 1925 and 1926. It would appear that American industry as a whole has experienced an unusual upward swing since the opening of the year which should do much toward relieving the unemployment reported during December and January.

All sections east of the Rockies have materially increased their rate of production since December. New England, which has been reporting operations at a low ebb for several months, witnessed a February rate of productive activity about 23.7 per cent over December, due very largely to an increase in the operations of the textile mills of over 21 per cent during the two-months period. The manufacturing plants of the Middle Atlantic States reported February operations 15.2 per cent over December, the North Central States 18.4 per cent and the Southern States 5.2 per cent. Productive operations in the Mountain and Pacific States appear to be on about the same level as in December.

Lumber and its products is the only industrial group not recording a materially increased rate of February operations over December, although this group did record increased February operations over January. The greatest increase in the rate of production since the opening of the year has been recorded by the rubber and its products industry, with February operations 41.8 per cent over December, followed by the automobile industry with a 39.7 per cent gain, stone, clay and glass 28.8 per cent, metal working plants 26.2 per cent, rolling mills and steel plants 21.1 per cent, leather and its products 20.7 per cent, chemical and allied products 18.5 per cent, textiles 13.6 per cent, food and kindred products 10.5 per cent, and paper and pulp 1.7 per cent. It is to be expected that materially increased production would be reported during January, February and March, but the rates of increase reported above are in most cases above that to be expected, based upon increases recorded in past years. It now seems probable that several industrial groups will hang up new records of production for the first quarter of the year.

# Business News and Market Conditions

## Trend of Sound Practice in Industry

*Survey Shows That More Companies Reporting a Decrease in Profits Reduced Prices Than Those Which Had an Increased Profit*

REDUCTION of manufacturing costs, the purchase of new machinery and an improvement in the quality of the product stand out as the three most important things which manufacturers have done to cope with competition. Following these as a close second, according to a published report of a survey of industry made by the Sherman Corporation of Boston, come product research, process research, market research, increased inventory turnover and a reduction of overhead cost. Of the concerns reporting profit increases 86 per cent said they had reduced the unit cost of manufacture. Concerns reporting profit decreases included only 64 per cent which said they had reduced unit cost to manufacture. Companies in the profit increase group included 63 per cent which said they had reduced their overhead, while 52 per cent of the profit decrease group reported overhead reductions. These figures are significant in showing the relation of profits to the reduction of overhead.

Sixty-one per cent of the concerns reporting profit increases increased volume of sales, while only 27 per cent of the companies showing decreased profits had increased their sales volume. Furthermore only 41 per cent of the profit increase group reduced selling price, while 64 per cent of the decreased profit group had cut selling price. This is regarded as especially significant, as "not getting a fair price" is regarded by many business executives as a key problem in manufacturing today. And the concerns reporting improved profit position reduced expense to sell two to one as compared with the concerns reporting profit decreases. A check of the most pressing current manufacturing problems, divided on a percentage basis, is as follows:

| | Per Cent |
|---|---|
| Sales | 35 |
| Production | 29 |
| Price | 21 |
| Style | 4 |
| Quality | 4 |
| Administration | 4 |
| Financing | 3 |
| | 100 |

The trend of sound practice obviously is toward reduction of unit manufacturing cost, maintenance of selling price, reduction of overhead, reduction of sales expense and, as a result of internal economy and efficiency, increase of sales volume. The book containing the report of the survey of industry is entitled "What Is Happening to Business." It also contains excerpts from interviews with representative business executives on the subject of the report.

The outstanding conclusions drawn, with the report as a basis, are given as follows:

1. The product itself is of primary importance. Its quality should not be impaired, but improved and kept to high standards. One way out for manufacturers is to develop merchandise of such quality that price-cutting tendencies can be met by getting into a class of business not dependent primarily on price. It is a day when an honest product is fundamental.

2. In manufacturing there can be no let-up in sound cost reductions. Increasing inventory turnover, getting greater value for the labor dollar, reduction of overhead and reducing time of manufacture are thoroughgoing economy programs which are vitally essential today in all lines of manufacture.

3. Much of the profit decline may be traced back to a hectic scrambling for a larger share of a market of certain fixed size and scope. If there is just so much market available, then cutting prices to get more of that market simply takes away from another manufacturer. Therefore, the necessity of developing new markets.

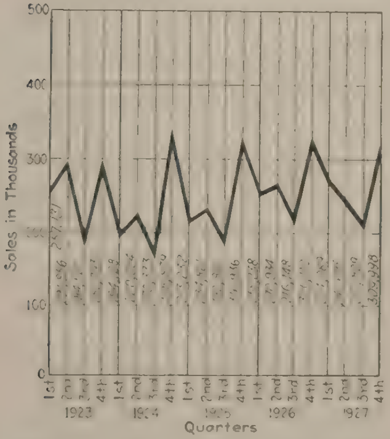
4. Research, a "competition in creation instead of on price," development of new products—these practices will open new markets and allow perhaps a better-balanced production in plants working at 40-50-60 per cent capacity.

5. Price maintenance, wherever possible, is vitally essential. "Price fixing" is out of the question. But the individual manufacturer who has a bottom price and conducts business solidly and courageously, even at a loss of certain volume, with the idea of keeping a semblance of soundness in his price situation, is rendering manufacturing industry a real service and laying the groundwork for improved profit position.

6. The "big pinch" in manufacturing business is selling expenses. Thorough analysis of sales with the purpose of reducing costs to sell is essential.

7. Consolidations and mergers on a basis of economical future operations, especially the reduction of selling and distribution expenses, and not solely on the "window dressing" of past earnings records, are inevitable.

### Vacuum-Cleaner Sales

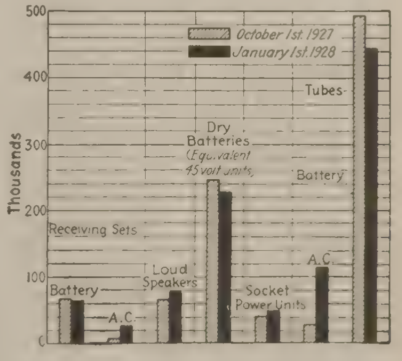


Vacuum-cleaner sales by quarters during 1923, 1924, 1925, 1926 and 1927. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

## Building Industry Starts Co-operative Development

Representatives of about 31 of the most important interests in and allied with the building industry launched a national co-operative movement to provide clearing house functions to promote the rehabilitation of the existing homes in America and to create an enlarged and stabilized market for the building industry. The purpose of the movement is said to be to act as a clearing house for the building industry and allied industries or interests and to promote activities such as to advance standards of housing and living; to provide a broader and enlarged market, a more uniform monthly and yearly building activity and employment and a resultant high level of national prosperity; to promote home ownership; to encourage improvements in financing methods and facilities in all communities; to develop, collect and disseminate information regarding markets, and to encourage study and research in all important aspects of housing.

### Stocks in Hands of Radio Dealers



*Actual returns of approximately 25 per cent of dealers listed*

Compiled by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., with the co-operation and assistance of the radio division, National Electrical Manufacturers' Association.

NOTE.—Radio business during 1927 approximated $500,000,000, according to a statement by R. A. Klock, chairman of the statistical committee, radio division, N.E.M.A.

# Market Conditions

STEADY trade is reported in the New England district, with the demand for small motors and industrial equipment at a good level. Negotiations for paper mill equipment are under way and street-lighting projects command attention. In the Eastern district sales are maintaining a good average. The call for prime movers shows an improvement, and a 60,000-kw. turbo-generator was purchased for St. Louis at a cost of $750,000. Orders for switching equipment totaled $310,000 and nearly $1,000,000 worth of wire and cable was bought by a New York utility company.

Healthy business is reported in the Southeast. A central-station company placed a large order for wire and several orders from textile mills are pending. In St. Louis a heavy demand for building materials was reported and an order for $71,000 worth of equipment was placed by a central-station company. Better business is indicated in the Middle West, but there is some apprehension regarding the bituminous coal situation. Industrial activity continues generally favorable. On the Pacific Coast industrial buying continues at a steady rate. The city of Seattle has awarded a contract for the Cedar Falls pipe line at a cost of nearly $250,000. Four carloads of pole line hardware were purchased by power companies.

## *Copper Demand Light—Price Stable*

The demand for copper has been light from domestic as well as foreign buyers. February copper statistics show heavy shipments during February. Lead is in normal demand after the heavy buying of last week. The zinc market continues to advance. A decrease in the price of tin attracted consumer buying.

NEW YORK METAL MARKET PRICES

| | Mar. 7, 1928 Cents per Pound | Mar. 14, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14.125 | 13.825 |
| Lead, Am. S. & R. price | 6 | 6 |
| Antimony............ | 10¼ | 10⅜ |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots........... | 5.875 | 6 |
| Tin, Straits.......... | 51¼ | 50¼ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper price March 14, 1928, 15¾ cents.

## *Buying in New England District at Steady Rate*

A steady demand for small motors and industrial equipment continued in the New England district. Small motor sales are well up in volume. Orders for a number of higher ratings from 50 hp. up and one of 600 hp. also is noted. Of interest was an order for a 3,150-kw. converter and increased activity in power control apparatus. Central-station supplies are in spotty demand, but pole line material is moving well. Some of the equipment for a short 33,000-volt line in southern New Hampshire was purchased and included about $10,000 worth of insulators. Negotiations for equipment for paper mills are under way.

Sales of contractors' supplies are more active. A number of motor pumping units were recently ordered and sales of arc-welding equipment are gaining as compared with those of last month. Among the major appliances, refrigerators are prominent, with commercial types rapidly gaining favor. Street lighting projects command attention. The Rhode Island Processing Company's plant recently destroyed by fire at a loss of $200,000 will be rebuilt. Authority for the carrying out of the Boston North Station plan for a large arena, new station and hotel has been granted. The Seth Thomas Clock Company, Thomaston, Conn., plans a four-story addition.

## *Sales Hold Good Average in Eastern District*

Good general demand for standard electrical equipment prevails in the Eastern district. A number of utilities are in the market for spring requirements and sizable commitments have been made. The call for prime movers shows improvement and inquiries indicate some desirable orders in this line at an early date. A central station at St. Louis has placed a contract for a 60,000-kw. generating unit with accessory equipment, to cost approximately $750,000. A utility at Keokuk, Iowa, is expected to place orders for several 2,000-kw. generating sets within a short time. A waterwheel manufacturer at York, Pa., has secured a contract for a unit for municipal service at Stoughton, Wis., the order for generating equipment going to a Minneapolis (Minn.) producer. The outlook for early increase in substation business is favorable. A central station in New Jersey has divided an order for switching equipment among three large manufacturers, the total approximating $310,000. The same interest also has purchased oil circuit breakers and auxiliary apparatus aggregating $100,000. A central station company in New York, in addition to the $320,000 worth of high-tension cable reported purchased last week, has ordered $670,000 worth of high-tension cable, $240,000 worth of rubber insulated cable and $60,000 worth of weatherproof wire and cable.

The call for industrial motors shows a temporary lag, following considerable business in larger-sized units in recent weeks. It is expected that there will be a resumption of the demand from iron and steel mills, paper mills and other active industries at an early date. A washing machine manufacturer in a northern New York city has placed a large order for fractional-horsepower units totaling $60,000.

Business in the Philadelphia district shows improvement. There is a better call for transmission line and substation equipment from utilities and early contracts are looked for. The United Gas Improvement Contracting Company recently placed an order for a 30,000-kw. turbo-generator with the Westinghouse Electric & Manufacturing Company and it will be built at the South Philadelphia works. The unit will be used for an installation at New Braunfels, Tex., and includes condensing apparatus.

Immediate construction operations are as follows: The Port of New York Authority, New York, is asking bids until March 26 for complete electrical equipment for the Elizabeth-Howland Hook bridge. The Skenandoa Rayon Corporation, Utica, N. Y., plans several plant units to cost $2,000,000. The Victor Plaster Company, Rochester, N. Y., plans a gypsum plaster mill at Victor, N. Y. The Corona Corporation, Jersey City, N. J., will build a five-story factory addition to cost $100,000. The Pennsylvania Power & Light Company will make improvements in transmission lines at Wilkes-Barre, Drums, Pa., and vicinity, rebuilding a considerable portion for heavier voltage. The Pennsylvania Water & Power Company, Holtwood, Pa., plans a hydro-electric development at Safe Harbor on the Susquehanna River. The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is asking bids until March 27 for three electric baking ovens for Newport News and Mare Island navy yards (Schedule 8674).

## *Healthy Business Reported in the Southeast*

The tone of electrical business in the Southeast is healthy and there is a considerable amount of business in prospect. A central-station company ordered 14 miles of bare stranded copper wire, 30,000 lb. of weatherproof copper and 10,000 lb. of bare copper wire. Another interesting power company order was for four 66,000-volt potential transformers and two 66,000-volt oil circuit breakers, while another company purchased creosoted pine poles amounting to $6,500. Orders for control batteries from central-station companies for the first two months of this year have been very good and considerably ahead of those for the same period of last year. Six electric industrial trucks have been placed in the New Orleans territory and one in Atlanta, and an order for 45 street trucks for a laundry company is pending.

A textile mill in Alabama ordered $20,000 worth of motors and transformers and a hosiery mill in Georgia ordered a 125-kva. generator with necessary engine and switchboard equipment. Bids have been asked for a 2,500-kw. turbine for the U. S. Government penitentiary and the engineering contract has been awarded on a new textile mill for construction in Arkansas. Several textile jobs in North Carolina are in the negotiation stage and will probably be closed this week. Municipalities continue their buying activities.

Construction projects are as follows: The Strowd-Holcombe Cotton Mills Company, Birmingham, Ala., plans an addition to cost $150,000. The Chatahoochie Sand & Gravel Company, Columbus, Ga., plans an electric-operated washing and screening plant to cost $200,000. The Proximity Manufacturing Company, Greensboro, N. C., plans an addition to its textile mill to cost $150,000. The Alabama Power Company, Birmingham, plans a transmission line about 50 miles long from its hydro-electric power development at Martin Dam. The Duke Power Company will build a 100,000-volt steel tower transmission line from the Lake James power plant to points in McDowell County. The Western Carolina Power Company will build a transmission line between Rutherfordton and Marion, N. C., and has acquired a site of 5 acres at Marion for a substation. The Bristol Gas & Electric Company plans a transmission line from Butler to Mountain City, Tenn.

## *Heavy Demand for Building Materials in St. Louis*

Business in the southwestern part of the St. Louis district is keeping up. An order for oil well pumping apparatus amounted to $8,500 and another for switches and circuit breakers amounted to $17,000. A central-station company purchased $71,000 worth of equipment. Small-sized motors and transformers sold in fair volume. A number of large buildings nearing completion has caused a good demand for conduit, wire and other electrical building materials. Manufacturers are figuring on several good-sized jobs.

Construction projects are as follows: Alexandria, La., plans an addition to its municipal power plant to cost $35,000. The Dixie Creamery, Inc., Shreveport, La., plans a new plant at Abbeville, La., to cost $100,000. The United States Cold Storage Company, Kansas City, Mo., plans improvements in cold storage and ice plants to cost $1,000,000. Marshall, Mo., plans extensions in its municipal power plant to cost $80,000. The Black River Hydro-electric Company, St. Louis, Mo., plans a hydro-electric generating plant at Poplar Bluff, Mo., to cost $3,000,000. The Empire Refineries, Inc., Tulsa, Okla., plans an industrial alcohol plant at Ponca City, Okla., to cost $300,000. The Magnolia Petroleum Company will extend its refining plant at Beaumont, Tex., to cost $200,000. The Gulf Coast Shell & Cement Company, Houston, Tex., plans a cement mill at Palacios, Tex., to cost $150,000. Cushing, Okla., St. Joseph, Mo., and Childress, Tex., plan installation of ornamental lighting systems.

## *Industrial Buying Steady on Pacific Coast*

Power company orders on the Pacific Coast have included four carloads of pole line hardware, $50,000 worth of distribution transformers for Tacoma and $3,000 worth of poles for Modesto. The San Joaquin Light & Power Corporation is in the market for 2,500 untreated poles, 7 in., 35 ft., for Fresno delivery, a potential order of close to $20,000. Projected building construction includes a $400,000 bank for Bakersfield, a $300,000 apple storage warehouse for Watsonville, a $600,000 church, a $300,000 marble yard and factory and a $500,000 stock exchange for San Francisco and a $500,000 theater and a $3,000,000 department store for Oakland. Overseas business included a 200-hp. synchronous motor and accessories, valued at $3,500, for a Hawaiian plantation and an electrical dredge for Malaya amounting to $30,000. Other varied industrial orders include two 500-hp. motors with switchboard and accessories amounting to $45,000 for an ice company and a 250-hp. induction motor and special control valued at $6,000 for a Nevada mining company.

Numerous but scattered sales of motors, ranging from 100 hp. down, were made to lumber mills, pulp and paper plants, irrigation and orchards, machine shops and other industrial plants by Seattle jobbers. Big orders for electrical equipment for several proposed pulp and paper mills are still in abeyance. The city of Seattle awarded a contract for the Cedar Falls pipe line for $242,024. The city of Seattle also awarded contracts for 32 indoor type and two outdoor type regulators for $42,129 to the General Electric Company, and called for bids for a fourteen-thousand-dollar switchboard and about $3,000 worth of outdoor type reactors. The Great Northern Power Company, Seattle, is planning an expenditure of $10,000,000 for enlargement of its hydro-electric plant at Gold Bar. Transmission line extensions are planned by the Grays Harbor Railway & Light Company, the Washington Water Power Company and the Puget Sound Power & Light Company in various districts.

Construction projects are as follows: The San Joaquin Light & Power Corporation, Fresno, Calif., plans a substation on Ashlan Avenue to cost $80,000. The Western Oil & Refining Company, Los Angeles, will make extensions in its refining plant at Wilmington to cost $1,000,000. The Western Oxygen Company, Los Angeles, plans a new plant at Sacramento, Calif., to cost $100,000. The United States Indian Irrigation Service, Los Angeles, will receive bids until March 28 for boilers, etc. The Alexander Industries, Inc., plans a new plant at Colorado Springs, Colo., to cost $100,000. The Longview Fibre Company, Longview, Wash., plans a new power plant to cost $150,000. The Great Western Sugar Company, Denver, Colo., contemplates a beet sugar refining plant in the vicinity of Powell, Wyo., to cost $150,000. Los Angeles, Los Banos, Santa Maria and Modesto, Calif., and Pendleton, Ore., plan ornamental lighting systems.

## *Better Business in View in Middle West*

The slight recession in business noticeable during February in the Middle West is apparently halted and better business is in view as indicated by steel mill operations, car loadings, automobile sales and retail trade. There is still a fair amount of unemployment. Some apprehension is felt regarding the bituminous coal situation as a tie-up of operations will undoubtedly affect general business in the coal regions. Industrial activity continues generally favorable with considerable construction work in view. Building activity in the Chicago suburban district increased 8 per cent. Manufacturers of pole line hardware report good business, one manufacturer operating 24 hours per day. Maintenance purchasing is quite large, adding materially to the general volume of business.

Construction projects are as follows: The Arkell Safety Bag Company, New York, plans a new branch plant at Chicago, to cost $100,000. The United Felt Company, Chicago, plans a new mill to cost $150,000. The Illinois Northern Utilities Company plans a steam power plant at DeKalb, Ill. The National Plate Glass Company, Ottawa, Ill., plans an addition to its local plant to cost $175,000. The Solem Machine Company, Rockford, Ill., plans an addition to cost $125,000. Evansville, Ind., is asking bids, until March 29, for generators, steam engines, switchboard and auxiliary equipment. The Major Brothers Packing Company, Mishawaka, Ind., plans a three-story plant to cost $350,000. Hawarden, Iowa, will build an addition to its municipal power station. Anderson, Ind., is taking bids on a 12,500-kva. turbo-generator, condensing equipment and auxiliaries. Charles Brossman is consulting engineer, 1010 Chamber of Commerce, Indianapolis, Ind. Swift & Company, Chicago, plans a meat-packing plant at North Platte, Neb., to cost $150,000. The Beet Growers' Association of North Platte Valley, Scottsbluff, Neb., plans a beet sugar refining plant to cost $115,000. The Northwestern Public Service Company, Aberdeen, S. D., will make extensions in its power plant to cost $250,000. The Lakeshire Cheese Company, Loyal, Wis., plans a plant to cost $100,000. The Houghton County Electric Light Company plans a transmission line from Houghton to Chassell, Mich. The Cleveland Electric Illuminating Company, Cleveland, plans a 58-mile steel tower transmission line to cost $1,800,000.

# Activities of the Trade

## Cutter Company Now Known as I-T-E Circuit Breaker

The Cutter Electrical & Manufacturing Company of Philadelphia, manufacturer of "I-T-E" circuit breakers and "U-Re-Lites" for 40 years, has changed its name to the I-T-E Circuit Breaker Company. Philip C. Gunion, sales manager, said that the primary reason for changing the name was that the company was constantly being confused with two other electrical manufacturers of similar name, one of which is owned by a competitive organization. There has been no Mr. Cutter connected with the company for more than 25 years. The name of the product, the I-T-E circuit breaker, was used in giving the company a descriptive name that cannot be confused with the name of any other company. The policies, personnel and products of the I-T-E Circuit Breaker Company are identical with those of the old company.

## Sundh Electric Appoints New Officers

Following the resignation of Louis Larsen, general manager, the Sundh Electric Company of Newark, N. J., announces the appointment of Edward Quimby as general manager, and H. J. Kaufman as general sales manager. Mr. Kaufman has been with the company for the last eighteen years, serving recently as supervising sales manager with headquarters at Chicago. The company states that no other changes were made in the organization.

## Refrigerator Sales Show Promise in 1928

Refrigerator distributors of the General Electric Company at a two-day meeting at Cleveland voiced indications of a very good year for 1928. It was brought out that the barometer of public interest for electric refrigeration had gone up. "Although the country has absorbed other products, so far refrigeration has not been fully exploited," said P. B. Zimmerman, sales manager of the electric refrigeration department, in addressing the distributors. "In 1927 387,000 electric refrigerators were sold and it is estimated that the 1928 production will not be less than 500,000. Only 4.3 per cent of the total number of wired homes in the country are equipped with electric refrigeration. The year 1928 will be a good one for the industry as a whole and especially for the General Electric refrigerator. In every case where distributors are leading the field in their territory, their business volume is in direct relation to activity. This is very significant," Mr. Zimmerman explained. The two-day meeting was called to discuss distribution problems in sections of the country and to exchange ideas on proper organization of dealers.

Three hundred members of the Metropolitan district sales force and General Electric executives from Cleveland and Schenectady also met recently at a breakfast given by Rex Cole, Metropolitan distributor, at the Hotel Commodore, New York. Several men spoke on the growth of electric refrigeration. On Friday of this week a special train carried the guests of Mr. Cole to Schenectady to visit the laboratories and plants of the General Electric Company.

## Westinghouse Gets Order for Circuit Breakers

An order for switching equipment has been placed by the United Electric Light & Power Company of New York with the Westinghouse Electric & Manufacturing Company. This contract includes eighteen 5,000-amp., three-phase, horizontally segregated phase oil circuit breakers, disconnecting switches and associated details. The breakers have an interrupting capacity of 1,500,000 kva. at 15,000 volts. This breaker order is a duplicate of a previous one and makes a total of 36 such breakers now on order for the United company. The contract also covers 100 500-amp. automatic network protectors, which will be applied to feed three-phase, four-wire, 120-208-volt secondary networks.

Schweitzer & Conrad, Inc., 4421 Ravenswood Avenue, Chicago, manufacturer of high-voltage protective and switching equipment, announces the appointment of J. Leo Scanlon as New York City correspondent with office at Room 492, 50 Church Street.

The Mansfield Sheet & Tin Plate Company, Mansfield, Ohio, manufacturer of electrical sheets, has consolidated with the Ashtabula Steel Sheet Company, the Waddell Steel Company, the Thomas Steel Company, the Falcon Steel Company and the Empire Steel Company of Cleveland. The new organization will be known as the Empire Steel Corporation. The manufacture of electrical sheets will be continued at Mansfield without change under the direction of W. J. Wooldridge, as heretofore. The Empire Steel Corporation will specialize on enameling furniture, and stove sheets, light grade auto body sheets and its complete line of silicon-alloy electrical sheets.

The Condit Electrical Manufacturing Corporation, Boston, manufacturer of circuit breakers and power switchboards, announces the appointment of Harris & Butler, Real Estate Trust Building, Philadelphia, as sales representatives for the eastern Pennsylvania territory, including Delaware and southern New Jersey. The western Pennsylvania region, including West Virginia, Belmont and Jefferson Counties, Ohio, and the southern portion of Columbiana County, in Ohio, has been placed in charge of the E. S. Stickle Company, Union Trust Building, Pittsburg.

The Belden Manufacturing Company, 23d Street and Western Avenue, Chicago, manufacturer of insulated wires and cables, announces the removal of its office from 399 Market Street, Newark, N. J., to 39 Cortlandt Street, New York City. S. C. Schenck is Eastern manager.

The Electro-Nite Carbon Company, 306 North Fourth Street, Philadelphia, manufacturer of carbon brushes, announces that its Michigan office is now in charge of A. G. McMann and is located at 307 Basso Building, 7338 Woodward Avenue, Detroit.

The Electric Machinery Manufacturing Company, Minneapolis, manufacturer of synchronous motors and vertical alternators, announces the appointment of L. Brandenburger, 149 West Second Street, South, Salt Lake City, Utah, as its representative. R. R. Poppleton, Inc., 35 First Street, Portland, Ore., and 2963 First Avenue South, Seattle, Wash., also was appointed representative for Portland and Seattle.

Earle V. Hennecke, Inc., 247 Park Avenue, New York City, has been organized by E. V. Hennecke, formerly vice-president and general manager of the Moto Meter Company, Inc., Long Island. The company will furnish sales and advertising counsel to manufacturers of automotive, electrical and radio products, and also will act as a sales organization handling the complete distribution throughout the world for several large manufacturers.

The Graybar Electric Company, Graybar Building, Lexington Avenue and 43d Street, New York City, announces that J. A. Mayer has been appointed Oklahoma manager, with headquarters at Oklahoma City, and R. W. Conrad has been appointed sales manager at Tulsa.

The Allis-Chalmers Manufacturing Company, Milwaukee, announces the purchase of the Monarch Tractor Corporation of Springfield, Ill., manufacturer of crawler or tank type tractors. The purchase of the Monarch line now marks the entrance of the company into the industrial tractor field. The Monarch line will continue to be built at the Springfield plant.

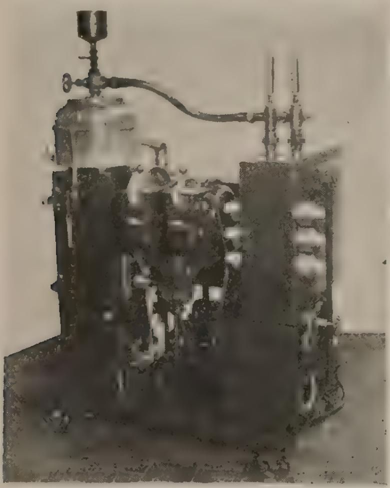
The Gurney Elevator Company, Inc., 1207 Race Street, Philadelphia, announces that Unit Rasin will have charge of sales in the Philadelphia district.

Combustioneer, Inc., 570 West Randolph Street, Chicago, has been organized by some of the officials formerly interested in the Iron Fireman Corporation of Chicago. The company is producing a new automatic coal-burning device for boilers rated up to 200 hp.

# New Equipment Available

## Oil Dehydrator and Filter

A new type of centrifugal separator and clarifier has been placed on the market by the "Positive" machinery division of the National Acme Company, Cleveland. The construction of the bowl and cylinders is such that it permits the use of a filter cylinder and filtering mediums, such as felt, linen, paper, etc. The company states that this combined centrifuging and filtering action not only dehydrates the oil but also removes the finest particles of suspended carbon. The separator is furnished in either stationary or portable types. Pumping, heating and cooling equipment are optional, but the company also is offering a portable separator with pumping equipment and immersion heaters mounted on a truck. The portable equipment is shown in the illustration.



*Portable type hydrator and filter with pump and immersion heaters mounted on a truck*

## Unit Pulverizer

Development made on different sizes of Riley "Atrita" unit pulverizers, made by the Riley Stoker Corporation, Worcester, Mass., are said by the company to give greater reliability, smoother performance and decidedly lower maintenance. The majority of these developments have been in the design and construction of the pulverizing elements. Originally the pulverizing elements consisted of small oval-shaped pegs. The next step in the development was the use of larger round pegs. This increase in the size of the pegs the manufacturer claims increased the life over the original design several times. With the peg type of construction it was necessary to install wearing plates on the rotor to take care of any tendency of the rotor to wear. The present construction consists of small cast segments which are installed on the rotor. The face of these castings acts as the wearing plate. The peg section of the unit casting is many times larger than the 2½-in. pegs previously used. Greater fineness of pulverization also has been obtained, as well as smoother operation.

The greatest feature of the new construction pointed out by the manufacturer is the low maintenance which has resulted from its use. The life of the pulverizing elements has been increased from four to seven times that of the peg construction. The method of supplying hot air to the unit pulverizer has also been redesigned to assure more effective use of hot air, which is particularly necessary when coal with a high moisture content is being used. The coils used in the magnetic separator have been entirely inclosed.

## Starter for Small Motors

A new motor starter with a maximum rating of 7½ hp. has been announced by the Westinghouse Electric & Manufacturing Company. The addition of this "Linestarter" now provides the company with a complete line of full voltage starting devices ranging from 1 to 75 hp. The starter comes equipped with hand reset of the thermal overload relay, but if automatic reset is desired the hand reset lever can readily be removed and an automatic reset obtained. The approximate dimensions of the dust-proof inclosing cabinet are 8½ in. wide, 12½ in. high and 5¾ in. deep and the approximate shipping weight is 15 lb.

## Elevator Control Devices

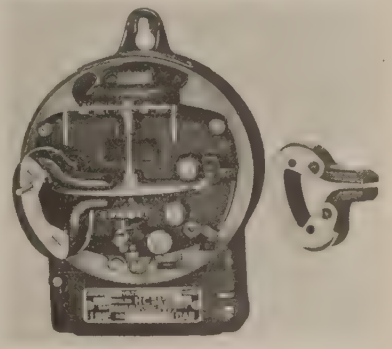
Three new control devices for elevator service, a limit switch, a reverse phase relay and a car switch, have been placed on the market by the General Electric Company. The limit switch is particularly designed for hatch mounting. It is suitable for emergency and overtravel limit protection on high-speed elevators and also may be used for normal limit protection on two-speed elevators, one limit switch being used for each speed. This limit switch is manufactured in three forms, as follows: Single-pole, double-break, normally closed; double-pole, double-break, normally closed, and single-pole, double-break, normally open.

The reverse phase relay is particularly designed for reverse and open-phase protection of elevator motors, although it is applicable to other types of service where the same protection is required. The car switch is designed for use with rheostatic control of either the alternating- or direct-current type and can be used either on single-speed or adjustable-speed motors. Two-point control in either direction of travel is provided.

## Watt-Hour Meter

The Sangamo type HC watt-hour meter that is temperature compensated on inductive and non-inductive load has been announced by the Sangamo Electric Company, Springfield, Ill. The company states that the improved performance of the type HC meter has been obtained without any fundamental change in the mechanical or electrical design of the type H, which was brought out in 1914. Such important parts as the upper and lower bearings, the full load and light load adjustments, as well as many others, are interchangeable between the type H and the type HC.

The outstanding changes and improvements incorporated in the type HC are stated by the manufacturer to be: (1) Complete temperature compensation on both inductive and non-inductive load. No appreciable variation in accuracy, at any power factor, from 20 deg. F. to 120 deg. F. (2) Straight line accuracy up to 300 per cent load. (3) Decrease in speed of 60-cycle meter so that both 25 to 60-cycle type HC meters have the same constant; this being 1,200 watt seconds for the 5-amp., 110-volt meter. (4) Reversal of direction of rotation (for purposes of standardization). Mechanical improvements also have been made.



*The dowel pins for the permanent magnet serve as thermal-responsive shunts*

Temperature compensation on non-inductive load is accomplished by thermal-responsive magnetic shunts in the permanent magnet system and on inductive load by use of a thermal-responsive magnetic shunt in the pole face of the potential magnet. At present the type HC is available only in capacities up to and including 25 amp., two and three wire, 60-cycle single-phase. Later, a complete line will be available at all frequencies.

Flashing Beacon.—A new single-color, one-way flashing beacon especially adapted for mounting at bridge entrances, approaches to railroad crossings, dangerous curves in highways and busy intersections has been developed by the General Electric Company. This device may be suspended by means of a hanger or mounted on a pipe. It consists of a standard reflector-type door assembly complete fastened to a casting containing the flashing mechanism.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Feb. 21, 1928)

1,660,084. Electrical Control System; E. R. Morton, New York, N. Y. App. filed Nov. 19, 1924. For controlling the frequency of wave generating devices.

1,660,093. Inclosing System for Electric Service Appliances; J. Sachs, Hartford, Conn. App. filed May 6, 1926. Meter service switch.

1,660,147. Electrolytic Gas-Generating System; W. G. Allan, Toronto, Ont., Can. App. filed Oct. 1, 1920.

1,660,150. Method of Volatilizing and Oxidizing Minerals; B. G. Cobb, Toronto, Ont., Can. App. filed April 6, 1921.

1,660,159. Production of Alloys of the Platinum Group; E. Haagn, Hanau-on-the-Main, Germany. App. filed Feb. 9, 1926.

1,660,161. Light-Dimmer Rheostat; E. H. Hansen, Metuchen, N. J. App. filed Nov. 2, 1923.

1,660,180. Combined Cross-Connecting Switch and Coupler for Electrical and Auxiliary Air Lines; H. E. Van Dorn, Chicago, Ill. App. filed April 19, 1922.

1,660,191. Current Regulating Means for Electric Induction Furnaces; C. B. Foley, Fort Wayne, Ind. App. filed March 23, 1922.

1,660,197. Electrical Relay; H. O. Holte, deceased, late of Pittsburgh, Pa. Orig. app. filed Sept. 9, 1924. Comprising a movable member arranged to be vibrated when alternating currents are supplied to the relay.

1,660,209. Electric Furnace; E. C. Sasnett, Washington, D. C. App. filed Sept. 24, 1919. Crucible induction furnace.

1,660,214. High-Tension Current Transformers; F. Ahrberg, Berlin-Halensee, G. Keinath, Berlin-Charlottenburg, and K. Schrader, Berlin-Halensee, Germany. App. filed Dec. 9, 1924.

1,660,218. Means of Heating Inclosures Electrically; C. L. Burgher, New York, N. Y. App. filed Oct. 27, 1925.

1,660,229. Storage Battery; P. Mallon, Paris, France. App. filed Dec. 16, 1927.

1,660,246. Process of Welding Cast Iron; H. V. Wille, Philadelphia, Pa. App. filed April 14, 1921.

1,660,256. Automatic Switch; J. T. Cowley, Syracuse, N. Y. App. filed Jan. 7, 1926. Particularly for use with refrigerating machines for controlling the motor in accordance with the temperature of the refrigerating chamber.

1,660,264. Method of Making Storage Batteries; E. A. Garlock, Baltimore, Md. App. filed July 15, 1924.

1,660,279. Separable Plug; S. R. Swenson, South Orange, N. J. App. filed Feb. 20, 1922.

1,660,285. Multiplier; E. F. Weston, Newark, N. J. App. filed Dec. 11, 1925. For a small indicating voltmeter.

1,660,290. Electrical Receptacle and Attachment; R. B. Benjamin, Chicago, Ill. App. filed July 14, 1920.

(Issued Feb. 28, 1928)

Reissue 16,892. Magnetic Motor; J. G. Ruckelshaus, Newark, N. J. App. filed June 11, 1926. For phonograph turntable.

1,660,317. Stand Lamp Construction; R. B. Benjamin, Chicago, Ill. App. filed June 5, 1924.

1,660,322. Voltage Regulator with Thermostatic Compensator; A. F. Brotz, Kohler, Wis. App. filed June 12, 1924.

1,660,390. Elevator Control Switch; M. B. McLauthlin, Malden, Mass. App. filed Sept. 17, 1921.

1,660,397. Battery Charging System; H. W. Sayles, Peoria, Ill. App. filed May 15, 1922.

1,660,399. Circuit Controller; W. C. Stevens, Milwaukee, Wis. App. filed July 26, 1920. For motors.

1,660,400. Exterior Operating Mechanism for Inclosed Circuit Controlling Devices; W. C. Stevens, Milwaukee, Wis. App. filed Nov. 8, 1920.

1,660,405. High Frequency Measuring System; H. A. Affel, Maplewood, N. J. App. filed Nov. 21, 1924.

1,660,422. Multiple Socket and Plug Device; B. P. McKinley, New York, N. Y. App. filed July 18, 1923.

1,660,425. Electric Butt Welding; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Sept. 10, 1924.

1,660,491. Method of Welding; J. A. Leeper, Wilkinsburg, Pa. App. filed Aug. 31, 1925.

1,660,498. Electric Grounding Connection; W. H. Vibber, New London, Conn. App. filed Feb. 6, 1925. Ground connection for a water pipe.

1,660,499. Conduit Grounding Bushing; W. H. Vibber, New London, Conn. App. filed April 3, 1925.

1,660,504. Pyrometer; A. A. Grubb, Mansfield, Ohio. App. filed Aug. 6, 1925.

1,660,518. Electric Pad; T. H. McComsey, Los Angeles, Calif. App. filed April 6, 1926.

1,660,534. Safety Lamp for Mines; H. Takata, Tokyo, Japan. App. filed Sept. 15, 1925.

1,660,548. Electrical Fixture; W. B. Crowell, New York, N. Y. App. filed May 3, 1926. Such as push button boxes; means for mounting.

1,660,556. Detachable Terminal Connection for Electric Stove Elements; J. McC. Gunn, London, Ont., Can. App. filed July 14, 1925.

1,660,562. Trolley Wire Holder for Electric Tramways and Other Railways; A. Linde, Muckenberg, Nieder-Lausitz, Germany. App. filed Sept. 3, 1926.

1,660,620. Brake; G. W. Lautrup, Yonkers, N. Y. App. filed March 18, 1926. Multiple shoe braking mechanism for elevator hoisting machines.

1,660,649, 1,660,650. Seal; R. D. Mailey, East Orange, N. J. Apps. filed Oct. 16, 1923 and June 16, 1925. In electric apparatus a seal between lead-ins and vitreous walls through which such lead-ins pass comprising fused silver chloride.

1,660,746. Motor-Traffic Signal; J. T. Dye, New York, N. Y. App. filed Sept. 14, 1922.

1,660,784. Resistance Element for Electric Irons and the Like; H. Blanksten, Chicago, Ill. App. filed May 8, 1922.

1,660,787. Electric Water Heater; A. Favale, Detroit, Mich. App. filed Dec. 8, 1926.

1,660,794. Light-Therapy Appliance; W. Hudson, Milton, Wis. App. filed April 11, 1927.

1,660,805. Method of and Apparatus for Electrobrazing; H. E. Moineau, Marlboro, Mass. App. filed Feb. 24, 1926.

1,660,807. Binding Post; O. B. Norgren, Chicago, Ill. App. filed May 28, 1925.

1,660,815. Pole Cable Terminal; L. M. Persons, Chicago, Ill. App. filed June 18, 1926.

1,660,827. Electrical Connecter; F. A. Anderson, Milton, Wis. App. filed Dec. 22, 1921.

1,660,828. Electric Fuse; R. M. Bird, Charlottesville, Va. App. filed Dec. 1, 1922.

1,660,863. Connecter Socket; O. A. Colby, Irwin, Pa. App. filed Jan. 23, 1923.

1,660,865. Switch Structure; R. C. Deale, Plainfield, N. J. App. filed July 16, 1925. For controlling the operation of planers and similar machine tools.

1,660,869. Wax Eliminator; L. V. Feike and J. R. Payton, Des Moines, Ia. App. filed Feb. 3, 1926. For use with a dentist's mold.

1,660,873. Trolley Conductor Support; B. Hines, Wilkinsburg, and H. N. Richards, Pittsburgh, Pa. App. filed Feb. 14, 1927.

1,660,874. Circuit Interrupter; C. H. Hodgins, Pittsburgh. Pa. App. filed July 15, 1920. Quick-acting type.

1,660,900. Relay; R. J. Wensley, Edgewood Park, Pa. App. filed April 16, 1918. For controlling rotary or synchronous converters.

1,660,920. Soldering Iron; H. J. Fanger, Oakland, Calif. App. filed Aug. 23, 1926.

1,660,921. Recording Galvanometer; R. Fischer, Frankfort-on-the-Main, Germany, App. filed May 4, 1921.

1,660,956. Coin Operated Rotary Time Switch; L. C. Eppler, Groton, N. Y. App. filed March 19, 1923.

1,660,965. Protective System; W. L. Hartzell, Chicago, Ill. App. filed Aug. 25, 1922. For the prevention of abnormal operation of polyphase induction motors and the like.

1,660,979. Current Control Device; W. J. Thayer, Westfield, N. J. App. filed June 30, 1926.

1,661,020, 1,661,021, 1,661,022. Elevator-Control System; E. B. Thurston, Toledo, Ohio. Apps. filed Dec. 10, 1921, May 8, 1922, and Sept. 28, 1923.

1,661,026. Electric Furnace; A. J. Asch, New York, N. Y. App. filed Feb. 4, 1927. As used in dentistry.

1,661,030. Weed Destroyer; W. E. Burt, Yuba, Wis. App. filed June 28, 1926.

1,661,054. Low Water Alarm for Boilers; F. E. Snyder and J. P. von Giesen, Bronx, N. Y. App. filed Dec. 27, 1926.

# New Trade Literature

CHAIN DRIVES. — The Morse Chain Company, Ithaca, N. Y., has issued a catalog covering the Morse silent chain drives. It describes the design and construction of these drives and contains price lists and reference tables. Illustrations showing the various applications of the drives to power transmission requirements in almost every industry are included. The catalog is virtually a handbook on silent chain drives.

SWITCHES AND PUSH BUTTONS.—The Clark Controller Company, Cleveland, is distributing bulletins 105-B and 110, describing and illustrating the Clark "Three C" starting switches for alternating-current motors, and the Clark "Three C" push buttons.

ELECTRIC RANGES AND WATER HEATERS. — A catalog issued by the Walker & Pratt Manufacturing Company, 31 Union Street, Boston, describes and illustrates the various types of "Crawford" electric ranges, water heaters and other "Crawford" electrics. Wiring diagrams and installation suggestions are also included. This catalog is being distributed by the Graybar Electric Company.

SWITCHES.—A series of new catalog sheets to supersede pages now in the company's catalog No. 17 are being distributed by the Trumbull-Vanderpoel Electric Manufacturing Company, Inc., Bantam, Conn., describing and illustrating its current breakers, its main line type "Mason" safety switches and type C inclosed switches.

LINE CONSTRUCTION.—A catalog issued by the Hoosier Engineering Company, 100 West Monroe Street, Chicago, entitled "Cutting the Cost of Transmission Line Construction" covers its overhead and underground line construction. An illustration and description of several typical installations are given.

ARC WELDING SUPPLIES.—A booklet issued by the Lincoln Electric Company, Cleveland, covers its line of welding supplies, including cables, glass, shields, welding electrode, rods, aprons, gloves, brushes, electrode holders, etc.

COUPLINGS AND EDGEWOUND RESISTORS. — Bulletins 103-A and 104-B issued by the Clark Controller Company, Cleveland, describes and illustrate the Clark "Three C" flexible couplings for operation in connection with motors driving reversing mill tables, pumps, compressors, cupola blowers, screwdowns, etc., and the Clark "Three C" edgewound resistors designed to suit all requirements of space or service. The bulletins contain tables of sizes, ratings, etc.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Toulouse, France (No. 30,044), for electric clocks and electric measuring instruments.

An agency is desired in Amsterdam, Netherland (No. 30,043), for household electrical appliances and wiring supplies.

Purchase and agency are desired in Vienna, Austria (No. 30,076), for household electrical appliances.

An agency is desired in Riga, Latvia (No. 30,049), for insulating materials.

Purchase is desired in Andheri, India (No. 30,096), of electric marble-polishing machines.

An agency is desired in Vienna, Austria (No. 39,045), for electric refrigerators.

Purchase is desired in Agua Prieta, Mexico (No. 30,094), of street lighting system equipment.

Purchase is desired in Ciudad Juarez, Mexico (No. 30,075), of complete ten-wire telephone line.

Purchase is desired in Palermo, Italy (No. 30,078), of tungsten lamp filaments.

Pawel Bitschan, Kredytowa 18, Warsaw, Poland, is interested in obtaining catalogs from American electric display sign manufacturers who desire to enter the Polish market.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## Growth in All Parts of the Union

THE best guide to the future is a study of the past. During the five years ended with 1927 sales of electrical energy by public utility plants in the United States increased at an average rate of $140,000,000 a year; from about $1,072,000,000 in 1922 to $1,783,000,000 in 1927. The energy output during the same period increased from 43,560,000,000 to 75,116,000,000 kw.-hr., or at a rate close to 6,300,000,000 kw.-hr. a year. On the whole the industry has thus expanded 73 per cent in output and 65 per cent in revenue in half a decade.

Such rapid growth is not unknown in recent business history, but it has in the main been confined to relatively new industries that are presumably in their period of most vigorous expansion, having passed through the initial developmental stage and having still far to go before their market approaches saturation. The electric light and power industry, however, is not a newcomer. Yet its gain since 1922, both in revenue and in energy output, was substantially equal to the whole magnitude in 1919. And 1919 is not so long ago. It may be safely assumed, therefore, that progress in the immediate future at least will continue at the same average rate as heretofore, with the attendant business in electrical goods of all sorts for added residential and industrial applications of power. Add also the necessary replacements of existing materials as they wear out or become obsolete, as well as all the requisite new construction in the power industry itself. The latter is meeting the increasing demands by the net addition of 2,000,000 kva. annually, aside from replacements. Nothing short of a nation-wide catastrophe, or radical interference with normal progress, is likely to affect so well established a trend, except very gradually, and any such catastrophe or interference would necessarily affect with equal severity our entire industrial equilibrium.

Further details are shown by analysis of regional figures. For this purpose the country has been divided into five major sections. Most rapid growth has occurred in the South Central States, particularly in the new industrial Southeast and in the farther Southwest. In that part of the country the output has doubled in the four years since 1923, rising in 1927 to 6,714,000,000 kw.-hr. Revenue, which exceeded $174,000,000 in 1927, fell short of doubling in four years, but more than doubled in five years. In 1927 the energy output exceeded that of 1922 by 138 per cent.

The next highest rate of growth in output occurred in the Atlantic States and amounted to 72 per cent in five years. Next comes the North Central region, with 69 per cent in the same period, and then the Western States with 63 per cent. Notwithstanding the difficulties that stand in the way of rapid load building in an old-established community, with industries long accustomed to the use of their own source of power, the increase in New England was 58 per cent. Were it not overshadowed by the still more rapid development elsewhere in the country this continued advance at 12 per cent annually would be considered remarkable. In many other lines of activity it would be extraordinary. It surely is evidence of constant growth in New England's industrial mechanism as a whole, for electricity constitutes the warp of the industrial fabric. Its increased use signifies more production. And what is here said of New England applies similarly, and in proportionate measure, to the changing electrical consumption elsewhere.

In actual output during 1927 the regional totals, in millions of kilowatt-hours, were: Atlantic, 27,086; North Central, 22,607; Mountain and Pacific, 13,727; South Central, 6,713; New England, 4,983.

In the several regions the revenue figures show the same changes as those for energy generated, except that the movements are generally a little smaller, as might be anticipated in view of the gradual decrease in the price of energy.

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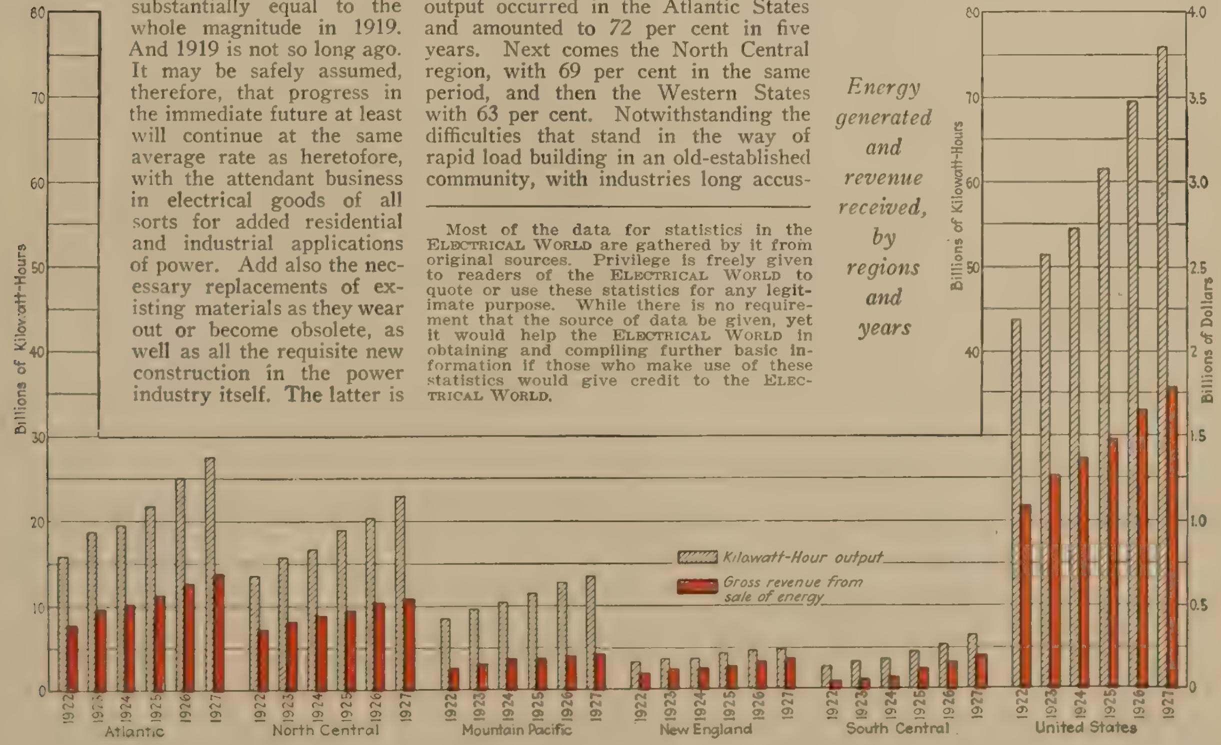
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.



*Energy generated and revenue received, by regions and years*

*Atlantic States have maximum output, South Central the fastest growth*

# Materially Increased Industrial Operations in Southern States

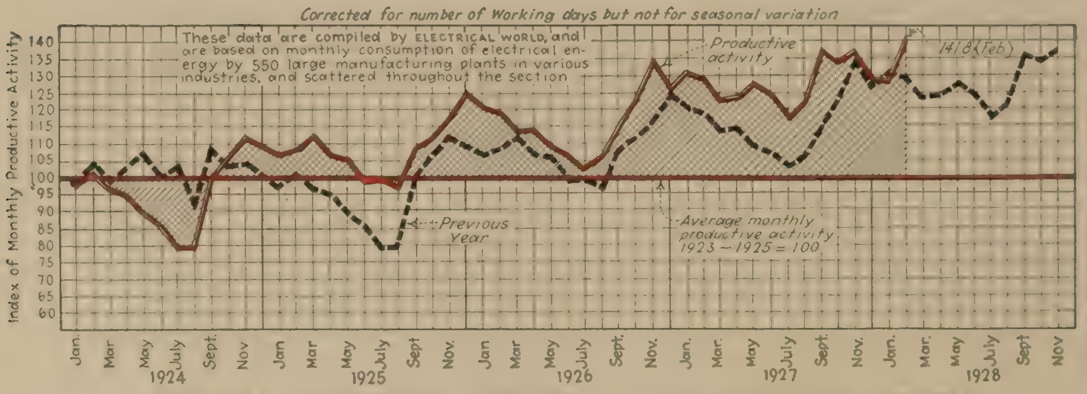
REPORTS on the consumption of electrical energy by the manufacturing plants operating in the Southern States indicate that the first two months of the year witnessed a slightly more than normal increase in the rate of industrial production in this section. February activity was about 11.5 per cent over January and 10.4 per cent over December. Compared with the same month last year the February activities showed an increase of about 9.4 per cent. An upward trend in the rate of production is to be expected at this season of the year, but the rate of increase witnessed from December through February was the greatest recorded in any year since 1923, which is the first year for which data on electrical energy consumption by manufacturing companies was collected.

*Indexes of Productive Activity in the Southern States*
(All Figures Adjusted for Number of Working Days)

| | Feb., 1928 | Jan., 1928 | Feb., 1927 | Average for Full Year 1927 | Average for Full Year, 1926 |
|---|---|---|---|---|---|
| All industries | 141.8 | 127.2 | 129.6 | 127.6 | 115.9 |
| Fertilizers | 121.7 | 115.0 | 224.0 | 109.5 | 184.3 |
| Metal industries group | 128.7 | 119.1 | 152.0 | 125.9 | 129.5 |
| Stone, clay and glass | 204.0 | 161.8 | 154.0 | 156.5 | 119.7 |
| Textiles | 145.7 | 132.6 | 149.2 | 146.0 | 117.9 |
| Paper and pulp | 136.5 | 135.3 | 127 5 | 126.9 | 118.3 |
| Lumber | 136.2 | 119.0 | 83.9 | 101.8 | 101.0 |
| Food | 129.1 | 125.1 | ..... | ..... | ..... |

These favorable conditions, however, have not been experienced by all of the basic industries of the Southern States. The textile plants, the most important industry of the section, reported a decrease in operations since December of about 4 per cent, and operations during February about 2.4 per cent under February of last year. This is the first time since 1924 that the February rate of textile activities has been under that of the same month in the year previous. On the other hand, the food, metal working, lumber, paper and pulp and the stone, clay and glass industrial groups all reported materially increased operations over the month of December.

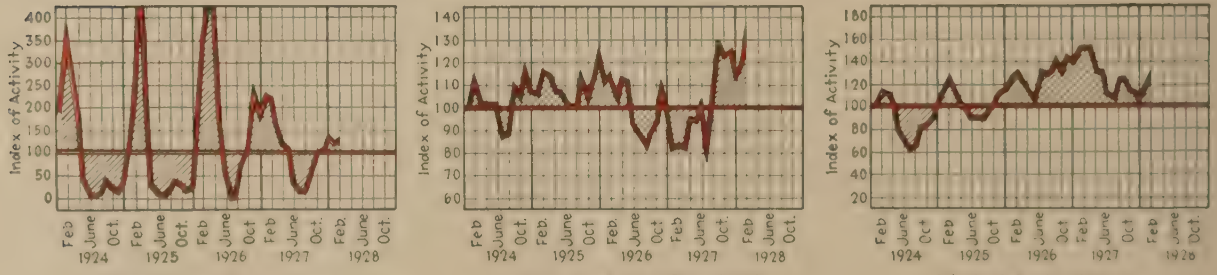
ELECTRICAL WORLD *Barometer of Industrial Activity in the Southern States*



**States in**
SOUTHERN
GROUP

Delaware
Maryland
District of Columbia
Virginia
West Virginia
**North Carolina**
South Carolina
**Georgia**
**Florida**
Kentucky
**Tennessee**
Alabama
Mississippi
Arkansas
Louisiana
**Oklahoma**
**Texas**

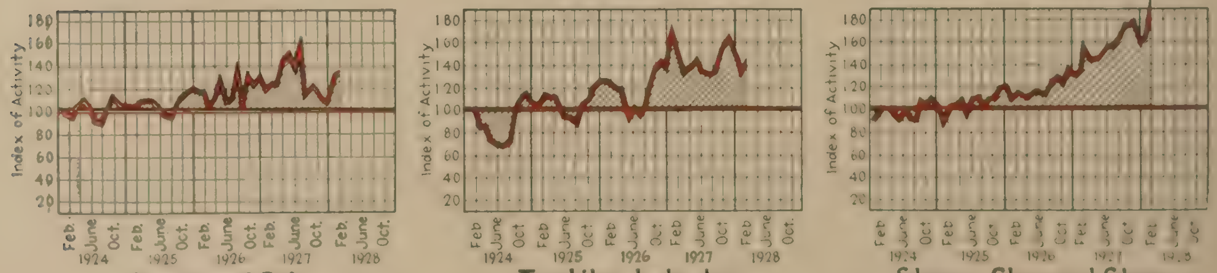
GENERAL INDUSTRIAL ACTIVITY IN THE SOUTHERN STATES



Fertilizer Industry

Lumber and its Products

Metal Industries



Paper and Pulp

Textiles Industry

Stone, Clay, and Glass

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE SOUTHERN STATES

# Electrical World

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W. H. ONKEN, JR.
*Editor*

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## *The San Francisquito Disaster*

JUST what caused the St. Francis Dam to burst in the night of March 12 and to unloose the deluge which brought swift death and destruction into the San Francisquito Canyon and the Santa Clara River Valley of southern California will eventually be revealed. The appalling fact is all that is certain at this writing, and its contemplation is far from gratifying to the engineering profession. Covering the blot for the present, however, with a mantle of charity, let us look with eyes undimmed by passion on the triumphs of engineering and of human relationships brought into action by the catastrophe.

Two generating stations of the city of Los Angeles, with an aggregate rating of 93,100 kw., are temporarily paralyzed because of the disaster. The Southern California Edison Company—thanks to its now adequate steam reserve—quickly took over the load of the municipal system and enabled the citizens of Los Angeles, so far as electricity supply was concerned, to go about their business as though nothing had happened. Magnanimous, one might say, considering the rivalry existing between the Power Bureau of the city of Los Angeles and the Southern California Edison Company; but nothing less could be expected of the Edison company. Engineering is no respecter of persons and calamity wipes out all rivalry. Besides, Chairman Miller, President Ballard and the entire Edison organization are so rooted and grounded in traditions of service that if human impulses and the needs of California did not stir them, their natural instinct for service would. The industry sympathizes with the Power Bureau in its affliction and rejoices in the fact that the Edison company so amply justified the confidence in it that every one familiar with its history and its spirit entertained.

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## *New York Legislature Passes Savings Bank Investment Bill*

PASSAGE without debate and without opposition by the New York Assembly of the bill authorizing savings banks to invest in the bonds of public utility companies doubtless presages its approval by Governor Smith, although Democratic senators from New York City opposed it. For more than five years the savings banks of New York have tried to get the state to permit them to invest in gilt-edge utility securities and now it appears that success will at last crown their efforts. This means that the utilities of the country will find the market for their bonds considerably widened and their credit position thereby strengthened.

Savings bank deposits in New York amount to $4,000,000,000, but, of course, all of this is not available for utility investment. Under the terms of the bill, however, at least $500,000,000 could be thus employed, enough to absorb many years' offerings of bonds measuring up to the standards set. This illustrates the size of the market with relation to the volume of offerings, and it is encouraging to feel that as other states liberalize their requirements the savings banks will absorb more and more of amply protected public utility securities.

* * * *

## *Mass Production in Steam Generation*

ON THE frontier of steam-generation developments the high-powered boiler unit is the heavy artillery of the advance. Recent improvements in furnace design centering upon the use of water-cooled walls and greatly increased volumes of combustion space point the way toward the building of boilers of colossal ratings compared with former units. Thomas E. Murray recently told the Midwest Power Conference that plans are now being made for boilers each having a capacity of 800,000 pounds of steam per hour; that the next installations will go to one million pounds per boiler, and that we may expect soon to have units large enough to supply individually all the steam required by turbines of 300,000 kw. or even greater rating. This development will not be a mere evolution of sizes, but will be accompanied by many radical changes. Mass production of steam will be the keynote of progress, however the line of development may swing toward or away from particular generating processes. Only by this means can the over-all efficiency and reliability of service now demanded by users of electricity produced from fuel be assured.

The art of steam generation bristles with interrogations. The economic values of the water-cooled furnace need to be brought out more widely from experience. The last word has not been heard from the manufacturers of refractories, if engineering history is instructive. The extent to which decentralization is desirable in pulverization systems, the place of unit dryers, use or non-use of air-heater and economizer combinations, simplification of boiler-control systems, betterment of practice in scale prevention and the choice of steam pressures and temperatures from the standpoint of dollar efficiency are all pressing problems. The performance of a commercial installation of the mercury vapor-steam process of power generation on the substantial scale embodied in the new South Meadow application at Hartford is awaited with intense interest. Other designs of steam generating apparatus are pressing for consideration here and abroad. Truly remarkable strides are being made, and while it is somewhat disappointing for the builder of a new station to be obliged to modify his plans for its enlargement almost from the day when its B.t.u.'s begin to return money on the investment, the keen struggle for over-all economic efficiency in the modern mass production of power presses irresistibly upon designer, operator and equipment manufacturer. Growing pains are not less healthful because of their acuteness.

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## *Senate Favors Government Operation of Muscle Shoals*

AFTER nearly three weeks of discussion, the Senate on March 13 passed the Norris bill dealing with Muscle Shoals. Senator Norris in his original measure sought to employ the proceeds obtained from government operation for experimentation with synthetic fertilizers requiring very little electricity. As the debate developed, however, Southern senators refused to abandon Nitrate Plant No. 2, which Senator Norris insisted was obsolete, and an agreement was reached whereby Plant No. 2 will be utilized to produce cyanamid, to determine whether it can compete commercially with the synthetic product. In order to secure Norris' support, however, the Southern senators had to agree to governmental distribution of power. Thus they defeated the amendment of Senator Harrison of Mississippi which would have eliminated the purely government operation feature of the Norris bill.

Under the measure as passed by the Senate, it is doubtful whether the Secretary of War will have much power to sell to the Southeastern power companies, because Plant No. 2 will require about 100,000 horsepower and states, counties and municipalities have a prior claim over private companies. Under the circumstances, therefore, and because of the fact that the power is subject to withdrawal for war purposes, the outlook for the power companies is not inviting. While no doubt an important factor influencing the vote of many senators was the "backwash" from discussions and action on the Walsh resolution to investigate the electric light and power industry, the result does not, as one senator insisted, "blaze the trail across the map of the United States for nationalizing the power industry."

The measure is now in the hands of the military committee of the House of Representatives, where other Muscle Shoals bills are under scrutiny. Whether there will be final legislation on Muscle Shoals at this session is problematical, although if the military committee reports the Norris bill favorably, the House, in its desire to rid itself of the Muscle Shoals white elephant, may approve it. The best interests of the South would decree otherwise, but politics is politics.

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## *Counsel Needed on What Housewives Think*

MORE than any other industry in the world, the electric light and power industry touches the people. It is not like the steel industry, which sells to railroads, to building erectors, to great manufacturers, and only through remote channels affects the individual. It is not like agriculture, which reaches its objective through the miller, the baker, the canner and the grocer. It is not like any industry in the world, because it touches at first hand every class and almost every individual, and it touches them almost every day. When the smallest customer snaps a switch he is in direct and instant physical contact with the company which supplies the energy he seeks. This truth places a heavy and unusual obligation upon the electrical industry's leaders. It requires that they shall know, appreciate, sympathize with and directly serve society down to its very dregs.

There is evidence that the central-station industry has been partial to "high hats," speaking in the vernacular, and to professional dignity. But this policy is bad for business, because the business deals with the humanities. Public servants must be "folks." If they cannot themselves be "folks," they must be guided by men who are. "I know of nothing more ridiculous than a gray-haired board of directors deciding on what housewives want," says a successful advertising man. Here in a sentence is a bookful. The men who decide "on what housewives want" should be men who know housewives—men who sell to housewives—men who understand how, why and when housewives think, and about what. These men are the salesmen. The salesmen should be invited into the industry's higher councils. They are needed.

* * * *

## *Record of the Electrical Manufacturers' Association*

THE progress which is being shown in the growth and development of the National Electrical Manufacturers' Association is an excellent example of the benefits that so often result from the patient process of making haste slowly. Last summer there were 285 electrical manufacturing companies listed in the membership and today there are 310. This in itself is significant. For manufacturers have always been by nature individualists. Industrial competition was originally just commercial warfare in which each man kept his own counsel and endeavored to outwit and to outsell his rivals. Then came the idea of co-operation. It was good and it took root. The trouble was that, as is so apt to happen, men in their enthusiasm went too far and their sound principle of co-operation for economic efficiency began to be distorted into selfish conspiracies among manufacturers against the public. Congress rallied to the defense of the people with the repressive and restrictive Sherman act and Clayton law. And manufacturers of all industries who had just begun to learn to work together were driven apart again. It has taken a long while for industry to discover what are really sound and safe purposes for organized co-operation, to regain confidence in the practical possibilities of association work and to restore a fair measure of enthusiasm.

It was natural, therefore, that when the electrical manufacturers year before last combined their apparatus and supply groups in one organization they should go forward cautiously. This spirit has been apparent in their meetings. Vigilant counsel has been a conspicuous brake on action, that the slightest appearance even of evil thought might be avoided. And this, of course, was right. Many have been impatient at times, however, that more constructive activities have not been undertaken more quickly. This is unavoidable until a revision of these laws some day shall give to industry the right to plan and build more freely in the public interest, in tune with the advancing thought of our increasingly industrial America.

The important point is this, that the N.E.M.A. is growing. It has more members, and these companies are gradually discovering and developing the elements of common interest and common purpose on which they may profitably work. Such groups must learn to discuss their problems freely together before they can expect to help one another solve them. The great need is always for facts, for the light of economic truth on which to base discussion. So they have been evolving a code of ethics and merchandising principles, and already eighteen sections of the association are compiling industry statistics on classes of products. These figures are incomplete and inadequate, but here is a start, of vital value to all branches of the electrical industry. And "Nema" should have the sympathy and support not only of all electrical manufacturers but of all electrical men.

* * * *

## *Mechanization and Unemployment*

IT IS alleged that mechanization of industry and the use of power produce unemployment and that existing conditions reflect this development in American industry. Some so-called cultural writers and some labor agitators seize this statement and use it with much apparent satisfaction. From census statistics it can be shown that present production methods can accomplish the 1914 volume in manufacture with about 30 per cent decrease in the number of workers and that this trend continues. Other data show that while the productive output per worker increased 40 per cent between 1914 and 1925, in the same period the total manufacturing production increased 65 per cent. Expanded markets because of lower costs of goods not only absorbed the 30 per cent of workers but called for 1,500,000 more workers in manufacturing plants. An increase of 1,500,000 workers and the use of 13,750,000 hp. additional power resulted in an increase in production of $39,000,000,000 in the twelve-year period.

The process of mechanization is a gradual one in all branches of industry, and in each branch it makes for employment instead of unemployment. It has made an increase of 40 per cent in national wealth and in national income since 1914. It has made possible new industries and the relocation of workers in a manner enabling them to secure continuous employment despite fluctuating business conditions in any single industry. It has reduced the cost of management 10 per cent and doubled the wages of workers since 1914. There is no basis for dire forebodings as to unemployment because of the mechanization of industry. This trend in the past as in the future offers the greatest available tool to improve the status of workers and lift them out of the "coolie" standards of living, if such standards still prevail in any occupation.

* * * *

## *Interchange Energy Introduces Metering Problems*

ON TRANSMISSION systems with extensive interconnections across state lines a difficult metering problem is encountered. For many reasons it is desirable to know the exact electrical quantities at each state-line crossing, but it is questionable whether the cost of metering equipment can be justified. At present very little energy crossing state lines is metered accurately, because values are based on generating-station energy measurements, energy sold to customers and estimated line loading and losses.

Generating-station metering is accurate and detailed for each hour of the day, but customer meter readings are monthly summations. As a consequence it is difficult to fix exact values for hour-by-hour or day-to-day kilowatt-hours and kilovolt-ampere-hours which cross state lines. Line loading changes rapidly, and electricity may flow in either direction during each day. With complex transmission systems it is difficult to draw an exact system load map for each day, and estimates are far from accurate.

Data on state line interchanges or at connecting points between utility systems have value largely as statistics and mean little to economic operation. Such data would help in allocating loadings for lines and stations more accurately, but it is questionable whether this would warrant a large investment in metering equipments. If a recording metering equipment for these applications can be developed at a low cost, there is little doubt that it would be used very extensively. The precision required is less than that for meters used in billing customers, and it would seem possible to develop high-tension metering equipment for this special application at a reasonable cost and in such a way as to decrease the service hazard introduced by current methods of metering.

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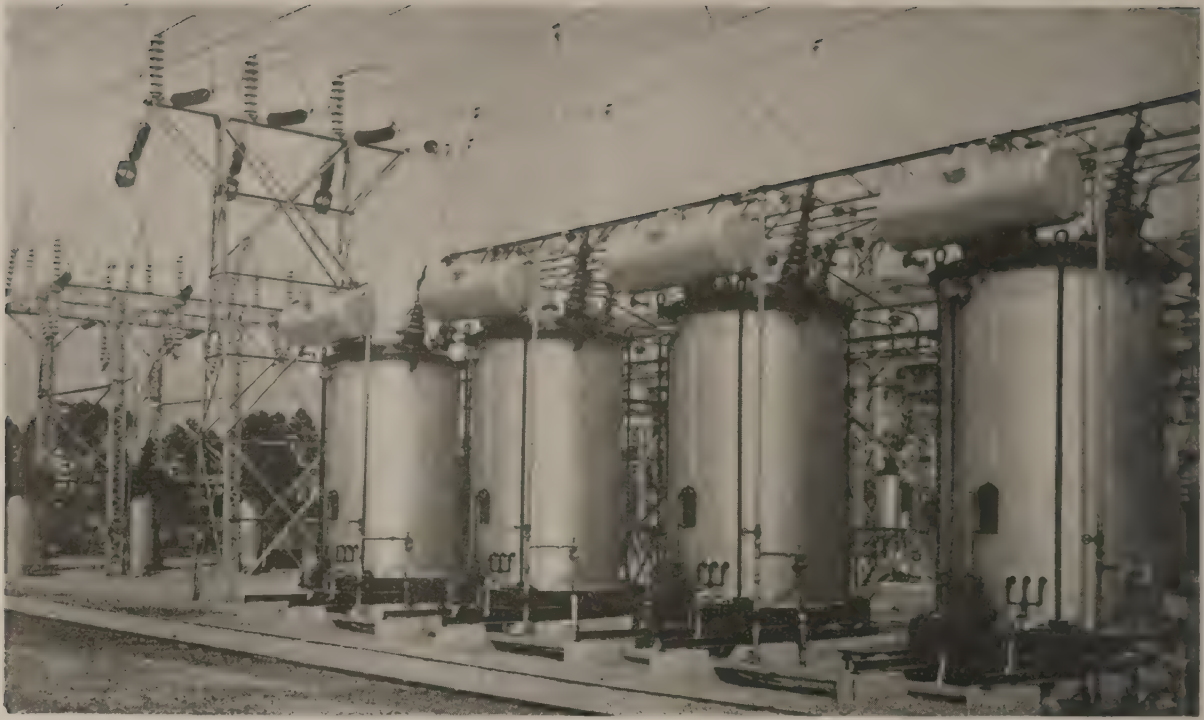
## *Prime Movers and Interconnection Stability*

WITH some reservations, the stability of interconnections between electrical systems is a measure of their value. It is not suggested that interconnections shall be so solid that in case of major trouble all of the systems shall stand together and valiantly and uselessly go down together. Neither is it intended that when a relatively small disturbance occurs they shall immediately separate like the sections of a glass snake and leave the afflicted part to suffer alone. But often enough to be embarrassing the systems in some interconnected groups, particularly those covering large areas of low-load density and linking together comparatively small and comparatively old generating plants, will perform in exactly the second way. They drop apart in spite of the very best intentions of their operators to keep them together.

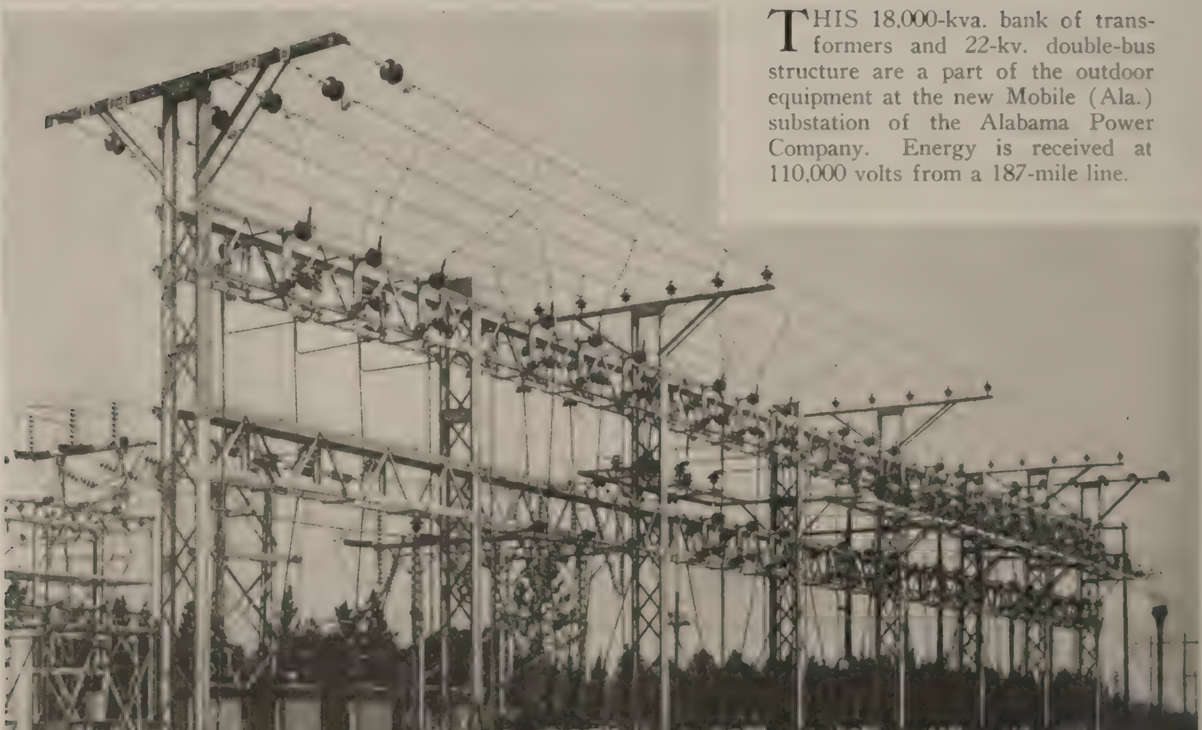
Possibly the trouble is due to lack of synchronizing capacity in the connecting lines. Or it may be due to hunting tendencies or the excitation responsiveness of the generators. In avoiding such weaknesses, however, the overload capacity of the prime movers should not be overlooked.

Sometimes the interconnected plants contain machines which supinely drop out of step whenever they receive a momentary heavy overload or secede from the union on equally trivial provocation. One holding company that controls a series of interconnected properties has laid down a policy in prime-mover purchases that is designed eventually to overcome this difficulty. All turbine units are specified to be able to carry a 50 per cent overload without reduction in speed for a period expressed in minutes. This specification does not affect the generator design, because the overload period is not long enough to produce an appreciable temperature rise. It affects only the steam end of the unit and in such a way as not to increase the cost or to decrease the normal operating efficiency. A unit of this kind will, of course, require that the boilers and auxiliaries be competent to carry their share of the overload. This requirement, however, merely makes it necessary that the overload performance be kept in mind during the course of plant design and shall not add greatly, if at all, to the cost.



# *New Automatic Substation in the South*

THIS 18,000-kva. bank of transformers and 22-kv. double-bus structure are a part of the outdoor equipment at the new Mobile (Ala.) substation of the Alabama Power Company. Energy is received at 110,000 volts from a 187-mile line.



# Single-Phase Condenser Motor

### Fractional horsepower motor characteristics, effect on economy of operation, application requirements, condenser motor theory and operation discussed

By Prof. BENJ. F. BAILEY
*University of Michigan*

UNTIL recently the users of small motors were interested only in price and reliability. Motors used for such purposes as operating vacuum cleaners, sewing machines or fans run only a small portion of the time and the cost of the energy consumed is negligible. The user is therefore not interested in efficiency, and as a rule knows nothing about the power factor or other characteristics of the motor. The central stations were not particularly interested since the connected load was small and was on the line only a small part of the time.

With the common use of electric refrigerators and oil burners requiring an electric motor the situation has radically changed. Such motors are used in enormous numbers and they are in operation a large percentage of the time. The user therefore should be interested in efficiency, since his monthly bill is considerable.

The average domestic refrigerator if equipped with some of the low efficiency motors now on the market will consume 750 kw.-hr. per year. By using the most efficient type of motor this may be cut to 500 kw.-hr. If energy costs 5 cents per kilowatt-hour the better motor will effect a yearly saving of $12.50. The saving in one year will easily pay the difference in cost between the two motors. In addition, the type of motor herein described is notably quieter than the usual single-phase motor and causes less interference with radio reception.

The progressive central station is interested in seeing that the motors on its lines are high in efficiency and power factor and require a low starting current. A low efficiency motor of course consumes more energy and therefore increases the central station revenue. On the other hand, small bills encourage the use of electrical appliances. When high-efficiency electric lamps replaced the old carbon-filament lamps the consumption of energy by no means decreased, but, on the other hand, showed a marked increase. Doubtless an improvement in motor efficiency would have a like effect in increasing consumption.

The central station is paid only for the energy consumed, since it is impracticable to meter power factor in domestic installations. The refrigerator and oil burner motors both operate on the peak of the load. A motor of low power factor is bad from the standpoint of the central station, since it requires a large current and consequently larger generators, feeders, transformers and switches. The best available ¼-hp., 110-volt, alternating-current motors require a current of only 2.5 amp. at full load, while the worst require 6.5 amp. It is rather surprising to find that to supply the better motor a metropolitan central station must make an investment of approximately $55 and for the poorer one $78, a difference of $23. The difference in cost between the two motors is far less than this. When a better motor is used the central station also gains by reason of better voltage regulation and lower losses in its feeders, generators and transformers.

Realizing the importance of the growing small motor load the Detroit Edison Company some three years ago financed an investigation of the characteristics of the fractional horsepower motors actually on the market, and about 25 small single-phase motors were carefully tested by the writer and his assistants. Some of the results obtained are shown in Figs. 1, 2 and 3. These motors are of the repulsion-induction and split-phase types. No condenser motors are included.

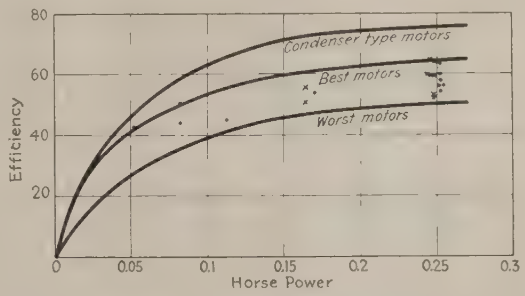


*Fig. 1—Efficiencies of small motors, 110-volt, 60-cycle, 1,800-r.p.m. Split-phase motors indicated by dots and repulsion-induction motors by crosses*

In Fig. 1 the full-load efficiencies of the motors tested have been plotted and two curves drawn showing approximately the best and the worst efficiencies of the present day commercial motors.

Considering, for example, the ¼-hp. motors, a simple calculation shows that the worst motors on the market, with efficiencies of about 50 per cent, consume about 373 watts at full load. The best commercial motors, with 64 per cent efficiency, require only 292 watts. If we compare the monthly bills of consumers using the poorest motors with those using the best motors it can be seen that there is a difference of 28 per cent.

On the same curve sheet I have also plotted full-load efficiencies which have actually been obtained with the condenser motors to be described later. It is entirely possible to obtain an efficiency of 75 per cent with a ¼-hp. condenser type motor. Such a motor would require only 250 watts for full-load operation and the monthly bill would be approximately two-thirds as great as with the poorest of the present-day motors, or approximately 85 per cent as great as with the best of the present-day motors.

In Fig. 2 I have plotted corresponding curves showing the power factor of small motors. The difference between the poorest and best motors is approximately the same as before. The upper curve shows power factors which can readily be obtained with condenser type motors. By using somewhat larger condensers it is perfectly possible to raise the power factor to 100 per cent, or even to cause the motor to take a leading current. In fact, condenser type motors are now on the market having power factors of more than 95 per cent. How high we should go is merely a question of how much it is worthwhile to invest to secure a high power factor.

In Fig. 3 I have shown the apparent efficiencies of small motors. The apparent efficiency is obtained by multiplying together the efficiency and power factor. Since the motors which have the lowest efficiencies usually have the lowest power factors as well, the divergence between the curves of best and poorest motors is even greater than before. It will be noted that some ¼-hp. motors have an apparent efficiency as low as 25 per cent, while the best run as high as 43 per cent. The condenser motor can easily be built to have an apparent efficiency of 65 to 70 per cent. The current required by such a motor is not much more than one-third of that of the poorest present-day motors and about two-thirds of that required by the best motors of other types. It is obvious from the standpoint of the central station that it is much cheaper to provide facilities to supply a motor requiring less than 2.5 amp. at full load than to supply one requiring 6.5 amp., and it is equally obvious that it is to the advantage of the customer to receive a monthly bill of $2 rather than one of $3.

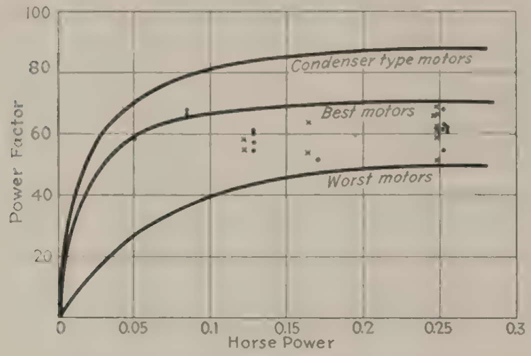


*Fig. 2—Power factors of small motors, 110-volt, 60-cycle, 1,800-r.p.m. Split-phase, dots; repulsion-induction, crosses*

### SPLIT-PHASE AND REPULSION-INDUCTION MOTORS

The circuits of a split-phase motor are shown in Fig. 4. The primary winding is usually on the stator, although it is sometimes placed on the rotor, and consists of a two-phase winding wound in slots. The winding marked 1 is the main or running winding. Winding 2 usually has fewer turns than winding 1 and is wound with finer wire. The switch $S$ is ordinarily automatically operated by centrifugal force, so that it opens when the motor attains its running speed. The non-inductive resistance marked $R$ is rarely present as a separate element, but the necessary resistance is secured by using finer wire in winding 2. This has the obvious advantage of cheapness. The rotor is usually of the squirrel-cage type.

When a motor must exert considerable starting torque with a low starting current the repulsion-induction type of single-phase motor is preferred. The stator is similar to that of a split-phase motor except that only a single winding is used. The rotor is like that of a direct-current motor having a commutator and brushes. These brushes are short circuited to one another and are not connected to the supply circuit. When the motor reaches nearly full speed a centrifugal device operates and short circuits the bars of the commutator to one another. The motor then operates as though it had a squirrel-cage armature. Its characteristics during normal running do not differ materially from those of the split-phase motor.

### SPLIT-PHASE MOTOR STARTING

The vector diagram of a split-phase motor when starting is shown in Fig. 5. $I_1$ represents the current in the winding 1 and it lags by a large angle behind the voltage $E$. The current $I_2$ in the winding 2 lags by a much smaller angle due to the fact that this winding has a relatively high resistance compared with its reactance. The two currents are therefore at an angle $\alpha$.

For the best results this angle $\alpha$ should be 90 deg., but it is obviously impossible to secure such an angle with this construction. The starting torque developed is proportional to the ampere turns in each of the windings, namely $N_1I_1$ and $N_2I_2$, to some constant which we will call $Q$ and to the component of $I_2$, which is perpendicular to $I_1$. It is then given by the formula

$$\text{Starting torque} = QN_1N_2I_1I_2 \sin \alpha.$$

In order to get sufficient starting torque in motors of this type it is necessary to make $N_2$ small. For a given size and weight of wire the impedance of the winding 2 is proportional to the square of $N_2$ and the current of $I_2$ is therefore inversely proportional to the square of $N_2$. The product $N_2I_2$ will therefore become greater as $N_2$ becomes smaller and the starting torque will be correspondingly increased. The number of turns $N_1$ in the main winding is of course fixed by the design of the motor and cannot be made unduly small without impairing the characteristics of the motor. Such a motor will quite obviously take a large starting current and develop only a comparatively small starting torque. The starting torque can, however, be made from 150 to 200 per cent of the full load running torque, but only at the expense of a large starting current.

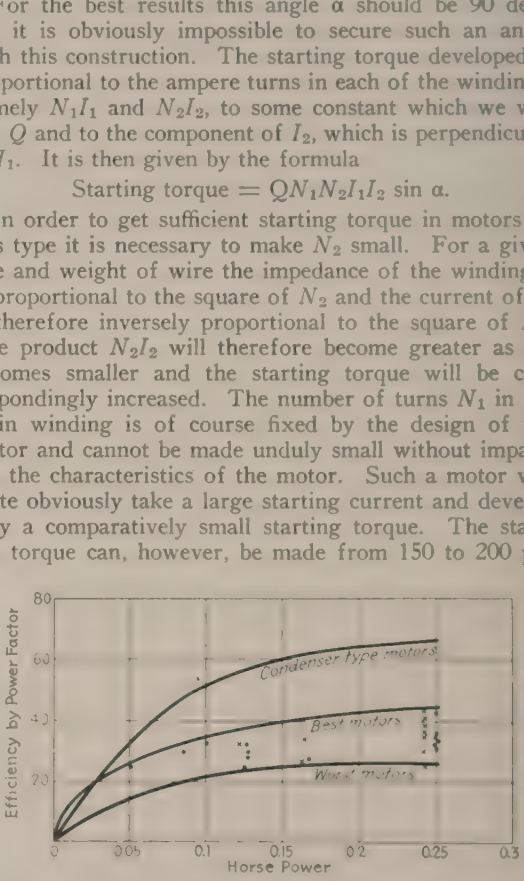


*Fig. 3—Apparent efficiencies of small motors, 110-volt, 60-cycle, 1,800-r.p.m. Split-phase, dots; repulsion-induction, crosses*

The starting efficiency of any motor can be determined by the following formula:

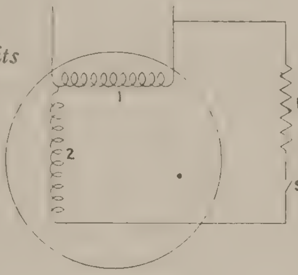
$$\text{Starting efficiency} = \eta = \frac{0.142\ TS}{\text{Volt-amperes}}$$

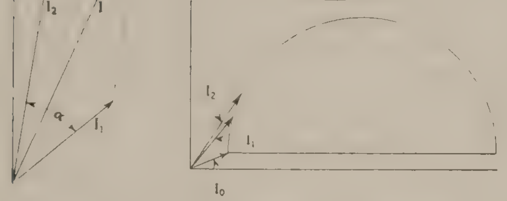
in which $T$ is expressed in pounds feet and $S$ is the synchronous speed in revolutions per minute. In the case of a polyphase motor proper allowance for the number of phases must of course be made in computing the volt-amperes.

The starting efficiency of a shunt-wound direct-current motor as determined by this formula is nearly 100 per cent, $S$ in this case being the free running speed of the motor. In the case of an alternating-current motor, $S$ is the synchronous speed and the starting efficiency is lower. For a squirrel-cage polyphase motor it is in the neighborhood of 20 per cent and for a wound-rotor polyphase motor about 50 to 60 per cent. In the case of the split-phase motor it is very low, being about 8 to 10 per cent. In other words, such a motor takes about ten times as much current for the same starting torque as a shunt-wound direct-current motor.

Under normal running conditions the switch $S$ is open and the winding 1 is alone active. The vector diagram of such a motor at full load is shown in Fig. 6. The current is shown lagging behind the voltage by a considerable angle. As is well known the locus of the end of the current vector for varying loads is approximately a circle. The current at very light loads is represented by such a vector as $I_0$, at full load by such a vector as $I_1$ and for overloads by such a vector as $I_2$. The power factor can never be 100 per cent. In general, it increases with the load up to about 50 per cent overload; beyond that it decreases.

*Fig. 4 (right)—Circuits of split-phase motor*





*Figs. 5 and 6—Vector diagrams for split-phase motor, starting and running, respectively*

Compared with a polyphase motor, such a motor has the disadvantage that it requires a very large starting current. Its output is small since the running winding occupies only a portion of the available winding space and its power factor is lower than that of a polyphase motor.

[The second part of Professor Bailey's discussion of the single-phase condenser motor will appear in an early issue.—Editor.]

## Hydro Plant Taps Two Watersheds

THE Great Falls hydro plant of the Tennessee Electric Power Company utilizes the waters of the Caney Fork River and also draws a supply through another penstock from the Collins River, which flows on the far side of a mountain ridge behind the plant. These two streams afford a reservoir equivalent of 6,000,000 kw.-hr. for the station, whose capacity is 35,510 hp.

# Long Cable Sections Reduce Expense

### Decrease number of manholes, splices, bonds, fireproof coverings, operating hazard, cost of cable, handling and installation

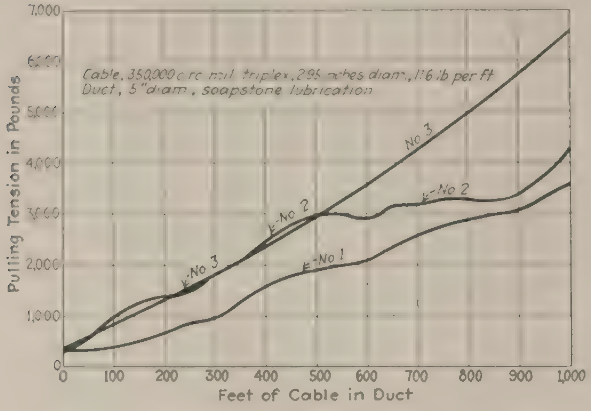
By C. H. Shaw
*Engineer Distribution and Installation Department, New York Edison Company*

MANHOLES and conduit structures are far more permanent than any cables that may be installed in them, so that in every important installation the design and arrangement of these facilities are usually based as much upon the expected requirements of the future as upon the immediate needs. The cost of the conduits and manholes is always very much greater than the cost of the cables installed in them, and when a large allowance is made for later growth the investment may be ten to twenty times the immediate cable cost. But since the increment cost of building one, two, four, or eight additional conduits, after the excavation, backfilling and repaving have once been undertaken, is only a fraction of the cost of the complete project, extra facilities are usually included with the original construction to secure the ultimate minimum cost per duct-foot of conduit.

Several new conditions have caused very rapid advancement in the design of underground conduit systems during the past two or three years. First, the unprecedented increase in the operating voltages for which cables have been designed has made it imperative that the detail arrangement of the cables in the ducts and the training, method of support and splicing of the cables in the manholes shall have expert engineering supervision; second, the introduction of large single-conductor cables, installed either singly or in multiple in the ducts, has made it advisable to increase the diameter of the ducts for many important feeder lines from the old standard of 3 in. to 5 in.; third, with the continuing advance in the operating voltages of underground transmission cables and the steadily increasing size of the generating units that are installed in the power stations it is important that the relatively permanent conduit structures be built of such sizes as will not in the future restrict the use of larger and higher voltage cables.

When the monolithic concrete conduit system that was later to house the highly successful 132,000-volt feeder cable in New York was under construction there were no data available upon which to base a decision as to the maximum length for which the conduit sections should be designed. But with the later adaptation of a continuous reading dynamometer, from which the pulling stresses required to draw cable into ducts could be secured readily, it became possible at once to develop new and more efficient methods for lubricating the cable during the pulling-in process and to discover the most advantageous lubricant for each type of conduit. These tests showed that the friction between the cable and the concrete walls of Murray monolithic conduits was almost entirely dependent upon the unit weight of the cable itself, as long as the cable was not too large for the duct.

Long sections of cable have several advantages. They reduce the number of manholes that are required in a given line and, as manholes are expensive, effect an important saving in the initial cost of construction. With a reduction in the number of manholes there is a corresponding saving in splicing, bonding and fireproofing of cables. The manholes are unquestionably more hazardous for the cables installed in them than are the individual ducts entirely surrounded by concrete. The cost of manufacturing long sections of cables is less per foot than for short sections, since all of the fixed processes, such as reeling up, impregnating, testing and crating, are almost independent of the length of cable section. With double the length of cable the unit cost of these processes is halved. The cost of installing one section of cable 1,000 ft. long is much less than the cost of pulling in two sections of 500 ft. each, and the investment in reels, cost of carting the cable to the job and of handling the empty reels is almost half as much per cable-foot for the long section as for two short ones.



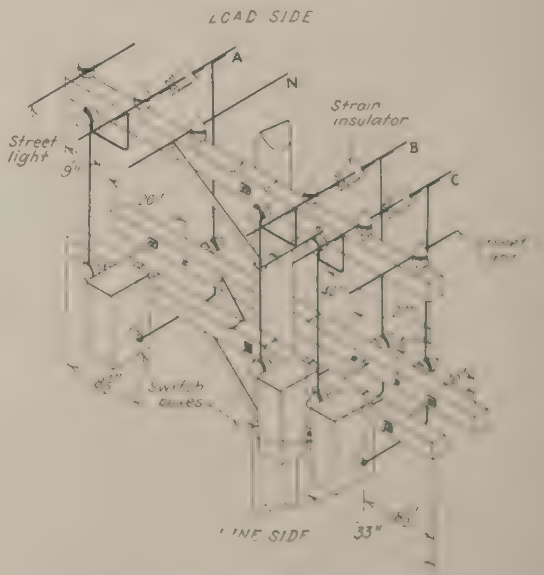
*Tensions required to pull three* 1,000-*ft. cables into Murray monolithic duct*

After the completion of the tests that revealed the low coefficient of friction that exists in properly lubricated Murray monolithic conduit structures, it was decided to build the maximum-length sections for which cable could be manufactured on an important underground transmission system from Dunwoodie substation in Yonkers to the Elmsford substation in Westchester, a distance of 11 miles. As the highway has a great many curves, only a few 1,000-foot straight sections could be fitted in. And as three single-conductor, 45,000-volt cables are to be placed in each duct the total weight of cable per duct-foot probably will be greater than ever before installed in so large an undertaking. In the first 7,000-ft. portion of the line to be finished there are three 1,000-ft. sections. With the completion of a series of trial tests it has been found that it will be practical to place the three 45,000-volt cables in one duct. All of these will not go in at one time, but will be installed in two operations, which will call for one cable first and for two cables to be drawn in over the first one in the second pull. The maximum pulling stress will not exceed 5,000 lb. per cable.

Over a portion of this line provision was made for the additional installation of two 13,200-volt feeders, and because of some unexpected developments it happens that one of these lower voltage feeders was the first to be installed for permanent operation. The installation of the three-conductor, 350,000-circ-mil triplex cable introduced an interesting problem, as the cable for this job was used cable, on hand in relatively short sections. These sections were duct-spliced in the salvage plant of the New York Edison Company to lengths of not more than 500 ft., this being the maximum length of this size cable that can be placed on a large standard reel. In order to install the 1,000-ft. sections a 500-ft. piece was first pulled in, with the end left above ground so that the duct-splicing crew could bring its equipment into the field and make a duct splice between the two 500-ft. sections, after which the cable was pulled in the remaining distance. This procedure was followed in several other sections of less than 1,000 ft. where the cable could not be placed on a single reel. The pulling tension of each of the three 1,000-ft. sections is shown in the accompanying diagram. The duct curve No. 3 had a slight bend in it, which accounts for the greater stress required than in the two other cases. This feeder, upon completion, was tested at 67,000 volts direct current for five minutes with a portable kenotron set and was found free from fault. If new 13,200-volt cable had been used it would have been made up as three single-conductor sections, each 1,000 ft. long and each on a separate reel. All three sections would have been pulled in together.

Unless manholes and duct entrances can be designed for expansion and contraction long cable sections cannot be used as the lead sheaths would crack. Experience shows that devoting careful study to the details of conduit and manhole design and construction not only reduces unit costs but produces much more acceptable cable operating conditions. The day of building important conduit lines without accurately prescribed grades and curves is over, and to consider that conduit construction is a mere pick-and-shovel job, as has been done all too frequently in the past, is much like leaving the design of the façade of an expensive building to the master bricklayer. While the developments that have been mentioned have been largely in connection with monolithic conduit construction, the tests that have been reported by the more important utility companies throughout the United States show an increasing appreciation of the importance of adequate engineering supervision.

## Mounting Disconnects for 4,000-Volt Circuits



*Standards of West Penn System*

# Capital Investment Rate Base*

### Economic defects of proposed Massachusetts plan of regulation. Inflation likely to follow application of price fixing to maintain stocks at par. Public welfare faces risks if bill passes

By PHILIP CABOT
*Head of Public Utility Courses*
*Harvard Graduate School of Business Administration*

A BILL before the Massachusetts Legislature (House 170) embodying the recommendations of the Governor and indorsed by the Department of Public Utilities proposes to create a new relation between the companies and the state by means of a contract fixing the amount paid in by the stockholders for stock and premiums as a permanent rate base on which the stockholders are entitled to receive a fair return, and rates are to be regulated in such a way that the profits of the companies shall be sufficient, but not more than sufficient, to keep the market price of the stocks at or above par. The object of this legislation is to obtain a necessary service for the consumers at the lowest possible price. This object is sound and wise, but I do not think that it can be reached by this method, because it violates certain fundamental economic principles. I shall confine myself strictly to these principles.

## RATE BASE MEASURED BY 65-CENT DOLLARS

The reason that this problem has arisen at this time is because of the wide divergence between the original cost of these utility properties and the present cost of reproducing them. This is an economic phenomenon observable in all business. There has been a general rise of prices since 1914 and the wholesale price index figure now stands at about 147, as compared with 100 in 1914. Now all economists agree that a general rise in prices is merely another way of saying that the value of the dollar has fallen. What has happened in this case is not that the prices of goods measured in other goods have risen, but that the yardstick with which we measure the goods is shorter. Values in most cases are not really higher than in 1914, but the dollars in which we measure them have shrunk to 65 cents.

What is proposed is that the property of these public utility companies shall be measured in these 65-cent dollars and that the value thus found shall be adopted as a permanent rate base and used to fix just and reasonable rates. Disregarding the possible injustice to investors of such a course, it would seem to be advantageous to the consumer because the purpose is to fix values at a low figure so that prices may be low and the consumer may benefit. If the value of these properties were measured by comparison with the prices of other goods and services; that is, on the basis of cost of reproduction new, the values and therefore the prices would be much higher.

Such consideration for the welfare of the consumer is commendable, but the question arises whether in the long run it will really benefit the consumer. I hold that it will not.

When prices rise, as they have in the last twenty years, it indicates primarily an increase in the demand for goods. For example, when the cost of building material rises it shows that more people are building houses, thus creating a demand for such material. Under normal conditions such a rise of prices works in two ways: (1) It tends to control the increase in demand, and (2) it tends to stimulate production of these materials and increase the supply. Prices will continue to rise until the demand is checked and the supply has increased, so that equilibrium has been re-established.

Now in the public utility business, production is increased by law; the companies are required to supply all the service that is demanded,† and under the method of regulation proposed by this bill prices, instead of rising to check the demand, are to be reduced. Thus the demand will be stimulated instead of being checked and the business will be expanded more rapidly than it would have been if the check of rising prices had been applied. Lowering prices always have the effect of increasing demand when the market is what economists call an elastic market. Most markets are more or less elastic—that is common knowledge—and the market for gas and electricity is very elastic, as the experience of the last twenty years has proved. It is, therefore, as certain as any economic result can be that if prices are reduced at the present time, when the demand for these services is excellent, the business will expand at a rapid and an abnormal rate.

## PRICE FIXING BEGETS INFLATION

This increased demand will require the expansion of the producing and distributing plants of the companies, and the expansion of them at a time when prices are high. The stimulation of demand by a lowering of price will force an abnormal expansion of plants and is likely to result in an overdevelopment of these industries. We have an ugly name for this sort of thing; we call it inflation, and it is a thing which we have learned to fear. It has often resulted from the efforts of governments to fix prices; in fact, it is the usual result, and we know that the ultimate effect on the consumer is bad.

The danger of inflation which I apprehend as a result of the method of price regulation proposed by this bill is the same as the dangers of currency inflation, with which you are all familiar, except that currency inflation affects all lines of business and this inflation will affect the public utilities alone. But the investment in them is

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**From an address to the legislative committee on power and light at Boston.*

†*Except in case of unprofitable extensions.*—[EDITOR.]

already very large, and if inflation of this industry is forced upon us by the action of the state the damage will be serious.

The matter is so important and the danger of it so great as to warrant a more detailed explanation. This is the way in which I think the thing will work. The demand for gas and electricity will be stimulated by low prices fixed by a rate base which will be about 50 per cent below the present cost of reproducing the properties. This increased demand will require the rapid expansion of the properties in the immediate future when prices of labor and material are high. As long as the prices are held artificially low, demand will continue to expand until a condition of inflation results. Under this bill the new plants will be paid for by new security issues, on which the state must practically guarantee a fair return because the stocks are to be maintained at or above par.

As long as the business continues to expand no difficulty will be encountered, but ultimately the end must come. A turn in the business cycle will come, demand will begin to fall and depression will set in. Then we shall be in trouble. The industry will be overexpanded; as demand falls off a large part of the plant will be idle, and revenues at current rates will be insufficient to pay fixed charges. An increase in rates will be necessary in order to maintain the prices of the stocks and this increase will come just at the time when there should be a decrease. Other prices will be going down, other business will be depressed, and in order to lift industry out of its depression lower prices for gas and electricity for industrial uses ought to be made. But that will be impossible. Regulating commissions will never stand the odium of raising prices for domestic service in order to help business. The rates for domestic service will stay down and rates for industrial service will have to bear the whole increase. The resulting burden on the community is difficult to gage, but it may be staggering.

### Bad Effect on Business Cycle

There is another economic angle from which this can be seen. The best brains in the country are being applied to finding some way to do away with the evils of the business cycle, or at least to mitigate the severity of it, but if this method of public utility rate regulation should be generally adopted the severity of the cycle would be very greatly increased. Artificially low prices in times of prosperity will force the utility companies into the market for labor and materials at the very worst time; that is, when prices are highest because business is good. When the depression comes the utility companies will be out of the market because their plants will be overbuilt and, to make matters worse, they will have to exact an increased price from industry when it can least afford to pay it.

By agreeing to fix rates which shall enable the companies to keep the prices of their stocks above par the commonwealth is repeating the blunder made in the public control act for the Boston Elevated Railway. Dividends in the stocks of the gas and electric companies will not be guaranteed, but when depression comes prices will have to be raised so that dividends can be earned, while the stockholders, who ought to take the risks of the business, sit back and let the commission do the worrying.

I am led to believe that this is a sound forecast of what may happen in the gas and electric industries by the example of what has actually happened to the electric street railway companies. These companies did, without intending it, just what I have described above. In fixing the 5-cent fare they set the price too low; the result was a rapid expansion of the business, ending in overexpansion, and when they tried to retrace their steps by raising their fares they found that the amount of business which they could get at the higher prices was too small to pay a fair return upon the plant. In most cases the stockholders stood the loss, but if the state had agreed to fix fares at a point which would keep their stocks above par the dilemma would have been serious, because we know by experience that there are many cases where no rate of fare which the public will pay is high enough to earn a return on the capitalization of the street railways. Just such a condition may arise in the gas and electric industry if the provisions of this bill are carried out. The plants of the companies may be expanded beyond the point where any rates that can be collected in times of depression will keep the stocks of the companies at par. In such a condition the state would be helpless. It would have agreed to fix prices which would accomplish this result, but it would be beyond its power to do so. Even the Commonwealth of Massachusetts must bow before the economic law. But the situation would be most humiliating and it is unnecessary.

There are already visible upon the horizon clouds which indicate that inflation is at hand in certain places in the electric power industry. This may perhaps be due to public regulation as now generally practiced, but the point is not clear. A certain rigidity in price regulation is unavoidable under any method of government control. There is bound to be delay in adjusting prices to changing market conditions, and the atmosphere of controversy and the spirit of litigation which hang like a cloud over all rate inquiries before the regulating commissions tend, so to speak, to make the visibility low. But the present methods have this great advantage over the method proposed by this bill. If inflation comes, and is followed by collapse in some cases, the state is not responsible for the losses which may ensue. These will fall where they belong, upon the stockholders.

I conclude, therefore, that the method of regulation proposed by this bill is not in the interest of the consumer. In the long run he will suffer, because this method violates a fundamental economic law, the law of supply and demand. The rigid rate base chained to the dollar is artificial and very dangerous.

If the rate base instead of being made rigid at an arbitrary point is allowed to move naturally with the price level and if prices are allowed to move up and down with other prices the dangers of overexpansion will be avoided. Cost of reproduction is a far safer rate base for the consumer than capital investment, because it will tend to check inflation, prevent overexpansion and keep the industry healthy.

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## Hydro-Electric Development in China

A HYDRO-ELECTRIC generating station has recently been completed near Yunnan, in the southeastern part of China. The installation comprises two stations working in series, one with a head of 47 ft. and the other with 52 ft. Each is equipped with one 300-kva., 3,300-volt generator. The power is stepped up to 23,000 volts for transmission over a distance of about 20 miles.

*Mobile substation follows Southern trend toward automatic equipment*

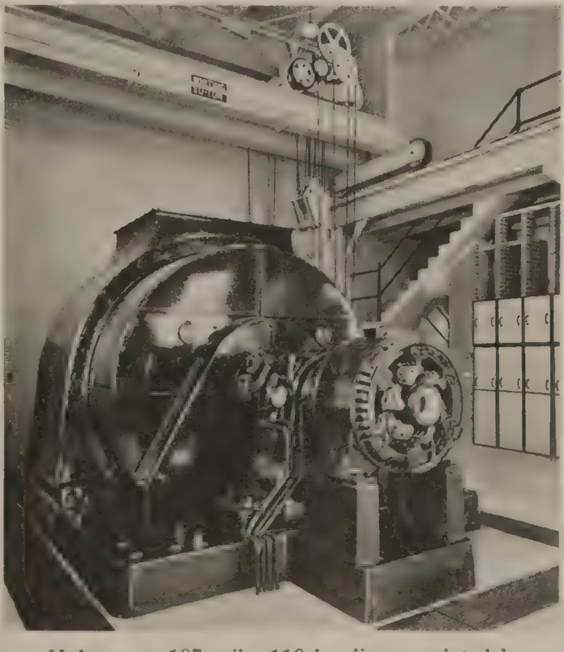
# Hydro Power on the Gulf Coast

Mobile, Ala., is second coast city to obtain power from streams of the South. Automatic operation of step-down substation with synchronous condenser described

By L. M. Smith and M. S. Merritt
*Engineering Department, Southeastern Engineering Company, Birmingham, Ala.*

"ON FRIDAY, Jan. 7, 1927, with appropriate public ceremony, hydro-electric power was ushered into the city of Mobile—Alabama's venerable and romantic 'City by the Sea.'" This brief statement of fact as read by the public in the daily press has in it, as every engineer knows, volumes of interesting but unchronicled studies, figures and experience that embrace between their inception and realization years of patience. The serving of Mobile, second city on the Gulf to receive hydro power, was no exception, and, if anything, more than the usual amount of study was necessary, as a glance at a map of southern Alabama would indicate.

For more than twelve months previous to the above-chronicled event engineering studies had been complete and construction crews had been at work on the 187-mile, 110-kv. transmission line between Mobile and the Lock 18 substation of the Alabama Power Company. For a somewhat shorter time construction work had been in progress on the new 18,000-kva. primary substation near Mobile and on the 22-kv. feeders radiating from it to serve a growing district of approximately 150,000 people.



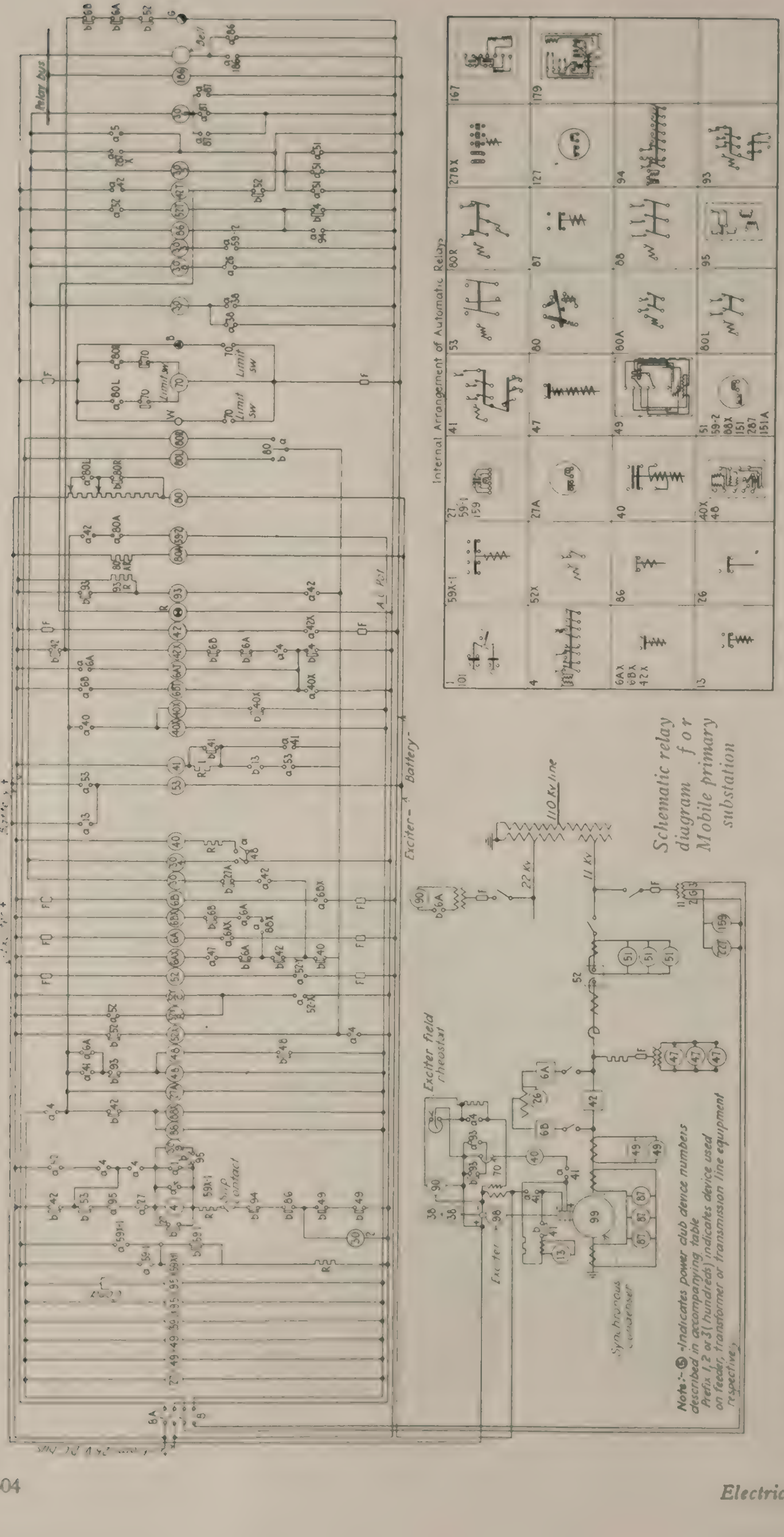
*Voltage on 187-mile, 110-kv. line regulated by 10,000-kva. synchronous condenser*

Of the many various phases of this project that could be treated only one will be undertaken at this time—namely, a description of the operation of the automatic equipment in the substation at the receiving end. This substation, on account of its importance to such a large and growing district, far removed from the source of power supply, had to include in its make-up provision for voltage control of the long line as well as every practicable device available that would insure to the city the same quality of service to which its neighbors up state had been accustomed. The selection of equipment, particularly that involved in the automatic operation of the substation, was therefore made with especial care.

If frequent reference is made to the elementary and schematic relay diagrams given herewith, the operation of this automatic equipment can be more readily understood. All devices are shown in their normal or de-energized position and auxiliary switches and contacts are marked *a* if open and *b* if closed when in normal open or de-energized position. The elementary diagram is for the automatic features of the synchronous condenser only, whereas the schematic relay diagram shows in full the wiring for the protection of and for the automatic features of the entire station except the condenser. All devices are referred to by standard power club numbers used by the Alabama Power Company and are completely described in the accompanying table.

The purpose of this automatic switching equipment is to start the 10,000-kva., 11,000-volt synchronous condenser and connect it to the line if conditions warrant; to reclose automatically the four outgoing 22-kv. feeder breakers when they trip with normal conditions on the 22-kv. buses; and to protect against abnormal conditions that might cause serious trouble. The operation of the condenser is entirely automatic after the pull-button switch is closed to release the equipment for operation, and this switch remains in the closed position until it is opened manually to take the machine out of service.

The condenser is started as an induction motor on reduced voltage from a starting auto-transformer, the condenser field being short circuited through a resistance during the starting period. Just as the machine reaches synchronous speed and the exciter voltage builds up, the starting



Schematic relay diagram for Mobile primary substation

Note:- ⑤ -Indicates power club device numbers described in accompanying table. Prefix 1, 2 or 3 (hundreds) indicates device used on feeder, transformer or transmission line equipment respective.

## *Devices and Relays Used in the Mobile Substation by the Alabama Power Company*

The key numbers given in the first column coincide with those used in text and on diagrams.

| No. | Type | Description |
|---|---|---|
| 1 | ............ | Master element |
| 4 | CR-2800 | Master contactor |
| 5 | ............ | Emergency tripping switch |
| 6A | FKR-132-A | Magnetizing oil-circuit breaker |
| 6AX | PB-54 | Hesitating control relay for 6*A* |
| 6AT | ............ | Magnetizing breaker trip coil |
| 6B | FKR-132-A | Starting oil-circuit breaker |
| 6BX | PB-54 | Hesitating control relay for 6*B* |
| 6BT | ............ | Starting breaker trip coil |
| 8 | LP-1 | Alternating-current control power switch |
| 8A | LP-1 | Direct-current control power switch |
| 11 | ............ | Control power transformer |
| 13 | PQ-33 | Synchronous speed device |
| 26 | TB-2 | Compensator thermal relay hand reset |
| 27 | IA-204Y3 | Alternating-current undervoltage relay |
| 27A | IA-204Y3 | Alternating-current undervoltage relay |
| 30 | Edwards | Annunciator |
| 38 | Foxboro | Bearing thermal relay |
| 40 | PB-55 | Alternating-current machine field relay |
| 40X | MC-10 | Auxiliary relay for 40 |
| 41 | CR-2810 | Field contactor |
| 42 | FKR-132-B | Running oil-circuit breaker |
| 42X | PB-54 | Hesitating control relay for 42 |
| 42T | ............ | Running breaker trip coil |
| 47 | PI-3 | Single or reverse phase voltage relay |
| 48 | MC-10 | Starting protective relay |
| 49 | TC-213D | Alternating-current thermal relay |
| 51 | IA-201 | Alternating-current overcurrent relay |
| 52 | O-221 | Line oil-circuit breaker |
| 52X | CR-2820 | Hesitating control relay for 52 |
| 52Y | 8 | Trip free control relay for 52 |
| 52T | ............ | Line breaker trip coil |
| 53 | CR-2800 | Exciter relay |
| 59-1 | IA-204Y3 | Alternating-current overvoltage relay |
| 59X-1 | PQ-25Y5 | Auxiliary relay for 59-1. |
| 59-2 | IA-204Y3 | Alternating-current overvoltage relay |
| 70 | CR-8422 | Motor-operated field rheostat |
| 80 | TR-W-1B | Direct-current undervoltage relay |
| 80A | PQ | Direct-current undervoltage relay |
| 80L | CR-2800 | Auxiliary relay for 80 |
| 80R | CR-2800 | Auxiliary relay for 80 |
| 86 | PQ-6Y | Current locking out relay hand reset |
| 87 | PQ-6Y | Differential current relay hand reset |
| 88 | CR-2810 | Oil pump motor contactor |
| 88X | IA-204-Y7 | Auxiliary relay for 88 |
| 90 | TA-T8 | Voltage regulator |
| 93 | CR-2810 | Field-changing contactor |
| 94 | CR-2800 | Tripping contactor |
| 95 | IJ-8Y1 | Underfrequency relay |
| 98 | Allis | Condenser exciter |
| 99 | Allis | Synchronous condenser |
| 127* | IA-204Y3 | Alternating-current undervoltage relay |
| 159* | IA-204Y3 | Alternating-current overvoltage relay |
| 167* | IB-1 | Reverse power relay |
| 179* | MD-2 | Automatic reclosing relay |
| 186* | PQ-6 | Bell alarm relay hand reset |
| 287* | IA-201 | Transformer bank differential relay |
| 287X* | PB-58 | Auxiliary relay for 287 |
| 227* | IA-204 | Alternating-current undervoltage relay |

* The prefix 1 to any device number indicates that the device is used on feeder equipment, and prefix 2 indicates its use on transformer equipment.

breakers are tripped and the running breaker is closed, connecting the condenser on full-line voltage. The short circuit is then removed from the condenser field and the field is connected direct to the exciter. The field resistance is then automatically adjusted to normal value and field current is applied as conditions warrant. If abnormal conditions arise at any time during the operation of the condenser, it will be shut down by some one or more of the protective devices described later.

The outgoing feeder breakers are first closed manually by pull-button control switches, and they may also be tripped by these switches. After automatic tripping of any of the feeders under normal conditions, the breaker will be reclosed three times and then locked out until the reclosing device for that breaker is reset manually, unless the breaker remains closed after one of the reclosures. In the latter case the reclosing device will reset automatically. This device for any breaker may be made inoperative at any time by opening a knife switch on the control panel.

With the foregoing explanation of the purpose of the automatic equipment a detailed description of the operations under normal and abnormal conditions will follow:

### Normal Operation

For normal operation, with all circuit breakers open and all protective devices reset, the 110-kv. line breaker is closed, energizing the 18,000-kva. transformer bank. Control switches 8 and 8*A* are then closed, energizing the 220-volt alternating-current control bus from the 2½-kva. power transformer 11, and the 125-volt direct-current control bus from the storage battery. If the alternating-current line voltage and frequency are normal, devices 27 and 95 close their *a* contacts and open their *b* contacts, and the condenser is ready to start.

The condenser is then released for automatic operation by closing pull-button switch 1. This energizes the coil of the master contactor, device 4, from the battery bus through the contacts of protective relays and *b* contacts of exciter relay 53 and running breaker 42, indicating that normal conditions exist, that there is no current in the field and that condenser is not connected to the line. Device 4 then closes its *a* contacts, energizing 27*A*; also 88, which starts the oil pressure pump for the condenser bearings; 88*X*, which starts to close its contacts; 48, which starts timing action, and 52*X*, which closes 52*Y*, which in turn closes 52. The closing of line breaker 52 makes a holding circuit for device 4, de-energizes 42*X* and 42*Y*, energizes condenser potential transformers and device 47. Voltage being normal, 6*AX* is energized through 47, *b* contacts of 6*A*, 40 and 42 closing 6*A*, which

## *Summary of Major Equipment Used in Mobile Step-Down Substation*

| Equipment | No. | Manufacturer | Type | Remarks |
|---|---|---|---|---|
| Power transformers | | | | |
| 6,000 kva., 110/22/11 kv. | 4 | Allis-Chalmers | O.I.W.C. | Capacity of each tertiary winding, 3,333 kva. |
| Station service transformer | | | | |
| 75 kva., 22 kv/230/115 volt | 3 | General Electric | O.I.S.C. | For station auxiliaries |
| Outdoor potential transformers | | | | |
| 500 va., 22 kv./110 volt | 1 | General Electric | O.I.S.C. | For regulator |
| 200 va., 22 kv./110 volt | 4 | General Electric | O.I.S.C. | For metering and synchronizing |
| Outdoor current transformers | | | | |
| 25-kv.-600/5 amp. | 2 | General Electric | K-202 | For metering |
| 110-kv. oil-circuit breakers | 1 | General Electric | FHKO-36-115B | Interrupting capacity 500,000 kva. |
| 25-kv. oil-circuit breakers | 7 | Westinghouse | O-221 | Interrupting capacity 455,000 kva. |
| 22-kv. lightning arresters | 4 | General Electric | Oxide Film | ........................................ |
| Synchronous condenser | | | | |
| 10,000 kva., 11 kv, three-phase, 60 cycle | 1 | Allis-Chalmers | ............... | Operates from tertiary of power transformers |
| Switchboard | | | | |
| 14 panel, 1½-in. slate | 1 | General Electric | 24x90 in. | Includes automatic equipment for condenser |
| Carrier current equipment | 1 | Westinghouse | ............... | 250 watt |
| Circulating-water pumps | | | | |
| 300 g.p.m. 70-ft. head | 2 | Allis-Chalmers | SH | For transformers and condenser |
| 110-kv. disconnecting switches | | | | |
| 400-amp. upright mounted | 1 | Southern States Equipment | VGL | For bypass on 110-kv. breaker |
| 400-amp. underhung mounted | 2 | Southern States Equipment | M | ........................................ |
| 22-kv. disconnecting switches | | | | |
| 400-amp. upright mounted | 24 | Southern States Equipment | "57" | Breaker disconnecting switches |
| 400-amp. horizontal mounted | 5 | Southern States Equipment | "57" | O. C. B. bypass switches |
| 22-kv. fuses | 14 | Schweitzer & Conrad | D | For potential and service transformers |
| Insulators | | | | |
| 110-kv. post | 27 | Jeffery-Dewitt | A-254; A-258 | 7 unit |
| 22-kv. post | 126 | Delta Star | DZO and ZDO | Post type |
| 11-kv. post | 43 | Delta Star | DK | Cat. No. 12590 |
| Disk insulators | 283 | Ohio Brass | No. 25622 | ........................................ |
| Traveling crane | 1 | Whiting | ............... | 30 ton |
| Storage battery | 1 | Electric Storage Battery Co. | MVJ-9 | 60 cells |

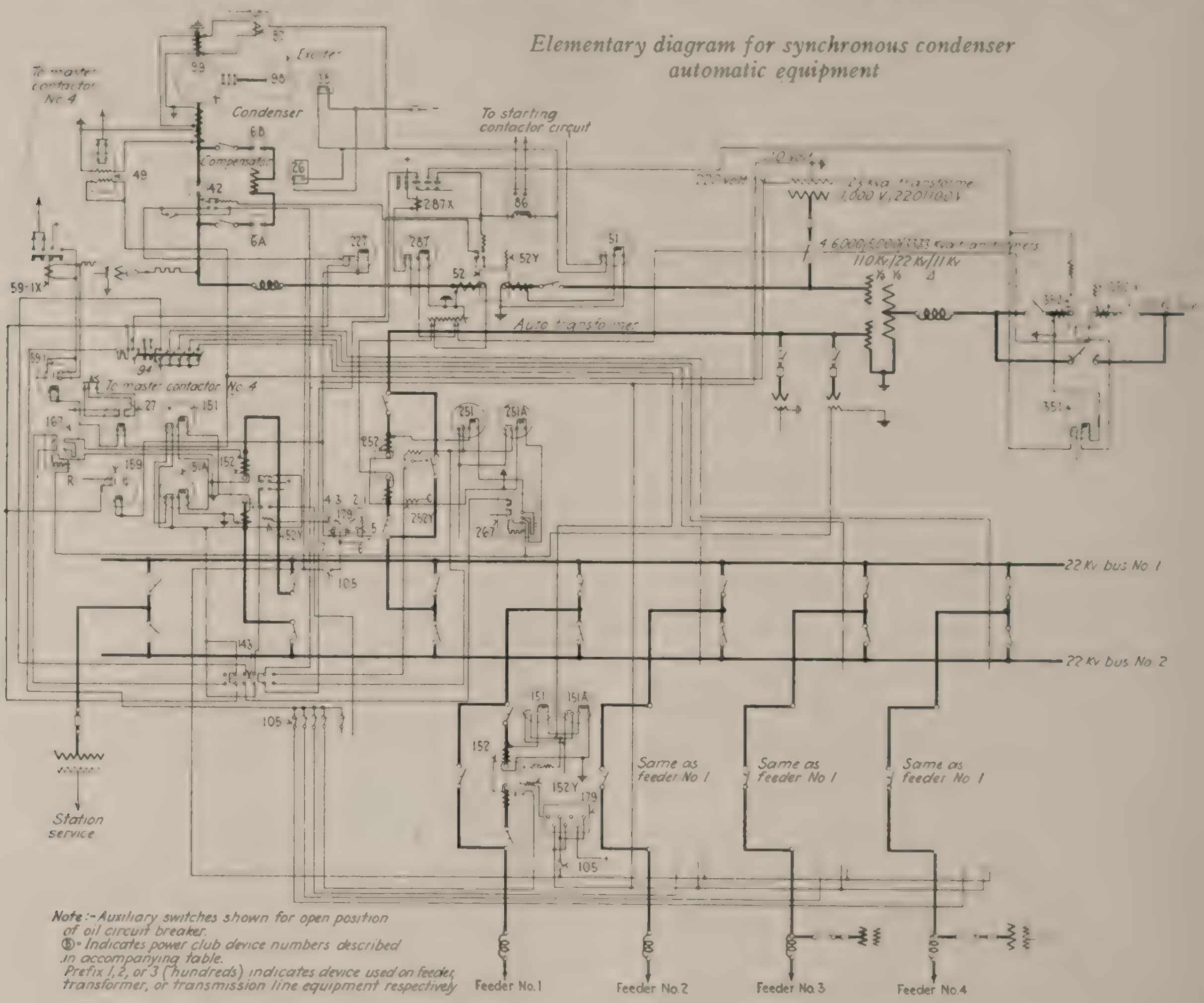
energizes the condenser-starting compensator. After a time delay 88*X* has closed its contacts, which energizes 6*BX* when 6*A* reaches its closed position, starting the condenser 99 to rotating.

The starting of 99 induces a heavy current in its field, causing synchronous speed device 13 to close its *a* contacts and closing the circuit to coil of 53 to the exciter leads. As 99 approaches synchronous speed the exciter voltage builds up to such extent as to operate the exciter relay and the current dies down in the field, allowing 13 to drop back, opening its *a* and closing its *b* contacts. The exciter relay 53 forms a holding circuit for its coil and with *b* contact of 13 energizes the coil of the field contactor 41. The closing of 41 removes the short-circuiting discharge resistor from the condenser field and connects the field to the exciter through high resistance, allowing sufficient current to flow to operate the field relay 40 with the aid of the potential winding. The closing of 40 breaks the closing circuit to breakers 6*A* and 6*B*, and closes timing relay 40*X*. The holding coil of 40*X* remains energized, but after a time delay opens its motor circuit and closes a circuit to the trip coils of 6*A* and 6*B*, and sets up closing circuit to the control relay 42*X*. When 6*A* and 6*B* trip, 42*X* is energized, closing the condenser running breaker 42, which connects the condenser on full-line voltage. Device 93 is then energized, which in turn closes its contacts, shunting out the high resistance in the field and allowing the voltage to build up to normal value. The condenser is now connected to the line and under the control of the voltage regulator, since the opening of the magnetizing breaker 6*A* closes the alternating-current potential circuit to the coil of regulator 90 through *b* contacts of 6*A*. If now the line voltage is too high, the contacts of 90 open, inserting resistance in the exciter field, which in turn decreases the condenser field, causing the condenser to operate at lagging power factor. Below a certain voltage the exciter operation becomes unstable, and to enable it to operate at a more efficient point direct-current undervoltage relay 80 drops out, closing its *a* contacts and closing circuit to the coils of 80*R*, which in turn operates the motor of the main field rheostat 70, cutting resistance into the condenser field, causing the condenser to operate at a still lower power factor. Regulator 90 then cuts resistance out of exciter field, allowing exciter voltage to return to a normal value. Device 80 then opens its *a* contacts, de-energizing 80*R*.

If the line voltage is too low, the regulator 90 increases the exciter field, causing the condenser to operate at leading power factor. If the exciter voltage should become too high, undervoltage relay 80 closes its *b* contact, energizing 80*L*, causing the motor-operated rheostat to decrease the resistance in the condenser field. The regulator 90 then brings exciter voltage down to normal, and 80 opens its *b* contact, de-energizing 80*L*.

With the condenser now on the line and the 22-kv. bus voltage normal, the control switches for the four feeder breakers are operated manually, closing these breakers, 152, through a circuit to 152*Y*. The control switches also set up circuits to the four reclosing relays 179, which circuits remain made until the control switches are operated to the trip position.

*Elementary diagram for synchronous condenser automatic equipment*



*Note:—Auxiliary switches shown for open position of oil circuit breaker.*
*⑤—Indicates power club device numbers described in accompanying table.*
*Prefix 1, 2, or 3 (hundreds) indicates device used on feeder, transformer, or transmission line equipment respectively*

## Abnormal Operation

This automatic equipment provides protection against abnormal operations, which are divided into two classes:

1. Transient troubles for which the condenser is shut down temporarily and prevented from restarting until normal conditions are restored:
    - (*a*) Undervoltage on bus.
    - (*b*) Overvoltage on bus.
    - (*c*) Reverse power through the transformer bank.
    - (*d*) Overheating of stator windings.
    - (*e*) Underfrequency.
    - (*f*) Overload on feeders.
2. Serious troubles which prevent resumption of opera-

tion until equipment is inspected and devices reset by hand:

(*a*) Failure of transformer windings.
(*b*) Failure of condenser windings.
(*c*) Overheating of condenser bearings.
(*d*) Incomplete start of condenser.
(*e*) Overheating of starting compensator.
(*f*) Overload on the condenser.

These operations will now be described in more detail.

### TEMPORARY SHUTDOWNS

*Undervoltage.*—With undervoltage on the alternating-current bus, relay 227 closes its *a* contacts, closing the circuit to the coil of tripping contactor 94, which in turn trips breakers 52, 152 and the bus tie breaker if the latter is operating as a feeder breaker. Upon tripping of these breakers by relay 227, relay 27 opens its *a* contact, which prevents the condenser restarting until normal voltage is restored. When this occurs, 27 closes its *a* contact, starting the condenser, which, as previously described, is then connected direct to the line by breaker 42. Reclosing relays 179 then close feeder breakers 152, also the bus tie breaker if operating as a feeder breaker.

*Overvoltage.*—If excessive voltage conditions occur with the condenser in operation, overvoltage relay 159 closes its contact, energizing contactor 94, which trips the feeder breakers and 52. At the same time 59-1 closes its *a* contact and opens its *b* contacts, energizing coils of 59*X*-1, which shunts out coil of 4 and holds it out until normal voltage is restored. When this occurs, 59-1 closes its *b* contact, allowing 59-*X*-1 to open its *a* contact so that the condenser restarts and the feeder breakers 152 reclose directly after the condenser is connected to the line.

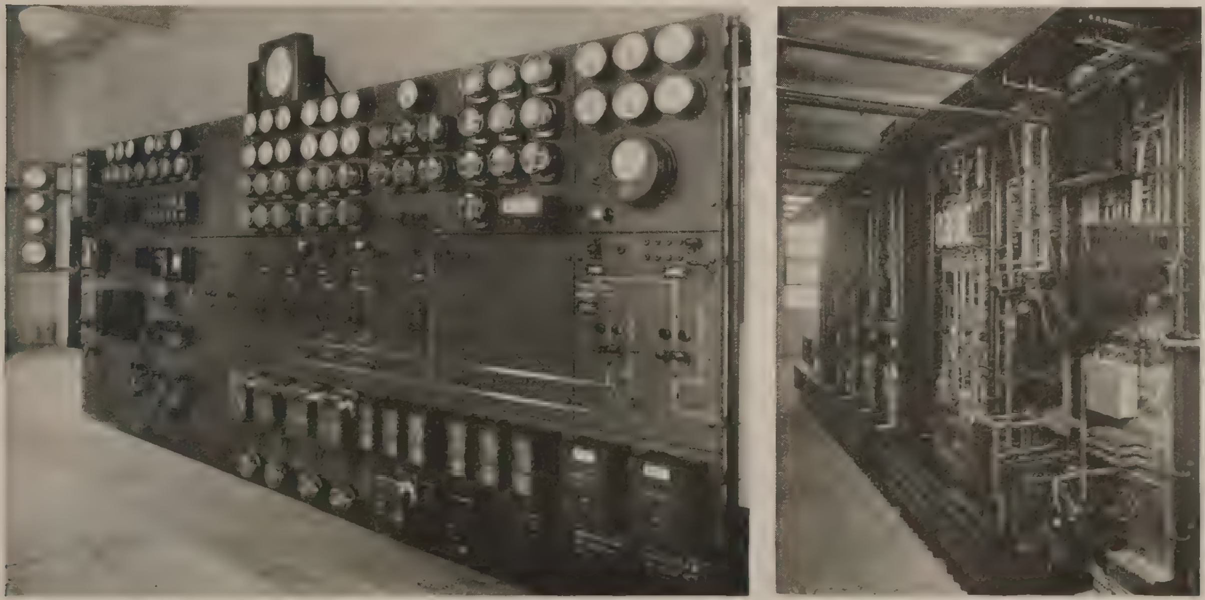
*Reverse Power.*—When any of the feeders are connected to the local steam plant and that plant is generating, the reclosing features of 152 are made inoperative by opening a knife switch on the front of the switchboard. For trouble on the 110-kv. line the steam plant contributes to the trouble and causes reverse power to flow through breaker 252. This reversal of power causes relay 267 to operate, energizing the coil of 94, which trips the 22-kv. feeder breakers and the condenser breaker. When alternating-current voltage is restored on the transformer bank, the condenser restarts automatically, but the feeders must be synchronized by hand, as the reclosing scheme is inoperative due to the operation of the steam plant.

*Overheating of Stator Windings.*—For the protection of the stator windings against overheating, thermal relay 49 contains an element with the same heating characteristics as stator windings, so that when current flowing through these windings reaches an excessive value and continues for a period sufficient to cause overheating, 49 opens its *b* contacts, which de-energizes 4 and holds it out until the thermal element has cooled to such a value as to allow its *b* contacts to close again. Tripping or opening of the *b* contacts also causes the annunciator to operate.

*Starting auto-transformer for 10,000-kva. synchronous condenser*

*Underfrequency.*—When the system frequency drops to 5 per cent below normal, relay 95 closes its *b* contacts and opens its *a* contact, the former shunting out coil of 4 and operating the annunciator; 4 prevents restarting the condenser until the frequency is restored to normal.

*Overload on Feeders.*—Should an overload develop on any feeder, its breaker opens due to action of overcurrent relay 151 or ground relay 151*A*. The *b* auxiliary switch of breaker 152 then closes a circuit to 179*X*, which completes the circuit to the release coil of reclosing relay 179, which allows its armature to rotate. After one minute the first arm of this relay closes its front contact, closing an auxiliary relay, which seals itself in. The back contact is then closed by the first arm, which recloses breaker 152 through 152*Y*. If 152 remains closed, the operating disk of 179 makes a complete revolution and resets itself for a new cycle, but if the breaker reopens within one minute, the second arm of 179 repeats the action of the first arm. If the feeder is still subjected to overload, 152 again trips and is reclosed for a third time by the third and last arm of 179. If after the third reclosure overload still persists, 152 again trips and closes its *b* switch. In this case there will be no reclosure, for after one revolution of the disk of 179, if the release coil is still energized, a stop arm engages the disk and holds it in the lock-out



*The switchboard in Mobile substation is compact and neat, as indicated in front and rear views* position until 179 is reset by hand. If, however, 152 remains closed after either the second or the third reclosure, 179 returns to the reset position ready to begin a new cycle.

### Permanent Shutdowns

*Failure of Transformer Windings.*—Upon failure of the power transformer windings a differential current flows in the leads from the high-tension and low-tension windings, causing relay 287 to close its contacts, operating 287*X*, which trips breakers 252, 352 and 52 and operates relay 86, locking out the condenser and giving an alarm to the operator.

*Failure of Condenser Windings.*—Failure of the condenser windings causes a differential current to flow between the condenser bus and the neutral leads. This current operates machine differential relay 87, which closes its *a* contact, tripping breaker 52 through lock-out relay 86 and giving an alarm through annunciator 30.

*Overheating of Bearings.*—Overheating of the condenser bearings causes the dial type thermometer 38 to close its contacts, which are set at the maximum safe operating temperature. Closing of these contacts operates 86 to trip 52 and to give an alarm through 30.

*Incomplete Starting.*—When the starting sequence is initiated, the magnetizing breaker 6*A* closes, energizing the starting protective relay 48, which starts a timing action. If after a definite time delay sufficient for the machine to come up to speed and be connected direct to line the *b* contact of 93 has not opened, deenergizing 48 and stopping the timing action, the delay contact closes, operating 86 to trip and lock out 52 and give alarm.

*Field Failure.*—Two methods are provided for shutting down the condenser in case its excitation is lost. With high alternating-current voltage loss of excitation causes relay 59-2 to operate through interlocks on 42 and 4 so that, if excessive voltage exists on the bus with machine in running position and exciter potential fails, 59-2 operates 86 to trip and lock out 52 and give an alarm.

With low alternating-current voltage loss of excitation with the machine in the running position causes 27*A* to be energized from the alternating-current bus through the *a* contact of 4. If the alternating-current voltage is low, allowing 27*A* to close its *a* contacts and the field current to drop low enough to allow the *b* contact of field relay 40 to close its *b* contact, a circuit is completed through these contacts and the *a* contacts of 4 and 42 operating relay 86 to trip and lock out 52 and give an alarm.

*Overheating of Compensator.*—With overheating of the starting compensator, the liquid in bulb of thermal relay 26, which is inserted in the compensator, expands with an increase in temperature, closing the relay contacts, operating 86 to trip and lock out 52.

*Condenser Overload.*—When an overload occurs on the condenser, overcurrent relay 51 operates 86 to trip and lock out 52.

Each and every one of the foregoing conditions was carefully worked out between the engineers of the company and the engineers of the General Electric Company, with the result that perfect operation resulted during the six months that the equipment has been in service.

## Operating Experience With Rectifiers

RESULTS obtained by the Chicago, North Shore & Milwaukee Railroad in operating mercury-arc rectifiers are presented below. Most of the data cover an entire year's experience and were presented by Caesar Antoniono, electrical engineer of the company, at the Chicago meeting of the A.I.E.E.

*Table I—Performance of rectifier and synchronous converter substations*

The kilowatt and efficiency values do not include the power used for the operation of automatic devices in auxiliaries such as vacuum pump, water pump, motor-generator set and heaters in the rectifier station nor the power used for auxiliaries and alternating-current contactors in the converter stations

| Substation | No. 1 | No. 2 | No. 3 | No. 4 | Liberty | No. 5 |
|---|---|---|---|---|---|---|
| Type Machine Rating, Kilowatts | Converter 1,500 | Converter 1,500 | Converter 1,500 | Converter 1,500 | Lake Converter 1,000 | Rectifier 1,000 |
| **May, 1927** | | | | | | |
| Total alternating current input, kilowatt-hours.... | 87,300 | 43,500 | 69,600 | 125,700 | 115,950 | 89,700 |
| Total direct current output, kilowatt-hours..... | 62,130 | 30,550 | 53,200 | 97,900 | 83,154 | 71,952 |
| Total hours run.......... | 341 | 201 | 310 | 434 | 496 | 403 |
| Average hours per day..... | 11 | 6.5 | 10 | 14 | 16 | 13 |
| Average kilowatt-hours per hour.................. | 182 | 151 | 171 | 225 | 167 | 178 |
| Efficiency, per cent....... | 71.2 | 70.2 | 76.5 | 78 | 71.8 | 80 |
| **June, 1927** | | | | | | |
| Total alternating current input, kilowatt-hours... | 86,800 | 34,200 | 74,400 | 84,300 | 139,950 | 75,900 |
| Total direct current output, kilowatt-hours..... | 59,024 | 23,214 | 58,200 | 62,400 | 105,844 | 62,857 |
| Total hours run.......... | 300 | 180 | 330 | 315 | 660 | 270 |
| Average hours per day.... | 10 | 6 | 11 | 10.5 | 22 | 9 |
| Average kilowatt-hours per hour.................. | 130 | 128 | 176 | 197 | 160 | 232 |
| Efficiency, per cent....... | 68 | 67.8 | 78.3 | 74 | 75.6 | 82.8 |
| **July, 1927** | | | | | | |
| Total alternating current input, kilowatt-hours... | 82,200 | 34,200 | 78,300 | 95,700 | 146,100 | 79,950 |
| Total direct current output, kilowatt-hours..... | 57,140 | 25,294 | 60,800 | 73,000 | 104,263 | 65,747 |
| Total hours run........... | 341 | 201 | 341 | 372 | 715 | 387.5 |
| Average hours per day.... | 11 | 6.5 | 11 | 12 | 23 | 12.5 |
| Average kilowatt-hours per hour.................. | 167 | 125 | 178 | 196 | 131 | 170 |
| Efficiency, per cent....... | 69.5 | 73.7 | 77.6 | 76.3 | 71.3 | 82.2 |
| **August, 1927** | | | | | | |
| Total alternating current input, kilowatt-hours | 95,700 | 32,100 | 104,400 | 84,600 | 119,250 | 70,215 |
| Total direct current output, kilowatt-hours..... | 69,770 | 21,133 | 83,200 | 65,800 | 88,246 | 56,721 |
| Total hours run.......... | 403 | 186 | 372 | 310 | 434 | 341 |
| Average hours per day.... | 13 | 6 | 12 | 10 | 14 | 11 |
| Average kilowatt-hours per hour.................. | 173 | 113 | 223 | 212 | 203 | 166 |
| Efficiency, per cent....... | 72.9 | 65.8 | 79.7 | 77.8 | 73.1 | 80.7 |
| **September, 1927** | | | | | | |
| Total alternating current input, kilowatt-hours... | 84,300 | 50,220 | 95,370 | 83,040 | 118,740 | 83,460 |
| Total direct current, output, kilowatt-hours .... | 61,190 | 33,197 | 75,300 | 62,300 | 88,731 | 67,868 |
| Total hours run ........ | 330 | 240 | 360 | 285 | 525 | 420 |
| Average hours per day ... | 11 | 8 | 12 | 9.5 | 17.5 | 14 |
| **September, 1927 (Continued)** | | | | | | |
| Average kilowatt-hours per hour.................. | 185 | 138 | 209 | 218 | 169 | 161 |
| Efficiency, per cent....... | 72.6 | 66.1 | 78.9 | 75.0 | 74.7 | 81.3 |
| Average efficiency of each substation, per cent..... | 70.8 | 68.7 | 78.2 | 76.3 | 73.3 | 81.7 |
| Average kilowatt-hours per hour.................. | 167.4 | 131 | 191.5 | 209.2 | 166 | 181.4 |
| Grand average, efficiency, per cent .............. | 73.4 | | | | | 81.7 |

TABLE II—RECORD OF SHUT-DOWNS OF RECTIFIER FROM MAY, 1926, TO MAY, 1927

| Cause of Shut-down | No. | Total Time Minutes |
|---|---|---|
| High temperature of tanks........................... | 2 | 48 |
| Exciter trouble ..................................... | 39 | 536 |
| Driving chain and motor on water pump............... | 13 | 315 |
| Loose connection and bad control circuit............ | 3 | 50 |
| Vacuum-pump trouble, motor and oil pump............ | 3 | 260 |
| Flashover of anodes................................. | 6 | 819 |
| Starting anodes sticking............................ | 5 | 602 |
| Miscellaneous unknown............................... | 12 | 1,109 |
| Total shut-downs.................................... | 83 | 3,739 |

Total time rectifier operated 337,140 minutes.

| Shut-down by failure of | No. of Times | Average Time Minutes | Per Cent of Time of Operation |
|---|---|---|---|
| Rectifier.................................. | 25 | 58 | 0.435 |
| Auxiliaries................................ | 58 | 39 | 0.674 |
| All........................................ | 83 | 45 | 1.109 |

TABLE III—RECORD OF FAILURES SINCE MAY, 1927, WHEN SUBSTATION WAS MADE AUTOMATIC

| Failure in auxiliary | No. of Shut-downs |
|---|---|
| Motor on one vacuum pump burned out....... .................. | 1 |
| Locked out after third reclosing of the oil circuit breaker within a definite time during storms.................................. | 3 |
| Locked out on account of broken spring on oil-switch mechanical latch ............................................ | 3 |
| Locked out after third reclosing of the oil circuit breaker within a definite time, cause unknown................................ | 5 |
| Fuse blown on operating transformer supplying power for the operation of devices.............................................. | 1 |
| Total shut-downs........................................... | 13 |

# Simplified
# Distribution Planning*

### Relations between transformer spacing, energy loss and voltage drop developed for equations of economical transformer and conductor sizes

By W. R. Bullard
*Electric Bond & Share Company, New York City*

IN CONSIDERING the characteristics of the secondary distribution system, where the conductors are arranged in straight line feeds without branches, the well-known relations between transformer spacing, energy loss and voltage drop are used in the development of simplified equations which can be used in determining economical transformer and conductor sizes to fit any given set of local conditions.

## Secondary System

Much has been written concerning the comparative merits of various voltage combinations in secondary distribution systems, such as three-wire single-phase for lighting, separate three-wire three-phase for power, four-wire three-phase for power and lighting, etc.

Therefore in this article no comparison is made between the different types of systems. However, in so far as possible, the methods and formulas have been made sufficiently general to apply to all the usual types of secondary systems.

*General Scheme of Design.*—As mentioned previously, there are two types of loads that should be considered separately in the design of the distribution system—namely, the general distributed load of the system as a whole, and individual loads of large sizes. Loads of the latter type are usually served individually by special transformer banks not connected to the secondary mains, or else by transformers of extra large size connected to the secondary mains, but located immediately adjacent to the concentrated load which they serve. Thus in designing the secondary system large concentrated loads need not be considered in connection with the selection of copper sizes, etc., since in general the current of these loads does not pass through the secondary mains.

In the selection of copper sizes and transformer sizes for the distribution system, exact calculations of the economics are not practicable, due to a number of indeterminate factors and to the fact that the exact characteristics and distribution of the load cannot be conveniently determined either for the present or for the future. However, by making a reasonable number of simplifying assumptions and by considering average conditions in different sections of the system, average sizes can be established for low-voltage copper and distribution transformers to serve the load economically.

In establishing average characteristics of the load it is, of course, not permissible to consider the entire system in one set of calculations unless the system should be comparatively small or unless conditions should be comparatively uniform throughout. However, in most cases it is possible to select a few sections of territory in any given system throughout each of which all the determining factors will be fairly uniform. In a medium-sized town, for instance, there is usually a business section where the load is fairly concentrated and of certain particular characteristics; a high-class residential district in which the load characteristics are different from those in the business section, but nevertheless fairly uniform, and a poorer class of residential section in which the load characteristics are different from those of the two other sections.

## Size of Transformers and Conductors

A practical procedure for establishing proper sizes of transformers and secondary copper in average distribution systems is to consider separately each of two or three different districts, such as those mentioned, and to make complete calculations in each case to fix the proper characteristics.

The calculations should be based on load conditions that will exist several years in the future. Thus if transformer sizes and copper sizes determined from the method that is to be described are adopted immediately, these sizes will be somewhat larger than those theoretically correct for existing conditions, but the proper economics will be approached during the growth of load for several years until the most economical point is reached, after which the cost will again gradually exceed the theoretical minimum, but at no time during a number of years of system growth will the over-all cost be greatly different from the theoretical minimum.

After the proper copper sizes have been determined, these sizes will of course be used for extensions and replacements of secondary mains in the particular sections to which the different sizes apply. The transformer sizes determined by the economics will, of course, be used in average cases in the particular sections to which they apply, although a small proportion of other sizes can be used when required. After a number of years have passed it is, of course, desirable to make a new study of the system economics and revise the values previously obtained. The new values can then be used for extensions and replacements of the old system.

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**The first article of this series appeared in* Electrical World *March 10, 1928. The third article will be published in an early issue.*

If, instead of increasing the transformer sizes with the growth of load, as is frequently done in the operation of distribution systems, the economical size of transformers be adhered to in all average cases and the growth of load be handled by setting new transformers of the same size at intermediate points between the old transformers, the growth of load can be handled indefinitely with the same secondary copper and with a gradually decreasing voltage drop and decreasing percentage of secondary copper loss.

It is not necessary, of course, to have a decreasing voltage drop or copper loss if the design of the system has fixed the proper values of these quantities at the start. In some measure, therefore, it is desirable to use at the start transformers somewhat smaller than those indicated by the calculations, gradually increasing the size until after a number of years, these sizes may be somewhat larger than the values indicated by the study. The tendency should be, however, toward the establishment of a more or less fixed standard of sizes and toward handling the growth of load by setting new transformers rather than replacing old transformers with new ones of larger size.

### STRAIGHT LINE FEEDS

In the following discussion the term "network feed" is used to indicate that each transformer feeds a portion of a system the secondary mains of which have a network arrangement formed by intersecting streets. The portions served by individual transformers may either be separated from each other, as in the case of a radial system, or may be interconnected to form a large network, as in the case of the so-called low-voltage multiple-feed network system.

The laws governing voltage drop and power loss in a circuit consisting of a single line without branches are well known. Where the low-voltage system consists of such a line, the load being uniformly distributed and the transformers being of equal size and uniform spacing, both the voltage drop and power loss are inversely proportional to the square of the number of transformers or directly proportional to the square of the size of each transformer.

Let $I_T$ equal the load current per leg of the transformer; $a$ equal the area of cross-section of each conductor of secondary mains in units of 1,000 circ.mil; $V$ equal the maximum voltage drop per conductor in volts; $W$ equal power loss in kilowatts per 100 ft. of single conductor; $D$ equal load density in amperes per conductor per 100 ft. of circuit. Then, if each transformer feeds current equally in each direction in the secondary mains,

$$V = \frac{0.137\, I_T^2}{Da}$$

$$W = \frac{0.0915\, I_T^2}{1{,}000\, a}$$

These two equations give volts drop and power loss per conductor in terms of the load at each transformer, load density and cross-section of copper.

In practice it is not always possible to have the transformers so spaced that the load will be equally divided between them, nor for any given section of secondary mains is it always possible to have the transformer in the exact center of the load. Therefore, due to these difficulties and due to variations in load density and variations in other system characteristics, the values of voltage drop and power loss would in practice be considerably higher than those given by the above equations.

In order to make the equations applicable to average conditions of practice in the majority of small- and medium-sized systems, the values of voltage drop and power loss should be increased about 100 per cent, which gives

$$V = \frac{0.274\, I_T^2}{Da} \qquad (1)$$

$$W = \frac{0.183\, I_T^2}{1{,}000\, a} \qquad (2)$$

The value of 100 per cent may seem at first sight to be a large proportionate increase in the constants of the equations to care for departures in practice from balanced and uniform conditions. However, when it is realized that an off-center spacing of only 25 per cent of the total length of line served by one transformer (three times as much load in one direction as in the other) will give 225 per cent of the theoretical voltage drop and 175 per cent of the theoretical power loss for perfectly balanced conditions, it can be seen that the increase of 100 per cent is a reasonable allowance for average systems in which it is not possible to maintain specialized organizations constantly to check and correct unbalanced conditions. Whereas the effect of the transformer being off center is to increase the voltage drop more than the power loss, the effect of the load being non-uniformly distributed is to increase the power loss more than the voltage drop. In practice, therefore, there is likely to be a similar increase of both quantities.

In large, thoroughly organized systems it will usually be possible to hold the values nearer to those corresponding to ideal conditions. The application of the equations given in this article to a case of this kind can be very easily corrected by increasing the value of the allowable voltage drop and decreasing the estimated unit cost of energy loss before these values are inserted in the equations. Probably in the largest and best organized systems an allowance of 50 per cent instead of 100 per cent could be made in deriving equations 1 and 2. In this case, to make the equations of economics given in the last part of this series applicable, the allowable voltage drop as estimated from service conditions should be multiplied by the factor $\frac{4}{3}$ and the unit cost of copper losses where applied to secondary mains should be multiplied by the factor $\frac{3}{4}$.

The equation for voltage drop is calculated on the basis of resistance drop only. However, in usual types of distribution systems, the power factor at the peak of the load is high, due to the high percentage of lighting load. Therefore the maximum voltage drop will usually only slightly exceed the theoretical values calculated for resistance only. A small amount of additional voltage drop due to the effect of the line reactance will usually be taken care of by the factor of safety used in equation 1.

Where the conductors are small and are spaced reasonably close together, the resistance is usually the dominating part of the impedance. Where the conductors are large and are separated by an appreciable distance, as for instance in the case of large single-conductor underground cables located in separate ducts, the reactance may be the dominating part of the impedance. In such cases, if the power factor of the load happens to be low, appreciable errors may be introduced into the calculations of economics by the fact that reactance has been neglected. However, even in such cases, the equations may be used to obtain a first approximation to the correct results, the figures obtained being then checked by actual calculation of voltage drop. If the error is shown to be appreciable by this method, very nearly correct results can be obtained by making a second set of calculations, using a value for allowable voltage drop, less than the actual value in proportion to the amount that the allowable value has been exceeded by the results of the first set of calculations.

*Economical Transformer Spacing and Copper Size.*—Upon applying certain simplifying processes the calculation of economical transformer spacing and copper size become a comparatively simple matter by the use of the above equations for power loss and voltage drop. Take first the case of a simple straight line circuit. Factors that enter into the calculations of economics are, cost of power loss in transformers and fixed charges on transformer investment, cost of power loss in secondary mains and fixed charges on investment in secondary copper.

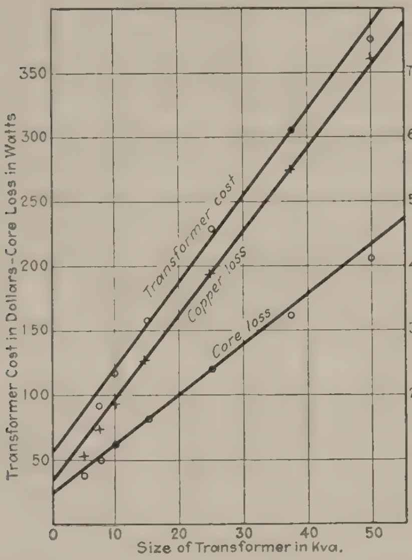

*Fig. 1—Cost and losses of 2,300-volt distribution transformers, single phase, 60 cycle*

If the investment costs of transformers are plotted against transformer sizes, the result is approximately a straight line for a limited range of transformer sizes. (See Fig. 1.) The point where this line cuts the axis of cost represents a cost that applies to each transformer regardless of its capacity. The slope of the line represents the cost per kilovolt-ampere capacity for any given number of transformers. Since the kilovolt-ampere capacity of any given system is fixed, this latter cost is fixed and therefore has no effect in determining the economics of transformer spacing. The fixed cost per transformer mentioned above, however, is a very useful quantity. If we take this cost and add to it the cost of installation, including auxiliary devices such as fuses, lightning arresters, ground connections, etc. (in the case of an underground system the cost of the transformer vault would be included), the result is a total fixed cost per transformer installation. This multiplied by a percentage figure to reduce it to fixed charges per annum gives an expression that can be used directly in computing the economics.

To this quantity, however, should be added the yearly cost of the fixed part of transformer losses. The latter can be obtained in the same manner as above by plotting losses against size of transformer (see Fig. 1) and using the values where the lines cut the axis of losses. In plotting the copper loss curve of Fig. 1 the values should correspond to the transformer loading that will be used in practice. For instance, if in order to obtain good economy it is desired to load transformers on the average of, say, 115 per cent of their rating at the system peak load, then the copper loss at 115 per cent load should be used in plotting the copper loss curve. In order to obtain the annual cost of core loss it is necessary to multiply by the total number of hours in the year, whereas in the case of copper loss the annual duration factor previously described must be used.

Let $C_1$ equal total yearly transformer costs per installation exclusive of the costs which vary with the size of transformer; $W_1$ equal copper loss in kilowatts per transformer installation taken from curves similar to those in Fig. 1; $W_2$ equal core loss in kilowatts per transformer installation; $C$ equal cost of copper loss in dollars per kilowatt-hour; $C_4$ equal the cost of core loss in dollars per kilowatt-hour; $C_5$ equal fixed charges on cost of each transformer installation including the intersecting point of the cost curve in Fig. 1 and investment in auxiliary apparatus per transformer installation. Then

$$C_1 = W_1 f C + 8760 W_2 C_4 + C_5 \qquad (3)$$

In deriving the value of $f$ for equation 3 in the case of automatic network systems where circuits may be taken out of service at periodical intervals, the actual load curves for the transformer should, of course, for accuracy be considered instead of the load curve of the whole system. This also applies to all the calculations that involve loss and voltage drop in the secondary mains. However, in cases where the system load factor is high, the practice of taking circuits out of service during light load periods has very little effect on the total losses, since the decrease in core loss is offset to a great extent by the increase in copper loss due to longer distances of feed. In such cases it is permissible to use the duration factor of the system load.

Since the number of transformers per 100 ft. of secondary circuit is represented by the expression $\frac{D}{I_T}$, we have for that portion of the yearly transformer cost per 100 ft. of secondary circuit which varies with the transformer spacing, the expression $\frac{C_1 D}{I_T}$.

In the case of the yearly cost of secondary copper, the portion of the cost that affects the economics is that portion which varies with the size of copper. For overhead systems this can be derived approximately from the cost per pound of copper delivered to the job. The remainder of the cost of overhead lines, including poles, hardware and insulators, is very nearly independent of the size of copper and therefore does not enter into the problem of economics. For underground systems a graph such as that given in the first of this series of articles, which appeared in ELECTRICAL WORLD, issue of March 10, page 501, should be used, only the slope of the straight line being taken and the fixed cost, represented by the intersection with the vertical axis, being excluded from consideration.

Let $C_2$ equal annual fixed charges on investment in secondary copper in dollars per year per 1,000 circ.mils per 100 ft. of single conductor, exclusive of installation costs and including only that portion of the cost that is directly proportional to the size of conductor. Let $n$ equal the number of current-carrying conductors in the secondary mains and $n_1$ equal the total number of conductors in the secondary mains including the neutral (neutral being the same size as the other conductors); then we have from equation 2 the total variable portion of the yearly cost of secondary mains (including losses) per 100 ft. of system equal to

$$\frac{0.183\, nfC\, I_T^2}{1{,}000a} + C_2 n_1 a \qquad \textit{(Formula a)}$$

where $a$ is the conductor cross-section in thousands of circ.mils. The first term of this expression represents the annual cost of losses, and the second term represents the annual fixed charges on investment. Differentiating this formula with respect to $a$ and equating to zero, we have

$$a = 0.01352\, I_T\sqrt{\frac{nfC}{n_1C_2}} \qquad (4)$$

This expression gives the economical size of copper in terms of load current at the transformer, number of conductors, cost of copper loss, fixed charges on investment and duration factor.

Inserting this value of $a$ in the above expression for total variable annual costs of secondary mains per 100 ft. of circuit (formula $a$), we have

$$0.02704\, I_T\sqrt{nn_1fCC_2}$$

The variable portion of the total annual cost of the whole system of 100 ft. of secondary circuit is then

$$0.02704\, I_T\sqrt{nn_1fCC_2} + \frac{C_1D}{I_T}$$

the last term being the variable portion of the annual transformer costs. Differentiating this expression with respect to $I_T$ and equating to zero, we have

$$I_T = \frac{6.08\sqrt{C_1D}}{(nn_1fCC_2)^{1/4}} \qquad (5)$$

Equations 4 and 5 give the economical size of copper and economical load at the transformer in terms of load density and the various other factors that enter into the problem. These equations are expressions for the complete economics of copper size and transformer spacing, where these quantities can be considered independent of voltage drop or current-carrying capacity of copper. Although equation 5 does not directly express the average size of transformer that should be used in practice, the latter can be easily determined from the load current $I_T$ by applying whatever factor of safety it is desired to use in the loading of transformers. This is a matter of judgment, depending upon the amount of supervision that can be maintained over the transformer loading. In general, it may be said, however, that for good economics the transformers should be loaded to safety limits.

In any given set of calculations equations 4 and 5 should be used first. After numerical values are obtained by means of them the results should then be tested to determine whether the allowable voltage drop or current-carrying capacity would be exceeded by the use of the values thus obtained. Voltage drop can be determined by the use of equation 1. The matter of current-carrying capacity is of course a question of comparing the size of copper obtained from equation 4 with one-half of the value of current $I_T$ obtained from equation 5.

Allowable voltage drop is primarily a matter of quality of service and must be determined by judgment based on operation experience. The direct result of poor voltage is the ill will of the customer but not always a physically decreased energy consumption. Attempts have been made to evaluate mathematically the loss in revenue due to decreased energy consumption caused physically by low voltage at the customer's service. However, the fallacy of such procedure is easily seen, since in the long run a certain percentage of customers will manage somehow to obtain the amount of light or power they require. If their lighting is poor due to low voltage and their complaints to the power company are ignored, they will use bulbs of lower voltage rating or higher wattage, thus bringing their power consumption equal to or above what it would be if the voltage were normal. Furthermore, in systems having primary feeder regulators of sufficient range the average service voltage can be held normal, regardless of the drop in secondary mains. In such cases the voltage drop in secondary copper can have little or no direct effect on power consumption.

The above is not intended to convey the impression that power consumption is entirely independent of the voltage regulation, but merely that there is no direct mathematical relation between the two. It is quite a common occurrence in the reconstruction of old distribution systems to have the improvement in voltage regulation bring about a noticeable increase in power consumption. However, there is usually no convenient means of determining how much of the increase is the direct result of the voltage improvement and how much is due to the increased use of energy in appliances, etc., by some of the customers resulting from the improved quality of service. At any rate there is usually little to be lost and much to be gained by providing service of high quality, and, as previously stated, the exact degree of this quality must be determined by judgment based upon experience.

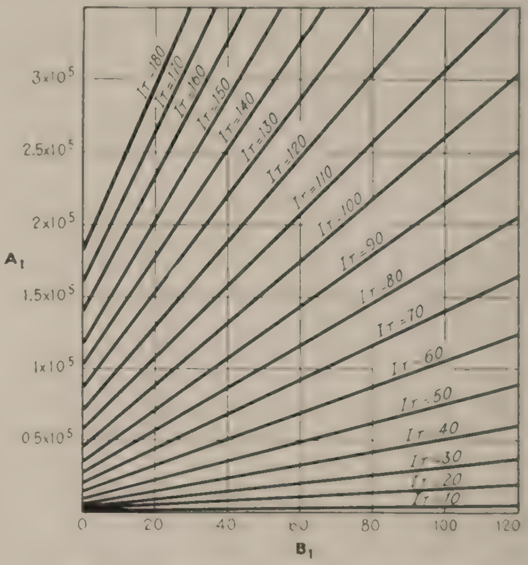

*Fig. 2—Economical load at transformer (Equation 9)*

In systems having no voltage regulators the entire voltage drop between station bus and customer's service must be taken into consideration in determining the allowable voltage drop in secondary mains. However, in systems equipped with feeder regulators the voltage at services nearest to the transformers can be maintained at values slightly above normal, allowing that at services farthest from transformers to fall slightly below normal. The maximum variation from normal voltage is then only approximately one-half the maximum voltage drop in the secondary mains. This is based on the assumption that the voltage drop in primary laterals is small enough to be neglected, which is quite often the case, as mentioned in the discussion of the primary system. Thus in many systems equipped with regulators a maximum secondary voltage drop of 4 per cent is probably a reasonable allowance, giving a variation from normal at the customer's service of approximately 2 per cent.

By normal voltage is here meant an average voltage slightly higher than the rated voltage of the lamps, since an allowance must be made for voltage drop in the customer's wiring.

If the allowable voltage drop would be exceeded by the use of values obtained from equations 4 and 5, then a new set of calculations must be made considering voltage drop as the limiting factor. An equation for this condition is obtained by inserting the value of *a* from equation 1, or

$$a = \frac{0.274\, I_T^2}{DV} \tag{6}$$

in formula *a* and adding the expression for yearly transformer costs. This gives a total variable annual system cost of

$$\frac{0.183\, DVnfC}{1{,}000 \times 0.274} + \frac{0.274\, C_2 n_1 I_T^2}{DV} + \frac{C_1 D}{I_T}$$

Differentiating and equating to zero, we get

$$I_T = 1.221 \sqrt[3]{\frac{C_1 V D^2}{C_2 n_1}} \tag{7}$$

If current-carrying capacity is the limiting factor, then the value of *a* in terms of its current-carrying capacity must be inserted in formula *a*. For overhead conductors the current-carrying capacity is very nearly proportional to the three-fourths power of cross-sectional area (see any good table of carrying capacities of copper wire), whereas for underground conductors this relation is roughly according to the square root of the cross-sectional area instead of the three-fourths power. (See paper by Donald M. Simons, *Journal A. I. E. E.*, May, 1923.) The occurrence in underground systems of a straight line feed is unusual; therefore it can be assumed that equations for straight line feeds are applicable mainly to overhead systems.

Let *b* equal the size in 1,000 circ.mil required to carry 100 amp. Then

$$a = \frac{I_T^{4/3} b}{1170} \tag{8}$$

Inserting this value in formula *a* and adding the expression for transformer cost, we have a total variable annual system cost of

$$\frac{0.214\, nfC}{b} I_T^{2/3} + \frac{C_2 n_1 b}{1170} I_T^{4/3} + \frac{C_1 D}{I_T}$$

and repeating the process of differentiating, we get an equation of the form

$$A_1 = I_T^{7/3} + B_1 I_T^{5/3} \tag{9}$$

where
$$A_1 = \frac{878\, C_1 D}{C_2 n_1 b} \tag{10}$$

and
$$B_1 = \frac{125.2\, nfC}{C_2 n_1 b^2} \tag{11}$$

Equation 9 gives the economical load at the transformer in terms of the various factors that enter into the problem. It has a somewhat complex analytical solution. Therefore, to facilitate its use, the values involved have been plotted as shown in Fig. 2. From this figure the required value of $I_T$ can be found by locating the point the co-ordinates of which are the numerical values of $A_1$ and $B_1$, then interpolating between the values of $I_T$ represented by the straight lines of the figure.

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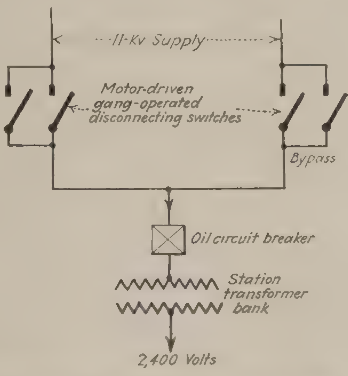
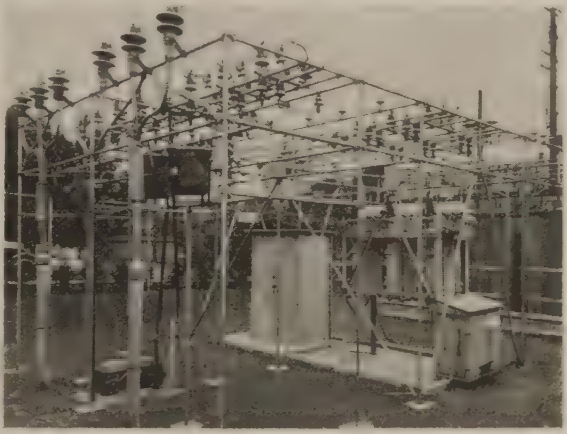
# Line-Transfer Scheme Uses Only One Circuit Breaker

By E. F. Pearson
*Electrical Engineer Northwestern Electric Company, Portland, Ore.*

Automatic selective transfer equipment is employed by the Northwestern Electric Company in substations to permit using a single 11-kv. breaker for handling two incoming supply lines to each station. Through the elimination of one heavy-duty breaker an over-all saving of approximately $3,000 per station is effected. Motor-driven air-break disconnecting switches automatically transfer a selected 11-kv. line to the circuit breaker. Connections are shown in the diagram.



*A single oil-circuit-breaker is used in this line-transfer arrangement. The disconnecting switches are motor operated*



In case of trouble on the line from which the station is operating, the sequence of operation is as follows: Relays open the oil circuit breaker, which breaks the load in case the station is not already dead. The motor-driven, gang-operated, interlocked air-break switches then transfer the oil breaker to the other line and the breaker closes and picks up the load. The complete switching operation takes place in five seconds. In case the second line is also in trouble the station will not be transferred, but will take service from the first line to be restored to normal.

The station may be transferred from one line to the other, if desired, without dropping the load by the manually operated by-pass disconnecting switches. In addition to the automatic transfer equipment the oil breaker is also controlled through a periodic-reclosing relay operating on station overload. In case of extreme overload the breaker will open and close twice, at predetermined intervals, and lock out if the trouble still exists after the last reclosure.

All motors and relays are operated with 120 and 240 volts alternating current, while release coils and circuit-breaker trip coils operate at twelve volts direct current.

To date, the first station equipped with this apparatus has transferred circuits three times during emergencies. A check on customers' equipment subsequent to the outages showed that a number of motor-driven ice machines of the meat-market type remained on the line after the transfer was made. This indicates that, in general, ice machines will resume service if the outage is five seconds or less.

## Indirect Costs on Transmission Projects

By M. J. Idail

*Electrical Engineer for F. R. Weller, Consulting Engineer, Washington, D. C.*

Careful cost records kept during the past five years on four large transmission projects show a good uniformity in the relation that the total indirect (or overhead) cost bears to the total cost. The projects studied covered widely different conditions, were for different clients, were handled with different types of construction organization and included tower lines, pole lines and large and small substations. The total cost of the largest project was $3,400,000, the smallest $500,000. Progress rates of the various jobs were such that the average rate of expenditure of money ranged from $170,000 per month to $50,000 per month.

INDIRECT COSTS INVOLVED IN TRANSMISSION-LINE AND SUB-STATION CONSTRUCTION IN TERMS OF PER CENT OF DIRECT COST*

| | Per Cent |
|---|---|
| Injuries and damages (compensation and liability insurance) | 1.0 |
| Other insurance (not including car or truck insurance) | 0.25 |
| Preliminary engineering investigation | 0.25 |
| Home office engineering and superintendence (studies, designs, supervision of construction; costs of engineering, purchasing, general accounting and treasury and legal departments) | 3.75 |
| Field engineering and superintendence (construction superintendent; general foremen; field engineering other than surveys) | 2.50 |
| Field office and storeroom (bookkeeping and cost keeping; disbursements; material receipt and issuance; field purchases of material) | 2.00 |
| Engineering fee and contractor's profit (including fees for home office purchasing, general accounting, treasury, etc., departments) | 12.50 |
| Interest during construction | 4.50 |
| | 26.75 |

* 26.75 per cent of direct cost is equivalent to 21.4 per cent of total cost

The accompanying table represents the average experience on the projects above outlined and is adjusted for differences in accounting practice. It goes without saying that differences in conditions and accounting practices may cause the reported indirect costs on other projects to be appreciably greater or less than those here given.

In preparing estimates of cost there is a tendency to fail to evaluate justly certain items which are on the border line between direct and indirect costs, to regard such costs as being cared for in the indirect cost allowance, and then to fail to make the indirect allowance sufficiently large. In actual cost keeping, many such items are easily evaluated and are charged to direct cost accounts, and to this extent the actual costs of the direct accounts exceed the estimated allowances. Examples of such items are depreciation on cars, trucks, camp equipment, office equipment, etc.; losses sustained by reason of camp not being self-supporting; local attorneys' fees and title abstract work in connection with easements on land. Field office drafting should be a direct charge against the land account. Truck and car operation, expense accounts of survey party chiefs, sub-foremen, the chief locating engineer, right-of-way men, etc., are direct rather than indirect costs.

## Employees Average 225 Lamps in Pittsburgh Campaign

A six weeks lamp sales campaign, undertaken in an effort to fill the empty light sockets throughout the territory of the Duquesne Light Company, was recently completed with sales averaging 225 lamps per salesman. A total of 116,739 lamps was disposed of by the 520 employees who took an active part in this work.

A preliminary estimate, according to George E. Whitwell, general sales manager of the company, indicated that 10 per cent of the residential lighting sockets were empty, and while this was not an exceptional condition the employee sales plan was adopted in an effort to remedy the situation because it was felt that the buying of lamps had not been made easy enough and because housewives had not been sold the idea of keeping a reserve supply of lamps on hand.

The work of the employees was stimulated by commissions on sales and the offering of additional cash prizes for those showing the best results. Sales promotional literature was furnished in connection with campaign circulars giving full information regarding the activities. Special order forms were prepared and furnished the solicitors showing various sizes of lamps and prices and employees were kept informed of progress by notations in the general sales manager's weekly bulletins and special bulletins were issued from time to time giving all details and status of the campaign.

Lamps were delivered by the company when desired by the patrons and charges were included on monthly bills for electric service. The special handy carton of assorted lamps was offered at a price of $2.47, containing two 100-watt, three 60-watt, two 40-watt and two 25-watt lamps. Although this was not the only way lamps could be purchased during the campaign, 3,383 of these special cartons were distributed. During this sale 15,683 100-watt lamps were distributed and 40 per cent of all lamps disposed of were of sizes 60-watt or larger.

Every effort was made, according to Mr. Whitwell, to assist competitive lamp dealers in increasing their lamp sales. They were kept informed of all activities in order that they might also "cash in" on the campaign. A series of advertisements was run in the newspapers, suggestions with reference to lamp buying were carried on customers' monthly bills and windows in various stores were suitably decorated. Local dealers were informed in advance of the dates on which these advertisements would appear and were also furnished with copies of reprints in advance in order that they might secure every possible help during the campaign.

# Profit vs. Volume in Pricing

Losses in business so general there must be a fundamental cause. Profit an obligation to progress. No justification for a company to operate without a profit if it fills a need

By W. L. CHURCHILL
*New York*

*A total productive capacity greatly in excess of the absorbing capacity of the market is pointed out by Mr. Churchill in this article as the basis of two companion evils: First, increased selling cost for selling effort is being expended to dispose of 100 per cent of the industry's capacity; second, price reductions are made in anticipation of a volume sale that is impossible of attainment. The net result is abnormal selling costs, subnormal selling prices and subnormal profits.*

FORTY per cent of all manufacturers are reporting deficits in their income tax returns on the average year after year; 70 per cent earns less than $5,000 net profit per year; only three firms out of five earn any profits whatever and only three out of ten earn more than $5,000 per year. The average net income of our entire manufacturing group is approximately $2,500,000,000 per year, or a little more than $20 per capita for our entire population. This is less than the amount that is being added to the investment in manufacturing enterprises year after year if the latest reports on this item from the Census Bureau are indicative of current trends. Manufacturing as an economic group does not earn enough to take care of its own expansion requirements created by our increasing population and increasing demand for manufactured products.

How accurately these figures reflect the conditions of the manufacturers engaged in the production of electrical equipment and goods would be difficult to determine. Assuming, however, that as a group it may rate well above the average of all of our manufacturing industries, it is quite obvious that profits are not commensurate with the service that is being rendered. Despite the outstanding and recognized success of prominent electrical manufacturing firms, the number of firms which are not regularly and consistently making a fair return to their stockholders and owners is altogether too large for the industry to assume any complacency over its own position in the structure of American industry generally.

### LOSSES CONTINUALLY SHIFT ABOUT

This is not a picture of a period of unusual depression. It is a picture that indicates just what occurred in 1927 and that prevailed during the prosperous year of 1926. Neither are the losses confined to small and irresponsible manufacturing firms. Deficits are reported by some of our largest and most prominent industrial enterprises that in times past have been very successful and profitable under the same management. Were it not for the fact that the losses shift about from industry to industry and firm to firm within industries, we would have a larger list of failures and receiverships than we now have.

A condition that is so general and that is not confined continuously to any product, group or class must have a fundamental cause or causes whose discovery will indicate the remedy or remedies. There is no justification for manufacturing enterprises, producing articles or products of service to society, operating without a profit. Quite the reverse is the case. Profit is an obligation, not merely to stockholders and owners but to progress. The manufacturing firm that makes no profit cannot out of its own resources conduct research, experimental and development work for improvement of its product or of its methods of production, or extend its markets. Being unable to do these things, it is unable to reduce costs or give greater values per dollar of sale, and as we cannot stand still, but must go either forward or backward, the firm that makes no profit sooner or later becomes a burden upon the community.

The opposite of this picture is that of a firm making not merely a profit but substantial profits. It is such firms that are responsible for developments and improvements in products that tend continually to lower their costs or give us greater values in the price of their products. It is the prosperous and profitable firms that improve, enlarge and add to their buildings, thus making business good for manufacturers of building materials and for the dealers, contractors, engineers, etc. It is the profitable firm that invests in new equipment, machinery and devices, that in turn employ designers and producers, all tending to increase our general business and progress. Even the cash dividends paid to stockholders become a means of stimulating all forms of business and professional services, improving our standards of living and our cultural levels.

When we recognize that to obtain products or services from worthy producers at prices that give them no profit we automatically restrict our own opportunities for business, then we will be just as insistent upon our suppliers obtaining a profit from our transactions as today we are eager to prevent it. When automobile manufacturers buy their steel at prices that mean a loss to the producers they automatically destroy a market for automobiles. This, in turn, correspondingly reduces the market for a large variety of electrical devices and equipment. This same reasoning can be followed through to suppliers of wire and other component materials, to the smelters and the mines. It takes but little imagination to see the beneficent effect upon all business derived from profits.

A few manufacturers are far-seeing enough to insist upon doing business only with suppliers who are to profit from the transaction. Others, although not taking quite so unusual a position, try to impress upon the people with whom they deal the importance of the transactions being fair to all parties; not for sentimental reasons but for purely selfish reasons. A large purchaser of public utility equipment has been known to criticise the manufacturers because the latter did not charge enough for their products. His reasoning was to the effect that the prices are so low that there are no profits with which to develop and improve the goods, so that they cost more than they would if liberal profits had been earned in the past and the product is not as advanced as it should be.

Manufacturers of electrical products have made tremendous progress in the short period during which the electrical industry as an industry has been in existence. In the earlier years it was fairly easy to obtain capital from other sources with which to start and develop electrical enterprises. It is getting to be more and more necessary that the industry find its own capital for its further development and progress from within its own sources. It must earn this capital in the form of profits or its progress will be seriously restricted. Electrical manufacturers are already making a beginning in the study of causes and the search for the remedy for existing conditions that are generally admitted to be unsatisfactory from the standpoint of profit as well as from the comparatively slow extension of markets.

### Inadequate Average Prices Chief Cause

The principal cause for both of these major conditions, low average of profits and slow development of additional markets, is that the average prices received by manufacturers of electrical (and other) products are inadequate to cover the costs of production and distribution and provide a surplus with which to pay stockholders cash dividends; to improve products so as to enlarge their demand, at the same time reducing their cost, and to enable lower prices still further to widen their demand. Simply stated, electrical manufacturers do not get enough for their goods. They do not get enough for their goods because they do not price them properly. They fail to realize that there are economic laws that must be observed in the pricing and merchandising of their products to insure their operating upon a continuously profitable basis and fulfilling their obligation to society as well as to the stockholders and owners.

As it will be impossible to deal with more than one of the several governing fundamental economic factors in this short article, I simply will touch upon one of the most important of these factors, that of the production volume upon which all costs and profits must be based for the establishment of sound selling prices for manufactured products. Most pricing of manufactured goods is done with the primary object of getting volume business. Electrical manufacturers, like all other manufacturers of established industries, have a total productive capacity greatly in excess of the absorbing capacity of the market for their products. This develops two companion evils. First, it increases selling costs, as selling effort is being expended to sell 100 per cent of the industry's capacity; second, it effects price reductions in anticipation of a volume sale that is impossible of attainment. The net result is that we have abnormal selling costs, subnormal selling prices and subnormal profits.

### Costs and Profits Based on Actual Production

To illustrate this feature, the case of the flour industry will be cited. The flour industry is chosen because of the simple nature of its product and the fact that government statistics are available in relation to proportion of production to capacity. For the year ended June 30, 1927, the flour mills of the United States (nearly 800) produced 55 per cent of their rated capacity, included in this being a considerable export production. An investigation discloses that efforts to sell 100 per cent capacity were adding to normal selling costs approximately 40 cents per barrel over and above that needed to dispose of what was produced. This investigation was necessarily limited, but if indicative of the industry as a whole would represent a needless expenditure of $50,000,000 a year that must be saddled onto the cost of the flour that is purchased and consumed. The profits of flour mills are approximately in line with those of general industry; the mills that succeed in obtaining a volume in excess of the average make some money, but the industry as a whole is no better than the average of all of our American industries. Our per capita consumption of flour is about one barrel per year. No amount of sales effort, advertising campaigns or other marketing activities can appreciably increase the consumption of flour in the United States; it is limited by the size of the great American stomach and can be increased only by displacing other products. What is true of flour is true of electrical products, except that the limitations of the American market are restricted to the size of the American dollar.

The electrical manufacturing industries, or different subdivisions thereof, may be disposing of 60, up to, in some cases, 75 per cent of their aggregate capacity, but you may rest assured they are not disposing of 100 per cent or anywhere near that on the average the year round. Figures recently compiled of representative groups of manufacturers, even in the busy period of 1927, range all the way from 40 per cent to 84 per cent. The automobile industry in 1927 operated at about 62 per cent capacity and it is increasing its capacity. A recent statement from the United States Steel Corporation was to the effect that over a period of six years it had operated at 66.6 per cent of capacity. These figures are merely cited to show that manufacturing firms which find that they have considerable idle or semi-idle capacity should first determine the relationship of their production to that of the average of the industry before spending excessive amounts merely to switch trade from some other producers to their plants. They must know upon what proportion of capacity they must build their costs and determine their profits for the purpose of establishing the selling prices before their cost systems can be used as the basis for guiding them to continuously assured profits and the perpetuation of their businesses.

Electrical manufacturers are catering to an expanding business, but productive capacity expands at an equal or greater rate, so that in effect the industry as a whole is selling to a saturated market. The limitations of this market are the limitations of the money available to invest in electrical devices, objects and equipment. Increase the dollars available for expenditure by the American public for its luxuries, conveniences and necessities and the electrical industry will get a major portion of this increase, as most of the things that we desire today either are directly connected with electrical manufacture or are produced with the use of electrical equipment. The logical means for increasing the money available to the American public is to increase the profits to the large body of American stockholders and owners. To accomplish this it is necessary that all transactions of manufacturing enterprises be conducted with the primary object of profit. When products are priced so low that it is necessary to sell an abnormal volume to insure normal profits these can be secured only by reducing profits and even creating losses for competitors whose trade is diverted away from them. This brings about retaliations; prices are met and still further reduced and normal profits cannot be sustained.

### Principle of Pricing an Individual Problem

Fortunately it is not necessary for an individual firm to wait for its competitors to accept and apply the principle of pricing its products upon a basis that will earn it a normal profit when it produces its normal quota of the offering business in order that the adoption of this principle may enable it to operate profitably. Intelligent merchandising will enable proper prices to be obtained and a sufficient quantity of goods to be sold to insure profits. If the merchandising is especially well conducted more than the normal quota of sales will be secured, but at prices that will insure greater than normal profits. On the other hand, sales may fall substantially below the normal quota of business before profits will drop to present average levels if they are subnormal.

It is useless for us to quarrel with the fact that surplus capacity exists. It does exist and in all lines. As fast as we develop business fully to absorb our operating capacity we immediately increase that capacity. Most industries find that at times they are required to utilize all of their capacity, even though it may be but for short periods. Other manufacturers are constantly seeking additional lines, often going entirely outside of their established fields to find articles to produce that will take up the slack of their idle equipment and more fully utilize their organizations. This, in turn, increases the productive capacities of the lines adopted, so that there is a tendency toward the equalization of the utilized capacities of all of our industries. There is a continual effort of adjustment of supply to demand. Our capacity to supply is greatly in excess of demand at present. It is not, however, in excess of the needs and desires of the buying public, but merely in excess of their ability to satisfy them. When manufacturing enterprises earn the profits that they should there will be a large addition to the funds now available to increase the demand.

We have seen the effect of increased wages upon business. Similar effects will follow the elevation of profits to their proper levels. There is nothing reprehensible about profits in themselves. Profits must be earned if we are to continue to progress. They are as well an obligation to stockholders and owners. This thought has been aptly expressed by the Illinois Manufacturers' Cost Association in its report on "Financial Burden in Cost." The concluding paragraph of this report states:

> From a moral, financial and sound business standpoint stockholders are just as much entitled to reasonable returns in the shape of dividends as bondholders are entitled to their returns in the shape of interest. The management of every business and industrial organization assumes a serious responsibility when it accepts stockholders' money. It should expect to meet this responsibility at all times.

To insure this result, manufacturers must adjust their prices so that these profits will be secured when they sell their quota of the offering business. There is no choice in this matter if the primary object is consistent and regular profits that will put manufacturing upon a basis that will make it a sound investment instead of a precarious speculation.

Pricing for profit instead of pricing for volume does not necessarily imply a loss of business. Intelligent merchandising will overcome the tendency in this direction and secure the profits through which cost reductions may be effected and prices lowered to the further benefit of all business. It has been estimated that American manufacturers ought to be earning at least $5,000,000,000 more profits per year than they now obtain. The electrical industry can assist manufacturers generally toward this goal by pricing for profit instead of pricing for volume.

## Invites Motorists to Plants and Emphasizes Power Resources

Travel on MAINE'S MILLION DOLLAR HIGHWAY
ROUTES 26-100
Lewiston-Auburn
The INDUSTRIAL CENTRE of NORTHERN NEW ENGLAND
Visit Gulf Island Dam - Abundant, Cheap, Hydro-Electric Power - New Industries

TOURISTS in the Androscoggin Valley of Maine are invited to visit the new Gulf Island hydro-electric plant of the Central Maine Power Company through the co-operation of the Lewiston-Auburn Chamber of Commerce and the utility, as indicated by the above billboard, which occupies a prominent place beside a new motor highway traversing this district. The attraction of industries by cheap power is effectively featured by this business organization.

## Latest Data on Farm Electrification

A VALUABLE contribution to the available information on farm electrification has just been published by the Committee on the Relation of Electricity to Agriculture in a 136-page booklet, "Electricity on the Farm and in Rural Communities." The booklet, which is issued as C.R.E.A. Bulletin, Vol. 4, No. 1, sets forth material which represents a summary of the best information at the command of the committee regarding rural uses for electricity.

In addition, it contains a review of the organization and activities of the various state and national associatons, agricultural colleges, experimental stations and the power companies working through the Committee on the Relation of Electricity to Agriculture to solve the problem of getting electric light and power service to the farms of the United States.

Among the data presented is an estimate of the number of farms in the country having electric service based on the results of a survey conducted by the rural electric service committee of the National Electric Light Association showing that 227,442 farms in 27 states had service from high lines on Jan. 1, 1927. This was an increase of 86 per cent for the same 27 states over Jan. 1, 1924. On this basis it is estimated that between 300,000 and 350,000 farms in the United States were receiving electric servce from distribution lines on Jan. 1, 1927.

It is significant with reference to the future development of rural electric service that 100 electric light and power companies report one or more men giving especial attention to this subject. Of this number 53 companies report the organization of rural electric service departments or divisions.

Other information set forth in the bulletin discusses different phases of the rural service problem, and the major portion is devoted to specific data on energy consumption of domestic and power applications of electricity on the farm. This information is given in an extensive description of the various applications and supplemented with some 80 tables and 208 illustrations.

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## Uses 30-Amp., Single-Pole Blocking Switches

By C. E. Schnell

*Electrical Designing Engineer San Joaquin Light & Power Corporation, Fresno, Calif.*

Even with increasing efforts directed toward better and more positive relay protection and with constant refinements in oil circuit breaker design and application to give greater continuity of service, still there are many things which enter into the complete scheme of operation of equipment which may defeat the purpose, such, for instance, as the blocking switch ordinarily inserted in the oil switch trip circuit to render the breaker nonautomatic or when it is desired to inspect or work on relays.

Experience of the San Joaquin Light & Power Corporation has been with the use of a somewhat varied line of switches for this service. The single-pole indicating snap switch, the single-pole tumbler switch with indicating handle and the single-pole knife switch all have been used. The two first mentioned have caused trouble due to incomplete and uncertain contact as well as flimsy construction, and while the tumbler switch gives the better appearance it has been the worst offender in this regard. While perhaps not so pleasing in appearance on the face of a switchboard, but because of more rugged construction, it has been decided to use for this service 30-amp., 125-volt, single-pole, single-throw knife switches mounted on the front of the board, but with studs for rear of the board connection. These are located near the relays whose tripping circuit they control and not only make a positive contact when closed but give a very desirable visual indication of their position at all times.

Blocking switches are operated only on direct instructions from the system load dispatcher, and it is the operator's duty carefully to check his board for proper position of these switches. During system disturbances, when an important line may be out of service, it is possible by opening the blocking switches on other lines to load them in excess of their normal relay settings until the period of such emergency operation is over. This does not disturb the relay setting and the blocking switch is closed on return to normal conditions, thus again making the automatic protective features effective.

## Refractor-Plate Lighting Gives Even Window Illumination

The department store of the C. T. Sherer Company, Worcester, Mass., is reported to be the first in the country to be equipped with prismatic refractor-plate window lighting. The installation is wired and equipped for a total capacity of 500 watts per foot overhead, the use of 150 watts per foot for the foot lighting, and numerous other outlets for floods, displays, etc. The present load of the windows is 350 watts per foot, including foot lighting. Seventy-eight plates and reflectors are used in three front windows; 88 circuits are provided for these, with 50 additional circuits for five side windows. Of the former, about 60 are used for overhead and foot lighting.

The illumination equipment consists of a row of light-directing Holophane plates, each about 1 ft. square and mounted separately or in groups in walnut frames. Each frame is fitted with hinges and latches to permit easy maintenance, lamp renewals and the insertion of color equipment. Plates and reflectors for this installation are mounted at an angle, the inner edge of the plates being at the ceiling line with the edge nearest the glass dropped 15 deg. below the horizontal. In addition, the light distribution is controlled by the filament distance from the plate surface and by the offset position of the reflector to the axis of the plate. Reflectors are mounted on Curtisstrip. In this type of construction the wireway rests on blocks cut at the desired angle. The reflectors can be moved either horizontally or vertically to obtain the desired lamp position.

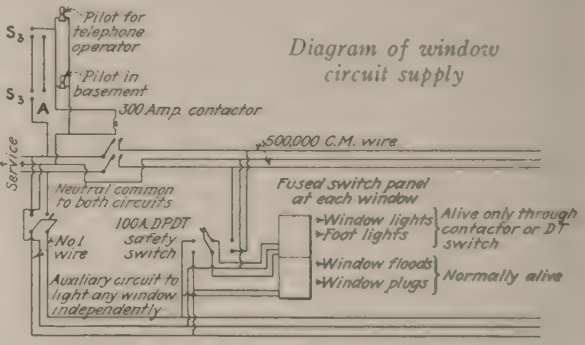


Diagram of window circuit supply
$S_3$
$S_3$
A
Pilot for telephone operator
Pilot in basement
300 Amp. contactor
500,000 C.M. wire
Service
Neutral common to both circuits
Fused switch panel at each window
100 A. DPDT safety switch
No. 1 wire
Auxiliary circuit to light any window independently
Window lights
Foot lights
Alive only through contactor or DT switch
Window floods
Window plugs
Normally alive

These windows are wired for two-point remote control at switches $S_3$, or control by clock or other switch at $A$. An auxiliary supply circuit independent of the contactor control is provided with a double-throw safety switch, enabling the major window displays to be lighted by either of the branch circuits shown.

An important feature is the use of spill light. No housing is located over the reflectors, and this light therefore is allowed to illuminate the store ceiling and, still more important, a light-toned transom curtain. Viewed from outside, there is an attractive effect of size and height along the entire store front which would be absent if everything above the window proper were left in blackness.

The foot lighting is unique in the use of 6-in. prismatic plates in place of the ordinary clear or diffusing glass. This results in improved distribution, doing away with the flux in so many other cases thrown into the eyes of passers-by. Lamps are located back of every other plate, or on 12-in. centers. As seen in the corner window, all plates appear to have about the same brightness, though differences can be noted when viewing them from inside or at comparatively wide angles. For the foot lighting 100-watt lamps are used. The foot lighting approximately doubles the background intensities at the desired heights.

At present the overhead lighting is by 200- and 300-watt lamps installed alternately along the window frontage portion of the ceiling.

For the current supply to the windows a feeder circuit of 500,000 circ.mils is installed, equipped with a remote-operated contactor. Control buttons and pilots are provided at two different points for turning all the windows on or off. The contactor method of control allows the use of any auxiliary device, such as a low amperage time clock, if desired. An auxiliary circuit also feeds double-throw switches at the switch cabinet for each window, which enable any window to be lighted independently for special occasions or during decorating and trimming work.

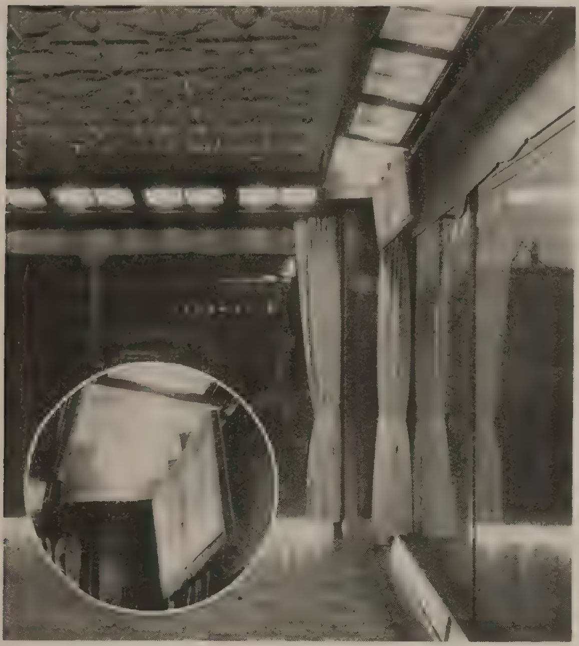


*Plate lighting installation of corner window; reflector mounting shown in insert*

## *Assets*

Our greatest business asset is the good will of the public we serve and it cannot be insured or treasured in a strong box—nothing but satisfactory service will safeguard and maintain it.

CONSUMERS POWER COMPANY
C. W. TIPPY,
*Vice-President & General Manager*

# Letters from Our Readers

## *Purchasing Agent Not Concerned With Price Cutting*

*To the Editor of* ELECTRICAL WORLD:

Referring to your recent article entitled "Who Pays the Cost of Price Cutting?" I would like to speak a word for the purchasing agent. The old law of supply and demand regulates the price of the commodity, and we are only concerned with getting values proportionate to the money we pay at the time of purchase, predicated on the price of raw material at that time. Price is important with us, but we want the best material we can buy, at the best price the manufacturer can make us, without his losing money, as we know no manufacturer can thrive without making a profit.

Speaking about the methods of buying, all deceit, trickery and pitting of salesmen against one another, as mentioned in your article, should be stopped.

On all large purchases, where bids are asked for, on electrical or any other material, where specifications, blueprints, etc., are furnished, and all bidders are bidding alike, the lowest bidder should be awarded the contract. If it is stated that all bids are to be in at a specified time, then, after all bids are in, no bidder should be allowed or asked to revise his price. This is the only way to get honest competition, as the bidder knows he is getting a square deal and, if his price is the lowest, will be awarded the contract. If the purchasing agent feels that the prices are out of line and too high, all bids should be rejected and new bids asked for.

The purchasing agent is not concerned with price cutting; we want the best price, predicated on the price of raw material, and want value received for the companies we represent.

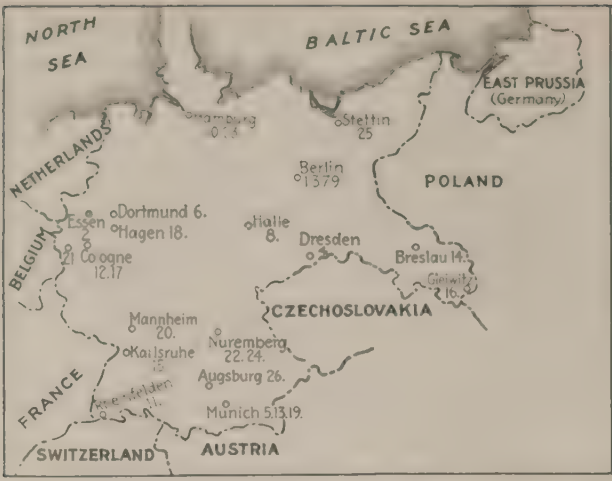
JOHN R. MCGIVNEY,
Purchasing Agent.
New Orleans Public Service, Inc.

## *How Electrical Development Is Proceeding in Germany*

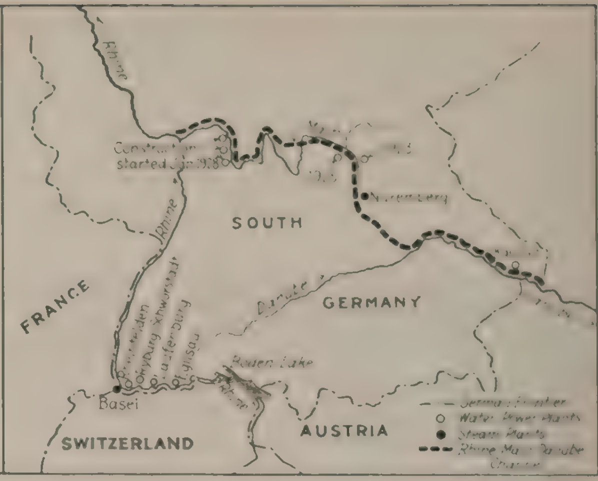
*To the Editor of* ELECTRICAL WORLD:

Official statistics published in the last half of 1927 show that at the close of the preceding year there were in Germany 26 generating stations, devoted mainly to the public supply of electric light and power, each of which sold more than 100,000,000 kw.-hr. in 1926. Two of these stations disposed of an output exceeding 1,000,000,000 kw.-hr. The table shows the capacity and the sales of these plants. With these figures as a background, the latest undertakings in Germany in connection with the supply of electricity stand out in their proper significance.

The undertaking of the Rhine-Main-Danube Company, founded in 1922 to build a waterway connecting the River Rhine—rising in the Alps and running through west Germany—with the Danube, which flows through the southern part of Germany before crossing Austria, Hungary and the Balkan countries on its way to the Black Sea, is on its way to successful completion. The project involves a wide channel navigable by boats of 1,500 tons, but its importance from the electrical point of view lies in the water-power sites developed concurrently with the improvement in navigation. These will, when completed, deliver to 35 power stations nearly



*Cities in which the largest German light and power companies have headquarters*



*Rhine-Main-Danube Channel and hydro-electric plants on the upper Rhine*

(The numbers refer to the table)

1,500,000,000 kw.-hr. a year, the average aggregate load of the stations being estimated at 250,000 hp.

The waterway is to run from the Rhine to the Main, crossing the Jura Mountains and descending again to the Danube. The power plants are built on sluices supplied from the main canals. The first plant was opened in 1923 with 4,350 hp., the second in 1925 with 4,800 hp. The largest plant yet built, not far from the point where the Danube leaves German territory, was begun in 1922 and went into service in the last months of 1927. It is rated at 75,000 hp. and generates nearly 275,000,000 kw.-hr. annually. Energy from it is distributed by the Betriebsgemeinschaft Kachlet-Franken, which, besides this enterprise, leases at Nuremberg, Bavaria, the 80,000-hp. plant of the Grosskraftwerk Franken.

Construction of the Rhine-Danube waterway has been made possible only by its power-generating features, the income of the power stations being charged with 90 per cent of the cost of the scheme. As utilization of the energy grew slowly in extent, construction of hydro stations was suspended for a few years, but in January last three additional ones were begun under contract with the Bavarian State, and everything now indicates that the project will be carried out in its entirety.

On the upper reaches of the Rhine also construction of a large hydro-electric station, to be known as the Ryburg-Schwörstadt, has recently begun. The Upper Rhine has a fall of 500 ft. between Boden Lake and the town of Basle, 104 miles distant. A channel for large ships is to be built through the rapids. As the Rhine at this point forms the boundary between Germany and Switzerland, these two nations will share in developing the sixteen sites selected. The existing power stations on this part of the Rhine are rated as follows: Kraftübertragungswerke Rheinfelden (German), 48,400 hp.; Laufenburg (Swiss), 69,000 hp.; Eglisau (Swiss), 42,000 hp. The new station, a few miles above Rheinfelden, will have four Kaplan turbines, with a total capacity of between 40,000 hp. and 120,000 hp., according to the flow. A possible development of 500,000 hp. is indicated. The output will average 650,000,000 kw.-hr. a year. Four shareholders have an equal interest in the undertaking—the Swiss government, the German state of Baden, the Kraftübertragungswerke and the Swiss company "Motor-Columbus," which owns the Laufenburg development. The plant will cost 60,000,000 Swiss francs (about $11,500,000), and energy will be generated, it is estimated, at a primary cost of about 0.3 cent a kilowatt-hour. GERHARD DEHNE.

Berlin, Germany.

*Large Central Stations of Germany (1926) with Output and Installed Capacity*

| | Energy Sold in 1926 (Millions of Kw.-Hr.) | Installed Capacity (Kva.) |
|---|---|---|
| 1. Elektrowerke A.-G. (Berlin) | 1,396.6 | 475,450 |
| 2. Rheinisch-Westfälisches Elektrizitätswerk A.-G. (Essen) | 1,218.7 | 612,000 |
| 3. Berliner Städtische Elektrizitätswerke A.-G. (Berlin) | 716.8 | 300,980 |
| 4. A.-G. Sächsische Werke (Dresden) | 528.8 | 231,405 |
| 5. Bayernwerk A.-G. (Munich) (Walchenseewerk A.-G.) | 307.0 | 122,600 |
| 6. Vereinigte Elektrizitätswerke Westfalen G. m. b. H. (Dortmund) | 274.6 | 229,520 |
| 7. Märkisches Elektrizitätswerk (Berlin) | 266.9 | 104,355 |
| 8. Elektrizitätswerk Sachsen-Anhalt A.-G. (Halle-on-Saale) | 245.0 | 46,400 |
| 9. Preussische Elektrizitäts A.-G. (Berlin) | 237.0 | 127,380 |
| 10. Hamburgische Elektrizitätswerke A.-G. | 231.3 | 122,310 |
| 11. Kraftübertragungswerke Rheinfelden | 216.7 | 29,200 |
| 12. Rheinisches Elektrizitätswerk im Braunkohlenrevier A.-G. (Cologne) | 212.1 | 170,700 |
| 13. Mittlere Isar A.-G. (Munich) | 181.3 | 92,000 |
| 14. Elektrizitätswerk Schlesien A.-G. (Breslau) | 164.2 | 140,120 |
| 15. Badenwerk A.-G. (Karlsruhe) | 162.3 | 73,450 |
| 16. Schlesische Elektrizitäts und Gas A.-G (Gleiwitz O. S.) | 155.3 | 81,000 |
| 17. Elektrizitätswerke der Stadt Köln | 147.4 | 15,000 |
| 18. Kommunales Eletrizitätswerk Mark A.-G. (Hagen, Westphalia) | 140.2 | 122,110 |
| 19. Stadtische Elektrizitatswerke München | 130.8 | 60,835 |
| 20. Grosskraftwerk Mannheim A.-G. | 129.7 | 37,500 |
| 21. Braunkohlen und Industrie A.-G. Zukunft (Weisweiler) | 120.4 | 67,500 |
| 22. Betriebsgemeinschaft Kachlet-Franken G. m. b. H. (Nuremberg) | 116.9 | 80,500 |
| 23. Nordwestdeutsche Kraftwerke A.-G. (Hamburg) | 115.7 | 88,090 |
| 24. Grosskraftwerk Franken A.-G. (Nuremberg) | 113.7 | ...... |
| 25. Uberlandzentrale Pommern A.-G. (Stettin) | 107.8 | 75,994 |
| 26. Lech-Elektrizitätswerke A.-G. (Augsburg) | 107.1 | 59,450 |
| Totals | 7,744.3 | 3,565,849 |

# Digest of Electrical Literature

## *Transmission, Substations and Distribution*

*Kelvin's Law for High-Voltage Transmission Lines.*—R. Roberts.—An exposition of the fundamental characteristics of the economic law for electrical power transmission developed many years ago by Lord Kelvin and adapted to the requirements of modern practice, with particular reference to conditions in Australia. It is stated by the author that while the law remains fundamentally correct in principle it is, when applied to modern high-voltage transmission lines, not the simple relationship it was once thought to be. In this discussion the formulas and load charts necessary for the development of the idea and a critical discussion of the values involved are offered. As a result of this investigation it is concluded that it is in general desirable to have synchronous condensers distributed over large transmission systems, but placing the centers of gravity at the loads; induction regulators should be used for particular feeders emanating from generating or substations, and that as there is an economic section of transmission line conductor, it is apparently preferable to use this economic section and to control the line pressure by devices located where necessary, although large copper sections for regulation purposes only are economically unsound.—*Electrical Times (Australia)*, Jan. 27, 1928.

*Problems in Connection with Three-Phase Star Loads.*—Alexander Russell.—The discrepancy between the value of the power factor of a balanced three-phase load obtained by the two-wattmeter and the three-wattmeter methods is mentioned by the author, as is the deviation in the ratio of the mesh voltage from the star voltage to earth from the theoretical value of the square root of 3. The author investigates the reasons for these variations and with the help of solid geometry develops a pictorial method of considering the problem. It is proved that the square root of 3 is the maximum value of the ratio of the mesh voltage to the potential difference between a terminal and earth. It is also indicated that a star inductive load only has an equivalent mesh load when the time constants of the arms of the star load are all equal.—*Journal of the Institution of Electrical Engineers (England)*, February, 1928.

## *Units, Measurements and Instruments*

*Determination of the Moment of Inertia of an Electrical Rotor.*—T. F. Wall.—Several methods of measuring the moment of inertia of rotating parts by means of the principle of oscillations are offered by the author and numerical values obtained by these measurements for specific machines are offered and compared. It is stated that the calculation of the moment of inertia of a composite structure like the rotor of an electrical machine is a very laborious process and cannot be expected to give accurate results without a great deal of arithmetical work. The methods considered include: The rotor removed from its bearings and arranged with its shaft supported on horizontal knife edges; the rotor suspended by means of ropes and wires and oscillated under gravity control; the rotor suspended by a single steel wire and allowed to oscillate torsionally about the axis of the shaft; the rotor caused to oscillate in small bearings about its shaft axis. The values obtained by these methods are useful in securing actual quantities for the measurement of the losses of the machine. It is stated that the performance of alternators in parallel is largely dependent on the magnitude of the moment of inertia of the rotating members of the respective machines.—*Engineering (England)*, Feb. 24, 1928.

*Extensometer for the Determination of Young's Modulus for Concrete.*—V. C. Davies.—The author has devised an extensometer particularly adaptable to the measurement of concrete test specimens. In the design particular efforts were made to secure an instrument which might be placed on the specimen while the latter is in position in the testing machine and which would be able to take specimens up to 4½ in. square. Previous experience on delicate extensometers has shown the necessity of securing a device which can be calibrated when fixed in position for test. The method of calibration employed is identical with that used in the well-known Ewing extensometer. The actual measuring device is arranged to measure the relative movement of a hardened steel screw fixed in the bottom frame and the flattened face of a cylindrical rod fixed in the top frame. The end of the calibrated micrometer is made hemispherical and this makes contact with the hardened steel cone fixed in the top frame. A bell-crank lever is pivoted to the framework so that the motion of the hand is magnified through a contact point by about 5 to 1. The end is provided with a jewel end-stone, making contact with the hardened steel point projecting from the frame of a swinging mirror. The movement of the bell crank is resisted by a long light cantilever spring, while contact between the point on the mirror frame and the end of the frame is maintained by means of a hairspring placed on the pivot arbor of the mirror. Both bell-crank lever and mirror frame are carried on cone pivots fitting into conical holes in the ends of small hardened steel screws.—*Engineering (England)*, Feb. 3, 1928.

## *Heat Applications and Material Handling*

*Industrial Electric Heating.*—The results obtained with specific installations of industrial electric heating in several British manufacturing plants are covered by this article. Operating costs developed as a result of several investigations indicated that the cost of maintaining an electrical industrial heating device was no higher than that for any other apparatus and that the same statements might be applied to operating costs giving in many cases a total cost much lower than that when other forms of heat treatment are used.—*Electrician (England)*, Feb. 3, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*Modern Research on the Structures of Metals.*—Wheeler P. Davey.—Research and development work with X-rays has been the special consideration of the author in this report of the activities of industrial research laboratories. The problems have been divided into several classifications, including, getting the factory out of manufacturing difficulties; development of new products and processes, and search for new scientific principles which may be applied to industry. It is stated that it is in the discovery of new facts or hitherto unknown ones upon which the future factory processes may be developed that the greatest usefulness of X-ray investigations is found. Practically all work of this sort depends upon the measurement of inter-atomic distances. These distances are so small that they cannot be measured directly. By the use of X-rays of known frequency in conjunction with the application of an X-ray defraction apparatus as a micrometer, these extremely small distances may be evaluated. Mention is also made of the method by which study may be undertaken of the mechanisms of melting which serve to correlate the melting point with the total expansion of the metal from absolute zero to the melting point. It is said to have been possible to prepare wire of certain alloys in a state of extreme purity by never permitting the metals to become melted even when making the alloy. Reasons for variations in physical properties are given.—*Journal of the Franklin Institute*, February, 1928.

*The Effect of Impurities on the Corrosion of Metals.*—Colin J. Smithells.—The prevention of corrosion is one of the most important problems confronting engineers and metallurgists at the present time and the enormous saving which results from each advance in this direction constitutes an important step in present-day engineering practice. Among the factors which influence corrosion the composition of the material is one of the most important. In this article the effect of impurities in metals is discussed in relation to the modern electrochemical theory. It is stated that the main factors which determine the influence of impurities on corrosion are electro-potentials of the metal and the impurity, the hydrogen ion concentration, the over-potential value of the impurity and the character of the corrosion product. Specific considerations for the more common metals and for the product formed by their destructive corrosion are offered in connection with the discussion. In conclusion, the author states that while the electrochemical theory leads to an expectation that corrosion resistance will be closely related to the constitution and structure of a material, the examples given indicate that it may also be applied to those small variations in composition which naturally occur in manufacture. Comparatively small changes in composition or the introduction of impurities to the extent of less than one part in ten thousand may materially modify the ability of an alloy to withstand corrosion in service.—*World Power*, February, 1928.

## *Illumination*

*Lighting in Industry.* — DUGALD C. JACKSON.—The problems involved in industrial lighting have been reduced largely to a research basis in this discussion. The subject is stated to involve three branches of science—physics of light, psychology, and physiology. The research was divided into a study and analysis of the scientific and industrial literature to determine previous accomplishments and a sound basis on which to start on a new investigation; experimental work by psychologists to supply certain information regarding sensitivity, discrimination, acuity, and fatigue that seem to be important in such an investigation; experimental work of a laboratory nature or under controls corresponding to those of a laboratory for the purpose of securing an understanding of the relation of scientific investigation of the conditions under which the conclusions may be applied when they are carried out in industry, and co-ordinated research in the study of factory workers, measurements of factory production, under different conditions of illumination, surveys of eye strain and general fatigue, and the adaptation of conclusions and inferences secured in the other branches of the investigation to application in the procedure, observation and conclusions of this branch, along with suitable verification of the soundness of the conclusions regarding "workers' efficiency." This discussion, the author of which is chairman of the Committee on the Relation of Quality and Quantity of Illumination to Efficiency in Industry, has resulted in a number of interesting recommendations and determinations. — *Journal of the Franklin Institute*, March, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*The Measurement of Acoustic Impendance and the Absorption Coefficient of Porous Materials.* — E. C. WENTE and E. H. BEDELL.—Various ways of determining the acoustic impedance and the absorption coefficient of porous materials from measurements on the standing waves in tubes are discussed. In all cases the material under investigation is placed at one end of the tube and the sound is introduced at the other end. Values of the coefficient of absorption of a number of commonly used damping materials as obtained by one of the methods are given. Several types of built-up structures are shown to have a greater absorption coefficient for low frequency sound waves than is conveniently obtainable by a single layer of material.—*Bell System Technical Journal*, January, 1928.

*Methods, Formulas and Tables for the Calculation of Antenna Capacity.*—FREDERICK W. GROVER.—The calculation of the capacity of an antenna has been developed upon the assumption of a certain charge upon the antenna and from which the resulting potential may be calculated. As the law of the distribution of the charge is not known difficulties are encountered in this method. The assumption has been made that sufficient accuracy is attained if at first a uniform distribution of charge is supposed to exist and the potential calculated at various points of the antenna, the average of these potentials being taken as the final equilibrium potential, but as the discrepancies between the values obtained by this method and the published values for the same antennas by the inductance method differ a factor of uncertainty is involved. The author demonstrates that if appropriate inductance formulas are employed the two methods will agree. Formulas are given for the common types of single and multiple wire antennas in a form convenient for numerical computation, together with tables of constants which will be found useful in such calculations. In addition tables of capacities of both horizontal and vertical single-wire antennas and horizontal two-wire antennas have been included which should render all calculation unnecessary in many important practical cases. —*No. 568 Scientific Papers of the Bureau of Standards.*

*The Attenuation of Wireless Waves Over Land.*—R. H. BARFIELD.—A description of a series of experiments undertaken to determine the attenuation of wireless waves over land. The intensity of the signals from the London broadcasting station 2 LO was measured along a number of radial lines in seven different directions up to a maximum distance of 100 miles. As a result of these measurements curves were prepared of the over-all attenuation, and derived curves showing only the surface absorption effect were produced. The experimental results were then compared with those obtained in accordance with the theory of Sommerfeld. The results indicate that the effects are not the same in all directions, the difference being quite important and considerably greater than that to be expected from previously determined values of the earth's conductivity. The conclusion of the author was that the greater part of the discrepancy between Sommerfeld's theory and experiment could be ascribed to the effect of trees, and also that the same agency offered a satisfactory explanation of the difference of attenuation observed in different directions—the greatest attenuation corresponding to the most-wooded regions, and vice versa.—*Journal of the Institution of Electrical Engineers (England)*, February, 1928.

## *Miscellaneous*

*Light Metals and Alloys—Aluminum, Magnesium.*—The physical and mechanical properties of aluminum and magnesium and their light alloys and the variation in properties caused by changing the composition of the alloy, by the presence of impurities, by mechanical working, by changes in conditions of manufacturing operations and by heat treatment, are given. The selection of the data available has been made and the data have been checked by representatives of the light-alloy industries in order to present reliable information. Equilibrium diagrams for the important alloy systems are presented, and the metallography, corrosion resistance and methods of protection against corrosion, the theory of heat treatment and the application of the alloys to industry are likewise discussed.—*No. 346, Publications of the Bureau of Standards.*

*An Electric Suction Dredge.*—An electrically operated suction dredge receiving power on board the vessel at a potential of 11,000 volts has been installed in a government development scheme in New Zealand. Power is taken from an 11,000-volt, three-phase transmission line at such points as may be nearest the section of the river to be dredged. An overhead line is run from there to the river bank and is carried in each direction for 1½ or 2 miles. A cable may also be laid across the river and other lines have been erected for same distance on the opposite side. The tap line is protected on the pole nearest the transmission line by an air-break switch, an oil switch with over-load trips and similar equipment. Air-break switches are erected at intervals on the river bank to enable the dredge engineers to isolate part of the line they are working on without the necessity of going to the extreme end of the tap line to do so. While the dredge is operating on one section the lines erected in a previous section are taken down and re-erected as desired. From the high-potential compartment a three-core cable is taken to a 300-kva., 11,400-volt, oil-cooled transformer and from there to a low potential compartment with distribution to the main pump motor control panel. — *Electrical Review (England)*, Feb. 24, 1928.

# News of the Industry

## Johnson Submits Boulder Dam Report

### California Senator Argues that the Bill Is Well Considered and Sound—House Committee Preparing New Measure on Muscle Shoals—Trade Commission Questionnaire

SENATOR JOHNSON of California on March 21 submitted to the Senate the majority report on the Boulder Dam bill. The report covers 31 printed pages. The amendments are discussed and the general project is outlined. Reasons are advanced to show why the project should be financially attractive to the government. Another section attempts to prove that the project has been fully investigated and that the federal government is the proper agency to undertake the development. A chapter is devoted to the Colorado River compact, and arguments are advanced in an effort to show the urgent need for flood control. Still another part of the report deals with the feasibility of the all-American canal and tries to show that there is not sufficient water for all. A chapter is devoted to power and an effort made to demonstrate that the project is financially sound. In conclusion the report says:

> The people of the Southwest are not asking of the government this great public improvement as a gift. All they ask is that the government lend its good offices to make this development possible. Established communities and responsible agencies will bind themselves to return to the government all moneys expended. The varied interests concerned with the development make a centralized agency necessary. The government is the logical agency. The beneficiaries assume all the financial obligations. Nor is this quite all. After the development is paid for the government still will retain ownership and control of the dam for such use as the Congress may deem wise and just. It is a great constructive improvement, not experimental, sound financially, well considered, shaped in the public interest, one the consummation of which will be a source alike of national pride and advantage.

Representative Douglas of Arizona has submitted a minority report from the House committee covering 45 printed pages. In it he says that he is opposed to the measure because of its unsound economic nature and not because he represents Arizona. He emphasizes particularly the contention that the project is not one for flood control, irrigation, domestic water or navigation, but does look to the development of the largest power project ever owned and operated by a government.

#### ANOTHER MUSCLE SHOALS BILL

After voting down the Norris Muscle Shoals bill (transmitted from the Senate), the Madden bill and the Morin bill, the House committee on military affairs has plunged into an effort to bring out a bill of its own. This bill is expected to set up a hundred-million-dollar government corporation to operate the property, make fertilizer and sell the surplus power. It is a radical departure from the Senate's plan and is not likely to meet approval there.

The House committee was not satisfied with the Norris bill because of its infringement on the rights of the states in the matter of control of rates and because the members did not regard the plan for fertilizer as a practical one. The Madden bill was even less acceptable. Some members of the committee feel that it is a gesture toward fertilizer production with the real intent of obtaining the power. The fertilizer guarantee was not satisfactory. The fact that the bidder for the property was not willing to turn it back if the fertilizer production should not succeed is cited as evidence strengthening the committee's impression. The refusal of the bidder to increase the offer when it was established that the Cove Creek dam and dam No. 3 would cost more than had been estimated also had influence.

The House committee regarded the Norris bill as a hodgepodge measure, interlocking the responsibilities of two executive departments in an impracticable fashion and complicating rate regulation. There was objection to additional installation on the ground that that depreciation would more than offset the limited use which could be made of the additional equipment. The fact that this machinery would use only secondary power would render it of small value unless the plant were a part of a large system.

Another suggestion which has been put forward is that the President be empowered to lease the plant. Should he fail to receive offers satisfactory to him, he is to be empowered to operate the plant until such time as a satisfactory offer may be forthcoming.

#### TRADE COMMISSION QUESTIONNAIRE

An eleven-page questionnaire has been sent to all electric and gas public utility companies by the Federal Trade Commission in connection with its inquiry into the conduct of those activities. The principal information requested follows: State of incorporation; date of incorporation; production; purchases and sales; distribution within state; distribution in other states; production within state; production in other states; companies from which purchases were made since Jan. 1, 1927; location and capacity of plant; names of companies with which interconnected; states in which transmission and pipe lines extend; gross earnings for 1927; net earnings from operations; number of shares, par value and book value, common and preferred stocks as of Dec. 31, 1927; amount of bonds and other long-time obligations; surplus; surplus reserves; persons or companies owning 1 per cent or more of voting stocks; ownership of stock in other companies; names of directors and chief officers; names of companies performing management, engineering, financing, construction, purchasing or other services.

A favorable report on the bill authorizing the Federal Power Commission to employ its own personnel has been made to the House by the committee on interstate and foreign commerce.

## Senators Find Fresh Fault with Utility Companies

Charges against the public utility industries continue to be made by United States senators. On Wednesday Senator Johnson of California read a photostatic copy of a letter which he said had been broadcast by Milton W. Harrison, president of the National Association of Owners of Railway and Public Securities, to holders of such securities, urging them to unite for protection "against unsound public discussion and unwise legislation" and to contribute $1 apiece to that end. The California Senator declared that if every stenographer, clerk and employee of corporations who had purchased a share of stock in them were to make a contribution, the collection would rival any fund ever collected.

At the same time Senator Walsh of Montana charged that public utility associations were "subsidizing lecturers and professors in colleges to instill in the minds of the youth of the land their peculiar views of public questions." Senator Norris of Nebraska wants a Federal Trade Commission investigation into newspaper purchases said to have been made or to be pending by Ira C. Copley, a former member of the House of Representatives and well-known utility man in the Middle West.

## Radio Bill Passes House

The conference report on the bill extending the life of the Federal Radio Commission for another year and embodying the new plan of distributing wave lengths and power was adopted by the House of Representatives on Wednesday, almost without opposition. Indications are said to be that the report will be accepted by the Senate and approved by the President.

## Engineering Section, N.E.L.A., Adopts Objectives

At the meeting of the executive committee of the Engineering National Section of the National Electric Light Association held at Louisville this week definite objectives were approved for the engineering committees to work toward. These objectives, as stated by Chairman E. C. Stone, are: More system capacity per dollar of investment, more kilowatt-hours per kilowatt of system capacity, a definite advance planning of system development and co-ordination of adjacent systems, comprehensive research in fundamental engineering problems of the industry co-ordinated through the committees, better conduct and wider distribution of serial reports, study of (and when desirable reports on) national engineering issues affecting the industry, constructive co-operation in the national movement for standardization, and greater engineering service to the industry through closer co-operation with the other national sections of the N.E.L.A. These objectives were approved with enthusiasm by the section members.

The various committees of the section met to discuss current work and to plan future work. The desire to realize more from investment dollars was evident in all the meetings, and much work was discussed or planned to bring about this result. Layouts for power stations, transmission systems, substations and distribution systems were analyzed to ascertain the best way to get acceptable service with a maximum simplicity in layout and a minimum investment. The use of automatic devices to reduce labor charges and improve performance was measured in terms of relative capital and operating costs in power stations. The prime movers committee discussed recent designs in terms of operating performance in an attempt to reach conclusions which would lead to maximum investment efficiency in the generation of energy. The overhead systems committee dealt largely with standards for wires, cables and construction whereby investment savings might be realized and better service rendered. Much was done to co-ordinate test work by utilities on such apparatus as oil breakers, lightning arresters and cables.

Technical discussions on metering, cable research, bin and unit pulverized-fuel systems, system frequency and load control and oil breakers took place in committee, and serial reports were presented and discussed which dealt with important engineering subjects. Accident prevention and inductive co-ordination committee activity was along constructive lines. General discussion showed a consensus of opinion against the proposal to merge the Safety Code and the Electrical Code.

Inspection trips were made to the hydro and steam stations in the vicinity and to Mammoth Cave.

# Collapse of St. Francis Dam Unexplained

### State, City and County Engineers Have Differing Opinions—Southern California Edison Gains Credit—City's Resumption Plans—Mead Will Head Investigators

ALTHOUGH agreed in discounting any theory that the St. Francis Dam disaster resulted from dynamiting or other sabotage, widely diverging opinions as to what caused the structure in San Francisquito Canyon to collapse and spread death and destruction throughout the Santa Clara River Valley have been expressed by engineers on the ground.

Edward Hyatt, Jr., State Engineer, blames foundation weakness in the abutments of the dam, refusing to express an opinion on whether the collapse was due to engineering mistakes or to causes over which man has no control.

William Mulhollan, chief engineer of the Los Angeles Bureau of Water and Power, under whose supervision the dam was built as a unit of the city's water system, declared his belief that a series of landslides above the dam caused the collapse. Other Water and Power Bureau engineers reported finding evidences of three slides.

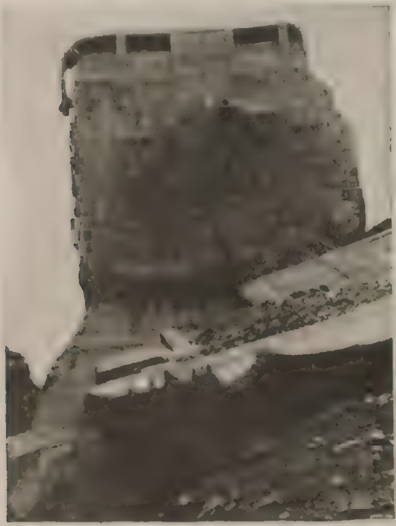
Charles Petit, county engineer of Ventura County, sharply criticised the foundation rock on which the sides of the dam were built. "It is my opinion," Mr. Petit added, "that a dam never should have been constructed at this point. The rock all seems to be largely of the same type."

As the illustrations below show, not only is the center part of the dam still erect but the two generators remain in the canyon firmly resting on their foundations, although the power house itself has been swept completely away.

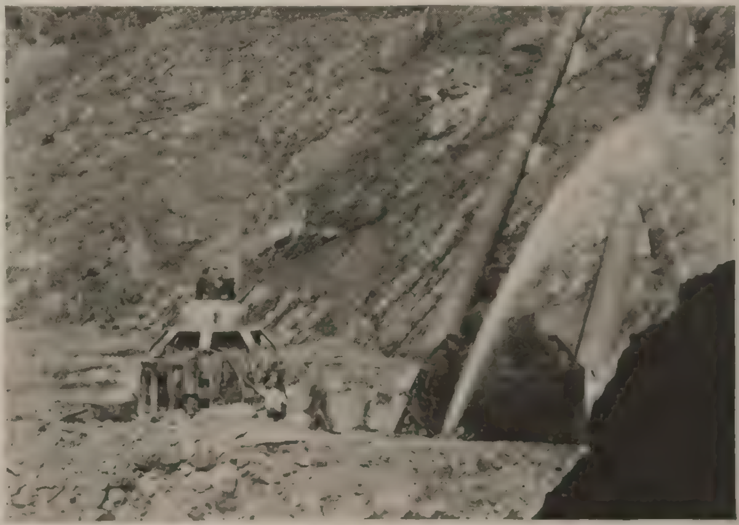
The outstanding feature of the situation is the remarkable manner in which the Southern California Edison Company came to the rescue and made up the deficiency in the city's supply of energy caused by the cessation of service from the city plants. It is a feather in the cap of the company and a proof of the wisdom of large steam reserves in metropolitan centers that ordinarily depend on water power.

From the Southern California Edison Company the following specially prepared account of the first warnings of the disaster and the way in which the company came to the rescue has been received by the ELECTRICAL WORLD:

The first warning of the impending disaster reached the Edison company dispatcher's office at 11:58 p.m., March 12, when one of the company's 60-kv. lines between Saugus and Lancaster went out. Trouble developed at the Saugus substation, and the entire Saugus substation crew was called immediately, which undoubtedly saved the lives of the operators at this substation.



*Center section of dam as it now appears*



*Where plant No. 2 stood—Generators still intact*

*Long Beach steam power house of Southern California Edison Company saves the day*

At 12:02 a.m. both of Los Angeles City's 110-kv. lines went out. At 12:04 a.m., just two minutes later, the Edison company picked up the total city load. At 12:39½ a.m. one of the Edison 220-kv. Big Creek-Los Angeles lines short-circuited. At 12:41 a.m. the second of these lines followed suit.

Up to this time neither the city of Los Angeles nor the Edison dispatcher's office knew what was causing the difficulty. A little before 1 o'clock an assistant patrolman of the Edison company on duty near Saugus called the dispatcher's office over the regular telephone lines and told what had occurred. He had been caught in the edge of the onrushing waters, but managed to escape and reach a telephone so as to get the warning in. Immediately the Edison dispatchers sensed the danger which this onrushing flood offered to the cities and towns in Santa Clara Valley, and calls were put through for all Santa Clara Valley substations.

Casitas substation, just north of Ventura, was the first one in the line, and the story was relayed to the operator in charge with the request that he immediately take steps to notify the chief of police in every one of the cities and towns in the Santa Clara Valley and then notify the Edison district managers in the territory affected. This man called the operators in the Saticoy switching station and other stations throughout the valley, and the story of the impending danger was spread. Undoubtedly many lives were saved by this timely action on the part of the Edison company dispatchers.

### City Orders Generator

Plans of the city of Los Angeles to restore its service are revealed by the fact that the Allis-Chalmers Manufacturing Company at Milwaukee has received a rush order for a generator, waterwheel and transformer to develop 30,000 hp. and to be placed in plant No. 1, located above the St. Francis Dam and not damaged by the flood. The equipment will be ready for shipment in about five months.

Dr. Elwood Mead, the Commissioner of Reclamation, has accepted the chairmanship of a special committee of engineers which will investigate the cause of the failure of the St. Francis Dam. The Secretary of the Interior has extended to Dr. Mead the necessary leave of absence.

## Manufacturing Executives at N.E.M.A. Meeting

Executives of the Policies Division of the National Electrical Manufacturers' Association gathered at the Edgewater Beach Hotel, Chicago, for group and general meetings extending from Wednesday afternoon to Friday morning of last week. Vice-president Clarence L. Collens, who is president of the Reliance Electric & Engineering Company, presided. It was announced that the membership had increased since the last meeting in September from 285 to 310 companies engaged in various branches of electrical manufacture. A code of ethics and sound merchandising principles introduced by N. A. Wolcott, president of the Packard Electric Company, was approved and referred to the board of governors for adoption.

R. J. Russell, president of the Century Electric Company, presented an analysis of present practice among manufacturers in terms of payment, showing the wide diversity in the use of the cash discount both as to the size of the discount allowed and the period taken and also the demoralizing influence of loose methods in regulating payments for goods sold. In a paper on the subject of minimum standard of performance for electrical products, W. S. Rugg of the Westinghouse Electric & Manufacturing Company recommended a minimum standard of performance as one way in which an industry can well serve its customers. Such a standard would be obtained by striking a balance among all the involved elements, such as lowest cost of manufacturing and distribution, greatest adaptability to the purpose for which the apparatus is to be used, greatest durability, lowest cost of maintenance and lowest cost of power to operate it.

The meetings were largely given over to the discussion of various phases of the manufacturing problem, embracing costs and channels of distribution, the possibility of changes in tariff schedule and administration, the need for more comprehensive industry statistics and the purpose of the Electrical Industry Sales Conference.

It was announced during the sessions that eighteen sections of the N.E.M.A. are now regularly collecting statistics on various classes of products and that four more are about to start. The next meeting of the Policies Division will be held at Association Island from July 29 to Aug. 1.

## Savings-Bank Bills Signed by Governor Smith

Governor Smith of New York on Wednesday approved the four bills introduced by the special legislative committee on savings-bank investments, commenting on their importance as he signed them. Among these bills is the one authorizing investments in the bonds of certain electric, gas and telephone companies whose passage by the Legislature was recorded in the ELECTRICAL WORLD last week.

The New York Assembly on Tuesday night passed and sent to the Senate without debate the Sargent water-power bills which carry provisions designed to insure to the state an adequate financial return for whatever private water-power development takes place on the inland streams. The first of these bills provides for the appointment of a commission of three members to be named by the Governor, the Speaker of the Assembly and the President pro tempore of the Senate. The commission is authorized to hold hearings to determine what would be a fair return to the state from private power development on the inland streams. The second of the bills is designed to give protection to the Adirondack resorts chiefly through specifically forbidding the proposed Oxbow reservoir near Tupper Lake, a provision which has been particularly demanded by Saranac Lake and near-by communities.

The proposed commission is required to report to the Legislature what it believes to be a fair rate of return from the private power development. If the rate is approved by the next Legislature, the way will be opened for the development of approximately one-third of the undeveloped hydro-electric power in the state, it is asserted.

The Sargent bills were passed by the Senate in the last-hour rush before adjournment on Thursday and sent to the Governor. His approval, although hoped for, is not yet certain. A premature press report reprinted in these columns last week indicated wrongly that the bills had already been passed and signed.

## Northwest Engineers Meet

*Distribution, Transmission, Lightning and Cable Terminal Failures Chief Problems Discussed at Spokane Gathering*

MEMBERS of the Engineering Section of the Northwest Electric Light and Power Association gathered for their fifth annual midwinter meeting in Spokane, Wash., March 8 and 9. The section, under Chairman O. L. LeFever, has had an active year, and a number of excellent papers were presented. One by M. T. Crawford on the overhead distribution network in Seattle dealt with the experience of the Puget Sound Power & Light Company with a common primary and secondary neutral system. Little trouble has been experienced with transformer outages due to cascading as long as the size of wire in the secondary network has not exceeded No. 4; on the contrary, better voltage regulation, greater economy and more reliable service have resulted, with little inductive interference with telephone service.

The work undertaken by A. O. Austin, Ohio Insulator Company, on high-voltage insulation and lighting was reviewed by H. V. Carpenter, Washington State College, who brought out the fact that Mr. Austin has shown greater economy and better insulator operating characteristics by the use of wooden poles, crossarms and pins and removal of the ground connection from pins than obtains where all-steel construction is used. An illustrated lecture on the Chelan development of the Washington Water Power Company was presented by the hydraulic power committee in which the advantages of the Wahlman gathering intake tube were brought out.

E. C. Stone, chairman Engineering National Section, held that the problem now before engineers of the industry is to secure more system capacity per dollar of investment and stressed the importance of the N.E.L.A. committees as a medium through which to work. A paper on lightning-arrester practice in the Northwest by Richard McKay of the apparatus committee showed little trouble from lightning when arresters are properly applied. The tendency is for bus as well as line protection. Discussion showed that protection resolves itself into a question of proper economic balance between line insulation, apparatus insulation and the cost of protection.

The most important contribution of the underground systems committee was the presentation of results of an investigation which disclosed the cause of failure in certain types of outdoor cable terminals. S. B. Clark showed that terminal failures experienced by one operating company were in large measure caused by internal flashovers caused by unfilled air spaces in vital parts of the terminal subjected to high voltage stresses and into which humid air is breathed. A paper on metal-tank mercury-arc rectifiers for 1,300-volt railway service by John Bankus indicated satisfactory operating results on a 1,500-kw. installation in Portland and greater economy than could be secured by synchronous converters. Success of gaseous rectifiers for railway service seems to presage a much wider application of this system of rectification and its extension to lower voltages.

Through the courtesy of the Washington Water Power Company those attending the meeting were afforded an opportunity to visit power plants and substations and other points of engineering interest in and around Spokane. Trips to the Lake Chelan development were also arranged.

## Arc-Welded Steel Frame

*General Electric Company's Use of This Method in an Addition, Nearly Complete, to Its Philadelphia Plant Described at Engineers' Meeting*

BEFORE a meeting of the American Society of Civil Engineers held at the Engineers' Club, Philadelphia, on March 14 Prof. Frank P. McKibben described the welded steel-frame factory building now being completed by the General Electric Company as an addition to its new plant in Philadelphia.

*Arc-welding a steel-frame building*

The structure is approximately 140 ft. wide, 600 ft. long and 50 ft. high and is erected at Sixty-eighth Street and Elmwood Avenue, Philadelphia. Across the Elmwood Avenue end and connecting to an adjoining building is a high bay or transept spanned by seven of the new welded roof trusses, each having a span of about 72 ft. The main wing of the building has a crane bay over which are twenty of the new trusses, each having a span of about 58 ft. There is also a gallery in an adjacent wing, over which there are twenty welded trusses, each of about 80-ft. span.

The large trusses used to support the roof on the new building are of particular interest because they involve new ideas in truss design. Each truss consists of two parallel lengths of metal latticed together by a system of tension and compression members. The common practice was to construct the trusses with angle iron, but in the new truss the two parallel members or chords are made of H-beams, the tension members are of channel iron and the compression members are H-beams.

The General Electric Company, in order to determine the relative holding values of welded joints, conducted many tests on welded and riveted joints. In one series of tests welded specimens were made by the company and the actual tests were conducted under the direction of Prof. T. R. Lawson of the Rensselaer Polytechnic Institute, Troy, N. Y., in the laboratory of that institution. These tests showed that a ¼-in. fillet will stand a safe allowable load of 2,600 lb. per lineal inch, using four as a factor of safety. Corresponding values for 5/16-in. and ⅜-in. fillets were 2,900 lb. and 3,200 lb. A ¾-in. rivet, the standard size, is estimated to stand a shearing load of 4,500 lb.

In his talk at the Engineers' Club Professor McKibben said that the use of welding resulted in a considerable saving of steel and a consequent reduction in the cost of the steel frame, in the elimination of noise due to riveting and in promoting the electrical industry.

The majority of the welding was done with ⅜-in. fillet welds, 5/16-in fillets being used to some extent at various times. The work is being carried on by the U. G. I. Contracting Company of Philadelphia, general contractor. Harris & Richards, architects of Philadelphia, designed the structure.

## Would Substitute Conferences for District Convention

Subject to the approval of the light and power companies of Minnesota, North Dakota and South Dakota, the executive committee of the North Central Electric Association, which is the geographic division of the National Electric Light Association comprising the three states named, has recommended that the annual convention be superseded by four conferences—accounting, commercial sales, engineering and managerial. This change has been contemplated for some time, and a tryout of two-day conferences was made last year in accounting, commercial sales and engineering. These three sessions drew an attendance of 309, and the response to the new plan was very favorable. Sectional meetings at various points in the district have also been well attended, more than 1,100 taking part. It has been suggested that the association conduct a convention only once every two or three years. A conference of executives and managers will be held at Breezy Point, near Pequot, Minn., June 15 and 16.

The South Dakota electrical conference of the North Central Electric Association was held March 21 at Sioux Falls with much success, speakers from Chicago, Minneapolis and Sioux Falls dealing with engineering and commercial subjects.

## Purchases and Mergers

*Washington Water Power Company Formally Taken Over by American Power & Light—Expansion in Pennsylvania and Other States*

CONTROL of the Washington Water Power Company by the American Power & Light Company of New York was taken over at the annual meeting of the Washington Water Power Company at Spokane last week. Several of the former members of the board were retained, including the executive officers, President D. L. Huntington, General Manager M. W. Birkett and General Counsel Frank T. Post. Sidney Z. Mitchell, president Electric Bond & Share Company, New York, heads the list of trustees and the executive and finance committees. (See ELECTRICAL WORLD, Jan. 21, page 166.)

Applications have been heard before the Pennsylvania Public Service Commission from the Glen Rock Electric Light & Power Company for permission to acquire the East Hopewell Township Light, Heat & Power Company, the Cross Roads Light, Heat & Power Company and the Manheim Township Light, Heat & Power Company, and from the Edison Light & Power Company for permission to acquire the Chanceford Light, Heat & Power Company, the Winterstown Light, Heat & Power Company and the North Hopewell Township Light, Heat & Power Company. All the companies sought by the two would-be purchasers are "paper" concerns, and what is really sought is permission to extend lines over territory contiguous to that now served.

Purchase of seven smaller companies by the Scranton Electric Company has been approved by the Department of State at Harrisburg, Pa., following the Public Service Commission's sanction. The companies purchased are the Carbondale Township Electric Company, Clifford Township Electric Corporation, Greenfield Township Electric Corporation, Laflin Electric Company, Newton Township Electric Corporation, Ransom Township Electric Corporation and Scott Township Electric Corporation.

The St. Lawrence County Utilities, Inc., and the Antwerp Light & Power Company have made a joint application to the New York Public Service Commission for consent to the transfer of the works and system of the latter to the former. The New York Power & Light Corporation has made application to the Public Service Commission for authority to acquire 155 of the 160 outstanding shares of the common stock of the Ticonderoga Electric Light & Power Company. The petition states that the New York company and its subsidiary, the Port Henry Light & Power Company, operate in a territory contiguous to that served by the Ticonderoga company.

An unusual situation has developed as the result of the purchase of 54 per cent of the stock of the Hammond (N. Y.) Light & Power Company by the St. Lawrence County Utilities of Potsdam, N. Y., and of the minority interest by Michael Doyle of Rochester, representing the Oswegatchie Light & Power Company of Gouverneur, N. Y. The minority stockholders, it is reported, gained control of a meeting following the sale, elected the directors and indorsed an expansion program favored by Mr. Doyle, and so far their action has not been reversed.

The Western United Gas & Electric Company, Aurora, Ill., has been authorized to purchase the Western Public Service Company, serving communities along the Burlington Road.

The light and power system at North Lewisburg, Ohio, has been sold to Cleveland capitalists by Frank A. Jordan for $20,000. The purchasers have incorporated as the North Lewisburg Light & Power Company.

The Consumers' Public Service Company, a new corporation with headquarters in Brookfield, Mo., has purchased and merged several utility companies in northern Missouri, including the Browning-Purdin Electric Company, the Laclede Electric Company, the Powersville Electric Light & Power Company and the Rothville-Sumner Electric Company.

Negotiations for the purchase of the Harford County property of the Northern Maryland Power Company by the Consolidated Gas, Electric Light & Power Company of Baltimore have been held up until certain figures shall be verified. Consummation of the deal, however, is expected within a month, according to President H. A. Wagner of the Baltimore utility.

As the result of a unanimous town election, the Southern Public Utilities Company will take over operation of the Walnut Cove (N. C.) electric light plant on June 1.

The Northern States Power Company at Sioux Falls, S. D., has increased its offer of $7,500 for the Canistota (S. D.) municipal electric light and distribution system to $10,000, and the Council will again submit the proposal for sale of the plant at a special election in April.

Milton, Fla., is to vote soon on the ratification of the sale of the town plant to the Gulf Power Company.

Fort Collins, Colo., will probably hold an election on April 3 to decide whether the city shall own and operate its own electric and gas plants. Electricity is now supplied by the Public Service Company of Colorado.

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## Portland Merger Election Set for April 9

In response to the formal request to the Portland (Ore.) City Council to provide for a special election at which an ordinance will be submitted to the voters on the proposed sale of the Northwestern Electric Company to its competitor, the Portland Electric Power Company, the date of the election has been set as April 9. As a part of the ordinance a new residential schedule is offered to the people of Portland which will bring about an average reduction of 11 per cent in domestic rates. Reduced rates, according to officials, are contingent upon operating economies to be effected through the unification of the companies and will become effective only in the event that the proposal is approved by the voters. As a protection to the public against any increase in rates the ordinance contains a clause stipulating that no increase in rates shall be contemplated or requested during a period of five years. A promise is further made that, if the unification is approved, steps will be taken immediately to establish lower rates for commercial lighting and power and that the maximum rate for commercial lighting shall not exceed 5 cents per kilowatt-hour as against the present top rate of 7 cents.

Following is the new domestic schedule: First 38 kw.-hr. per month, 5 cents per kilowatt-hour; next 32 kw.-hr., 2.8 cents; excess, 1.9 cents. For an installation of 600 watts or less 38 kw.-hr. will be charged for at 5 cents per kilowatt-hour and one additional kilowatt-hour will be sold at 5 cents for each 30 watts of installation in excess of 600 watts. Lighting only will be considered in the determination of the demand. The minimum charge will be $1 per month for lighting customers and $2 per month for cooking and heating customers having a connected load in excess of 2 kw.

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## Illinois Men Convene

*State Electric Association Takes Part in Two-Day Meeting at Springfield Embracing Three Utility Bodies—Street-Lighting Business a Topic*

GOVERNMENT ownership was characterized as an attempt to transform the state into a benevolent Santa Claus, "doing everything for everybody at no cost to anybody," by Henry Swift Ives, vice-president of the Casualty Information Clearing House, Chicago, who addressed the opening session of a two-day annual convention of the Illinois State Electric, Gas and Street Railway associations held at Springfield on March 14 and 15. He warned the utility delegates that the "old feudal doctrine that the government should support the people" is having a remarkable revival in this country.

Further addresses and discussions in the two morning general sessions of the convention by J. P. Barnes, Oscar H. Fogg, B. J. Mullaney, George R. Jones, Mrs. Marc J. Fowler, Jay G. Mitchell, Charles N. Wheeler, F. S. Armstrong, E. R. Dillavou and others were devoted to considerations of public policy, domestic utilization of utility services, telling the utilities' story to the public, accident prevention and the terminable permit idea. The record of accomplishment of the Illinois Committee on Public Utility Information during the nine years of its life, presented by Mr. Mullaney, showed conclusively that such work is worth while.

The Illinois State Electric Association held its sessions on Wednesday and Thursday afternoons. The report of the industrial relations committee, by W. J. McPherson, summarized the better adjustment of this important factor. R. J. Malcolmson dealt with "Street Lighting as a Source of Revenue." His view of the possibilities of this class of business where there is aggressive sales effort brought out an animated discussion. The paper emphasized the necessity for high-intensity lighting since the fixed-investment charges on any installation are only slightly affected by lamp sizes.

The status of and market for residential refixturing was covered by R. G. Raymond. Methods used and results obtained from fixture sales campaigns by the Ohio Public Service Company and in Chicago by the Electric Association were detailed.

Prof. E. W. Lehmann, who is director of the Illinois project on rural electrification, made his final report, presenting definite data on costs of equipment and energy. The view that rural electric business should be treated separately from other classes was taken by J. Paul Clayton, who pointed out that methods of distribution, rate forms, accounting practices and sales efforts for rural business are different from those for ordinary urban business. A paper by F. B. Sans on progress in connection with superpower transmission in Illinois closed the sessions.

The total convention registration, including all groups, was more than 800, and approximately that number attended the convention dinner, at which Colonel Sidney Storey spoke on the necessity for an American merchant marine.

## Best Oklahoma Meeting

*Manufacturers and Suppliers Have Exhibit—Local "Good-Will" Gatherings to Be Extended Because of Success at Okmulgee and Lawton*

WHAT was declared the most successful convention in the history of the Oklahoma Utilities Association closed at Tulsa on March 15. Besides the events briefly noticed last week (page 573), notable addresses at the general sessions were made by Alexander Forward, managing director American Gas Association; E. K. Hall, vice-president American Telephone & Telegraph Company; J. W. Welsh, general secretary American Electric Railway Association, and others.

The importance of maintaining the public relations and public speaking program was emphasized by W. S. Vivian of Chicago, director of public relations, Middle West Utilities Company. H. S. Bennion, director of engineering of the National Electric Light Association, gave some interesting information on "Interstate Power."

Papers presented in the Electric Light and Power Division were on refrigeration, by R. W. Curran, Bartlesville; rural electrification, by Edwin Kurtz, A. and M. College, Stillwater, and L. S. Reagan, Oklahoma City; developing the small industrial load, by S. I. McElhoes, Oklahoma City; safety methods, by C. H. Meyer, Tulsa; developing power load in the oil fields, by O. A. Jennings, Oklahoma City; rates, by George Mills, Dallas, Tex., and decorative lighting, by A. E. Warner, Oklahoma City.

Five hundred and fifty persons attended the banquet and entertainment on March 14—200 more than last year. Congressman Eaton's address, in which he attacked tendencies to state socialism, as evidenced by endeavors to bring utility companies under public ownership, and defended the utility industries was well received.

Twenty manufacturers and suppliers had exhibits at the convention, almost the entire fifteenth floor of the Mayo Hotel being devoted to this purpose. Establishment of a safety, claims and accident prevention committee to operate within the Public Relations Division of the association was authorized by the executive board. This division announced that it will be more active during the coming year than ever and will continue and extend "good will" meetings like those held recently at Okmulgee and Lawton, where there was a larger registration of outsiders than of public utility men.

New officers to serve until March 14, 1929, are: President, L. W. Scherer, Yale, president of the United Telephone Corporation; first vice-president, H. L. Montgomery, Bartlesville; second vice-president, T. H. Steffens, Sand Springs; treasurer, W. R. Emerson, Oklahoma City; manager (re-elected), E. F. McKay, Oklahoma City. Frank J. Meyer, Oklahoma Gas & Electric Company, was elected chairman of the Electric Light and Power Division, and L. P. Arnold, Public Service Company of Oklahoma, chairman of the Public Relations Division.

## Briefer News

PORT ANGELES, WASH., PLANS CITY POWER PLANT.—Port Angeles, Wash., has filed application for 650 sec.-ft. of water from the Elwha River for a proposed city power and light project capable of developing 10,000 hp. and to cost $750,000.

CENTRAL STATES ELECTRIC COMPANY TO BUILD 100 MILES OF LINE.—Besides increasing the capacity of its Iowa Falls and Armstrong stations, the Central States Electric Company of Cedar Rapids, Iowa, will this year, Vice-president John A. Reed announces, build 100 miles of 33,000-volt, three-phase line, extending from Havelock to Fenton, from Iowa Falls to Eldora, and from Blairsburg to Duncombe and Stratford.

TOKYO CENTRAL-STATION COMPANIES TO BE MERGED ON APRIL 1.—Announcement comes from Japan, where unrestrained competition has prevailed to a large degree in the electric light and power business, that the Tokyo Electric Light Company and the Tokyo Electric Power Company will be merged on April 1. This is regarded as a first and very important step toward establishing the industry in that country on the basis of regulated monopoly.

NORTHWESTERN ONTARIO WILL SOON HAVE 56,000 HP. ADDITIONAL AT SPRUCE FALLS.—Excellent progress on the hydro development of the Spruce Falls Power & Paper Company at Smoky Falls on the Mattagami River, 50 miles north of Kapuskasing, Ontario, is reported, and the plant may be completed by the middle of April. It comprises a power development of 75,000 hp., 50 miles of transmission line and the same length of standard-gage railway between the 600-ton mill and the power site. Four generating units will eventually be installed, of 18,750 hp. each, under a head of 114 ft. The present installation includes three of these.

SAN JUAN RIVER HAS POTENTIAL WATER POWER OF 280,000 HP.—According to the Geological Survey, the San Juan River, called the second largest tributary of the Colorado, has unused resources sufficient to sustain a large development in agriculture and water power. The present power demands are small and are supplied by less than 7,500 hp., generated in four plants. The undeveloped power resources consist of ten power sites capable of yielding, with storage, about 280,000 hp. The report was made by E. C. LaRue.

MOBILE DESIRES TO IMPROVE STREET LIGHTING.—Engineering estimates totaling approximately $270,000 have been compiled and submitted to the Board of City Commissioners of Mobile, Ala., on a proposed extensive ornamental "white-way" street-lighting system for the city. The plan embraced in the survey would require approximately 490 12-ft. standards and 825 10-ft. standards. It would equip practically all the principal streets of the business district with "white-way" lighting and would include about three miles on Government Street, a leading residential thoroughfare.

DUKE COMPANY PLANS STILL ANOTHER CATAWBA RIVER DEVELOPMENT.—With the approaching completion of the Duke Power Company's 56,000 hp. hydro-electric plant at Oxford Shoals, N. C.—the twelfth on the Catawba River—comes a report that the company has already begun preliminary work incident to still another plant on this stream. Details of the project have not been made public, but it is believed that the plant will rank with the largest yet constructed by the company. It will be built just above the Mountain Island plant, near Castonia, completed two or three years ago. No estimates of costs have been announced.

UPSTATE NEW YORK COMPANY PLANS SUBSTANTIAL CONSTRUCTION. — The New York State Gas & Electric Corporation expects to spend $1,672,418 for construction and improvements to its system during 1928. The program includes a 7,500-kw. turbine installation at Ithaca, a 33-kv. transmission line between Liberty and Jeffersonville, a waterwheel at Colliers, an extension from Mount Upton to Gilbertsville and Morris, a transmission line from Walton to Cannonsville and Hancock, substation and substation additions at Walton, Deposit and Hancock, and minor equipment at Delhi.

NEW KENTUCKY TRANSMISSION LINE COMPLETED.—The Kentucky Utilities Company placed in service on March 15 its new 66,000-volt, 36-mile, double-circuit, steel-tower transmission line connecting Morganfield and Earlington, in western Kentucky. The line, which cost nearly $300,000, has transformer substations at both ends and took six months to build. It forms an important link in a transmission loop to be completed in the coming summer, which will include the Earlington, Graham and Paducah generating stations of the Kentucky Utilities and the Grand Tower and Muddy stations of the Central Illinois Public Service Company.

Electric Drills Seek More Oil 7,600 Ft. Beneath Surface.—What is pronounced the most remarkable test yet made of the use of electricity in oil-well drilling is that of the Texas Oil & Land Company on land owned by the University of Texas in the Big Lake field. When the report was received this well was past the 7,600-ft. mark and was being sunk still deeper. But for the adaptability of electric motors in handling the drilling tools it would have been impossible to drill the well to so great a depth, it is asserted. The electric motors are so efficient that the tools can be raised, the bailer run twice and the tools run back on bottom in one hour and thirty minutes.

Three-Cornered Agreement Over Delco-Remy Service Adopted. — The difficulty noted on Feb. 11 (page 324) over additional power and standby service for the Delco-Remy plants at Anderson, Ind., which employ seven thousand persons, has been adjusted by a six-year contract with the Indiana General Service Company for all power in excess of what the municipal plant can furnish. The power company will build a 132-kv. transmission line to the east edge of the city and erect a substation, while Anderson will build lines from the corporation limits to the Delco-Remy plants and also to the municipal plant. Whenever the city takes energy from the Indiana General Service Company the latter will be repaid from the municipal plant.

Montreal Investigates Power Possibilities of Aqueduct and of Garbage Incinerators.—The possibility of utilizing the aqueduct in Montreal, where electric pumping has been substituted for steam, to furnish light and power is being investigated. The city spends annually more than $750,000 for electrical energy and the indicated saving is thought worth while. The aqueduct is about seven miles long and the installation of a city power system would not only provide power for it but also for the sewer department, street lighting and civic building. Engineers are also estimating the available power development from the combustion of garbage at incineration plants which the city expects to erect this year.

Illuminating Engineers of the World to Tour American Cities.—An International Congress on Illumination, to bring together leaders in the field of lighting from all parts of the world, is to be held in the United States in September. The event will open on Sept. 7 with a tour by the foreign delegates to various American cities, will include the twenty-second annual convention of the Illuminating Engineering Society at Toronto on Sept. 17-20 and will close with the eighth session of the International Commission on Illumination, to be held at Saranac Inn, N. Y., from Sept. 22 to 28. The arrangements are being made under the auspices of the Illuminating Engineering Society and the United States National Committee of the International Commission on Illumination. John W. Lieb, vice-president New York Edison Company, is serving as chairman of the reception committee. Julius Daniels, Edison Electric Illuminating Company of Boston, is chairman of the executive committee in charge of arrangements.

Sixty Thousand Visit New Orleans Electrical Exposition. — Almost sixty thousand persons visited the electrical exposition sponsored by the Electrical League of New Orleans and held at the Delgado Trades School early this month. Many manufacturers and electrical companies had booths, and the lighting was an especially attractive feature. Credit for the success scored is due in large part to the arrangement committee, of which W. E. Clement, commercial manager New Orleans Public Service, Inc., was general chairman. The illustration shows the booth of the company just named.

Application to Missouri Commission for Bagnell Site Temporarily Withdrawn. — The Missouri Hydro-Electric Power Company on March 13 withdrew for the present its application for an extension of the certificate of convenience and necessity granted it by the Missouri Public Service Commission two years ago to construct a dam and power plant on the Osage River near Bagnell. Protests against the project were made by residents of Camden and Benton Counties, and especially by citizens of the village of Linn Creek, which, it was said, would be obliterated. It was stated that the federal license issued to Walter Cravens, former head of the company in Deecmber, 1925, had been transferred to the company. The estimated cost of this project is $19,000,000, and, as stated on Feb. 18 (page 369), Stone & Webster and the Union Electric Light & Power Company may possibly become actively interested in it.

A.S.M.E.'s Tentative Plan for Fuel Research.—A preliminary plan for research in fuels, as approved by the main research committee of the American Society of Mechanical Engineers, has been issued. This research is to be carried on as one of the society's activities, and the chairman of the special committee having the research in charge—F. R. Wadleigh, 1 Broadway, New York—solicits suggestions and assistance from all interested. A booklet, "Research Activities," issued by the society, is available.

Municipal Ownership in Missouri.—Voters of Kennett, in southern Missouri, with but nine dissenting votes, on March 14 decided to build and operate a municipal light and power plant and distribution system, although on the day before the election the Arkansas-Missouri Power Company, which has been serving the town, announced a substantial reduction in its rates. The town has three proposals under consideration, several plant-equipment concerns having offered to install equipment and accept payment out of the plant's profits if the town will furnish the building. Trenton, in the other end of the state, has a municipal plant under consideration, its estimates being based on the cost of the one in Chillicothe, Mo.

Extension of Bureau of Standards' Control of Weights and Measures Opposed.—The American Institute of Weights and Measures is out in opposition to a bill now before a committee of the House of Representatives and designed to empower the Bureau of Standards to approve or disapprove all weighing and measuring devices or mechanisms used in the country. The American Institute of Weights and Measures recommends that every one concerned take steps to inform himself regarding the provisions of this bill. It accuses the Bureau of Standards of seeking authority to police every conceivable kind of device in use for producing articles dimensioned in terms of the standards of weight and measure. Micrometers, gages and meters of every kind are mentioned among the apparatus which the protesters think would automatically be included in the provisions of the bill.

American Electrochemical Society's Spring Program at Bridgeport. —Dr. George W. Vinal of the Bureau of Standards will be in charge of the first session of the American Electrochemical Society's spring meeting at Bridgeport, Conn., on April 26-28, the symposium subject being "Chemical Production of Electricity" and covering electrolytic rectifiers, storage batteries, gas cells, dry cells and standard cells. The evening will be devoted to an illustrated lecture on the "Refraction of X-Rays in Elements and Compounds," by Prof. Bergen Davis of Columbia University. On Friday morning a discussion on industrial electric heating, held jointly with the National Electric Light Association, will be participated in by R. M. Keeney, John L. Christie, R. E. Talley and others. A new film on "Electric Heat in Industry" will be presented. Dr. B. D. Saklatwalla, chairman of the electrothermic division, will preside at an informal round-table discussion on refractories for electric brass melting. Saturday morning's session, in charge of Prof. E. M. Baker, will deal with the plating of silver, nickel, brass and chromium.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

Southwestern Division, N. E. L. A.—Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Institute of Electrical Engineers — Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A.—Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

# Commission Rulings

Condemnation of Land by Public Utility Includes Coal and Fireclay Beneath It.—The Duquesne Light Company in condemning a parcel of ground on which to erect a substation was refused permission by the owner to acquire coal and fireclay underlying it. In view of the danger of subsidence of the plant if the underlying strata were removed, the company appealed to the Public Service Commission of Pennsylvania, which sustained its claim to the subsurface as well as the surface of the plot.

Nebraska Commission Limits Bond Issue.—Passing on an application from the Central West Public Service Company of Nebraska for approval of an issue of 6 per cent 30-year bonds in the sum of $500,000, the Nebraska State Railway Commission holds that no bonds should be issued in excess of 75 per cent of the present value of the property offered as security and that in ascertaining the basis of such valuation there must be eliminated the working capital and going-concern value as well as any value placed on a water right acquired by purchase. It, therefore, declined to approve any issue in excess of $400,000. All the company's stock is owned by the Central West of Delaware. None of the bonds is to be sold to the public, but they will be substituted for stock now used as collateral for a mortgage of the parent company.

Georgia Commission on Supreme Court Valuation Dicta and on Combination Companies.—In handing down a decision in a street-railway fare dispute involving the Georgia Power Company, the Public Service Commission of Georgia said: "The Supreme Court of the United States, to our mind, has not been as definite in prescribing rules as a guide for arriving at a fair value as a proper rate base as we believe should have been the case. However, considering its expressions on this subject as a whole, it is very clear that it leans more to the reproduction-cost theory than to any other method. It is our belief that a strict adherence to the reproduction-cost theory would not be best for the company or the citizens it serves. Conditions could happen, as they have happened in the past, which to apply to such a method would work disaster for the company as well as hardship on the public. Such a theory if applied in the last half of 1914, 1915 and 1916 would have bankrupted most of the companies throughout the country. . . . The commission has consistently held that where different classes of utility service are being rendered by one company, as far as practicable these properties should be segregated and the patrons of each class should bear their part of the burden of producing a return on the fair value of such property as is devoted to their use. To do otherwise would have the effect of creating discriminations between the different classes of patrons of the company. In the instant case it is true that many car riders do not use electric light or gas, whereas, on the other hand, many patrons of the gas and electric departments rarely if ever use the street-car service. It therefore follows that if the street-railway department is not earning a reasonable return on the fair value of its property, it would be a discrimination and unfair to the users of gas and electricity to require them to pay excessive rates to make up losses in the railway department. . . . If the street-railway property is to be treated in conjunction with the gas and light and power property, people throughout the state would be called upon to contribute to the support of the street-railway property, although comparatively few would ever have need for its use. Such a theory is fundamentally unsound."

Petition by Consumers for Increased Monthly Charge Dismissed.—The Indiana Public Service Commission has dismissed a petition from most of the customers of the Madison Light & Power Company asking that the minimum monthly charge be increased as an offset to a reduced lighting rate offered by the company. The commission said that the expense of the hearing required by law would be greater than the relative advantage that the customers were seeking.

# Recent Court Decisions

Railroad Found Liable to Power Company for Bridge Constructed by Latter.—The United States Court at Charlotte, N. C., has decided that the Southern Railway owes the Blue Ridge Power Company $260,000 as reimbursement for expenses growing out of the construction of a bridge across Green River just above Saluda on a division of the Southern Railway. The power company, the decision explains, replaced a wooden trestle by a concrete bridge after it had asked for permission to construct a dam that would end the usefulness of the former trestle. The court found that the new bridge had benefited both companies equally and that the railway should reimburse the power company. Appeal will be taken.

Utility Confined by State Commission to Certain Part of Divided Territory Not Deprived of Property Without Due Process of Law.—In sustaining the decision of the New Jersey Board of Public Utility Commissioners fixing a territorial boundary in the borough of Spring Lake for the observance of rival light and power companies (Electrical World, Feb. 18, page 374), the New Jersey Supreme Court said (Eastern New Jersey Power Company vs. Board) that it could find no merit in the contention that the order deprived the plaintiff of property without due process of law. "It is manifest," said the court, "that an electric light company which undertakes to furnish a municipality with lighting for its streets or public buildings and enters into a contract with such municipality, for either a short or long term of years, to that end necessarily takes into consideration the cost of furnishing adequate equipment for the purpose designed and that a time will come when the term of the contract will expire and the municipality may not see fit to renew the contract. . . . Neither of the companies has a right in perpetuity to furnish the electric lighting for the borough. . . . We can discern nothing in the order of the board which attempts to do anything more than to regulate how the two electric light companies shall exercise their franchises." (140 At. 258.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

C. W. Wallace has been elected a director of the Toledo Edison Company.

J. E. Webster has been appointed chief plant engineer of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa.

G. D. Horne, district operating supervisor of the Central Hudson Gas & Electric Company at Beacon, N. Y., has been transferred to Poughkeepsie as division engineer.

J. M. Bennett has been appointed manager of the department of public relations recently organized by the Philadelphia Electric Company for the handling of all matters relating to publicity and advertising.

P. C. Brooks, president of E. & T. Fairbanks & Company and vice-president of the Canadian Fairbanks-Morse Company, Ltd., has been made a vice-president of Fairbanks, Morse & Company, Chicago.

Sebastian L. de Ferranti, past-president of the Institution of Electrical Engineers of Great Britain, a pioneer in high-tension transmission and well known in this country and throughout Europe, has been elected a fellow of University College, London.

H. C. Blackwell, president of the Union Gas & Electric Company, Cincinnati, has been named chairman of the Cincinnati Safety Committee organized by the Industrial Commission of Ohio. Mr. Blackwell has long been active in civic affairs in Cincinnati, at the present time being president of the Cincinnati Chamber of Commerce.

Lewis Buckley Stillwell of New York has been re-elected chairman of the Engineering Foundation, the research organization of the national engineering societies. Mr. Stillwell, who enters upon his fourth term, is past-president of the American Institute of Electrical Engineers and the American Institute of Consulting Engineers. He is a native of Pennsylvania and a graduate of Lehigh University.

Frank Milhollan, chairman of the Board of Railroad Commissioners of North Dakota, has resigned, effective April 1, to become president and general manager of the Central West Public Service Company. Ben Larkin, who has been a member of the board for more than two years, has been selected by Governor Sorlie to succeed Mr. Milhollan.

Edward B. Myers, formerly assistant to J. T. Hutchings, vice-president in charge of engineering development of the United Gas Improvement Company, Philadelphia, has been named assistant to the president. Mr. Myers has been associated with the U.G.I. or its subsidiaries for 24 years, starting as a cadet engineer with the city district of the Philadelphia Gas Works in 1904. In 1911 he became associated with the engineering department of the Northern Indiana Gas & Electric Company, South Bend, Ind., returning to Philadelphia two years later.

## *Ballard Now President of Southern California Edison*

Russell H. Ballard, executive vice-president and general manager of the Southern California Edison Company for the past eight years, was elected president of that company at the recent meeting of the board of directors, in succession to John B. Miller, who retains the chairmanship of the board. The selection of Mr. Ballard is the logical and expected result of his services to the company in the years during which it has grown from the status of a comparatively small organization exploiting the water-power resources of southern California to one of the greatest metropolitan central stations in the land, with immense steam plants supplementing its hydro installations and with reserve steam equipment capable of picking up the 93,000-kw. load dropped by the municipal plants in the recent disaster. With experience in commercial and financial work for power companies in the East, South, Middle West and Mountain States, Mr. Ballard became auditor of the Southern California Edison Company in 1904 and progressed steadily to the posts of assistant general manager, vice-president and assistant general manager, and vice-president and general manager. The last-named office he assumed in 1920.

*R. H. Ballard*

Mr. Ballard's sphere, however, is not merely territorial. His election to the presidency of the National Electric Light Association in 1919 brought him into national prominence in the light and power world, and the outstanding services he rendered during his occupancy of that office have had lasting results. With the able assistance of M. H. Aylesworth, whom he installed as executive manager, he remodeled the structure of the association, giving it the form it still retains. By extensive speaking tours and participation in the conventions of the geographic divisions he reawakened the interest of industry executives in association activities, and the methods adopted in his term are still in favor at headquarters Mr. Ballard's own interest and participation in national work continue unabated.

D. B. Ranno has been named superintendent of the Schuylkill division of the Philadelphia Suburban-Counties Gas & Electric Company with headquarters at Norristown and R. R. Daniels has been appointed superintendent of electric production of the Schuylkill division.

John F. Carney has resigned as treasurer of the Utica (N. Y.) Gas & Electric Company after 26 years of service to become affiliated with Stone, Seymour & Company, Inc., investment brokers of New York. Mr. Carney will continue to reside at Utica.

Lee J. Ruf has been appointed power plant superintendent of the Nebraska Power Company to succeed the late Edward McDonald. Mr. Ruf formerly was identified with the Omaha Electric Light & Power Company before that property was taken over by the Nebraska Power Company.

J. M. Flanigen, who was appointed division superintendent of the Georgia Power Company in Rome last December, has been recently transferred to the company's office in Atlanta. Mr. Flanigen was formerly connected with the Alliance division of the Ohio Public Service Company.

M. H. Montross has been appointed general superintendent of the Wisconsin Valley Electric Company, Wausau, Wis. Mr. Montross was formely divisional manager at Stevens Point and prior to his connection with the Wisconsin Valley Electric Company he was associated with the Gary (Ind.) Heat, Light & Power Company and the Toledo Edison Company.

Richard Lincoln has been appointed superintendent of the appliance department of the Edison Electric Illuminating Company of Boston, succeeding C. Ernest Greenwood, who recently resigned to become commercial manager of the National Electric Light Association. Mr. Lincoln's early career began in the electric railway construction field in Massachusetts and Virginia. He entered the collection department of the Boston Edison Company in 1909, was transferred to the sales department in 1916 and for three years was in charge of merchandise sales in the Framingham district. In 1919 he was promoted to be assistant superintendent of the appliance department, and will now be in charge of all merchandising activities of the company. He is a past chairman of the merchandising bureau of the Commercial Section, New England Division, N.E.L.A.

W. C. Gilman, formerly connected with the commercial department of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., is now identified with the Carolina Power & Light Company at Raleigh, N. C.

Robert J. Deneen and Frederic Attwood were elected vice-presidents of the Ohio Brass Company at a meeting of the board of directors held Feb. 7, 1928. Mr. Deneen is in charge of the company's sales activities in the Chicago district, while Mr. Attwood is in New York in charge of the Eastern sales district.

Robert W. Purchas, formerly purchasing agent for the Northern States Power Company in Minneapolis, has been appointed assistant to Vice-President H. W. Fuller, head of the engineering and construction department of the Byllesby Engineering & Management Corporation, Chicago. Mr. Purchas served as purchasing agent of the Northern States company for eight years.

R. H. Denman has been assigned to the Albany district of the New York Power & Light Corporation in the capacity of rural expert. Mr. Denman's duties will include the extending of electrical service on the farms in the Albany district. Mr. Denman is a graduate of Cornell University in agricultural engineering.

A. E. Kaiser, who has been associated with the Westinghouse Electric & Manufacturing Company since 1895, has been appointed director of production for all works. During his period of service with the company he had a wide range of experience. After serving in various departments, he was appointed assistant director of production in 1912 and in 1919 he was promoted to be director of production of the East Pittsburgh works. Later he was made assistant works manager of the East Pittsburgh works.

Guy P. Norton, a vice-president of the Miller Company, Meriden, Conn., was elected a director of that company at a meeting of the stockholders held March 8. Mr. Norton first became engaged in the manufacture of lighting fixtures in 1898. He helped perfect the first Duplex-a-lite organization, which became the Duplex Lighting Works of the General Electric Company in 1918. In 1924 this company was sold to the Miller Company and a year later Mr. Norton was made a vice-president of the company and placed in charge of Duplex-a-lite sales.

Leon M. Brockway has affiliated himself with the New England Power System, Worcester, Mass., where he will co-ordinate the office and field engineering with the hydraulic development construction work. Seventeen years ago Mr. Brockway was identified with the New England system as resident engineer on the Shelburne Falls Development, but he left in 1913 to enter the employ of the Electric Bond & Share Company. Subsequent connections followed with the Ontario Power Company, the Power Construction Company, the Atlantic Loading Company, and Conway & Reid, general contractors, before he returned to the New England Power System.

E. S. Zuck, formerly rate engineer of the Penn-Ohio System, is now power engineer of the United Gas Improvement Company, Philadelphia. Mr. Zuck's resignation brought to a close an association which covered a period of nine years, during which he served as power salesman, power sales engineer and finally as rate engineer. Before affiliating himself with the Penn-Ohio System Mr. Zuck had been connected with the Western Electric Company at Cleveland, the Electric Furnace Company at Salem and the Westinghouse Electric & Manufacturing Company at East Pittsburgh.

Earl L. Carter has resigned as chief engineer of the Indiana Public Service Commission effective April 1, in order to enter private consulting work. In his position as engineer for the commission, one of his principal duties was to fix valuations of utilities for rate-making purposes. He entered the service of the commission in 1917 as assistant engineer and became chief engineer six years ago. He graduated from Purdue University in 1914 and received a master's degree in 1918. Harry V. Wenger, formerly a member of the engineering staff of the commission, has been selected as Mr. Carter's successor. Mr. Wenger took a position with the commission in 1917 and also is a graduate of Purdue. He served on the commission engineering staff about three and one-half years. He left in 1923 after having been elected chief engineer of the railroad commission of South Dakota. Later he returned to Indianapolis and has engaged in private engineering work since that time.

## Obituary

R. D. Pike, general purchasing agent for the Pennsylvania-Ohio Power & Light Company, died at his home in Youngstown, Ohio, March 12. Mr. Pike had been with the company for fourteen years. He was 44 years of age.

Clifton H. Dwinnell, president of the First National Bank of Boston, died at his residence in that city March 13. He was 54 years of age and was graduated in electrical engineering in 1894 from the Worcester Polytechnic Institute, of which corporation he was a member.

Dr. Thomas B. Freas, noted inventor and professor of chemistry at Columbia University, New York, died at Lenox Hill Hospital, after a short illness, March 15. Professor Freas was recognized as an authority on thermodynamics and had invented thermostats, ovens, ventilating apparatus and other laboratory necessities. He was a member of the American Electrochemical Society, the American Association for the Advancement of Science and other technical societies.

L. W. Llewellyn, president of the Walsh & Weidner Boiler Company, Chattanooga, Tenn., died March 18. Mr. Llewellyn had been incapacitated, due to heart trouble, since August, 1926. Besides being president of the Walsh & Weidner company he was also president of the Chattanooga Implement Manufacturing Corporation, treasurer of the Provident Life Insurance Company of Chattanooga and a member of the board of directors of a number of prominent enterprises around Chattanooga.

Conrad Hubert, chairman of the board of directors of the Yale Electric Corporation, New York, died March 14 at Cannes, France, in his seventieth year. Mr. Hubert organized the Ever-Ready Battery Company and held the presidency prior to the sale of the business to the National Carbon Company, about ten years ago. He subsequently purchased a majority of the stock of the Yale Electric Corporation, which manufactures flashlights and electric batteries for automobiles and radios. Mr. Hubert was interested in other industrial enterprises.

Ralph Blakeman, manager of the Public Service Company of Colorado at Louisville, Colo., died suddenly at Windsor, Colo., Feb. 29.

Albert W. Flor, who had been associated with the Electric Bond & Share Company for the past fourteen years, died Feb. 6 in his 42d year. After extensive experience in the government service, Mr. Flor joined the Utah Power & Light Company in Salt Lake City, previous to removing to New York. Among the executives whom he assisted were C. E. Groesbeck, E. K. Hall and F. B. Odlum.

Samuel F. Moran, well known public utilities lawyer, died March 20 at St. Vincent's Hospital, New York, of chronic intestinal nephritis. Mr. Moran was admitted to the New York bar in 1903 and was assistant corporation counsel of Buffalo from 1906 to 1909. For many years he specialized in public utility law. Among the companies for which he was attorney are the Brooklyn Edison Company, the Kings County Lighting Company, the Cohoes Power & Light Corporation and the Citizens Water Supply Company of Newtown, New York. In 1919 he had charge of the merger of the electric corporations heretofore operating in Brooklyn which formed the Brooklyn Edison Company and since that time he had represented that corporation in all proceedings involved in stock and bond issues. Mr. Moran was 53 years of age.

# Financial and Statistical News

## *Keen Investment Demand*
## *Stocks at New High Levels*
## *Fewer New Issues Sold*

KEEN investment demand for public utility securities, combined with a sharp reduction in new issues, has resulted in a smaller visible supply of these securities. New power and light issues are now running between 40 and 50 per cent below last year. Another factor in the situation is the passage of the savings bank investment act in New York State. In addition to the actual legalization of a large volume of issues, the act will undoubtedly affect the trend of legislation elsewhere, in some degree at least.

The market for power and light securities has been exceedingly firm during the past few days. Averages are now at new high levels and the trend is distinctly upward. During the past week Edison of Boston went up fourteen points, to 272; Pacific Gas & Electric rose thirteen points, to 192; Public Service of New Jersey reached a new high of 138, and Southeastern Power & Light a new high of 47½; North American common reached a high of 67, and Electric Investors a high for the present movement of 48. These are only a few examples of the price rises in common stocks. A number of preferred issues have made substantial gains also. Buying of these issues by investment trusts is reported to be unusually active.

## Company Reports

| Name of Company | Gross Earnings Twelve Months Ended Jan. 31 1928 | 1927 |
|---|---|---|
| American Power & Light subs.* | $62,786,765 | $59,411,694 |
| American Wtr. Wks. & Elec. | 48,866,582 | 45,790,401 |
| Idaho Power* | 3,146,573 | 2,869,474 |
| Kansas City Power & Lt.* | 12,502,403 | 10,877,859 |
| Kansas City Power & Lt. | 12,667,634 | 10,955,810 |
| New Orleans Public Service, Inc.* | 18,442,108 | 17,624,514 |
| Public Service Company of New Hampshire & subs. | 3,631,593 | 3,469,173 |

* Twelve months ended Dec. 31, 1927.

## North Carolina Developments in 1928

According to a recent statement of the Department of Conservation and Development of North Carolina new hydro developments totaling 295,000 hp. are now under construction. It is rumored that one of the large power companies will construct a 100,000-hp. steam station during the year. The Carolina Power & Light Company expects to begin construction on 110,000-volt transmission lines from Sanford to Cape Fear Station (10.7 miles), from Norwood to connect with existing lines (16 miles), from Canton to Greenville (55 miles), from Canton to Asheville (20 miles) and from Moncure to Sanford (37 miles), a total of 138.7 miles. This company completed during the present year the first 132,000-volt line in the state, leading from Roxboro to Danville, Va. The Virginia Electric & Power Company has planned to construct 32 miles of 33,000-volt lines during the year in the northeastern part of the state.

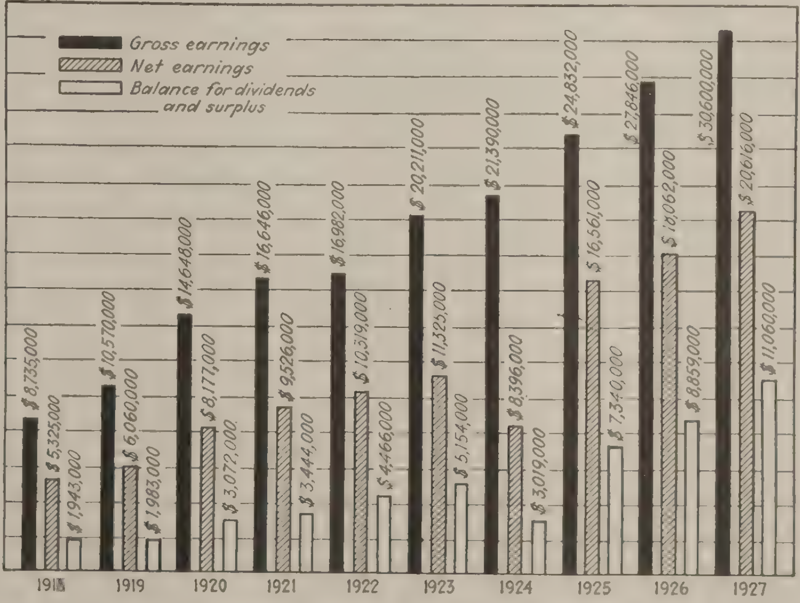
It is probable that during the year one or more of the larger municipal steam plants in the east will pass into the control of private interests, and this in turn will probably lead to new high-voltage lines being built in that section.

Altogether 1928 promises to be a year of considerable activity in power development in the state, and the ever-increasing power demand of new industries and expansion of existing activities will continue to be met by added power facilities adequate to supply whatever requirement exists.

## Southern California Edison Reports Prosperous Year

IN SPITE of the reduction in lighting rates, which had been in force during the last six months of 1927, gross earnings of the Southern California Edison Company totaled $30,600,637, an increase of 9.9 per cent over the preceding year, when gross earnings amounted to $27,846,518. Net earnings amounted to $20,615,686, an increase of 14 per cent, and were equivalent to 3.54 times annual interest requirements. The coupling of these financial figures with the operating statistics makes a picture which reveals the satisfactory results of the year's operations. Sales of electric energy aggregated 1,877,204,517 kw.-hr. The maximum demand of over 600,000 hp. exceeded all previous records. Due to abundant water, favorable fuel costs and economies in operation, a reduction of $390,429, or 5.3 per cent, was effected in operating expenses. Taxes paid to federal, state and local governments amounted to $3,076,252. According to the report under review the year was also noteworthy with respect to the additional load connected, which aggregated 218,417 hp., the greatest amount of load taken on the lines in any twelve-month period of the company's history.

The company's financing program during the year included the sale in January of an additional issue of 25-year refunding mortgage bonds amounting to $15,000,000 and the offering in September of refunding mortgage 25-year bonds amounting to $30,000,000. Part of the proceeds of the first issue was used to retire outstanding notes and maturing debentures and proceeds from the second issue provided funds for the retirement of 6 per cent refunding mortgage bonds due in 1943. As a result of this new financing the company effected a considerable annual saving in fixed charges and materially improved the credit position of its subsequent bond issues. At the present time, in addition



*Southern California Edison earnings show substantial gain* to the 5's of 1951 and 5's of 1952 mentioned above, the funded debt includes general and refunding mortgage bonds due Feb. 1, 1944, paying 5 per cent interest, amounting to $10,000,000, and 5½ per cent interest, amounting to $10,225,000. Also there are outstanding general mortgage 5 per cent 30-year gold bonds, due Nov. 1, 1939, totaling $13,360,000. Underlying bonds complete the set-up with a total of $15,412,700. The entire funded debt amounts to $134,971,700. The year closed with no floating debt against the company and with $5,023,599 cash on hand and in banks. Total assets as of Dec. 31, 1927, amounted to $309,837,988, an increase of $41,630,345 during the year.

Since 1917 the company's junior financing has been accomplished principally through the sale of its capital stocks to its consumers and the local public. At the close of the year 1927 individual stockholders numbered 114,150, with holdings averaging 50.3 shares each. The adoption of this customer-ownership plan, together with voluntary reductions in rates, is largely responsible for the cordial relations existing between the company and its customers. The trend of maximum rates for energy since 1920 is shown in the accompanying table.

| | Cents Per Kw.-Hr. |
|---|---|
| 1920 | 10.16 |
| 1921 | 9 |
| 1922 | 7.92 |
| 1923 | 6.5 |
| 1927 | 5.6 |

In closing the report, John B. Miller, president, says: "The company commands a strong financial position in the credit market and enjoys the confidence and support of the public in its territory. Physical properties are in excellent condition, covered by insurance against fire, earthquake, casualty and other contingencies, and proper provision has been made for depreciation and replacements."

AMERICAN SUPERPOWER INCREASES STOCK.—At a general meeting of stockholders of the American Superpower Corporation held March 9 an increase in the class A stock from 600,000 to 1,000,000 shares was authorized, as well as an increase in first preferred stock from 200,000 to 400,000 shares.

## Bonds Called in March

Among the securities of electric light and power companies called for payment in advance of maturity are the following:

| Issue | Due | Amount |
|---|---|---|
| Toledo Edison, 7s | 1941 | $13,500,000 |
| Ohio Power, 6s | 1953 | 10,000,000 |
| Western States Gas & Elec., 6s | 1947 | 8,850,000 |
| Western States Gas & Elec., 6s | 1937 | 5,000,000 |
| National Electric Power, 5s | 1945 | 8,662,500 |
| Pennsylvania Water & Power, 5½s | 1953 | 3,000,000 |
| Holtwood Power, 6s | 1954 | 2,750,000 |
| Queensborough Gas & Elec., 6s | 1953 | 2,000,000 |
| Coast Valley Gas & Electric, 6s | 1952 | 1,813,000 |
| Quincy Gas, Elec. & Heating, 5s | 1935 | 1,400,000 |
| Eastern Wisconsin Electric, 5s | 1947 | 1,024,500 |
| Western Pwr. Lt. & Tele. 6½s | 1929 | 1,000,000 |
| Northeastern Iowa Power, 6s | 1929 | 800,500 |
| Northeastern Iowa Power, 5s | 1928 | 300,000 |
| Ottawa Light, Heat & Power, 6s | 1953 | 650,000 |
| Central States Power & Lt., 5½s | 1928 | 250,000 |
| Minnesota Elec. Distributing, 7s | 1934 | 182,000 |
| Public Service of N. J., 6s | 1944 | 19,595,000 |
| Public Service of N. J., 5½s | 1956 | 15,000,000 |
| Interstate Public Service, 6s | 1948 | 8,551,900 |
| Interstate Public Service, 5½s | 1950 | 2,838,500 |
| Central States Electric, 6s | 1945 | 9,691,000 |
| Beloit Water, Gas & Electric, 5s* | 1937 | 30,000 |
| Sandusky Gas & Electric, 5s* | 1945 | 13,000 |

* Not entire issues.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday March 20 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | k 80 | 72 | 81 |
| Ala. Pwr., $7 com. pf.—no par | 113 | 114 | 115 |
| Allis Chalmers Mfg., 6% com. | 120 | 115 | 125 |
| Aluminum Co. of Amer., com. | 126 | 120 | 136 |
| Aluminum Co. of Amer., 6% pf. | k107 | 105 | 108 |
| Amer & Foreign Pwr., 7% pf.—no par | 106 | 105 | 108 |
| Amer. & Foreign Pwr., com.—no par | 25 | 22 | 27 |
| Amer. Bosch Magneto, com.—no par | 22 | 15 | 23 |
| Amer. Brown Boveri Elec.† | 15 | 10 | 18 |
| Amer. Brown Boveri Elec., pf. $7 | 55 | 46 | 63 |
| Amer. Gas & Elec., 6% pf.—no par | 108 | 106 | 109 |
| Amer. Gas & Elec., com. †—no par | 139 | 117 | 145 |
| Amer. Lt. & Trac., 6% pf. | 113 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 191 | 170 | 193 |
| Amer. Pwr. & Lt., 6% pf. | 105 | 104 | 109 |
| Amer. Pwr. & Lt., com. †—no par | 81 | 62 | 83 |
| Amer. Pub. Serv., 7% pf. | a100 | 99 | 101 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | 94 | 90 | 95 |
| Amer. Pub. Utilities, 7% pr. pf. | 99 | 94 | 101 |
| Amer. Pub. Utilities, com. | k 60 | 60 | 65 |
| Amer. States Sec., A | a 6 | 4 | 6 |
| Amer. States Sec., B | a 6 | 4 | 6 |
| Amer. Superpwr., 6% ptc pf.—25 | m 30 | 28 | 30 |
| Amer. Superpwr., 6% 1st pf. | l 102 | .... | .... |
| Amer. Sup pwr., Class A†—no par | 40 | 37 | 41 |
| Amer. Sup pwr., Class B†—no par | 42 | 37 | 43 |
| Amer. Wtr. Wks. & Elec., 6% pf. | k102 | 101 | 105 |
| Amer. W.W. & E., com. new—no par | 60 | 52 | 61 |
| Anaconda Copper cap. $3 | 55 | 53 | 59 |
| Appalachian Electric Pwr., 7% pf. | 107 | 108 | 110 |
| Arkansas Pwr., & Lt. 7% pf | 107 | 108 | 109 |
| Assoc. Gas & Elec., $3.50—50 | 54 | .. | .. |
| Assoc. Gas & Elec., pf.—$6—no par. | 95 | 96 | 98 |
| Assoc. G. & E., Class A, 10—no par. | 48 | 47 | 51 |
| BABCOCK & WILCOX, 7% com. | 118 | 117 | 124 |
| Binghamton L., H. & P., $6 pf. | 105 | 102 | 105 |
| Birmingham Elec., pf.—$7—no par. | 109 | 109 | 111 |
| Blackstone Valley G. & E., 6% pf. | k106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | 166 | 132 | 169 |
| Blaw-Knox, com.† | i104 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f208 | .... | .... |
| Brazilian Trac., Lt. & Pwr., com., new | f 53 | .. | |
| Broad River Pwr., 7% pf. | 106 | 105 | 107 |
| Brooklyn Edison, 8% com. | 227 | 206 | 235 |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26 | .... | .... |
| Buffalo, Niagara & East. Pwr. com $1.20—no par | l 37 | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf | k 98 | 98 | 101 |
| California Ry. & Pwr., 7% pf. | k135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l110 | 109 | 110 |
| Central & S. W. Util., $7 pf.—no par | a102 | 99 | 105 |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a105 | 103 | 108 |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 105 | 107 |
| Central Ill. Pub. Serv., $6 pf. | a100 | 97 | 100 |
| Central Ind. Pwr., 7% pf | a 99 | 95 | 99 |
| Central Maine Power, 6% pf. | 96 | 96 | 98 |
| Central Maine Power, 7% | k108 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 105 | 104 | 105 |
| Central States Elec., 7% pf. | 113 | 104 | 113 |
| Century Elec., 6% com. | b143 | 140 | 145 |
| Cincinnati Gas & Elec., 5% com. | g 98 | 97 | 99 |
| Cities Service, $6 pf.—no par | l 99 | 87 | 94 |
| Cities Service, pf. B—no par | l 9 | 8 | 8 |
| Cities Service, pf. BB—no par | l 94 | 80 | 86 |
| Cities Service, com.—20 | l 59 | 40 | 58 |
| Cities Service, Bks. Shrs.—10 | l 29 | 22 | 27 |
| Cities Service Pwr. & Lt., 7% pf. | k106 | 106 | 109 |
| Cities Service Pwr. & Lt., 6% pf. | k 98 | 95 | 100 |
| Cleveland Elec. Illg., 6% pf. | 112 | 113 | 115 |
| Cleveland Elec. Illg., 10% com. | 390 | 350 | 410 |
| Columbia Gas & Elec., 6% pf. | k108 | 107 | 110 |
| Columbia G. & E. com. $5—no par | 94 | 89 | 97 |
| Columbus Elec. & Pwr., $2 com.—no par | 71 | 64 | 71 |
| Columbus Elec. & Pwr., 7% | 113 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 108 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 107 | .... | .... |
| Columbus Ry., P. & Lt. com.—no par | k115 | .. | |
| Commonwealth Edison, 8% com. | a181 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 103 | 102 | 104 |
| Commonw'th Pwr., $2, com.—no par | 72 | 62 | 72 |
| Conn. Lt. & Pwr., 8% pf. | 120 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 116 | 118 | 121 |
| Cons. Gas of N. Y., pf | 102 | 101 | 102 |
| Cons. Gas of N. Y., com. $5—no par. | 140 | 119 | 141 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111 | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | m111 | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf. | m111 | 110 | 115 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e102 | 100 | 102 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com $3.00—no par | e 73 | 67 | 72 |
| Consolidated Pwr. & Lt., 7% pf. | 103 | ... | .... |
| Consumers Pwr., 6% pf. | 103 | 105 | 106 |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 106 | 106 | 108 |
| Contl. G. & E. com. $4.40—no par | k230 | 240 | 265 |
| Crocker Wheeler, com.† | 30 | 24 | 30 |
| Crocker Wheeler, 7% pf. | 90 | 77 | 90 |
| DALLAS PWR. & LT., 7% pf. | 110 | 110 | 111 |
| Dayton Pwr. & Lt., 6% pf. | 108 | 108 | 109 |
| Derby Gas & Elec., 7% pf. | 99 | 96 | 99 |
| Detroit Edison, 8% com—ex. div. | 183 | 166 | 191 |
| Dubilier Condenser, com.—no par | 2 | 2 | 3 |
| Duke Pwr., cap. | k140 | 130 | 145 |
| Duquesne Lt., 7% pf. | m116 | 115 | 116 |
| EASTERN NEW YORK UTIL., $7 pf. | k110 | 111 | 112 |
| Eastern New York Util. com. | m 65 | | |
| Eastern States Pwr. $7, com. | 12 | 11 | 15 |
| Eastern States Pwr., pf. | 97 | 98 | 99 |
| East Tex. Elec., 7% pf | 107 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d272 | 252 | 275 |
| El Paso Elec. 7% pf. | 113 | 110 | 112 |
| Elec. Bond & Share, 6% pf. | l109 | 109 | 111 |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 92 | 76 | 94 |
| Electric Household Util.† | a 21 | 13 | 24 |
| Elec. Investors, 6% pf.—no par | 102 | 101 | 103 |
| Elec. Investors, com.†—no par | 48 | 40 | 48 |
| Elec. Pwr. & Lt., ctfs. pf. | k107 | 106 | 110 |
| Elec. Pwr. & Lt., ctfs., 40% pd. | k125 | 120 | 125 |
| Elec. Pwr. & Lt., ctfs., com.—no par | 39 | 28 | 39 |
| Elec. Refrig. cap.† | 17 | 11 | 17 |
| Elec. Ry. Securities, com.—no par | 6 | ... | ... |
| Elec. St. Battery com. $5.25—no par | 73 | 69 | 77 |
| Elmira Wtr., Lt. & R.R., 7% pf. | k106 | 104 | 107 |
| Empire Pwr., ptc.† | 31 | 27 | 35 |
| Engr. Pub. Serv. $7, pf.—no par | 109 | 107 | 110 |
| Engr. Pub. Serv., com.—no par | 40 | 33 | 41 |
| Eureka Vacuum Cleaner, com. $4—no par | 74 | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | k108 | 104 | 108 |
| F.-M., com.—$3—no par | 37 | 32 | 40 |
| Federal Lt. & Trac., com $1.40 | 51 | 42 | 55 |
| Federal Lt. & Trac., $6 pf.—no par | 103 | 98 | 105 |
| Florida Pwr. & Lt., 7% pf. | 105 | 104 | 107 |
| Ft. Worth Pwr. & Lt., 7% pf. | l114 | 113 | 114 |
| GALVESTON-HOUSTON ELEC. 6% pf. | 78 | 75 | 78 |
| Galveston-Houston Elec., com | 32 | 31 | 34 |
| General Cable, Cl. A | 80 | 56 | 84 |
| Gen. Elec. $3 com.—no par | 142 | 124 | 144 |
| Gen. Elec., special—6% | 11 | 11 | 11 |
| Gen. Gas & Elec. (Del.) com A $1.50—no par | 42 | 35 | 43 |
| Gen. G. & E. (Del.) pf. A $8—no par | k124 | 122 | 126 |
| Gen. G. & E. (Del.) pf. A $7—no par. | k112 | 108 | 113 |
| Gen. G. & E. (Del.) pf. B $7 | k106 | 105 | 108 |
| Gen. Pub. Serv., $7 cum pf., no par. | k117 | 110 | 120 |
| Gen. Pub. Serv., com., no par | 21 | 16 | 21 |
| General Public Utilities, $7 pf. | 98 | 98 | 99 |
| Ga. Lt., Pwr. & Rys., com | k 58 | 55 | 65 |
| Ga. Ry. & Pwr., 8% pf | m125 | . | |
| Ga. Ry. & Pwr., 7% pf | m113 | .. | |
| Gt. Western Pwr., 7% pf | h104 | .. | .. |
| IDAHO PWR., 7% pf. | 104 | 109 | 110 |
| Ill. No. Utilities, 6% pf | k 96 | 96 | 98 |
| Ill. Pwr. & Lt., 7% pf | 104 | 103 | 107 |
| Indianapolis Pwr. & Lt., 6% pf | 104 | 102 | 107 |
| Indianapolis Pwr. & Lt. $7 pf | 104 | 100 | 105 |
| Ingersoll Rand com | k 91 | 90 | [illegible] |
| Int. Combus. Engr., com. $2—no par | 52 | 45 | [illegible] |
| Int. Combustion Engr., 7% pf. | 101 | 103 | [illegible] |
| Int. Util., Class A—$3.50—no par | k 46 | 45 | 51 |
| Int. Utilities, Class B—no par | 8 | 6 | 10 |
| Interstate Pwr., pf.—$7—no par | 101 | 99 | 103 |
| Interstate Pub. Serv., 7% pf. | 104 | 103 | 106 |
| Iowa Ry. & Lt., 7% pf. | k 99 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 107 | 105 | 107 |
| Johns-Manville, com.†—no par | 117 | 111 | 125 |
| Johns-Manville, 7% pf. | m121 | 119 | 121 |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 17. lBid price Wednesday, March 21. mLatest quotations available. †Dividend rate variable

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday March 20 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | k114½ | 115 | 116½ |
| Kansas Gas & Elec., 7% pf. | l110 | 107 | 109 |
| Kentucky Hydro-Elec., 7% pf. | a104½ | 102 | 104¾ |
| Kentucky Sec., 6% pf. | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | k102 | 100 | 103 |
| LACLEDE GAS LT., 10% com. | k200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 26½ | 19½ | 27½ |
| Long Island Ltg., 7% pf. | 111 | 110½ | 112½ |
| Long Island Ltg., 6% pf. | 106½ | 107 | 108½ |
| Long Island Ltg., com.†—no par | k178 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | h108 | 105½ | 109½ |
| Louisville Gas & Elec., cl. A. $1.75 | 30½ | 28 | 30 |
| MAN. ELEC. SUPPLY, cap. $5—no par | 58½ | 50 | 61 |
| Manilla Elec., com.†—no par | k 47 | 45½ | 50 |
| Maytag Mfg., com. 50—no par | 31½ | 30 | 34¼ |
| Memphis P. & L., pf.—$7—no par | 109 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 105½ | 103 | 107½ |
| Metropolitan Ed., pf.—$7—no par | k108 | 109 | 111 |
| Metropolitan Ed., com. $5—no par | k140 | 125 | 155 |
| Middle West Utilities, 7% pf. | a122½ | 116½ | 124½ |
| Middle West Util., 7% pr. lien | a126¼ | 125 | 129¼ |
| Middle West Util., com. $7—no par | a134 | 123½ | 135 |
| Midland Utilities, pr. ln. 6% pf. | a 96½ | 94½ | 97 |
| Midland Utilities, 6% pf. A | a 92½ | 90½ | 92½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k103 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k100 | 98 | 101½ |
| Minn. Pwr. & Lt., 7% pf. | l108 | 107 | 109 |
| Miss. River Pwr., 6% pf | 108 | 94 | 109½ |
| Miss. River Pwr., 3% com. | m 62 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k107 | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | k104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 30½ | 29½ | 31½ |
| Montana Pwr., 5% com. | 163½ | 102½ | 167½ |
| Montreal Pwr., 7½% com. | f 93 | .... | .... |
| Mountain States Pwr., 7% pf. | k104 | 97 | 105 |
| Mountain States Pwr., com.† | 17 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109 | 98 | 110½ |
| National Carbon, 8% pf. | m138½ | 138 | 139 |
| National Elec. Pwr., A† | a 31½ | 27½ | 32½ |
| National Lt., Ht. & Pwr., com | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | k109½ | 108½ | 111 |
| National Pwr. & Lt., com.†—no par. | 26½ | 21½ | 27½ |
| National Pub. Serv., 7% pf. | 102 | 99 | 103 |
| National Pub. Serv., 7% ptc., pf. | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 25½ | 22 | 27½ |
| National Pub. Serv., B com.—no par | k 27½ | 24½ | 30 |
| Nebraska Pwr., 7% pf. | l111 | 110 | 111½ |
| Nevada-Calif. Elec., com. | k 38½ | 33½ | 42 |
| New Brunswick Pwr., 4% pf. | k 62 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k108 | 98½ | 109½ |
| New Eng. Pub. Serv., pf. $7 | k106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf | k103½ | 101 | 104 |
| New York Power & Light 7% pf. | 115 | .... | ... |
| New York Power & Light, 8% pf. | m114 | .... | . |
| Newport News & Hampton Ry., Gas & Elec., 5% com | m109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | m109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28 | 27½ | 28½ |
| No. Amer., 6% pf.—50 | 54½ | 53½ | 55 |
| No. Amer., com.—10 | 67 | 58½ | 67 |
| No. Amer. Edison, $6 pf.—no par | 103½ | 102½ | 105½ |
| No. Caro. Pub. Serv., pf.—$7—no par | m109 | 93 | 105 |
| Northeastern Pwr., com. | 20½ | 19½ | 23 |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 25½ | 18 | 25½ |
| No. Ont. Lt. & Pwr., 6% pf. | k 99 | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | k109½ | 108½ | 109½ |
| No. States Pwr. (Del.), 8% com. | 136½ | 123 | 136½ |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par. | 100 | 89 | 100½ |
| Ohio Brass, 6% pf. | k107 | 106 | 111 |
| Ohio Pwr., 6% pf. | 106½ | 104 | 107½ |
| Ohio Pub. Serv., $6 pf. | k102 | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | 111 | 107 | 112 |
| Ohio River Edison, 7% pf. | 108 | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 112½ | 106 | 114 |
| PACIFIC Gas & ELEC., 6% pf. | 27½ | 26½ | 28½ |
| Pacific Gas & Elec., 8% new com. | 48 | 43½ | 49½ |
| Pacific Pwr. & Lt., 7% pf. | l109½ | 106 | 109 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 80 | 79½ | 82 |
| Penn-Ohio Edison, 6% pf. no par | k 94½ | 93½ | 96 |
| Penn-Ohio Edison, 7% pf. | 107 | 106½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l109½ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 70 | 68 | 72½ |
| Phila. Co., 5% pf.—50 | k 45½ | 45½ | 48½ |
| Phila. Co., 6% pf.—50 | 54 | 52 | 54½ |
| Phila. Co., com.—50 | k156 | 149½ | 163 |
| Phila. Elec., 8% com.—25 | c 59½ | 55½ | 59½ |
| Portland Elec. Pwr., 7% pf. | 102½ | 100 | 104¼ |
| Portland Elec. Pwr., 6% pf. | 93½ | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 86 | 55 | 88 |
| Portland Elec. Pwr., com. | 51½ | 42½ | 52 |
| Potomac Elec. Power, 6% pf. | j111½ | .... | .... |
| Pwr. Sec., pf.—no par | k 58 | 50 | 60 |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | l105 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 105½ | 103½ | 106½ |
| Pub. Serv. of N. J., 7% pf. | 118½ | 118 | 120½ |
| Pub. Serv. of N. J., $2 com.—no par | 46½ | 41½ | 46½ |
| Pub. Serv. of No. Ill., 6% pf. | a111½ | 110 | 113½ |
| Pub. Serv. of No. Ill., 7% pf. | a119 | 119 | 121 |
| P. S. of No. Ill., com. $8—no par | a172 | 159½ | 180 |
| Pub. Serv. of No. Ill., $8 com. | a172 | 159½ | 180 |
| Pub. Serv. of Okla., 7% pr. ln. | k106 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109 | 108 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | 109½ | 109 | 113 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 99 | 92 | 99½ |
| Puget Sound Pwr. & Lt., com. | 60 | 34½ | 63½ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 56½ | 54½ | 57½ |
| Radio Corp. of Amer., com.—no par. | 160 | 85½ | 160 |
| Rhode Island Public Service, pf. $2—no par | 31½ | 30½ | 31¾ |
| Rochester Gas & Elec. 6% pf. D. | 105 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B. | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C. | 105½ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | k116 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | 7 | 4½ | 7½ |
| Sierra Pacific Elec., 2% com. | k 37 | 29 | 38½ |
| Sioux City Gas & Elec., 7% pf. | 107 | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 109 | ... | . |
| Southeastern Pwr. & Lt., ptc. pf. | l 87½ | .... | .. |
| Southeastern Pwr. & Lt., com.—no par | 47½ | 40½ | 47½ |
| So. Calif. Edison, 8% pf. | k 46½ | 38½ | 41 |
| So. Calif. Edison, 7% pf. | k 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 26½ | 25½ | 27½ |
| So. Calif. Edison, 8% com. | 48 | 43½ | 48 |
| Southern Cities Utilities, 7% pf. | k 80 | 75 | 78 |
| Southwestern Lt. & Pwr., A $3 | 75 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 91½ | 88 | 92½ |
| Southwestern Pwr. & Lt., 7% pf. | k111½ | 103 | 113 |
| Standard Gas & Elec., 8% pf. | 67½ | 65 | 68 |
| Standard Gas & Elec., 7% pr. pf. | 114 | 110½ | 114 |
| Standard G. & E., com. $3.50 | 64½ | 57½ | 65 |
| Standard Power & Light, com. | 41½ | 29½ | 45 |
| Standard Pwr. & Lt., 7% pf. | 106¼ | 103½ | 106½ |
| Staten Island Edison, pf.—$6—no par | 102 | 99 | 103½ |
| Superheater, $6 com.—no par | 165 | 162 | 175 |
| Syracuse Lighting, 7% pf. | k110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 64 | 62 | 64½ |
| Tenn. Elec. Pwr., 6% pf. | 102 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 108 | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 10 | .... | .... |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf | l114½ | 113¼ | 115 |
| Tide Water Pwr., 8% pf | 110 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 126¼ | 112½ | 134 |
| Toledo Edison, 7% pf. | l109½ | .... | .... |
| Toledo Edison, 6% pf. | k104 | 95 | 105 |
| Toledo Edison, 6% com. | k145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | k 99 | 96 | 102 |
| UNITED GAS & ELEC., 7% pf. | 97 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c120¾ | 111½ | 120¾ |
| United Lt. & Pwr., pf.—$4—no par. | k 56 | 49 | 56½ |
| United Lt. & Pwr., pf.—$6.50—no par | a 98 | 95 | 100½ |
| United L. & P., com. A .48—no par. | a 18½ | 14 | 19½ |
| United L. & P., com. B .48—no par. | a 24 | 19 | 24 |
| Utah Pwr. & Lt., 7% pf. | l 111½ | 109½ | 111½ |
| Utica Gas & Elec., 7% pf. | 105 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101 | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 32½ | 28½ | 34½ |
| Utilities Pwr. & Lt., com. B $1—no par | 24½ | 18½ | 26½ |
| VERMONT HYDRO-ELEC., 7% pf. | k 98½ | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | k110½ | 108 | 111 |
| WAGNER ELEC., 7% pf. | b101 | 96½ | 102 |
| Wagner Elec., com.—no par | b 53 | 37 | 55 |
| Washington Ry. & Elec., 5% com. | j485 | .... | .... |
| Washington Ry. & Elec., 7% pf. | j103½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | k227 | 175 | 235 |
| West Penn Elec., 7% pf. | 113½ | 109½ | 114½ |
| West Penn Elec., Cl. A $7 | k107½ | 106½ | 110½ |
| West Penn Pwr., 7% pf. | 116 | 114½ | 116½ |
| West Penn Pwr., 6% pf. | k109½ | 109½ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf. | k102 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 100 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 105 | 88½ | 105½ |
| Weston Elec. Instrument, Cl. A $2—no par, ex. div. | 32½ | 30½ | 34 |
| Weston Elec. Instrument, com.—no par | 12½ | 12½ | 14½ |
| Wheeling Elec., 6% pf. | k104 | 95 | 104 |
| Worthington Pump, 7% pf. A | 50 | 46½ | 55 |
| Worthington Pump, 6% B | 46½ | 41 | 49½ |
| Worthington Pump, com. | 31½ | 28 | 34½ |
| YALE & TOWNE com. $5—25. | k 70 | 70 | 75 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, March 17. *l*Bid price Wednesday, March 21. *m*Latest quotations available. †Dividend rate variable.

## Illinois Power & Light to Retire Preferred Stock

It is proposed by the Illinois Power & Light Corporation, Chicago, Ill., to call and retire all of its 7 per cent cumulative preferred stock. In order to raise funds with which to accomplish this, the corporation proposed to create and sell a new class of preferred stock. This class will be without par value, will be preferred in involuntary liquidation at $100 per share and in voluntary liquidation at $110 per share, plus accrued dividends. The call price will also be $110 per share. The call price of the existing 6 per cent preferred stock, as well as its price on voluntary liquidation, will be $110. Otherwise, the new class will have substantially the same charter protection as the existing preferred stock. This proposed refinancing plan is subject to action of the stockholders at a meeting to be held for that purpose on April 23 and to the approval of the Illinois Commerce Commission.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of 1,136,344 shares of second preferred stock, series A, of American & Foreign Power Company outstanding and 633,155 shares of second preferred, series A, to be added to the list on official notice of issuance, making the total amount of second preferred stock, series A, applied for 1,769,499 shares. There have also been recently authorized for listing 250,000 additional shares (no par value) preferred stock of the North American Edison Company on official notice of issuance upon conversion of its 5 per cent debentures, series A, due March 1, 1957, making a total of 450,000 shares of preferred stock applied for. Additional common stock of the Pacific Gas & Electric Company has been authorized for listing on the New York Stock Exchange to the amount of $6,458,350, making the total amount applied for $71,191,150. The listing of $60,000,000 in 5 per cent secured gold bonds, series A, of the Philadelphia Company has been authorized for listing on the New York Stock Exchange, as has also $45,000,000 in first and refunding mortgage gold bonds, 4½ per cent series, of the Public Service Electric & Gas Company.

SHAWINIGAN WATER & POWER INCREASES STOCK.—At a special meeting of the shareholders of the Shawinigan

Water & Power Company held Feb. 21, the capital stock was increased from 1,200,000 shares without par value to 1,600,000 share without par value and at a subsequent meeting of the directors an issue of stock, without par value, to the shareholders was authorized at a price of $50 per share on the basis of one share of new stock for each four shares of the outstanding holdings of record March 26. Rights expire May 1.

## New Capital Issues

First lien 5½ per cent gold bonds, series B, of the United Public Utilities Company were offered to the amount of $3,750,000, at 97¾ and interest, yielding about 5.70 per cent. These bonds will mature April 1, 1947. The United Public Utilities Company, a New Jersey corporation, controls subsidiaries operating in a group of communities in Ohio, Indiana, North Dakota, South Dakota, Alabama and Louisiana.

The American Commonwealths Power Corporation issued 50,000 shares of first preferred stock, $6.50 dividend series, at 95 and accrued dividend, yielding about 6.85 per cent. Proceeds from the sale of the stock will be used for the acquisition of stock of certain companies and for other corporate purposes.

New York Utility Changes Name.—The New York State Gas & Electric Corporation, Ithaca, N. Y., has filed a certificate in the office of the Secretary of State changing its corporate name to New York State Electric Corporation.

## Annual Reports Show Gross Up 8.9 Per Cent

APPROACHING the normal yearly growth, gross revenue of power and light companies increased considerably less in 1927 than was the case during 1926. To date approximately 50 per cent of the companies, or, more properly, companies representing half the gross revenue of the industry, have issued their 1927 financial statements. The aggregate revenues of these companies has increased but 8.9 per cent over that reported by them in 1926, while 1926 figures show a 13.6 per cent growth over 1925 for the same companies.

These figures indicate that estimates published by Electrical World in the issue of Jan. 7 were substantially correct, in so far as this half of the industry is concerned. At that time it was estimated that gross revenue for the entire year would exceed that of 1926 by 8 per cent, reaching a total of $1,783,700,000. Companies which have already reported have a gross of $850,400,000, against $780,347,000 in 1926.

While substantially lower than the 1926 increase, and also that of 1925, an annual increase of 8 to 9 per cent approximates what would appear to be a normal or average annual increase. In 1926 the revenue of the industry increased 11.6 per cent; in 1925, 9.3 per cent, and in 1924, 7 per cent. Furthermore, the increase in power generated in 1927 over 1926 was 8.6 per cent.

## Metropolitan Edison Simplifies Structure

Fifteen issues of securities, totaling over $20,000,000, will be retired as part of a plan for simplification of the capital structure of the Metropolitan Edison Company. To accomplish the plan, as well as to pay for additions and betterments to the company's property, and other corporate purposes, an issue of $25,000,000 Metropolitan Edison Company first and refunding mortgage 4½ per cent bonds will soon be offered the investing public. The plan will also effect a substantial saving in interest charges. Carrying out of the program will reduce the number of issues of the company from seventeen to three. The funded debt, upon completion of the financing, will consist of the new issue of bonds, $7,650,000 first and refunding mortgage 5 per cent bonds (secured by the same mortgage as the new 4½s) and one divisional issue which is non-callable—$1,500,000 York Haven Water & Power Company 5 per cent bonds, due June 1, 1951. The issues being retired range in amounts from $6,252,600 down to $10,500. They consist of one Metropolitan Edison Company issue and fourteen issues of divisional bonds. The principal issues being retired are: $6,080,000 Metropolitan Edison Company 6 per cent bonds, $6,252,600 Pennsylvania Edison Company 5 per cent bonds, $3,250,000 Metropolitan Power Company 6 per cent bonds, $2,348,000 Metropolitan Electric Company 5 per cent bonds, $1,345,000 York Haven Water & Power Company 5 per cent bonds.

# Hartford Electric Light Company Reports Good Year

CONTINUED prosperity shared with its customers is reported in the annual message of President Samuel Ferguson of the Hartford (Conn.) Electric Light Company to stockholders covering the year 1927. The various rate reductions made at the beginning of the year caused a decrease in revenue in excess of $300,000, compared with what it would have been at last year's prices, but in the face of this gross revenues increased approximately $275,000 over 1926. Steady gains marked the year's business. Net earnings applicable to dividends and surplus enabled the company to declare a 40 per cent "customers' dividend" in the form of a discount on all October bills, which amounted to $185,000. Energy sold locally totaled 145,000,000 kw.-hr., against 137,000,000 kw.-hr. in 1926, while power sold other companies totaled 52,000,000 kw.-hr., against 55,000,000 kw.-hr. the year previous. The total power exchanged (with the Connecticut Valley group) was 23,000,000 kw.-hr., compared with 31,000,000 the year before. Sales of electrical energy totaled $5,330,400 (after customers' dividend reduction); expenses totaled $2,655,200, and net after taxes and retirement reserve was $1,711,900, compared with $1,662,900 for 1926. Total income for 1927 was $2,058,400, against $1,842,400 for 1926, and the balance carried to surplus was $336,400, against $384,100 for 1926. During the past three years "customers' dividends" have totaled $694,000.

President Ferguson states that during the year the company's investment in 10,000 shares of the New England Power Association was sold to the International Paper Company, the profits from the transaction being distributed to stockholders in the form of a payment of $1 per share. Regarding the deposit of stock, Mr. Ferguson states that all the directors and more than 35 per cent of the stockholders have complied with the company's recommendation that this be done, and suggests that others holding less than 200 shares should deposit all their stock and those holding larger amounts should deposit 200 shares to indicate their approval of the trust project, voting the balance themselves. The year was also a successful one for the Connecticut Power Company, which is largely owned by the Hartford company. The net earnings of the former increased $183,000, which is approximately 20 per cent greater than the earnings figure for the previous year.

## Energy Output in Mexico

Statistics on the output for the year 1926 of the leading electrical operating companies in Mexico, according to information recently received from the Mexican Department of Industry, Commerce and Labor, are given in the following table:

| Company | Kilowatt-Hours Generated |
|---|---|
| Cia. Mexicana de Lus y Fuerza Motriz, S. A. | 593,472,460 |
| Cia, Agricola y de Fuerza Eléctrica del Rio Conchas, S. A | 137,149,400 |
| Cia. de Tranvias Lus y Fuerza de Puebla | 86,400,440 |
| Cia. Eléctrica de Chapala | 80,175,522 |
| Michoacán Power Co | 53,715,788 |
| Cia. Eléctrica de Tampico, S. A | 38,789,590 |
| Guanajuato Power & Electric Co. | 36,617,91 |
| Cia. Tranvias Lus y Fuerza Monterrey | 26,085,98 |

# Business News and Market Conditions

## Bureau of Commerce Plans to Expand Facilities

Among the developments of the Bureau of Foreign and Domestic Commerce of the Department of Commerce made possible by added appropriations for the next fiscal year will be the establishment of six new district offices. These branches are to be located in Denver, Indianapolis, Birmingham, Pittsburgh, Milwaukee and one in the state of North Carolina. The Commerce Department already maintains 23 district offices and 34 co-operative offices in this country. The object of these offices is to render immediate service to nearby business men. The records of the department show that during the last fiscal year these offices performed more than 2,000,000 commercial services, an increase of approximately 600 per cent during the past five years During the same period statements from 405 concerns thus served indicate actual sales and savings approximating $10,000,000. These branch offices are equipped with foreign trade information regarding conditions abroad, sales openings, names of prospective buyers, packing suggestions, foreign tariffs, etc. They also have, or are developing, facilities for the promotion of domestic trade.

Another advance in the program of the Bureau of Foreign and Domestic Commerce during the next fiscal year will be preliminary work on three new regional surveys in the national commercial survey program which is planned ultimately to cover the entire United States. The "Commercial Survey of the Southeast" has already been completed and is available at the price of $1 per copy from the Superintendent of Documents, Government Printing Office, Washington, D C., or from any district office of the department. Field work in the New England survey has been completed and the report is now being prepared. Field work on the Pacific Southwest is well under way. Preliminary steps also have been taken for beginning field work in connection with four other regions.

## Primary Market for Carbon Brushes

An estimate of the primary market for carbon brushes, based on the 1925 census of manufactures compiled by the Department of Commerce, is given in the accompanying table. It is further estimated that the replacement market would be four times the primary market, considering the average life of the equipment listed as ten years and the average life of the carbon brush 2½ years.

## British Act on Wire and Cable Imports

A report of the standing committee of the Board of Trade to Parliament respecting the importation of insulated electric wires and cables has been published and is now available through the British Library of Information, 5 East 45th Street, New York, at 10 cents per copy. Primarily the report recommends that all imported wires and cables be properly identified as to their origin at the time of importation and also at the time of sale except such material as forms an integral part of a completed article.

## *Delinquent Electrical Accounts*

(Data Supplied by National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

| Division | January 1927 | January 1928 | Per Cent Increase or Decrease | Twelve Months 1926–7 | Twelve Months 1927–8 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | 372 | 260 | −30.1 | 4,238 | 3,508 | −17.2 |
| Middle and Southern Atlantic States | 137 | 159 | +16 | 2,172 | 2,021 | − 6.95 |
| New England | 112 | 133 | −18.7 | 1,508 | 1,884 | +24.9 |
| Pacific Coast | 9 | 11 | +22.2 | 249 | 222 | −10.8 |
| Central | 767 | 798 | + 4.04 | 10,126 | 10,515 | + 3.84 |
| Total | 1,397 | 1,361 | − 2.58 | 18,293 | 18,150 | − .78 |

TOTAL AMOUNTS REPORTED

| Division | January 1927 | January 1928 | Per Cent Increase or Decrease | Twelve Months 1926–7 | Twelve Months 1927–8 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | $62,293 | $49,527 | −20.4 | $639,987 | $552,454 | −13.6 |
| Middle and Southern Atlantic States | 14,289 | 17,511 | +22 5 | 269,412 | 239,255 | −11.2 |
| New England | 10,608 | 14,774 | +39.2 | 108,887 | 225,462 | +107 |
| Pacific Coast | 1,154 | 1,933 | +67 5 | 34,623 | 27,311 | −21 1 |
| Central | 91,704 | 100,755 | + 9 87 | 1,223,498 | 1,286,981 | + 5 19 |
| Total | $180,048 | $184,500 | +2.47 | $2,278,407 | $2,331,463 | +2.42 |

AVERAGE AMOUNTS

| Division | January 1927 | January 1928 | Twelve Months 1926–7 | Twelve Months 1927–8 |
|---|---|---|---|---|
| New York | $167 | $190 | $1,807 | $1,901 |
| Middle and Southern Atlantic States | 104 | 110 | 1,446 | 1,432 |
| New England | 94 | 111 | 1,090 | 1,444 |
| Pacific Coast | 128 | 175 | 1,583 | 1,763 |
| Central | 120 | 126 | 1,433 | 1,362 |

## *Estimate of Primary Market for Carbon Brushes*

Based on the 1925 Census of Manufactures Compiled by the Department of Commerce

| Type of Equipment | Number Produced, 1925 | Average Number of Brushes per Machine | Total Number of Brushes |
|---|---|---|---|
| Alternating-current generators: | | | |
| Steam-turbine driven | 386 | 4 | 1,544 |
| Other including synchronous condensers | 1,712 | 2 | 3,424 |
| Direct-current generators: | | | |
| Steam-turbine driven | 6,562 | 8 | 52,496 |
| Other | 9,410 | 4 | 37,640 |
| Motor-generator sets and dynamotors: | | | |
| Under 50 kw. | 13,530 | 3<br>8 | 40,590<br>108,240 |
| 50-kw. and over | 779 | 6<br>60 | 4,674<br>46,740 |
| Automotive generator and starter motors | 3,879,208 | 3 | 11,637,624 |
| Self-contained power and lighting outfits | 43,408 | 4 | 173,632 |
| Motors: | | | |
| Fractional horsepower | 2,288,348 | 2 | 4,576,696 |
| 1 hp. and over, direct current | 77,637 | 8 | 621,096 |
| Polyphase induction motors: | | | |
| 200 hp. and under | 25,000<br>With brushes | 6 | 150,000 |
| Over 200 hp. | 1,000<br>With brushes | 15 | 15,000 |
| Single phase | 75,688 | 2 | 151,376 |
| Synchronous motors | 1,985 | 4 | 7,940 |
| Electric fan motors | 300,000<br>With brushes | 2 | 600,000 |
| Radio transmitting sets | 1,076 | 4 | 4,304 |
| Vacuum cleaners | 1,107,592 | 2 | 2,215,184 |
| Portable electric tools: | | | |
| Grinders and buffer | 10,000 | 2 | 20 000 |
| Drills | 70,000 | 2 | 140,000 |
| Carbon contacts | ......... | .. | 500,000 |
| Total | | | 21,108,200 |

# Market Conditions

SALES during March have shown a decidedly better trend than in the previous two months. Buying of small motors is prominent in the New England district. Several large orders for general schedule material also are reported. Much interest is noted in street lighting, and there is a steady demand for construction material. Industrial sales are active in the Eastern district and include turbo-generator units totaling $100,000. Substation equipment also was in demand by central-station companies.

Industrial buying continues active in the Southeast and steady business was reported. A street-lighting contract involving more than $1,000,000 was placed in St. Louis, and a normal volume of motor and transformer business was done with industrial concerns. The Middle West reports a general improvement in March with the trend continuing. On the Pacific Coast power company buying of equipment was the outstanding business, which included a 32,200-hp. waterwheel generating unit.

## *Metal Markets Quiet—Little Change in Prices*

Buying of the non-ferrous metals has been in limited volume in the domestic market. This lull was not unexpected after the activity of the first half of March. The large primary producers of copper continued to maintain their position at 14⅛ cents. Most of the business was done at lower prices ranging down to 14 cents, Connecticut. In spite of absence of active buying, lead prices continue firm at 6 cents, New York. Zinc is quotably a little stronger than a week ago, but sales are decidedly sparse.

NEW YORK METAL MARKET PRICES

|  | Mar. 14, 1928 Cents per Pound | Mar. 21, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 13.825 | 13 78¾ |
| Lead, Am. S. & R. price | 6 | 6 |
| Antimony............ | 10⅞ | 10½ |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots............ | 6 | 6.0½ |
| Tin, Straits.......... | 50⅛ | 53¾ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper price March 21, 1928, 15⅞ cents.

## *Industrial Sales Active in Eastern District*

Industrial and utility business combine to bring increased activity in the Eastern market. Industrial interests have been developing a pronounced demand for prime movers of the turbo-generator type. A leading manufacturer of such equipment has secured an order from a company at Waterbury, Conn., for a 2,500-kw. unit to cost about $45,000, and a paper mill at Albany, N. Y., has purchased a similar unit to cost approximately $42,000. A chemical concern at Syracuse, N. Y., has contracted for several smaller turbo-generators for its local plant, totaling around $20,000. While the call for industrial motors has slackened, a resumption of demand is looked for at an early date. Copper mining companies have been prominent in the market recently for motors and kindred industrial apparatus and some sizable commitments are expected from this quarter in a short time. Baking interests, likewise, have been active, and among others the Continental Baking Company, New York, will likely be a large purchaser at an early date in connection with proposed plant expansion. Export account for industrial motors, particularly from South American mining companies, is showing improvement, with a primary call for units of heavier and larger sizes. Business in fractional-horsepower motors is fair, with a tendency to be a little spotty.

Substation and affiliated electrical equipment continues in good demand for central-station account. A utility company in the metropolitan district has placed an order for oil circuit breakers to an amount of about $175,000, while another central-station company has contracted for 2,000 distributing switches of the 7,500-volt type, totaling $14,000. A Buffalo utility company has purchased 200 switches of the 13,000-volt open type for rural line service from the same manufacturer. Circuit-breaker business has shown advancing proportions during the past month and there are excellent prospects for further sizable commitments. Line hardware has been recording some good sales and cable reels have been in demand by telephone companies. Marine electrical equipment is expected to enjoy a pronounced call within the next month or two; the government has several contemplated projects which are to be definitely settled within that time, while the city of New York will probably place orders for an electric-operated ferry-boat and fire-boat.

A feature of immediate construction work in the Eastern district is the expansion program of the Public Service Electric & Gas Company, Newark, N. J. Other construction projects include the following: The International Nickel Company, New York, will improve its properties at Port Colborne and Copper Cliff, Ontario, over a period of months to cost $12,000,000. The DuPont Cellophane Company, Buffalo, N. Y., plans an addition to its paper mill to cost about $200,000. Riverside, N. J., will improve its street-lighting system. The Amalgamated Silk Company, East Mauch Chunk, Pa., has authorized the electrification of its mill. The Pennsylvania Power & Light Company, Allentown, Pa., will build transmission lines in Roaring Creek at Catawissa Townships through two subsidiaries. The Stetson Rubber Company, Butler, Pa., will build a mill to cost $100,000. The Eastern Shore Public Service Company plans a transmission line to Millville, Ocean View, Bethany Beach and vicinity. The Love Point Light & Power Company, Love Point, Md., will build a transmission line to Queenstown. The Kelly-Springfield Tire Company, Cumberland, Md., plans a refrigerating plant for rubber conditioning to cost $100,000. The Board of District Commissioners, Washington, D. C., will receive bids until March 26 for lamp-posts and fittings for the electrical department. The Bureau of Supplies and Accounts, Washington, D. C., will receive bids until April 3 for insulated cable and wire for Eastern and Western yards (Schedule 8708).

## *Small Motor Buying Steadies New England Trade*

With the demand for heavy equipment and central-station supplies rather quiet, the encouraging activity in small motors in the New England district gives notable strength to the market. The sales volume of motors was slightly above normal and among the orders were recorded many units from 15 hp. to 600 hp. Small switch and control sales are fair. A number of large orders for general schedule material were placed, one for $6,500, another for $2,500, and consignments for general contractors' supplies totaling over $15,000. Much interest is reported in street lighting. Electric automatic pumping units are being considered for two localities in southeastern Massachusetts. Inquiries also are being received for a large number of special institutional lighting systems. Much encouragement is seen in the steady demand for new construction requirements.

Construction projects are as follows: The Boston Ice Company has bids open for a plant for Cambridge. The U. S. Gypsum Company has acquired a water frontage and will expend about $1,500,000 for a new plant at Boston. The Edison Illuminating Company, Boston, plans additions to the Edgar station consisting of extensions to the switch house and boiler plant. The Boston Rubber Shoe Company, Malden, Mass., has authorized electrification of its mills at Malden and Melrose, Mass.

## *Steady Business Reported in the Southeast*

An order for a complete 25,000-kva. substation was the most prominent one placed in the Southeast. The volume of business in meters and transformers is good, though the individual orders average about $1,500. One company purchased $5,700 worth of small power and distribution transformers and $1,200 worth of house type meters. A central-station company in south Georgia ordered regulators amounting to $4,000, while another company purchased $1,300 worth of sign equipment for four small installations. In connection with merchandising activities in the section, one power company recently sold 2,650 flat-irons in one town in a special campaign.

One of the small independent telephone companies in Georgia ordered 250 Southern white cedar poles.

A textile mill in North Carolina purchased a 1,000-kw. steam turbine and auxiliary equipment for its bleachery and a textile plant in Alabama ordered motors, transformers and switchboard equipment amounting to $17,000. A textile resale firm placed an order for motors totaling $8,000, and a Georgia ice plant ordered synchronous motors amounting to $2,000. Wiring materials totaling $30,000 are being ordered in connection with the Southern Railway shops at Macon, Ga., though this amount is being split in a number of small orders to local jobbers. Motor and transformer equipment on that job will cost in the neighborhood of $50,000 and orders on the same are pending. A municipally owned plant in one of the larger Florida towns is contemplating the purchase of a 1,500-kw. turbo-generator and a number of active negotiations for waterwheels and generators for the northern part of the section are under way. It is expected these latter propositions will be definitely closed during the coming week.

Construction projects are as follows: The Georgia Portland Cement Corporation, Saundersville, Ga., plans a mill to cost $1,000,000. Henderson, Ky., plans improvements in its power plant to cost $50,000. Paducah, Ky., has authorized surveys for a municipal power plant. The Carolina Gas & Electric Company will build a transmission line to Kinston, N. C. The North Carolina Public Service Company plans a transmission line to Mebane, N. C., and vicinity. The Powell Knitting Company, Spartanburg, S. C., plans a mill addition to cost $175,000. Danville, Va., plans improvements at its municipal power plant to cost $35,000.

## *Large Street Light Contract Placed in St. Louis*

Conditions in the St. Louis district have been fair. A normal volume of medium-sized motors and transformers for industrial concerns has been purchased. Contracts for street lighting to include the St. Louis down-town section were awarded at a total cost of considerably over $1,000,000. A railroad company signed a contract for five gas-electric cars, each with a 400-hp. single-unit power plant at a total cost for electrical equipment of about $70,000. Another railroad company also bought apparatus for converting four gasoline cars to gas-electric service at a total cost of $30,000.

Construction projects are as follows: The Southwestern Gas & Electric Company, Shreveport, La., plans a steam power plant to cost $1,000,000. Normandy, Mo., plans a vocational school to cost $125,000. The Commissioner of Indian Affairs, U. S. Indian Service, St. Louis, Mo., will receive bids until April 9 for electrical supplies (Schedule 22-a). The Bartholomew Battery & Supply Company, St. Louis, Mo., plans a new plant at Columbia, Mo., to cost $100,000. The Pillsbury Flour Mills Company, Minneapolis, Minn., plans a mill and elevator at Enid, Okla., to cost $1,000,000. The Southwestern Irrigated Cotton Growers' Association, El Paso, Tex., plans a cottonseed oil mill to cost $150,000. The Panhandle Power & Light Company plans construction of a transmission line to Claude, Tex. The Gates Chemical Company, Denver, Colo., plans a branch plant at Houston, Tex., to cost $200,000. The Fair Baking Company, San Antonio, Tex., will build a baking plant at Houston, Tex., to cost $175,000. Poplar Bluff, Mo., and Port Arthur and Forth Worth, Tex., plan ornamental lighting systems.

## *Improvement Noted in Middle West*

The consensus of opinion in the Middle West is that the first half of March showed an improvement and the last half will show the same trend. Reports emanating from the steel industry are encouraging and considerable construction work is under way. Utility companies are preparing for spring activities with a large amount of line extension planned. Orders placed covered eighteen 15,000-amp., two 2,000-amp. and four 4,000-amp., 15-kv. oil circuit breakers and disconnecting switches valued at $10,000, and "Mazda" lamps valued at $150,000. Jobbers' sales have accelerated somewhat.

Construction projects are as follows: The Miehle Printing Press & Manufacturing Company, Chicago, plans additions in plant to cost $500,000. The Buick Motor Car Company, Flint, Mich., plans a factory branch in Chicago, to cost $600,000. The Iowa Soap Company, Burlington, Iowa, will build a plant to cost $100,000. The Interstate Power Company, Dubuque, Iowa, plans a power plant at Harper's Ferry, Iowa. Hawarden, Iowa, has approved a municipal power plant to cost $40,000. The Iowa Railway & Light Company has applied for permission to build a hydro-electric plant on Cedar River, near Rochester, Iowa, to cost $2,000,000. The Consumers Power Company, Jackson, Mich., plans a hydro-electric plant in vicinity of Morley, Mich., to cost $5,000,000. Mora, Minn., contemplates a municipal power plant. Harvard, Neb., has authorized $40,000 for a municipal power plant. The Nebraska Electric Power Company plans an addition to its power plant at Ogallala, Neb. Cincinnati, Ohio, is having plans drawn for an automotive trade school, to cost $125,000. The Marshall Electric Company, Marshalltown, Iowa, plans a transmission line for service at Hartland, Dillon and Marietta. The Indiana General Service Company will build a transmission line from Fort Wayne to Marion, Muncie and Kokomo to operate at 132,000 volts. The Otter Tail Power Company plans reconstruction of transmission lines at Lisbon, Forman, Enderlin and Cogswell, N. D. Cedar Rapids, Iowa, and Whitefish Bay (Milwaukee, P. O.), Wis., will build ornamental lighting systems.

## *Power Companies Buy Equipment on Pacific Coast*

Power company business has bulked large on the Pacific Coast. The outstanding order was placed by Los Angeles City for its San Francisquito plant No. 1 and awarded to the Allis-Chalmers Manufacturing Company for a 32,200-hp. waterwheel, valued at $117,465, and a 25,000-kva. generator, valued at $165,200. The Westinghouse Electric & Manufacturing Company also was awarded a contract for oil circuit breakers to cost $29,294. Los Angeles also is in the market for 700,000 ft. of guy strand and $20,000 worth of poles. Eugene, Ore., is buying the initial material for its 18,000-hp. plant, to cost eventually $2,250,000, and is placing orders for a 9,000-hp. turbo-generator at a cost of $73,000, and six 2,500-kva. transformers for $34,660. Material for a 15-mile farmers' telephone line is wanted in the Ukiah district and for a 25-kilometer line by Mazatlan, Mexico. Railroad buying is rather quiet, industrial business is good and contractors' business, after a very poor February, is decidedly better.

Numerous motor orders placed by irrigation and orchard districts in eastern Washington and by lumber mills in the Puget Sound district, for replacements mainly, amounted to approximately $40,000 and included about 250 motors comprising from 300 hp. down for a "Kraft" paper mill in Pierce County. Tacoma also placed an order for its annual requirements of power and distribution transformers approximating $100,000. Specifications have been issued for motors and pumps for a cold storage plant in Wenatchee to cost $150,000. The British Columbia Electric Railway Company plans immediate construction of a 20,000-kw. distributing station in Victoria. The Pacific Telephone & Telegraph Company plans additional long-distance circuits connecting Seattle, Spokane and other cities at a cost to exceed $200,000.

Construction projects are as follows: The Mission Rock Company, Harry S. Scott, president, San Francisco, Calif., plans a cold storage and refrigerating plant to cost $200,000. The Truckee Utility District, Truckee, Calif., plans a distributing system to cost $20,000. The Hawley Pulp & Paper Company, Oregon City, Ore., plans electrification of its pulp mill. The Maple Creek Coal Company, Salt Lake City, Utah, plans extensions at its mines to cost $50,000. The Willapa Pulp & Paper Mills, Inc., South Bend, Wash., plans a pulp mill to cost $500,000. Monrovia, Modesto and San Leandro, Calif., plan installation of ornamental lighting systems. The Southern Sierras Power Company, Riverside, Calif., will build a steel tower transmission line from San Bernardino to Seal Beach, 58 miles, to cost $750,000. The Commonwealth Utilities Corporation, Denver, Colo., plans a 44,000-volt transmission line. The Pacific Power & Light Company plans transmission lines at Walla Walla, Wash., to cost $150,000, and a substation to cost $35,000.

# Activities of the Trade

## Railway & Industrial Gets Large Switch Order

A very large order for outdoor substation switching equipment recently has been placed by the Public Service Corporation of New Jersey with the Railway & Industrial Engineering Company of Greensburg, Pa. The order covers equipment for the West Orange, Roseland and Metuchen substations and includes the steel structures for two of the stations. The stations are for 154 kv. to 37 kv. service.

The major items that are to be furnished include 203 three-pole sets of "Hi-Pressure" contact switches, 102 motor-operating mechanisms, 1,250 interchangeable unit bus supports, 157 sets of single pole equipment and 450 tons of steel. The apparatus is similar to that furnished for the Public Service Corporation's Hudson station in 1927.

## Westinghouse Accident Due to Failure of Test Apparatus

The fatal accident which occurred on March 13 in the South Philadelphia works of the Westinghouse Electric & Manufacturing Company was not due to the explosion of a turbine, as stated in the newspapers, but to the failure of part of the temporary shop equipment for testing. The accident happened during the heater box run on the low-pressure spindle of a large turbine, stated H. T. Herr, vice-president of the company. During the shop tests of a large spindle, temporary equipment is required to permit the overspeed run in a special casing installed in the erecting shop. A coupling adapter plate, which is part of this equipment used only in shop tests, burst during the test and broke the coupling housing into fragments. This is the first accident resulting in serious injury since the opening of the South Philadelphia plant ten years ago.

## Woodward Governor Confers With Hydro Operators

As a means of giving operating men and engineers a more thorough knowledge of the basic theory and practical use of its equipment for the control of hydraulic turbines, the Woodward Governor Company recently held a four-day conference at Rockford, Ill., at which 58 operators from hydro-electric plants in the United States and Canada attended. This was the second annual conference which the Woodward company has arranged and both meetings have enabled the operators and engineers who design the equipment to study and discuss operating problems and conditions encountered in a large number of hydro-electric plants.

Methods by which highest efficiency and most accurate control could be obtained were demonstrated by actual operation of governors and the use of cut-away views of various types of machines. The final day of the conference was devoted to a general discussion of power plant operation and new types of machinery were suggested to be developed so that certain local plant conditions might be handled automatically. Both the governor company and the plant operators felt that the conference was a very definite benefit and plans have been made to hold such a meeting each year.

## American Pulverizer Moves Into New Plant

A new modern plant located at 1249 Macklind Avenue, St. Louis, is now the home of the American Pulverizer Company, manufacturer of the American rolling ring crushers. The company was formerly at Eighteenth and Austin Streets. The new plant has about 12,000 sq.ft. of floor space, is equipped with modern machinery, including an electric traveling crane, and is served with a private switch track connecting with the principal railroads. It is said that the company is now in a position to better than double its former production.

The Allis-Chalmers Manufacturing Company, Milwaukee, announces that E. D. Hill will represent the company at 42 Church Street, New Haven, Conn. The sales will be under the direction of A. F. Rolf, manager of the company's New York office at 50 Church Street.

The Black & Decker Manufacturing Company, Towson, Md., manufacturer of portable electric tools, announces the electric sander for smoothing surfaces.

The Wodack Electric Tool Corporation, 4627 West Huron Street, Chicago, announces the type B portable electric hand saw, which, in addition to vertical sawing, provides for bevel sawing at any angle up to 60 deg.

The National Carbon Company, Inc., Cleveland, announces the removal of the branch sales office and factory of the carbon sales division from 357 West 36th Street, New York City, to new and larger quarters at the company's plant at Fourteenth and Henderson Streets, Jersey City, N. J.

The Electric Vacuum Cleaner Company, Inc., Cleveland, announces that M. R. Sutherland and Harry C. Hahn have been appointed assistant sales managers. Mr. Sutherland assumes entire charge of organization matters and is responsible for the personnel of the field organization, while Mr. Hahn is responsible for trade relations and is essentially a contact and sales promotion man. He will have as his personal staff three regional representatives bearing the title of manager of trade relations. These men are Otto Best, Jr., with headquarters in New York City; Walter J. McCord, Jr., with headquarters at Cleveland, and G. L. Lord, with headquarters at Chicago. V. M. Cannon has been appointed assistant to the sales manager.

The Federal Electric Company, 8100 South State Street, Chicago, announces a new product, the "Fedelco" porcelain electric clothes washer.

The Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago, announces the opening of a new Kansas City, Mo., office in charge of L. C. Hitzeroth, who has been transferred from the sales engineering division of the Chicago factory.

The Sundh Electric Company, Newark, N. J., manufacturer of control apparatus, announces the appointment of the Chas. L. Ward Company as its representative. The Ward company has offices at 701 Midland Building, 1229 Baltimore Avenue, Kansas City, Mo.; 734 Electric Building, Omaha, Neb., and Tulsa, Okla.

The Copperweld Steel Company, Glassport, Pa., announces that Paul Van Wagner has been appointed representative for the Pittsburgh district in charge of central-station and railroad sales, covering the distribution of Copperweld products in western Pennsylvania, western Virginia, western Maryland and the state of West Virginia.

The Electric Machinery Manufacturing Company, Minneapolis, manufacturer of synchronous motors and vertical alternators, announces the appointment of T. H. Hayes, 705 Traction Terminal Building, Indianapolis, Ind., as its sales representative for the Indianapolis territory.

The Krich Light & Electric Company, 558 Broad Street, Newark, N. J., jobber, announces a change in policy. The company has discontinued its general electric supply business and will hereafter confine its activities to the merchandising of electric specialties, such as vacuum cleaners, refrigerators, ventilating fans, sewing machines, radio, etc.

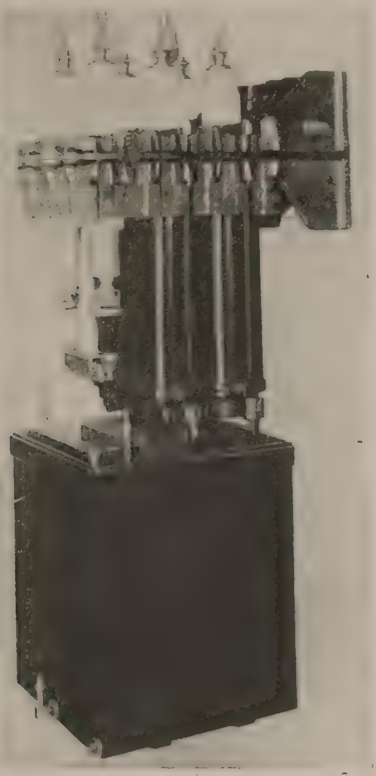
The National Fireproofing Company, Fulton Building, Pittsburgh, announces that Sidney F. Heckert was elected president at the annual meeting of the board of directors held on March 2.

Copeland Products, Inc., Detroit, announces that 35 new dealers have been added to the list of firms handling Copeland electric refrigerators, according to W. D. McElhinny, vice-president in charge of sales. The company recently demonstrated at Detroit its "Silica Gel" refrigeration unit which does not require a motor and compressor but is of the absorption type.

# New Equipment Available

## Compact High-Rating Oil Circuit Breaker

The type D-131 oil circuit breaker of relatively high interrupting capacity and comparatively small dimensions has been developed by the Condit Electrical Manufacturing Company, Boston. The line is built for 400, 600, 800 and 1,200 amp. at 15,000 volts, and 1,600 amp. at 7,500 volts, with an estimated interrupting capacity of 7,000 amp. at 15,000 volts. It is available in two, three and four-pole, single-throw, manually or electrically operated units. Features of the design include a double-tank construction cradle and spring suspension, a rugged frame and heavy arcing contacts.



*Double tank construction is used in this compact high-rating circuit breaker*

**Limit Switch for Control Circuits.**—A limit switch for controlling the limits of travel on such applications as motor-operated window- or door-opening apparatus, valves, etc., where magnetic control is used has been placed on the market by the General Electric Company. The switch is provided with two normally closed contacts, one for each extreme of travel. These contacts are operated by two cams, mounted on opposite faces of a molded gear. The two cams are adjustable with respect to each other and, as a further refinement, each contact has a micrometer screw which makes possible very close adjustment of the opening point for each contact after the general position of the cams has been set. The molded gear, with the two cams, is driven by means of a worm gear. The entire mechanism is inclosed in a cast-iron box with sheet-steel covers on the front and back. The contacts are both of silver.

## Heavy-Duty, Gang-Operated Disconnecting Switch

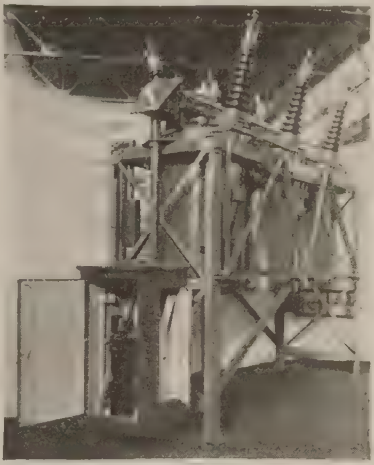
For heavy duty railway service and use on trunk feeders where the operating voltage is 11,000, the Delta-Star Electric Company, Chicago, has developed a gang-operated switch. It is equipped with corrosion and ice-breaking mechanism to insure easy and positive action at all times and is provided with ball bearings on the rotating bearings and swivel joints.

The full-floating, self-aligning contacts are fully covered by a copper sleet shield. The number of parts have been reduced to a minimum and all are said to be of exceptionally rugged construction. Although primarily designed for remote control by means of a motor mechanism, this switch can be furnished for remote manual control.

## High-Voltage Outdoor Oil Circuit Breakers

The design of a new line of outdoor oil circuit breakers has just been completed by the General Electric Company. The line is designated as the FHKO-139 type with interrupting capacities ranging from 350,000 kva. to 2,500,000 kva. The breakers are built to operate on voltages from 15,000 to 220,000. The breakers, from 15,000 to 88,000 volts inclusive, are mounted on a structural iron framework, while breakers of 110,000 volts to 220,000 volts are floor mounted. The breakers are built with "A," "B" and "C" interrupting capacity ratings, the "A" breaker having the wedge and finger plain break contacts, while the "B" and "C" ratings employ the explosion chamber. The breakers are constructed of boiler plate steel welded in place. The detailed design factors, electrical clearance, stroke, pressure type joints, sizes and weights for a given voltage and interrupting capacity were decided from tests both in the factory and in the field and in conformity with the company's experience in oil circuit breaker application.

Each single-pole unit has a flame-resisting lining of high dielectric strength, an oil gage, drain and fill valves and a separating chamber. The single-pole units are made of interchangeable design in so far as is possible. A semaphore is provided for the complete breaker to indicate the position of the breaker contacts; that is, whether open or closed. The drain valves are connected to a pipe at the bottom of the oil tanks in such a way as to permit complete drainage of the oil. The oil circuit breaker contacts are operated by a mechanism for providing a simple straight line motion. Each single-pole unit is equipped with buffer springs compressed in the closed position, a toggle effective in the closed position, a toggle stop, and dashpots to prevent rebound of the contacts. Each unit is provided with a balancing spring and the complete breaker has an opening spring such that the contacts are constrained to open throughout the complete stroke. The breakers may be manually operated, solenoid operated or motor operated. Trip free mechanisms are available for either solenoid or motor applications, while alternating-current operation is provided by means of the motor mechanism, which is of the centrifugal type. For breakers up to and including 37,000 volts the standard compound filled bushings are provided. For 50,000 volts and all higher voltages oil-filled bushings are provided. Breakers of 15,000-, 25,000- or 37,000-volt ratings are so designed that the American Institute of Electrical Engineers' minute test for the next higher voltage rating may be applied.



*Type FHKO-139, 73,000-volt solenoid-operated oil circuit breaker*

**Polyphase Switches.**—A line of polyphase switches built in sizes ranging from 60 amp. to 400 amp. with test connections and from 60 amp. to 600 amp. without test connections has been placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Conn. These switches can be furnished with fuses sealable or accessible when the switch is in the "off" position. The switch is of slate base construction and the contacts are mounted on the top where they can be inspected in the "on" position.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued Feb. 28, 1928)

1,661,014. Short Circuiting and Brush Lifting Device for Dynamo Electric Machines; E. Schmock, Kiel, Germany. App. filed Dec. 16, 1925.

1,661,062. Electrical Water Heater; P. Ambory, Royal Oak, Mich. App. filed June 11, 1927.

1,661,102. Ended Cord and Method of Producing the Same; E. E. Waite, Framingham, Mass. App. filed Feb. 28, 1924.

1,661,103. Thermostatic Regulating Device for Heat-Producing Apparatus; A. O. Appelberg, Stockholm, Sweden. App. filed Nov. 3, 1925.

1,661,109. Transmitter for Electrical Control Systems of the Selective Type. Granted under the provisions of the act of March 3, 1883. R. C. Coupland, of the United States Army, Dayton, Ohio. App. filed May 13, 1926.

1,661,124. Terminal Clip; H. M. Koretzky; New York, N. Y. App. filed May 7, 1923.

1,661,127. Electrically-Controlled Combination Mechanism for Locks; R. H. Malicki, Chicago, Ill. App. filed April 18, 1925.

1,661,138. Incandescent Lamp Retainer and Mounting; R. M. Hill, Washington, D. C. App. filed May 28, 1923. Of the type used in motion picture apparatus.

(Issued March 6, 1928)

1,661,156. Production of Welded Wire Fabric and Apparatus Therefor; A. Armstrong, Tynemouth, England. App. filed Nov. 18, 1924.

1,661,166. Relay; T. S. Casner, Plainfield, N. J. App. filed April 23, 1925. Of high sensitivity adapted to be operated by relatively weak electrical impulses to open and close a local circuit of considerable magnitude.

1,661,170. Electric Driving System; J. Drukker, Amsterdam, Netherlands. App. filed Jan. 7, 1927. For phonographs.

1,661,173. Electric Furnace; C. B. Foley, Fort Wayne, Ind. App. filed March 23, 1922. Induction furnace of crucible type.

1,661,199. Container Cover; H. A. Selah, Erie, Pa. App. filed Dec. 26, 1924. Cover for conduit boxes.

1,661,208. Large Automatic Generating Plant; E. R. Witzel, Kohler, Wis. App. filed May 14, 1927.

1,661,222. Electric Heater; W. C. Hunt, Toronto, Ont., Can. App. filed March 12, 1927. Bowl reflecting type.

1,661,224. Primary Galvanic Battery; E. W. Jungner, Kneippbaden, Sweden. App. filed June 1, 1920.

1,661,258. Case for Fire Alarm Signaling Mechanism and the Like; F. B. Love, and B. H. Smith, Shelby, Ohio. App. filed Feb. 17, 1925.

1,661,268. Combined Transformer and Conduit Box Cover; A. E. Rittenhouse, Honeoye Falls, N. Y. App. filed May 1, 1926.

1,661,281. Electric Radiator; J. Bilan, Flint, Mich. App. filed June 13, 1927.

1,661,303. Electrode Rack; H. G. Price and B. K. Smith, Houston, Tex. App. filed Feb. 24, 1927.

1,661,331, 1,661,332. Apparatus for Winding Armatures; A. B. Gomory, Anderson, Ind. Apps. filed Sept. 26, 1924 and Feb. 3, 1923.

1,661,345. Alternating Current Magnet; C. H. Rippl, East Cleveland, Ohio. App. filed Feb. 26, 1927. As employed in contactors, circuit breakers and the like.

1,661,346, 1,661,347, 1,661,348, 1,661,349. Thermostatic Controlling Mechanism; C. B. Sawyer, Cleveland, Ohio. Apps. filed Nov. 17, 1922, April 4, 1923 and March 17, 1924. Such as depend for their operation upon the expansion or contraction of a fluid due to temperature changes.

1,661,352. Electric Switch; W. G. Young, Dayton, Ohio. App. filed April 30, 1925. Of the plunger type.

1,661,354. Anti-Freeze Container; W. W. Ayre, West Englewood, N. J. App. filed March 17, 1927.

1,661,373, 1,661,376. Conductor Clamp; E. F. Leighton, Anderson, Ind. Apps. filed March 15, and June 7, 1926.

1,661,434. Electric Switch and System; A. R. Locke, Chicago, Ill. App. filed Aug. 14, 1922. As applied to a multi-color lighting system such as used in theatre stages and auditoriums.

1,661,464. Heating Element Support; W. Campbell, Detroit, Mich. App. filed Aug. 13, 1923.

1,661,495. Swivel Connection; P. M. O'Neill, Fort Ethan Allen, Vt. App. filed Aug. 4, 1925.

1,661,497. Battery Terminal; G. D. Pate, Akron, Ohio. App. filed April 25, 1925. For storage battery.

1,661,553. Vacuum Cleaner Attachment; L. Baar, Los Angeles, Cal. App. filed March 19, 1927.

1,661,585. System of Rectification; F. Transom, Washington, D. C. App. filed April 2, 1925.

1,661,589. Anode Spacer; W. J. Winninghoff, East Orange, N. J. App. filed Aug. 27, 1924.

1,661,597. Water-Cooled Lamp; L. J. Buttolph, East Orange, N. J. App. filed Jan. 1, 1924. Apparatus for controlling radiant energy devices.

1,661,622. Brake System for Vehicles Running on Rails; H. Pieper, Brussels, Belgium. App. filed April 15, 1926.

1,661,625. Brake Device; H. Pieper, Brussels, Belgium. App. filed June 5, 1926.

1,661,637. Decoding Apparatus; A. J. Sorensen, Wilkinsburg, Pa. App. filed Nov. 18, 1926.

1,661,651. Electromagnetic Apparatus; P. N. Bossart, Swissvale, Pa. A direct-current electromagnet operated from a source of alternating current through asymmetric units.

1,661,683. Electric Heating System for Oil Pipe Lines; C. Setzefant, Modesto, Cal. App. filed Aug. 10, 1927.

1,661,689. Electric Candle Socket; T. A. Both, Stratford, Conn. App. filed July 26, 1921.

1,661,693. Electric Water Heater; J. H. Ewart, London, England. App. filed July 7, 1926.

1,661,694. Electric Resistance Furnace Adapted for Heating by Nitrogenization; A. Fry, Essen-on-Ruhr, Germany. App. filed Aug. 2, 1926.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase or agency is desired in Berlin, Germany (No. 30,122), for hot air driers and electromedical appliances.

A sole agency is desired in Caracas, Venezuela (No. 30,131), for household electrical appliances and small motors and dynamos.

An agency is desired in Alexandria, Egypt (No. 30,123), for portable reading lamps and light vase adapters and wiring devices.

Purchase or agency is desired in Basel, Switzerland (No. 30,168), for lighting fixtures, including flood lights and advertising appliances.

Purchase is desired in Vancouver, Canada (No. 30,176), of lighting fixtures and electric signs.

Purchase or agency is desired in Bucharest, Rumania (No. 30,167), for electric refrigerators.

An agency is desired in Munich, Germany (No. 30,126), for tools (electric hammers).

An agency is desired in Essen, Germany (No. 30,124), for portable electric tools.

An agency is desired in Frankfort, Germany (No. 30,125), for portable electric tools.

Two agencies are desired in Berlin, Germany (No. 30,128) and (No. 30,130), for portable electric tools.

An agency is desired in Fulda, Germany (No. 30,129), for portable electric tools.

Purchase is desired in Florence, Italy (No. 30,132), of electric vacuum cleaners.

An agency is desired in Mainz, Germany (No.30,127), for electric washing machines.

Marc-Henry Bornet, 8 Rue de Rive, Geneva, Switzerland, desires to get in touch with American manufacturers of electromedical apparatus, electrical household appliances and electric refrigeration units for the purchase of such material and to eventually arrange for an agency.

# New Trade Literature

STARTING SWITCHES AND PUSH BUTTON STATIONS.—Bulletins No. 209, No. 704, No. 709, No. 710, No. 720, No. 211 and No. 800 issued by the Allen-Bradley Company, Milwaukee, describe and illustrate respectively its direct-current across-the-line starting switch, alternating-current reversing switch, type J-1552, form B, across-the-line starting switch, type J-1552 form T across-the-line starting switch, type J-1552 form M across-the-line starting switch, type C-1201 direct-current automatic starter and its push button master stations.

DECORATIVE AND INDUSTRIAL LIGHTING.—A booklet issued by the Bryant Park Electric Lamp Company, 330 West 42nd Street, New York City, covers its colored lamps and their applications. The company is also distributing a bulletin covering the "Factrolite" unit, a modern industrial lighting source.

RAILWAY ELECTRIFICATION.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-828 and GEA-851, in which it describes the electrification of the Butte, Anaconda & Pacific railway and the electrification of the Mexican railway.

FLOODLIGHTS AND PROJECTORS.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletin No. 2109 describing the applications of floodlighting in buildings, monuments and signs of every sort. A number of illustrations show the various effects obtained. Bulletin No. 2106 issued by the company describes its types LCE, LCA, LDA and LDE floodlight projectors.

ELECTRIC HOISTS.—Bulletin No. 31 issued by the Chisholm-Moore Manufacturing Company, Cleveland, covers the C-M electric hoist for every purpose. It contains construction details and illustrations showing typical installations. Drawings and complete dimensions also are included.

BRAKES.—The Clark Controller Company, Cleveland, has published bulletin 102-C in which it describes the Clark "Three C" brakes. Illustrations are given showing the construction of the brakes and tables giving approximate dimensions, ratings, weights, etc., are included.

LIGHTNING ARRESTERS.—Booklet No. 248 issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, entitled "Valve Characteristics of Lightning Arresters" is the fourth of a series covering the technical features of the crystal valve lightning arrester as they apply to modern lightning protection.

WINCHES.—The Silent Hoist Winch & Crane Company, 762 Henry Street, Brooklyn, N. Y., has issued bulletin No. 27 describing and illustrating the different types of Silent Hoist vertical and horizontal capstans, single and double drum winches, and self-contained units complete with electric motor and gasoline engine drive.

SWITCHBOARDS AND SWITCHING EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-283A and GEA-582A, covering its alternating-current small plant and industrial switchboards with oil circuit breakers and its automatic switching equipment for synchronous motor-generators in lighting service.

PUMPS.—Bulletin No. 36 issued by the Beach-Russ Company, 50 Church Street, New York City, describes and illustrates its rotary pumps for various uses.

INDUSTRIAL LIGHTING.—"Points on Productive Lighting for Industry" is the title of a booklet published by the Benjamin Electric Manufacturing Company, 120 Sangamon Street, Chicago. It contains industrial lighting information, descriptions of various types of lighting equipment and their adaptation to meet specific requirements, a listing of recommended intensities for industrial uses and a chart for estimating lamp sizes for given areas.

PULVERIZING, GRINDING AND MIXING MACHINERY.—The Abbe Engineering Company, 30 Church Street, New York City, is distributing bulletin No. 23, describing and illustrating its pulverizing grinding and mixing machines.

ELECTRIC DRIVE FOR TANKERS.—The General Electric Company is distributing bulletin GEA-871, entitled "Diesel-Electric Drive for Tankers," in which it gives illustrations and data on ships equipped with the Diesel electric drive.

Electrical World

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W. H. ONKEN, JR.
*Editor*

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## *Unemployment Alarmists Are Belied by Facts*

FIGURES for unemployment in this country, freely bandied about, have attained a size that seems to have no basis other than that of political propaganda. The reliable available data show that the published unemployment figures for the country as a whole are in considerable part based on conditions of a seasonal or regional character. The energy consumption of about three thousand manufacturing plants throughout the nation, compiled by the ELECTRICAL WORLD, shows that the rate of production during February was about 16.2 per cent over December. This is slightly under the the rate reported for the same period of 1927, but considerably over the rate of increase reported for the same month in 1924, 1925 or 1926. In the electrical industry there is a distinct feeling of optimism as to the trend in business, particularly since the first of March.

To show further how far wrong current figures of unemployment are there may be cited the conditions in Baltimore, which recently was chosen by the Department of Commerce as a test city for determining actual employment conditions. Some opinions placed the number of unemployed in Baltimore at 70,000, and a careful estimate made by the Chamber of Commerce in conjunction with the various labor organizations set the figure at 60,000. An actual census made by the Department of Commerce gave the true figure as only 17,000, showing that the previous totals were hopelessly inaccurate. Unemployment figures are valuable to the executive as an aid in guiding his business. Unless they can be shown to be based on fact they should be cast aside as worthless.

* * * *

## *Indoor or Outdoor Domestic Metering*

AN ALMOST unanimous opinion and requirement on the part of electric light and power companies relegates the domestic meter to the dark inaccessibility of the far corners of the consumer's cellar. No hazard of life or limb is unknown in the multitudinous stretches between the back door and the entrance switch. Metermen must, in some cases, call many times before a reading can be obtained. Calibration tests are delayed and interminably postponed through failure to gain an entrance. Meters cannot be set or removed when desired. It is another item in the long roll of lost hours, labor and money. Is it necessary?

The large number of summer homes within its territory and a racial dislike on the part of local housewives to the tramping of muddy shoes across spotless and inviolate kitchen floors led a well-managed utility to consider the advisability of outdoor metering. Commercial and operating men agreed that it could be done if the increased cost of protective equipment were minimized. The result was the development of a zinc-aluminum case for back-porch or shed mounting, the inclosed meter being read through a glassed port. Service is brought directly from the pole to the meter. No fuses are used. Small insulated-handle switches are, however, utilized to break the circuit for test conditions. The distributing fuse box and service switch are installed in the cellar at a convenient point. Fuses for meter protection are considered economically unnecessary as a result of the comparison of figures for the cost of meter protection and of those for losses through burnouts. Meter accuracy is said to meet reasonable requirements. The plan is being approached slowly, but there are highly desirable features involved. It is estimated that, on a quantity-production basis, the metal cases will pay for themselves in less than a year when lost hours and income are evaluated in connection with installation charges.

* * * *

## *Super-Codes for Wiring and Lighting*

PROGRESS in the introduction of improved devices and methods has come largely through selling efforts by the manufacturers or by broadcasting the information through technical publications and conventions. This has always worked well and doubtless will continue so to do, but as time goes on cases are arising with increasing frequency where co-operative action by the industry is needed. One of the best examples of a co-operative effort of the industry directed to a specific purpose and accomplishing far-reaching results was the promotion of the convenience outlet idea in California in 1919-1922. Where the issues are more complex promotional effort is needed not merely to popularize the device or idea, but to prevent unfairness due to the large number of materials and methods involved. Of this class there is already one prominent example—the "red seal" plan—and more are apparently in the making.

An opportunity for co-operative effort exists in the illumination field. The Illuminating Engineering Society has drawn up codes for several classes of lighting, some of which have been made legal in various states. State laws can go no further, however, than to regulate matters pertaining to public health and safety. In illumination, as in many other things, there is quite a margin between minimum legal requirements and standards of good or desirable practice. But would it not be possible to draw up and get the general indorsement of the industry for certain super-codes of lighting of various classes which would in time come to be recognized as common standards of excellence? In other words, why not a "red seal" specification for the lighting of offices, another for industrial lighting, and so on?

Such specifications would naturally fall to the Illuminating Engineering Society. The promotion of the idea and practical working out of the plan would naturally be done through co-operative industry organizations, as in the case of "red seal" wiring. Such a movement would put a considerable check on the activities of numerous unscrupulous and ignorant salesmen working in the illumination field and would provide the customer and the conscientious illumination salesman with a standard by which to judge, or to have judged, the good and bad qualities of a lighting installation.

A start in this direction has already been made in Chicago under the name of the "Franklin specification," by which residence lighting fixtures for use in a refixturing campaign receive a Franklin specification certificate tag if passed by a technical committee. A Franklin specification for commercial lighting has also been promulgated. Local initiative in such things is desirable, for out of such local experiments come the most successful national movements.

* * * *

## *Attacking Operating Problems Instrumentally*

MEASUREMENT has been vital to electrical progress from its earliest days. Qualitative attacks upon involved problems and complex phenomena have been of little use to the engineer. Only as facilities for scaling quantities and values have been developed have control of energy in transmission and other links in the chain connecting sources of power and its utilizing equipment advanced toward mastery. This is an outstanding lesson of a paper by A. C. Monteith before the recent Midwest Power Conference on development in transmission apparatus tending to increase the reliability and efficiency of its service. The industry is surely entering an era of more accurate appraisal of transmission phenomena, and the next few years are bound to witness many striking advances in the collection, interpretation and interchange of vital information upon the many problems of successful energy transfer.

Instrumentation—using the term in a broad sense—lies back of modern studies of surges, characteristics of insulators, flashovers, relaying, checking apparatus design against operating performance and the control of frequency and voltage regulation. Recent developments in devices for the recording of extremely rapid phenomena on high-tension lines have opened a new door to the operating engineer, and these, combined with improvements and experiments in various auxiliary apparatus fields, promise much from the standpoints of reliability and efficiency. Money spent upon analyses now available through the skilled use and interpretation of improved forms of oscillographs and other means of reading subinstantaneous values will repay those who thus put their confidence in the latest methods. Field instrumentation has limitations of considerable magnitude, and the goal of the transmission engineer is still far off; for a vast amount of work must be done in the fields of apparatus design and analysis of operating situations before the anticipated standards of service will be attained in the face of lightning and other difficulties. But at least it has been made clear by Mr. Monteith and others that power men are "on their way" toward overcoming obstacles to service through the use of improved tools of engineering research.

## *Cutting Departmental Red Tape*

COMPLEX organizations created by the growth of power systems are doubtless essential to successful operation. It is possible, however, to carry organization refinements too far in the conduct of departmental affairs. Observation of such activities at close range indicates that on some properties a rigid application of account classifications in small matters may defeat its own ends. In a generating plant, for example, a fireman breaks a mirror in the boiler washroom. A replacement order starts on its way up the ladder of officialdom. It receives the successive approvals of the boiler-room foreman, chief engineer, assistant superintendent and superintendent of the production department, and then arrives on the purchasing agent's desk. Alas, poor Yorick! The mirror is pronounced, not steam-plant equipment, but furniture. Some other department officials' approval is required, seriatim, and after various delays for which no individual is to blame, the purchasing agent calls for competitive bids, and the machinery of office routine finally delivers a new mirror to the automobile department, which hauls it to the plant at a departmental charge of 25 cents per mile or less and delivers it in exchange for a receipt whose journeyings back to the "P.D." file need not be chronicled.

The moral of this and similar episodes is that there is a field for a limited petty cash or miscellaneous expense allowance under control of the ranking officer of the department needing minor supplies. Too often, we fear, high-salaried executives and their staffs in many companies find their conference proceedings encumbered by topics of petty-cash importance over which departments disagree, thanks to the elaborateness of the prevailing accounting system. Is not a larger sense of proportion needed in these cases and cannot trusted subordinates be allowed more latitude in reference to making minor purchases than at present exists? Why use sledgehammers to kill mosquitoes?

* * * *

## *Home-Modernizing Movement Deserves Hearty Support*

EVERY branch of the electrical industry should be keenly interested in the national movement to stimulate the modernizing of old homes that is right now being organized. The plan springs from three conditions:

1. There are some ten million homes in the country with obsolete equipment that modernizing would restore to full market values.
2. There is an enormous fund of money now in building and loan associations seeking investment.
3. The building trades are at present experiencing a slump with attendant unemployment.

This situation naturally suggests the possibility of a comprehensive national program for the remodeling and re-equipment of these homes to provide employment and investment and to recreate real-estate values through modernization. The scope of such a movement grips the imagination.

Some thirty-one industries and trades have interested themselves in the idea. They embrace lumber, paint, steel, cement, brick, gypsum, asphalt, insulation, plumbing, heating, bathroom and kitchen equipment, gas, electricity, real estate, and building and loan interests, with many representatives of special groups such as oak flooring, shingles, metal lath and the like. They plan to promote local modernizing campaigns in which civic beautification and other public interests will be invoked, and it would seem that the purposes involved would have a strong popular appeal.

The interest of the electrical industry is obvious. The inadequacy of house wiring is giving serious concern, because it blocks both the sale of appliances and the consumption of kilowatts. The manufacturers of wiring materials are suffering from overproduction. The contractors are facing a dwindling market in residence wiring. Jobbers and dealers are vitally affected. Electrical wiring and equipment will play a prominent part in the rehabilitation of these countless old homes so conspicuous in all cities. Therefore the electrical industry should support and help promote this movement, with a co-operating joint committee, in position to speak for all four of our national group associations. W. H. Hodge of the N.E.L.A. Commercial Section is chairman of a committee representing the electrical industry in this movement.

* * * *

## *The Private-Plant Bugaboo*

MUCH ado is made about the use of private plants in industries. This is true even in those cases where the use of large amounts of process steam or other local conditions point very positively to the private plant as the economic solution when all cost and service values are studied. Any utility company should take the position that its duty is first to the industry it serves. If a proper analysis shows that any particular industry should make its own electricity, the utility should be first to advise such a course. This case will be the exception, and it will not mean a total loss to the utility, for there will be indirect benefits. Every employee of an industry must have electric service in his home; the community streets must be lighted; there are stores and other industries to be developed and thus a very large business for the utility is made possible. It may be far more profitable than a power business done at no profit.

* * * *

## *Overcapacity of Industry a Logical Condition*

OVERCAPACITY of industry is a much-abused term owing mainly to a lack of the proper appraisal of the trend of business. What constitutes an apparent overcapacity is mainly an economic growth based on the tendency to increased efficiency in production. A very important factor has been a decrease in the cost of production. This has been obtained through the addition of new machinery even to the extent of building new plants, and the industry is equipped with a capacity distinctly larger than is needed to meet current consumption—a logical condition because of expectations of business growth. The danger lies not in this temporary overcapacity but in the effort of each executive to get business in a factory designed to meet future demands by taking work from a competitive factory through the use of price levers. If overcapacity is balanced against the need that created it, if current markets are analyzed, if future growth is measured and if new markets are aggressively cultivated, overcapacity will cease to be a bugbear and become the marginal reserve necessary to any well-conducted enterprise.

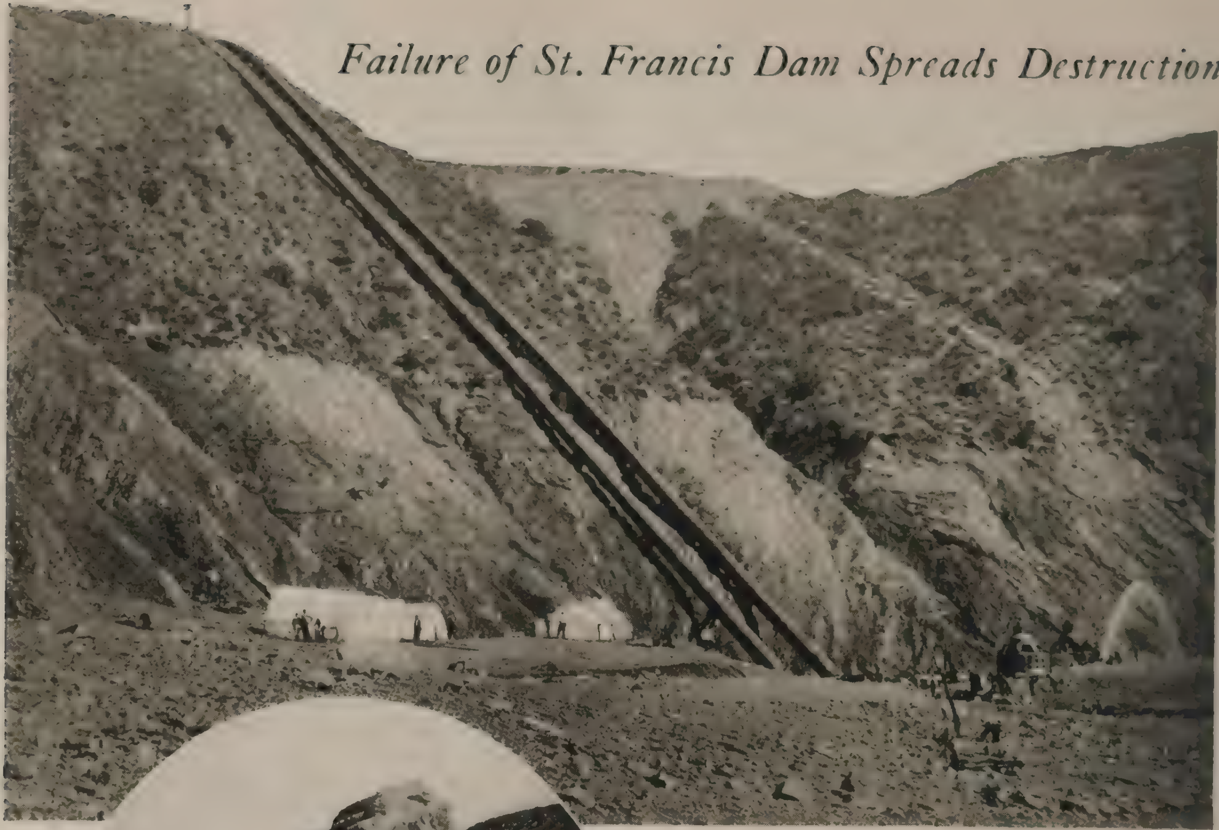
## *Reinvesting "Called Preferreds"*

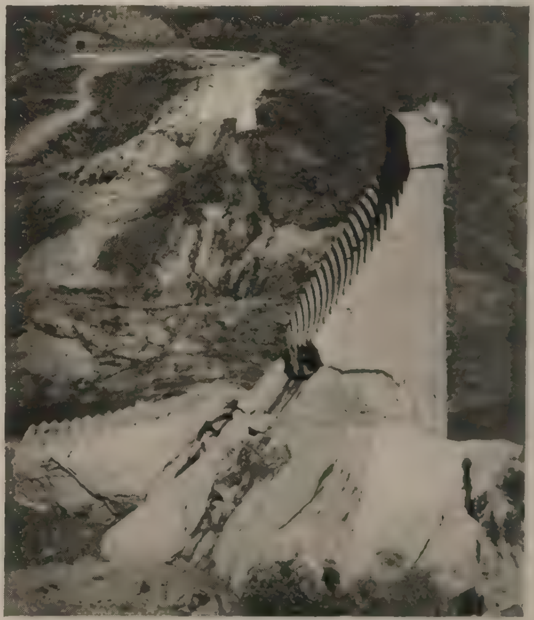
THE present downward trend in yields on high-grade public utility preferred stocks has a bearing on public relations that should not be overlooked by bankers and power company executives. Thousands upon thousands of customers and employees are facing the problem of reinvesting the proceeds of preferred stocks which have been redeemed at stated call prices, and the need of good advice and sound action is great. Probably most of these particular security owners are reaping a profit on the purchase price of their holdings. This is well, but when they approach the matter of yield on current reinvestment opportunities the picture changes. A definite reduction in income from preferred issues stares them in the face, and the course for the customer or employee owner to follow needs sympathetic consideration by the investment banker and by the utility man concerned in the distribution of company securities.

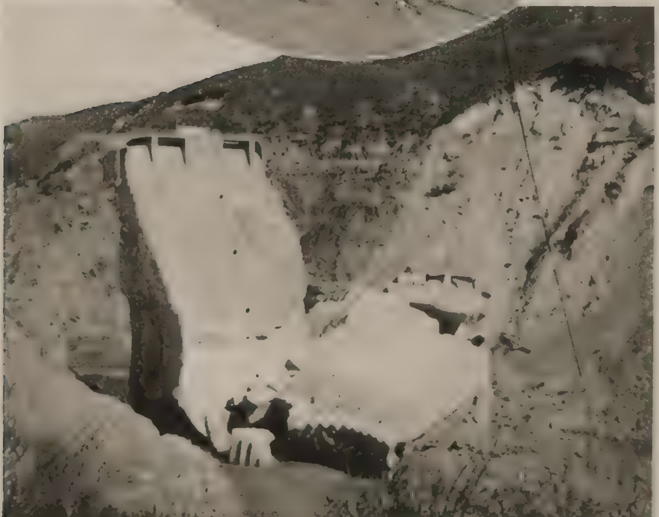
It is not enough to point out that the callable feature of a preferred stock formerly paying, say, 7 or 8 per cent was printed on the certificate and that the buyer who assumed that these rates would be continued for two or three decades after the close of the war has only himself to blame if he is upset over the termination of such returns. Nor is it sufficient to point out that countless security owners are receiving good profits on their transactions. The utility which has conducted vigorous customer-owner campaigns may well go beyond this purely defensive position and do what it can to render its preferred stockholders financial explanations which will enable them to understand the situation and in the long run to suffer as little as possible from a change due to the working out of the unchangeable law of supply and demand. This service may be given by the utility itself or by investment banking houses in close touch with the property, but where the operating or holding company has sought investment money from customers or employees, it now has a real opportunity to perform an important task in public relations by helping its investors to adjust themselves to the new conditions.

Various incentives to reinvest in the lower-rate preferreds are being offered holders of called stocks. Without cataloging these, it appears that in many cases the owner may share in the future prosperity of the company by participating in common-stock dividends above a stated figure, by converting the new preferred shares into common on favorable terms, or by receiving the right to buy common shares at established prices during a stated period, regardless of the market. These advantages appeal to some owners but not to others. An alternative is, of course, to invest the proceeds of the redeemed preferreds in utility common stock or bonds. The value of recurring rights to share in company growth through common-stock ownership increases the yield rate over a given period, and the high repute of common stocks of first-class companies as collateral for loans deserve to be emphasized. In many cases, indeed, the preferred stockholder need lose little or no income if he "switches" with intelligence, and opportunities still exist, indeed, for actual increase of total income through purchase of listed equities. For others the possibilities of bond appreciation should not be overlooked. Without embarking on a program of responsibility for advice concerning investments, utility companies face an opportunity to build warm business friendships with customer and employee owners during this transition period in security values.

# *Failure of St. Francis Dam Spreads Destruction*







NEAR midnight on March 12 the St. Francis Dam, in southern California, failed, releasing 38,000 acre-ft. of water, creating a flood estimated at between 500,000 and 900,000 sec.-ft., sweeping destruction to the valley below. Loss of life is estimated at 300 persons and property damage will amount to approximately $25,000,000.

Top—Remains of San Francisquito power house No. 2 showing two 26,250-kw. generators in the débris
In circle—Section weighing 5,000 tons swept 2,000 ft
Above—Dam failed first on far side of river canyon
Left—Central portion of dam remained standing

# Single-Phase Condenser Motor

## Recent investigation and development of improved power factor motors indicate high attainable efficiency. Construction cost not a deterrent factor

By Prof. Benj. F. Bailey
*University of Michigan*

*The general characteristics of fractional-horsepower motors, the effect of design upon economy of operation, the application requirements of the several types and the desirability of motor improvements were discussed by Professor Bailey in the March 24 issue of* Electrical World, *page 597. The design, performance and operation of fractional-horsepower, single-phase condenser motors, offered as a corrective solution of the problem, are detailed in this second and final installment.*—Editor.

The fundamental idea of the condenser motor is old, but so far as I am able to find out no serious investigation of its possibilities has previously been made. The connections of a condenser motor are shown in Fig. 1. As in the split-phase motor, there are two windings, 90 electrical degrees from each other. The winding 2, however, would usually have approximately as much copper in it as the winding 1, although the number of turns in the two windings need not be the same. In most cases it would be advantageous to use more turns in winding 2 than in winding 1 and a correspondingly smaller size of wire, making the weight of the two windings approximately equal. Instead of a resistor we use a condenser $C$ connected in phase 2; this condenser remains permanently in circuit, although, as will be shown, it is usually advisable to use more capacitance when starting than when running.

The vector diagram of the motor when starting is shown in Fig. 2. The current in the winding $I_1$ lags by approximately the same angle as before, but by using a proper value of the capacitance the current in winding 2 may be made to lead. The total current is of course the vector sum of the two and may be made to be very nearly in phase with the voltage. The motor has therefore nearly 100 per cent power factor when starting. The angle $\alpha$ between $I_1$ and $I_2$ may be made nearly 90 deg. The starting torque for the same phase currents is therefore much greater and the sum of the currents is less, since they are added together at approximately 90-deg. phase difference.

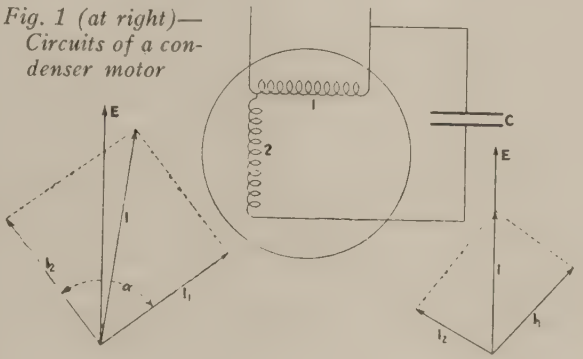
The starting torque of the motor, in fact, can be made as great as or greater than that of a polyphase motor, and since the currents add at nearly 90 deg. the line current will be less. The motor will therefore develop about the same torque as a polyphase motor with about 70 per cent as much current, giving a decidedly higher starting efficiency.

As in the case of the ordinary single-phase motor, the starting torque can, if necessary, be very much increased by reducing the number of turns in the winding 2. In general, however, the winding 2 may have more turns than the winding 1 and the motor will still develop ample starting torque. This enables us to use a smaller and cheaper condenser.

The vector diagram of this motor under full load and 100 per cent power factor is shown in Fig. 3. The current $I_1$ lags less than when the motor is starting and the current $I_2$ with the proper value of capacitance is nearly at right angles to $I_1$. The motor is therefore operating practically as a two-phase motor. It has the advantage over the latter, however, in that the currents $I_1$ and $I_2$ combine at such an angle that their resultant $I$, which is of course the line current, may be in phase with the line voltage $E$. The line current may of course be made to lead the line voltage if this is desirable.

If the capacitance of the condenser is so adjusted that the motor gives its best all-around performance under normal load it will be found that the starting torque with the same condenser will be quite low, usually in the neighborhood of 50 per cent. By using a condenser several times as large as this the starting torque can be increased to from 200 to 400 per cent. If the static torque of the load to be started is very low, but increases rapidly with the speed, a motor with a fixed condenser may be satisfactory. For example, a fan requires very little torque at the instant of starting and the necessary torque increases approximately as the square of the speed. A motor using a condenser adapted to give the best running conditions will be found to have a similar speed-torque curve (see Fig. 17), and hence may be used with advantage for such an application. Centrifugal pumps and grinders also have such speed-torque characteristics that they can probably be satisfactorily handled with a fixed condenser.

*Fig. 1 (at right)—Circuits of a condenser motor*



*Figs. 2 and 3—Vector diagram of condenser motor when starting and condenser motor vectors when at full load and 100 per cent power factor*

If, however, the motor must start a load such as a refrigerator compressor having large static friction it will be necessary to use a much greater value of the condenser at start and then reduce this to a suitable value for normal running. One method of doing this is shown in Fig. 4. Switch $S$, which may be operated either by a relay or by centrifugal force, is used to disconnect the condenser $C_2$ as soon as the motor has reached about two-thirds of normal running speed.

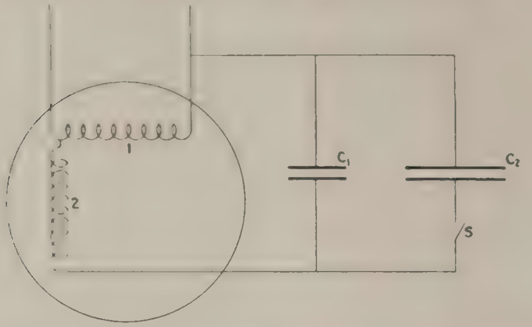


*Fig. 4—Method of varying capacitance after starting with high value*

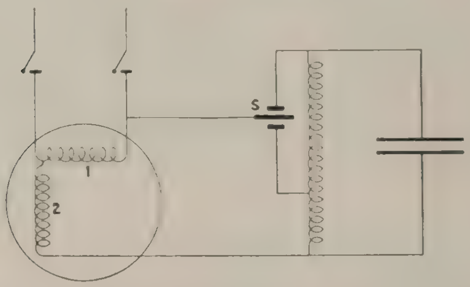


*Fig. 5—Method of varying capacitance by use of transformer*

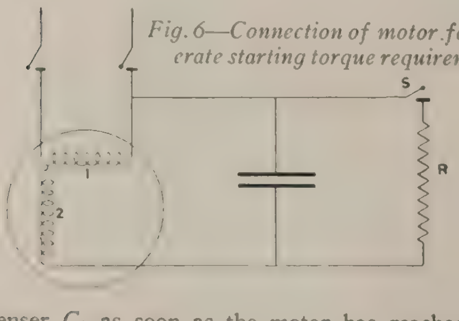


*Fig. 6—Connection of motor for moderate starting torque requirements*

Since the condenser $C_2$ may have several times the capacitance of the condenser $C_1$ its cost would be excessive if it were of the usual construction. This would be particularly true in the case of low-voltage motors. One method of reducing this cost is to use an electrolytic condenser in the place of $C_2$.

Electrolytic condensers have been known for a number of years. They consist essentially of two plates of aluminum immersed in a proper solution. Borax is frequently used for this purpose. The plates are first formed by passing direct current through them until a very thin film has been formed on the surface of the plates. Each plate then acts as an electric valve, allowing the current to flow in one direction only. Since the film is very thin such a condenser has an enormous electrostatic capacity in proportion to the size of the plates.

Electrolytic condensers have not been used to any great extent on account of their comparatively high loss. A paper condenser will have a power factor of approximately 0.5 per cent, whereas an electrolytic condenser will have a power factor of from 10 to 30 per cent. This large loss is of course objectionable in itself and in addition causes the cell gradually to lose its rectifying properties. It is therefore impracticable to use these condensers in continuous work where any large amount of power is involved.

For starting a condenser motor these disadvantages largely disappear. The increased loss results in only a small reduction of starting torque and the starting period is so short that the rise in temperature of the solution is negligible. Evaporation from a properly constructed electrolytic condenser can be made very slow, so that water need be added not oftener than once every two years. A rather crude home-made elctrolytic condenser has been operating in connection with a condenser motor driving the compressor of an electric refrigerator under my observation for twenty months. During this time it has had absolutely no attention. The level of the liquid due to evaporation has not lowered more than $\frac{1}{16}$ in. During one summer the outfit stood idle for about two months without any apparent depreciation.

Another connection designed to effect the same object is shown in Fig. 5. A condenser is connected to the motor through a variable ratio transformer. Preferably an auto-transformer is used, since this is somewhat cheaper and more efficient than the ordinary type of transformer.

At the instant of start the switch $S$ is closed on the lower contact of the transformer. The voltage applied to the condenser is increased and the current taken by the condenser is increased in the same ratio. The current flowing through the motor circuit is again increased by this same ratio due to transformer action. For normal running the switch closes on the upper contact and the effect of the condenser is correspondingly reduced. The upper tap on the auto-transformer, at least for higher voltage motors, might preferably be made at the extreme upper end. In normal running the transformer would therefore be inactive. Providing the necessary switches were not too complicated it might be entirely disconnected.

It is obvious that with this scheme a condenser of smaller capacitance may be used. On the other hand, it must not be forgotten that the thickness of the dielectric must be sufficient to stand the higher voltage. If we compare the condensers on the basis of their volt-ampere capacity this scheme effects no saving. It is, however, true that a condenser of a given volt-ampere capacity is less costly at say 440 volts than at 220. This saving is at least partially offset by the cost of the auto-transformer and the cost of the more complicated switch. There is, of course, a constant loss in the transformer and this reduces the running efficiency of the motor by about 2 to 4 per cent.

If only a moderate starting torque is necessary and if a comparatively large starting current is not objectionable the scheme shown in Fig. 6 may be used. Here a resistor is substituted for the condenser $C_2$. A motor operated in this manner will have better starting characteristics than a plain split-phase motor, but will, of course, not be so good in this respect as the condenser motor. The scheme is obviously cheap and might perhaps be satisfactory in connection with such applications as motors for oil burners or washing machine motors.

In Fig. 7 I have shown the characteristic curves of a condenser motor and those of the best motor that I have found of the ordinary repulsion-induction type. Both motors are of the same rating, namely, ¼ hp., 1,800 r.p.m., 60 cycles and 110 volts. The full load efficiency of the condenser motor is 75 per cent, that of the repulsion-induction motor 64 per cent. In other words, the customer's bill for the condenser motor would be 85 per cent of that with the best available repulsion-induction motor.

The power factor of the condenser motor at full load was 86 per cent, that of the other 66 per cent. By using a larger condenser the power factor of the condenser motor could be raised to 100 per cent.

The apparent efficiency of the condenser motor at full load is 64 per cent and that of the repulsion-induction motor 42 per cent. The corresponding full load currents are respectively 2.6 amp. and 4 amp.

In building the condenser motor a standard split-phase ¼-hp. motor was used. The stator winding was removed and replaced by a winding suitable for the condenser motor, otherwise the motor was unchanged. The total weight of the motor exclusive of condensers was 28 lb., whereas the repulsion-induction motor with which it was compared weighed 43 lb. I wish to make it clear that the improvement in characteristics was not obtained by using a large and expensive motor. It should also be emphasized that the repulsion-induction motor with which it is compared is one of the best, if not the best, on the market. For example, the full-load current of this motor was 4 amp. Other motors of the same rating which I have tested have taken full-load currents as large as 6.5 amp., giving an apparent efficiency of only 25.5 per cent. In Fig. 8 I have shown these same data graphically. In addition it will be noted that these two motors develop approximately the same locked torque. The locked current of the condenser motor is, however, 41 per cent greater than that of the repulsion-induction motor and its starting efficiency is correspondingly lower. The pull-out torques of the two motors are approximately the same.

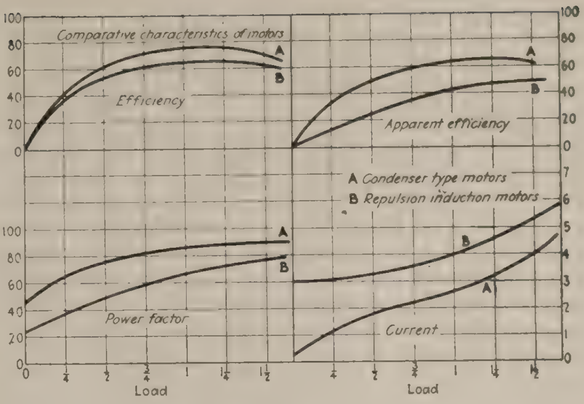


Fig. 7—Characteristic curves of condenser and repulsion-induction motors

In Fig. 9 I have shown a similar comparison between the same condenser motor and the best of a number of split-phase motors tested. The difference in efficiency, power factor, apparent efficiency and current is even more marked than before. In fact, it will be seen that the full-load current of the split-phase motor is nearly double that of the condenser motor. The locked torque of the split-phase motor is much less than that of the condenser motor and its locked current is much greater. The torque per ampere of the condenser motor is nearly four times as great as that of the split-phase motor, as indicated by the comparative starting efficiency. In pull-out torque the two are about the same.

### Comparison of Two-Phase and Condenser Motors

In order to get an accurate comparison between a polyphase motor and a condenser motor a standard ½-hp., 1,800-r.p.m., two-phase, 60-cycle, 220-volt motor was obtained. This motor was first carefully tested as a two-phase motor, with the results shown in Fig. 10. Without any change whatever the motor was then connected as a condenser motor, with the results shown in the same figure. It should be noted that the efficiency of the single-phase compares well with that of the two-phase. It is, however, slightly lower at light loads and at overloads due to the fact that the currents do not divide evenly between the two windings. This naturally results in greater $I^2R$ loss. At full load the efficiencies are prac-

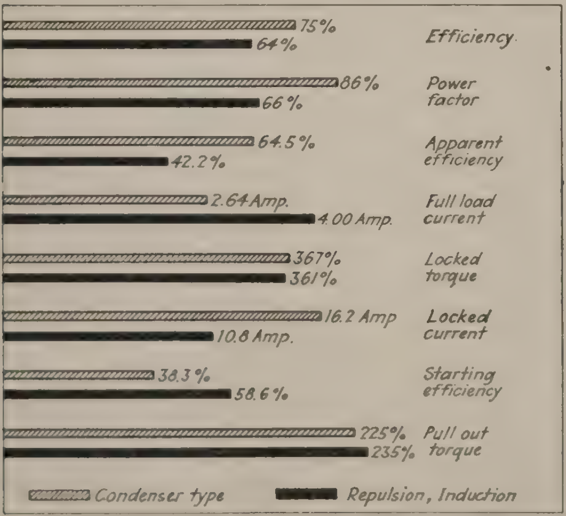


Fig. 8—Graphic comparison of condenser and repulsion-induction motors

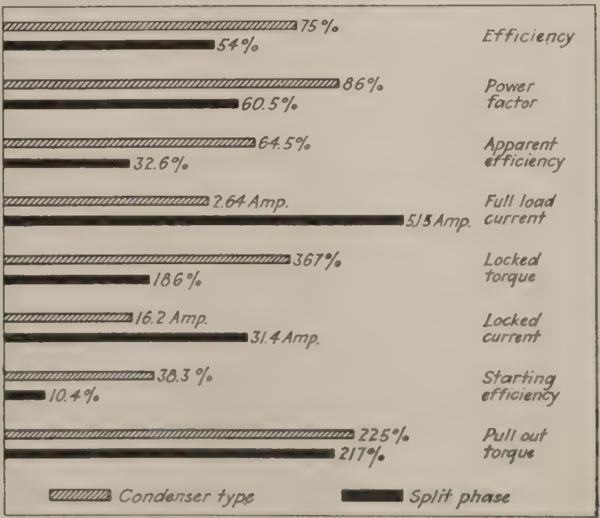


Fig. 9—Graphic comparison of condenser and split-phase motors

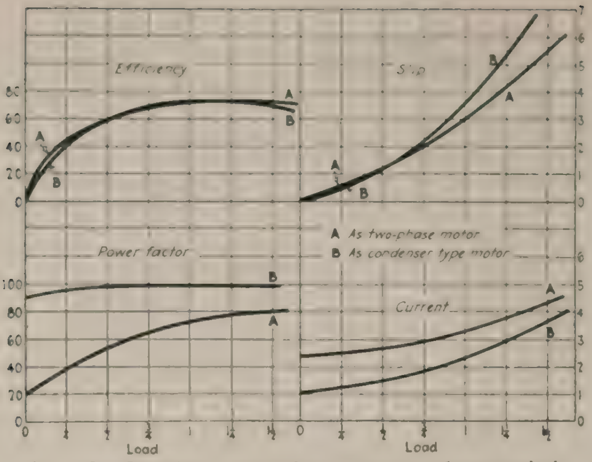


*Fig. 10—Standard two-phase motor characteristics compared to operation as a condenser motor*

tically the same. The power factor of the single-phase motor is much the better, being nearly 100 per cent throughout the usual working range. The slip in the two types of motor is practically the same. Since the efficiencies at full load are nearly the same, there is but little difference in heating at full load. The rating as a single-phase motor would be nearly as great as that of the two-phase motor.

The pull-out torque of the single-phase motor is, however, decidedly less. With the particular value of capacitance used it was 207 per cent, in comparison with 316 per cent in the case of the motor operated two phase. It was, however, amply high for all practical purposes and could have been made still higher by using somewhat greater capacitance.

The starting characteristics are shown in the following table:

| | Starting Characteristics | | | | Ratio Winding 1 to 1, |
|---|---|---|---|---|---|
| | Torque, Per Cent | Starting Current | Starting Watts | Starting Efficiency, Per Cent | Power Factor, Per Cent |
| Two-phase | 307 | 19.7 | 2,980 | 26.3 | 68.8 |
| Single-phase condenser motor | 362 | 17.72 | 3,880 | 34.5 | 99.5 |

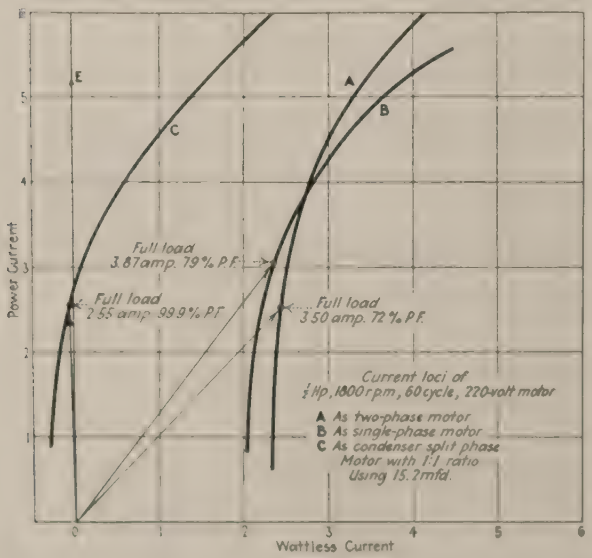


*Fig. 11—Curves taken on a two-phase motor with and without condenser*

It will be seen that the condenser motor has considerably more starting torque than the two-phase motor. If necessary, this could have been greatly increased by reducing the number of turns in the auxiliary winding. The starting current of the two-phase motor was 9.85 amp. per phase, or 19.7 amp. in all, whereas the single-phase motor required only 17.72 amp., or approximately 90 per cent as much. The single-phase motor necessarily took more power in starting, but its starting efficiency was much better. The power factor at start of the single-phase motor was 99.5 per cent and that of the two-phase motor 68.8 per cent. It is apparent that the starting characteristics of this type of motor are better even than those of a polyphase motor. Moreover, they can be varied to suit different conditions by changing the ratio of turns in the two windings and by changing the capacitance.

Fig. 11 will help to make clear the relative action of the two-phase, single-phase and condenser motors. These curves were all taken with a small two-phase motor. Curve *A* shows the locus of the current when the motor is operated two-phase. The angle between the vector marked *E* and any line drawn from the origin to the curve *A* indicates the lag of the current behind the voltage. The cosine of this angle is of course the power factor. In order to make the curves comparable the current plotted is that taken by both phases of the two-phase motor. It will be evident that the power factor will rise to a maximum at somewhat above full load and will then decrease for greater loads than this.

Similarly, curve *B* shows the locus of the current when operating on one of the two phases. It will be seen that in general the power factor of the single-phase motor is worse than that of the two-phase motor, particularly for heavy loads. By adding a condenser and connecting as shown in Fig. 1 we obtained the curve marked *C*. At light loads the current leads the voltage by a small angle. At full load it is nearly in phase with it, giving practically 100 per cent power factor, and for overloads the current lags, giving a power factor slightly lower than unity. The decided improvement in power factor will be evident from the diagram.

Fig. 12 is a more complete locus diagram of the different voltages and currents under various loads. The line voltage marked *E* is taken as axis of reference and of course remains constant. The curve marked "current in winding 1" shows the variation in circuit 1 as the load on the motor is changed. The current in circuit 2 remains nearly constant, as is shown by the short curve marked "current in winding 2." Obviously the power in this winding is also nearly constant.

The line current is obtained by adding vectorially the currents in winding 1 and winding 2. As is evident from the figure, the line current at all loads is nearly in phase with the voltage, giving practically 100 per cent power factor for all loads. As before, the line current is slightly leading for light loads and slightly lagging for heavy ones. The curve marked "voltage across winding 2" shows that this voltage does not vary much, but decreases somewhat as the load is increased.

In Fig. 12 the two windings had the same number of turns. Each winding, however, consisted of two circuits connected in parallel. By connecting the two circuits of winding 2 in series the ratio of turns was changed from 1 to 1 to 2 to 1. The capacitance of the condenser used was reduced from 15.2 mfd. to 6.75 mfd. Since it was subjected to a higher voltage, however, the volt-amperes in the condenser remained practically the same. (Fig. 13.)

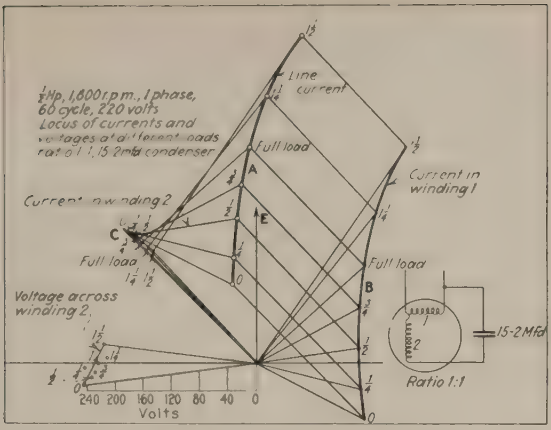


Fig. 12—Complete locus diagram of condenser motor with 1 to 1 ratio of turns

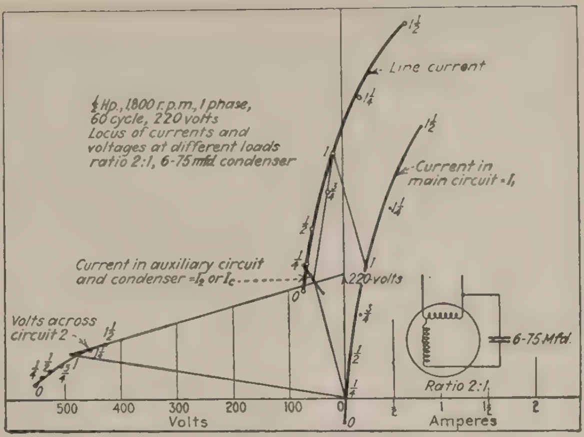

½ Hp., 1800 r.p.m., 1 phase, 60 cycle, 220 volts
Locus of currents and voltages at different loads ratio 2:1, 6-75 mfd condenser
Line current
Current in main circuit = I₁
Current in auxiliary circuit and condenser = I₂ or I_c
220 volts
Volts across circuit 2
6-75 Mfd.
Ratio 2:1
500 400 300 200 100 0
Volts
½ 1 1½ 2
Amperes

Fig. 13—Locus diagram of condenser motor with 2 to 1 ratio of turns

As before, the power and current in the condenser circuit remain practically constant. Obviously this current must be at right angles to the condenser voltage represented by the line drawn from the end of the voltage vector to any point on the curve marked "voltage across circuit 2." Since the voltage across circuit 2 is nearly twice as great as before, the condenser voltage is more nearly at right angles to the line voltage. The current is therefore more nearly in phase with the line voltage and as a result forces the current in circuit 1 also to be nearly in phase with the line voltage. As before, the vector sum of these two currents gives the line current. This leads slightly at light loads and lags somewhat at heavy loads, giving 100 per cent power factor at approximately full load. The use of a high ratio enables us to use a condenser of small capacitance, and it is therefore somewhat cheaper, although the volt-ampere capacity is approximately the same. It will be evident that the currents in the two windings are far from being 90 deg. from one another and therefore are not in the best relation to give high efficiency and large overload capacity to the motor.

### Change of Performance with Capacitance

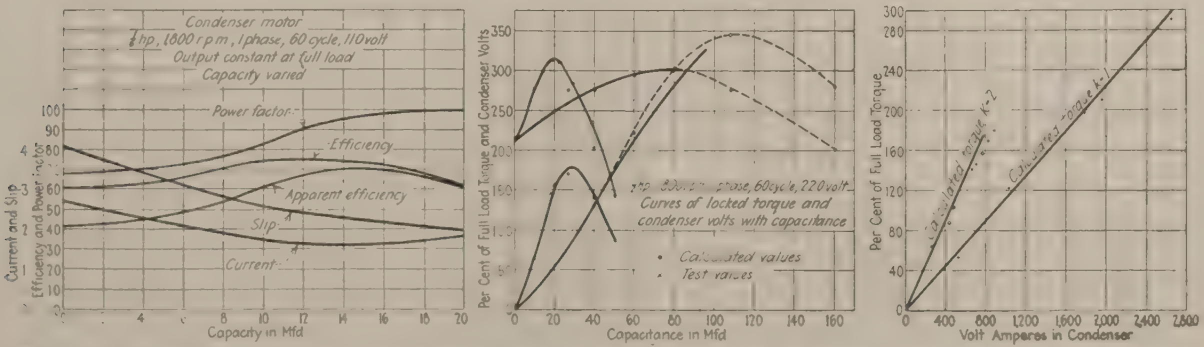
In Fig. 14 I have shown what happens in a small condenser motor operating with different values of capacitance. The output of the motor was held constant at ¼ hp. and the capacitance varied from zero to 20 mfd.

With zero capacitance the motor, of course, operated like the usual split-phase or repulsion-induction motor. Its efficiency and power factor were both low and the current and slip high. As the capacitance was increased the efficiency improved, reaching its maximum at about 12 mfd. Beyond this point it again decreased. The point of best efficiency is reached when the currents in the two windings are approximately proportional to the cross-section of the wires used. This results in minimum copper loss and high efficiency.

The highest power factor, namely, 100 per cent, was attained with 18 mfd. The efficiency, however, was decidedly lower. The highest value of apparent efficiency and the lowest value of current are obtained with approximately 14.5 mfd. The slip continually decreases as the capacitance is increased. The best all-around performance of this motor is obtained with approximately 12 mfd., although its characteristics are nearly as good with only 10 mfd.

In Fig. 15 I have shown how the starting torque varies with the capacitance. These tests were made on the same motor previously used in obtaining the curves of Figs. 12 and 13. When operated with a ratio of 1 to 1 the torque rose to a maximum of nearly 350 per cent with 110 mfd. The torque can be computed by fairly simple methods and both the observed and calculated values are shown on the curve.

The smaller curve at the left shows the starting performance of the motor when connected with a ratio of 2 to 1. The maximum torque is half as great as before and is obtained with only one-quarter as much capacitance. The microfarads required per pound foot are



Figs. 14, 15 and 16—Effect of variable capacitance on performance and on starting torque and relation between volt-amperes and torque of condenser motor—points calculated, curves observed therefore only half as great. In designing one of these motors, so far as starting torque is concerned, the cheapest construction will be obtained by using as high a ratio of turns as will allow us to obtain the necessary starting torque. If necessary, the torque could be made exceedingly great by using a very low ratio, but only with a very large and expensive condenser. The two other curves starting from 220 volts show the voltage across the condenser with different values of capacitance. The peaks of these two curves should theoretically reach the same maximum value. The differences observed are probably due to the difficulty of keeping the temperature of the motor constant with the heavy starting currents used.

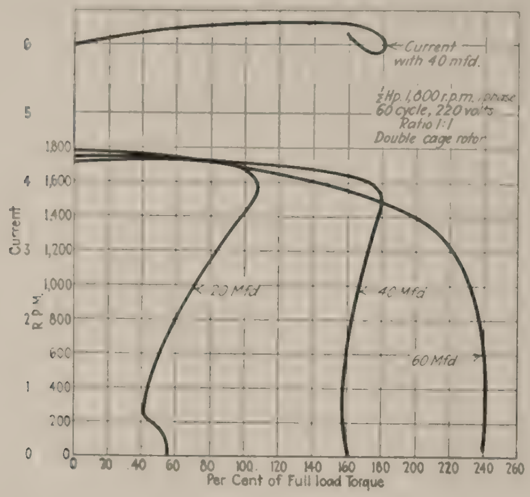


*Fig. 17—Speed-torque curves of a condenser motor*

In Fig. 16 I have plotted the volt-amperes in the condenser and the per cent of full-load torque. The volt-amperes are of course obtained by multiplying the current in the condenser by the voltage at its terminals and may be obtained from the preceding curves by a simple calculation. It can be shown theoretically that these curves should be straight lines and this is confirmed by the tests. As before, with the ratio of 2 to 1, only half as much condenser capacity per pound foot is required as with the ratio of 1 to 1.

The curves of Figs. 15 and 16 referred to the locked torque of the motor. This is, of course, important, but it by no means tells the whole story of the starting ability of a motor. A frequent complaint in connection with the repulsion-induction motor is that while it will start the load it will not pull it up to speed. In Fig. 17 I have plotted the complete speed-torque curves of this same motor. It will be seen that the torque remains nearly constant from standstill until the motor has attained normal running speed. However, with a small value of capacitance there is a decided increase of torque as the motor speeds up. This, as was previously pointed out, makes it possible to start certain kinds of loads even though the initial torque is rather small.

Fig. 18 will serve to show the possibilities of the condenser motor. The motor in question was rated at only ¼ hp. In spite of the small size a full-load efficiency of 73 per cent and maximum efficiency of 75 per cent were attained with a full load power factor of 86 per cent. The motor developed a starting torque of 320 per cent. This large torque was not obtained by the use of a high-resistance rotor, as will be evident from the fact that the slip at full load is only 2.5 per cent. Such performance is entirely beyond the possibility of the split-phase or repulsion-induction motor, or, to put the matter a little differently, no matter how good the performance of a split-phase motor might be, it could be very much improved by rewinding and operating it as a condenser motor.

The above facts serve to show that it is now possible to build single-phase motors nearly equal in efficiency to two-phase motors and far superior in power factor. Compared with split-phase motors, the characteristics of the condenser motor are superior in every respect. They are better than those of the repulsion-induction in every respect except in locked torque per ampere. The pull-in torque, however, is much better than that of the repulsion-induction motor, so that, everything considered, I have no hesitancy in saying that the starting performance also is superior.

### Cost the Handicap

At the present time, due to the high cost of condensers, a condenser motor costs somewhat more than the repulsion-induction type and decidedly more than the split-phase motor. It is, of course, too early to predict the difference in price with any real accuracy, but it is apparent that this difference need not exceed $10 in the case of a ½-hp. motor, and if such motors are produced in large quantities the difference will undoubtedly be less. The motor itself will cost about the same as the split-phase motor and decidedly less than the repulsion-induction motor. The condenser is the costly element, but if these are produced in quantities the price can undoubtedly be materially reduced.

Even though this difference should be as much as $10, it is clear that the central station could save more than this if the better motor were used. Unfortunately, there is no obvious way in which the central station can directly finance the introduction of these motors.

The customer would profit by reason of reduced bills. This reduction would amount to from 50 cents to $1 per month and would easily pay for the increased cost of the motor in a short time. The fact that the motor is quieter than other types, due to the fact that it operates practically as a two-phase motor, is also of tremendous importance. It may well be that the reduced noise will be the advantage which will result in the introduction of these motors, since the question of noise, particularly in modern apartment houses, where hundreds of refrigerators are running at the same time, is assuming very great importance.

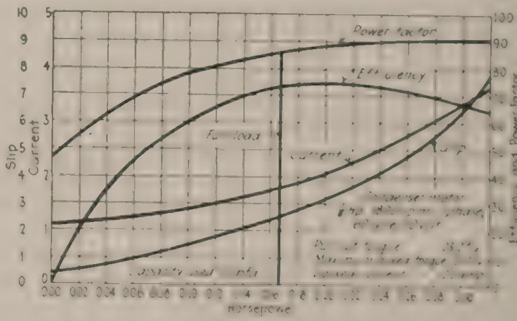


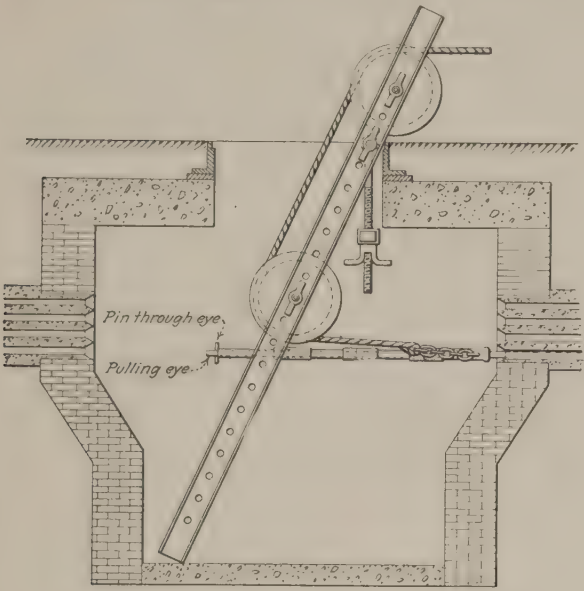
*Fig. 18—-Performance possibilities of condenser motor*

# Slack-Pulling Device Protects Cable Sections

By N. E. Buck

*Superintendent Underground Cable Work*
*Commonwealth Edison Company, Chicago, Ill.*

After a length of underground cable has been pulled through the duct and approximately to the center of the manhole, or in line with the pulling equipment, it then becomes necessary to pull additional slack to provide a sufficient length of cable to train around the manhole wall. In the past it has been the practice to pull this slack with various kinds of hitches, including woven wire grips. However, if the pull is long, or if the cable is "soft," that is, contains a large percentage of insulation to copper and lead, the lead sheath may be damaged or even broken by such hitches.



*Cable slack pulled without straining materials*

The Commonwealth Edison Company utilizes a slack-pulling tackle by means of which the necessary amount of slack may be pulled without injury to the cable. The cable is pulled through the duct by means of a pulling eye soldered to the copper and lead, and this eye is left in place until after the slack has been pulled. The device consists of a number of sections of straight steel tubing about 1 ft. long on one end of each of which is welded a steel collar. When the sections are assembled the end of one section enters the collar on the adjacent section, and the several sections of cable together form a very rigid tube. The sections are slipped on the end of the cable in sufficient number to build up a tube equal in length to the slack desired. The section at the cable end is prevented from coming off by means of a heavy pin passed through the pulling eye, and the last section, the one nearest to the duct, is equipped with a sling, to which the cable-pulling rope is attached. The slack is thus pulled from the end of the cable, the sheath and insulation are subjected to no undue strain and usually the total slack can be obtained in one pull.

# Portable Automatic Substation Aids in Maintaining Service

An AUTOMATIC 1,000-kw. substation equipped with rotary converter, transformer, oil circuit breaker and feeder equipment has been mounted on a railway car and placed in service by the British Columbia Electric Railway. The portable substation is designed for use in emergencies or where there is a sudden increase in demand.

The equipment includes a 1,000-kw., 600-volt d.c., six-phase, 60-cycle rotary converter, a 1,100-kva., three-phase, self-cooled transformer, a motor-operated high-tension oil circuit breaker, a.c. and d.c. lightning arresters, gang-operated air-break switches and two service-restoring 1,100-amp. direct-current feeder equipments.

The apparatus is mounted on an all-steel car with converter and switchboard inclosed. The transformer, oil circuit breaker and all other high-tension apparatus of the outdoor type are mounted on the uncovered portion of the car.

The station is fully automatic, being started and stopped by load demand. Protection against low voltage, phase reversal, a.c. and d.c. overload, overheating of windings and bearings, reverse polarity, overspeed, phase unbalance, loss of field, etc., is provided. Connection to either a 11,500- or 34,500-volt line may be made. Feeders are automatic, reclosing upon condition of normal resistance in the feeder. Excess direct-current load actuates contacts of load-limiting resistances and shifts the load to other stations. Thermal relay action permits automatic restarting when high temperature conditions have been relieved by radiation.

The car is the joint product of the Ottawa Car Company and the Canadian Westinghouse Company, Ltd.

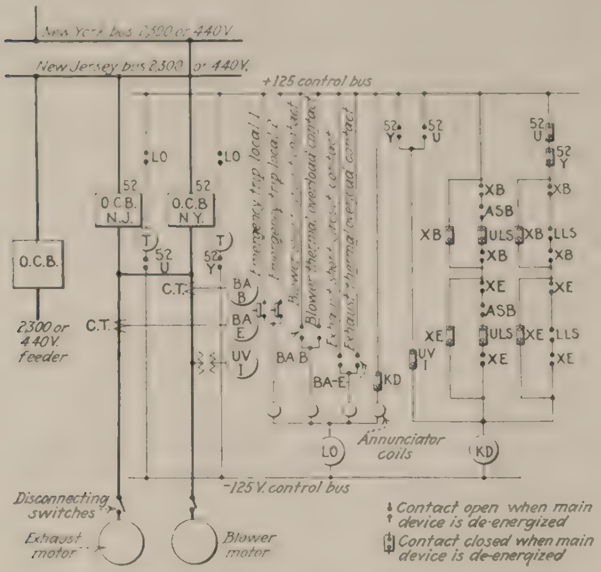
BRITISH COLUMBIA ELECTRIC
PORTABLE AUTOMATIC RAILWAY SUBSTATION
1000 KW.
P-1

*Railway supply substation has flat-car base*

# Complete Relay Protection for Fan Motors

By J. P. Maxwell
*Switchboard Engineer*
*Westinghouse Electric & Manufacturing Company*

Motors driving the blower and exhaust fans used in the Holland vehicular tunnel (New York-New Jersey) are provided with full protection against incorrect operation and emergencies. Large blowers and exhaust fans operate from 2,300-volt service, small ones from 440-volt buses.



*Protective wiring plan for fan motors*

ASB—Auxiliary speed relay for blower.
ASE—Auxiliary speed relay for exhaust.
LO—Multicontact lockout relay.
KD—Undervoltage time-delay relay.
BA—Short-circuit and thermal overload relay.
CT—Current transformer.
LLS—Lower limit switch on damper, closes when damper is closed.
T—Trip coil.
ULS—Upper limit switch on damper, closed when damper is open.
XB—Auxiliary switch on blower motor disconnecting switch.
XE—Auxiliary switch on exhaust motor disconnecting switch.
52—Oil circuit breaker.

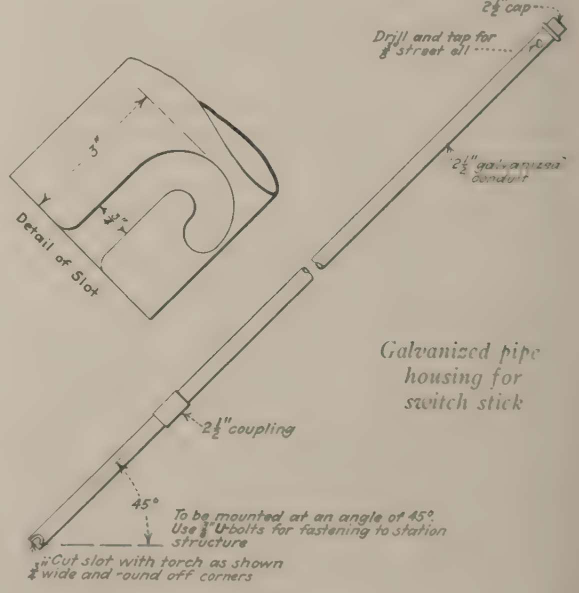
Whether the switchboard or local control is employed, the protective features for the motors are the same. Each motor circuit has a thermal overload relay with a short-circuit element. Besides protecting the motor from excessive temperature rise due to overload, the relay will operate if a short circuit occurs. To protect the motors during the starting and stopping period against failure of the speed-control devices and against the accidental closing of the dampers when the motors are running, a long time delay undervoltage relay has been supplied. This relay, known as Westinghouse type "KD," is continuously energized as shown on the diagram through one of the following circuits:

Through the auxiliary switch of either closed circuit breaker and a contact of a de-energized undervoltage relay; through the contacts on the auxiliary switch on the blower motor disconnecting switches (disconnecting switches being open); through the auxiliary switch on the blower motor disconnecting switches (disconnecting switch being closed); through the interlock on the auxiliary speed delay for the blower; through the upper limit switch on the damper when damper is closed, and similar circuits on the exhaust motor; through a circuit made by the contacts of both oil circuit breakers that are in the open position; through an auxiliary switch on both blower and exhaust motor disconnecting switches (switches being closed), and through the lower limit switch on the damper when the damper is closed.

All the protective relays used with the motors operate a multi-contact lockout relay. This lockout relay has several contacts, one of which changes the brilliancy of the white lamp on the control board from dim to bright, indicating an automatic operation, another of which energizes a bell alarm relay. These lockout relays are of the hand-reset type, and when once energized by the protective relay the operator must reset them before the oil circuit breaker can be reclosed. The protective relays, in addition to operating the lockout relay, also pick up an annunciator relay, Westinghouse type "JL," thus indicating which protective relay tripped out the motor breaker.

# Switch-Stick Housing

Outdoor substations that include stick-operated disconnecting switches present a small problem on some properties. Shall a stick be kept at the station, perhaps hung up somewhere and exposed to the weather? Or shall it be the duty of the man who comes to operate the disconnecting switches to bring a stick along with him? Both of these answers are open to obvious criticism. On the system of the Kansas City Power & Light Company this difficulty is met by use of the device here illustrated. It consists merely of a piece of 2½-in. galvanized conduit capped at the top end and with the slot as shown in the accompanying illustration in the other end. The stick is pushed into the pipe, handle first, and the hook on the head is turned into the slot, thus preventing the stick from sliding out of the pipe. The pipe is mounted at an angle of 45 deg. wherever convenient on the station structure. The turned down ⅜-in. ell near the top of the pipe is to permit air circulation along the length of the stick and thus to prevent moisture condensation on it.


2½" cap
Drill and tap for ⅜" street ell
2½" galvanized conduit
3"
¾"
Detail of Slot
2½" coupling
45°
To be mounted at an angle of 45°. Use ⅜" U-bolts for fastening to station structure
Cut slot with torch as shown ¾" wide and round off corners

*Galvanized pipe housing for switch stick*

# Coal-Handling System of Buffalo Utility

By F. S. Helfter
*Junior Engineer Buffalo General Electric Company, Buffalo, N. Y.*

UP TO the present time at the Charles R. Huntley station coal to and from storage has been handled by grab buckets operated from locomotive cranes on trestles and tracks in the coal storage yard. With the installation of additional station capacity, which included coal pulverizing equipment, this system of coal handling has been found both inadequate and impractical. In the new arrangement two cars, after previously being weighed on a track scale, are dumped simultaneously into four concrete hoppers which are built into the existing trestle. A shaking feeder, having a rated capacity of 75 tons per hour, located at the mouth of each hopper feeds the coal onto a horizontal belt, *A*, which in turn discharges onto an inclined belt, *B*, delivering normally to a 12-ft. x 19-ft. Bradford breaker. However, depending upon the position of a flopper gate, the coal falling from the head end of this belt may be deflected in whole or in part through a chute directly onto another belt, *C*, delivering the uncrushed coal to the initial pile of the drag scraper system for yard storage.

The coal passing through the breaker falls on a short feeding belt that discharges through a flopper gate either onto a belt, *E*, delivering to the house, or onto the inclined belt, *C*, to the initial storage pile for the drag scraper, or if desired both ways at the same time. Normally, only run-of-mine coal is stored, but the equipment permits of similarly handling the crushed coal.

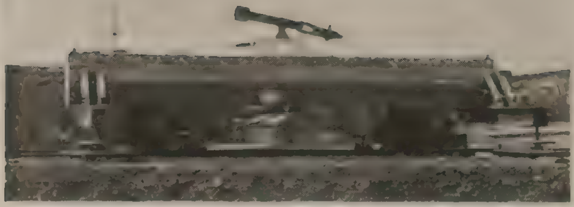
The belt into the house is equipped with a "Merrick" automatic conveyor weightometer. Its chief purpose is to keep track of all coal from storage which does not again pass over the track scales.

A cross-over belt is supplied to reach the far elevator. Magnetic separators are installed in the discharge chutes from the bucket elevators, where the coal drops onto the bunker belts, and automatic samplers are placed at this point.

*"Rooster block" used in handling return cable when tail block car is placed for handling coal from points in storage yard farthest from winding engine*

All of the new equipment, with the exception of the Bradford breaker, is driven by double squirrel-cage induction motors with automatic cut-over type resistance starters and push-button control. On account of the high inertia of the coal breaker, a wound-rotor induction motor is used for this machine with a controller and starting resistance. All the controls are interlocked through auxiliary switches on the contactors and switches on the flop gates, so that if for any reason a conveyor or the breaker stops all equipment feeding coal to it also stops. If a gate is shifted to feed coal to a conveyor or the breaker when they are not running, this automatically shuts down all the equipment ahead of it. In starting up, if the coal is to be sent into the house the conveyors above the bunkers must be started first and the proper se-

*Housings for conveyors, Bradford breaker and drag scraper, winding engine and controls*



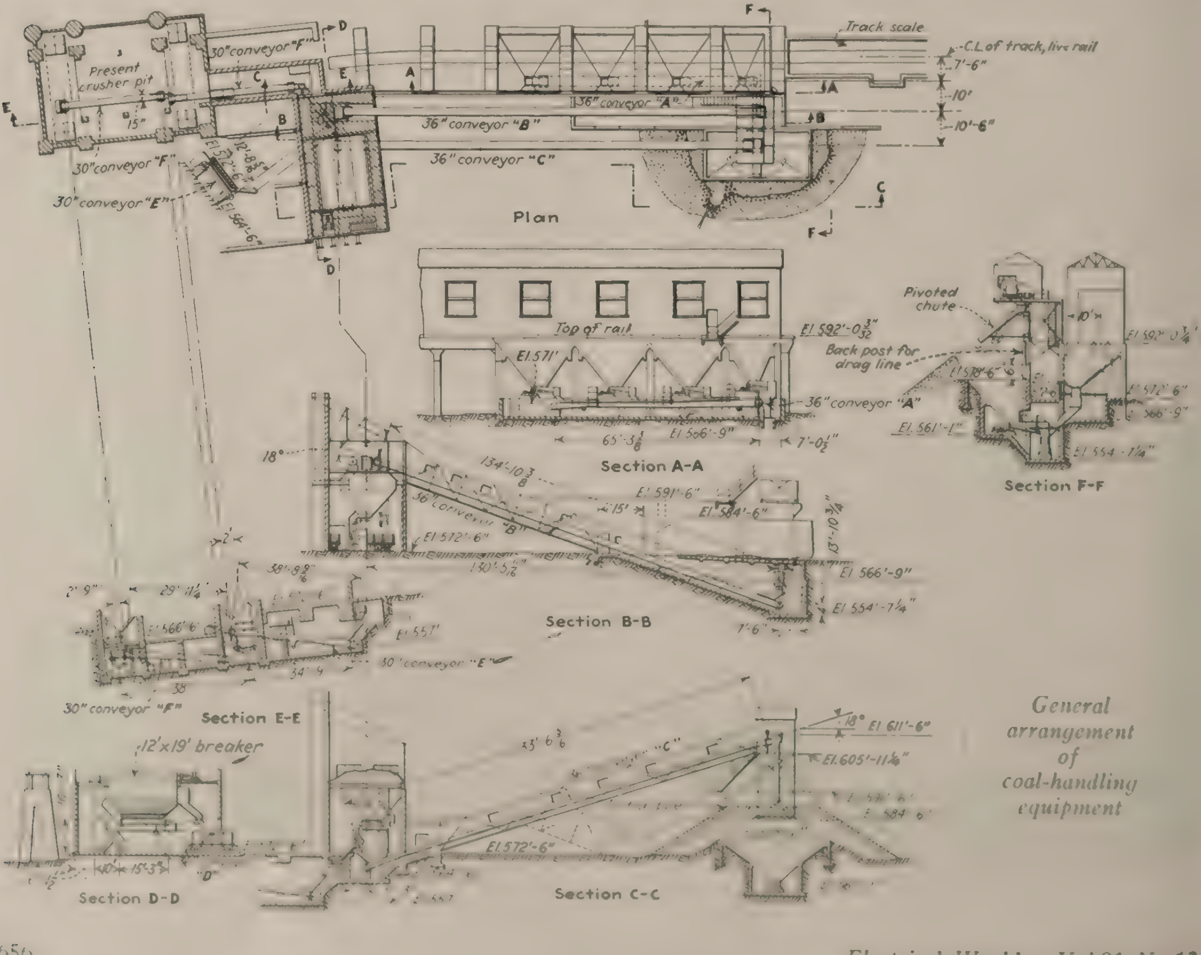
*Tail block car used in distributing or reclaiming coal from any part of the storage yard*

quence followed through to the feeders at the hoppers. In the storage yard the coal in the pile formed by conveyor *C* is distributed about the field by means of a Beaumont drag scraper in the center of one side of the storage area. Around the other three sides is a track on which the movable tail block car may be shifted by block and tackle as required. The tail car, counterweighted with concrete, weighs about 33 tons. In addition to this weight, rail clamps and outriggers are employed to keep the car from tipping. The coal is stored out, or reclaimed, by a scraper having a capacity of 2 tons, which plies back and forth between the front post and the tail car at the will of the operator. The machinery handles coal, either "run-of-mine" or crushed, at a rate of 225 tons per hour at 100 ft. haul. All that is necessary in order to change from storing out to reclaiming, or vice versa, is to reverse the scraper bucket on the cable. The cable after passing around the sheave on the tail car is kept from burying itself in the coal by passing through other fixed blocks (called rooster blocks) located at the corners of the field. One man can control this equipment. The operator's position is above the winding engine and at an elevation such that he has a clear view of the entire storage area. Operation is by a large wheel which controls the direction of rotation of the cable drums through a system of levers and cone friction clutches. A 100-hp. continuous-running squirrel-cage induction motor operates the scraper system. The capacity of the storage area with coal piled 25 ft. high is about 80,000 tons.

To facilitate the removal of frozen coal from the cars, a thawing shed has been provided which has a capacity of six coal cars. Some of the hot gases from either of two boilers are by-passed through this building by means of an auxiliary induced draft fan. Dampers are provided to control the temperature around the cars, and a recording thermometer shows how well this is being done. At a temperature of 200 deg. F. cars are sufficiently thawed in about four hours' time to permit the car gates to be opened.

Practically all of this equipment is external to the main building. Hoppers and trenches below ground are of concrete. The remaining structures are of steel with corrugated asbestos board roofs and siding. The breaker unit itself is inclosed in a sheet-steel dustproof case made up with removable panels.

The new equipment permits putting 300 tons per hour into the house and 500 tons per hour into storage.

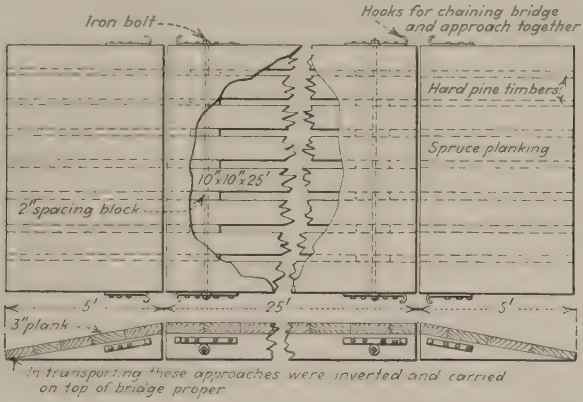


*General arrangement of coal-handling equipment*

# Moving Transformers with a Portable Bridge

By R. G. Kennison
*Central Maine Power Company, Augusta, Me.*

FIVE power transformers aggregating 35,000 kva. in rating and 137 tons in weight were recently transported over a 13-mile route involving the crossing of eight streams, none of which was provided with bridges deemed safe for the loads to be handled. The problem was solved by building a portable reinforcing bridge 25 ft. long, with portable 5-ft. approaches for each end, as shown in the accompanying illustration. Three of the transformers were of 5,000-kva. rating, 66 kv. to 33 kv., and the two others were three-phase regulating transformers of 10,000 kva. each, the individual weights of the two types being 23 and 34 tons. The total cost of the job was about $500, including hire of tractors.


Iron bolt
Hooks for chaining bridge and approach together
Hard pine timbers
Spruce planking
10"x10"x25'
2" spacing block
5'
25'
5'
3" plank
In transporting these approaches were inverted and carried on top of bridge proper

*Portable reinforcing bridge enabled 34-ton transformers to pass safely over existing bridges*

The transformers were transported one at a time on a Rogers 20-ton trailer hauled by one or more tractors. A 14-ton Lombard, 10-ton Holt and Caterpillar sixty tractor were used. The road conditions ranged from partially bare to glazed surface, with deep snow in some places. The ordinary procedure on the level was to hook one or two tractors ahead of the load, all three tractors being required on up-grades, especially if snow or ice was encountered. On down-grades, except on bare ground, it was necessary to hook one tractor on behind for snubbing, the ice and snow rendering the trailer brakes useless.

The transformers were shipped from the factory partly full of oil in order that the coils might be covered and to obviate the need of a heat run before being put in service. As all transformers exceeded 15 ft. in overall height the greatest care had to be taken to center them properly and to fasten them down to prevent tipping over.

The first process was to shore the transformers on the cars upon which they arrived from the factory. They were then moved on rolls from the cars to the trailer, where the shoes were bolted down by hook bolts under the flanges of the I-beams forming the trailer frame. The tops of the transformers were guyed four ways by 1-in. iron rods bolted to the flanges of the I-beams. This made it practically impossible to overturn a transformer without tipping over trailer and all. The shoe was 12 in. high and this, with the height of the trailer from the ground, brought the transformer top about 17 ft. into the air. This made it necessary for one man to devote his entire attention to the removal of wires, service loops and telephone loops encountered along the road. In most cases this was easily done by a man standing on a ladder against the transformer casing and using rubber gloves and a forked stick for pushing the wires up and out of the way.

The portable bridge consisted of eight 10-in. x 10-in. timbers 25 ft. long, fastened together and planked over as shown. This was used to reinforce each bridge in turn as the transformer passed over it. Seven of the bridges were of spans varying from 13 to 19 ft. The portable bridge gave a safe bearing at each end. One bridge was of 30-ft. span and in this case special precautions were taken. The bridge was shored up underneath with a crib pier near its center, and for reinforcement a second portable bridge was made and the two butted together so that the joint came over the new pier. Hardwood plank 3 in. thick would have scored less than spruce had the former been available for flooring at the time.

The portable bridge was transported by a truck equipped with a shear and winch. The winch cable was hooked via the shear to an eyebolt in the front of the portable bridge, and when it was necessary to move it along the road the front end was simply pulled up about 1 ft. from the ground by the winch and dragged along until the next bridge was encountered. The moving was usually done between 6:30 a.m. and 6:30 p.m., the return being made at night with the trailer. Loading was done by a night crew.

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# Pole-Yard Derrick Saves Time and Labor

A DERRICK used by the Northwestern Electric Company in its Portland (Ore.) pole yard is shown. The boom is 70 ft. long and is swung at a fixed angle by a tag line or by pushing the load. A motor-driven winch operates the whip line. Through the use of this derrick two men can load and unload and move poles about the yard with a great saving in time.

# Government Investigation and the Investor

### Investment banker has no apprehension of what investigation will disclose, but fears business and investment reaction

*An Interview with*
H. P. Wright,
*President Kansas Gas & Electric Company*

"THE successful hunter goes where the ducks are before he begins to shoot. The fellow who goes out into the middle of the street, points his gun straight up in the air and blazes away because he has heard a rumor that there are some ducks around somewhere does not have duck for dinner. But he does attract a lot of attention. Maybe that was his idea all along. Of course, no one except the man who pulls the trigger can truthfully say whether or not he really hoped or expected to get a duck or whether he wanted the noise to awaken the neighbors. But one can form an opinion as to which is the true reason for all the shooting that's going on.

"So far as the properties in which I am interested are concerned, I am positive that any investigation of any kind will not turn up any flagrant moral derelictions in financing, management or in treatment of the customers who pay for service. I believe, also, that by far the greater number of electric utilities in the United States can say the same thing in full consciousness of rectitude and in perfect willingness to account for their every action. In these regards the so-called Walsh investigation which the Senate has committed to the Federal Trade Commission causes me no perturbation. But I do have a real fear that harm will result, not from any disclosures of the investigation, but from the animus of the investigation and manner in which it may be prosecuted.

"There is no doubt of the principal nature of the animus behind the Walsh resolution. It is political. The minority investigates the majority. Democrats investigate Republicans. The pendulum was on the other side of its swing during and immediately after the Wilson administration, when the papers were full of charges of malfeasance and misfeasance in office in regard to the disposition of alien property and to the inflated profits of patriotic (?) manufacturers supplying war materials. Investigations will always be with us so long as the political party not in power can depend on the strength of the vocal cords of its members. This is not to say that some investigations, in fact a large number of them, are not justifiable as well as natural. When an investigation is directed toward specific and definite charges against specific and definite persons or corporations, like the hunter who goes where the ducks are, then there is likelihood that the result will be of worthily corrective nature. But if an investigation, such as that sponsored by the Walsh resolution, has nothing to go on except vague and hazy accusations against the whole body of a national industry, then the result is foreordained to be more harmful than good.

### May Jeopardize Investors' Interests

"The result will be harmful to business in general and to the investing public, which in this day includes a not inconsiderable fraction of the total population of the country. Business will be harmed because the precedent will have been established that governmental prying into private concerns is gratuitous, that competent and specific evidence of wrongdoing is not required to get a federal investigation started; all that is required is for an industry to attain such success and prosperity as to make it a shining target for any one who feels the urge to throw a brick. If the electrical industry is investigated on these unpositive bases, as it appears that it will be, then another industry will be next, and so on. The result will be harmful to the investing public, which, through savings banks and insurance companies, includes a much larger number of people than is generally appreciated, because of the impairment of confidence in the values behind outstanding securities. It is very probable that the stocks and bonds of operating and holding companies that are haled before the commission will be quoted at lowered prices on the markets. It will make no difference whether charges are substantiated or even not made; the market reflects apparent, not always factual, conditions. The assumption is that the defendant is guilty until he proves himself innocent. And will the investigators surround the innocent and discharged defendant with the trumpet blaring and circumstance that accompany his summons before them? Well, every one knows that the accusation of vice gets more newspaper space than does the proof of virtue.

"For these reasons, and not because I fear that any considerable or even appreciable evidence of turpitude will be uncovered, I deplore the investigation and what it portends for American business in general.

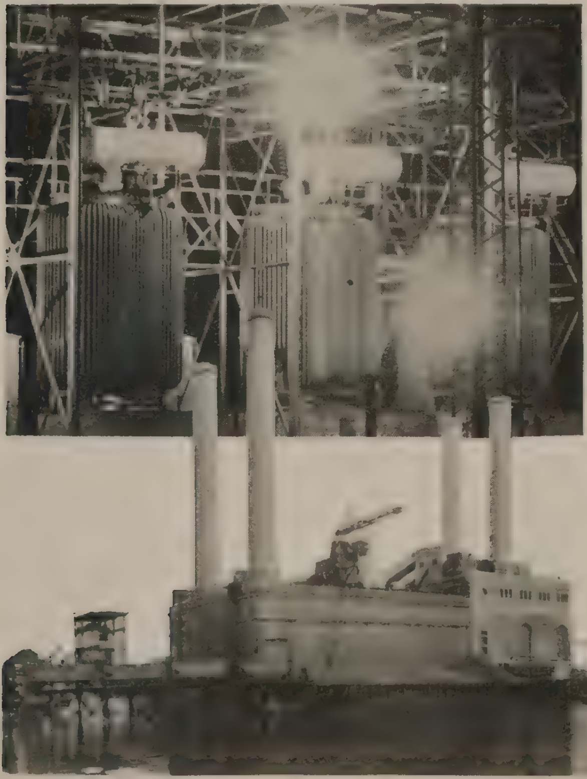
### Already Under State Supervision

"Another thing occurs to me: What are the alleged nefarious acts of electric utility organizations that cause the coldly speculative eye of suspicion to swing in their direction? Are not these acts authorized and permitted by the laws of the states in which they are performed? A baseball game is started under rules fully understood by all the players. A runner gets to second base and some one begins yelling for an investigation as to how he got there, although the umpire said he was safe on first. Yes, he observed the rules as far as we know, but he must have spiked the first baseman or something. We'll investigate and find out if he did or did not do something wrong between the time he hit the ball and the time he touched second in spite of the umpire's ruling at first. We have no evidence that he did do anything wrong, but let's disorganize the game for as long as is required to have an investigation as to whether or not he did play square. A more reasonable course would be to let the player go on, let the game continue, while consideration is given to the rules and to amending them if necessary to make a fairer game hereafter. This is the situation in regard to the electric utilities. They have entered the game and have complied with the rules as laid down and the umpires have declared them safe all along the line. Instead of hindering their progress, governmental effort should be directed to considering the rules of the game. Most states have blue sky laws of one kind or another. All such laws are characterized by one thing, the requirement that securities and companies issuing securities must conform to certain stated conditions. These conditions satisfied, the sale of securities may proceed with the sanction of the state. The manner of satisfaction of these conditions is no one's concern. And sometimes on this account the blue sky law fails of its purpose to protect the investor and he suffers. Would it not be better if, instead of simply setting up conditions to be fulfilled before the sale of securities, the blue sky laws should be made to be actually what they were intended to be, laws against fraud? Would they not be simpler and easier to enforce to their desired end? If any investor in light and power securities has suffered loss from the malicious acts of the issuing company would he not have the same recourse at law as if a counterfeit bill had been passed on him? If any user of electricity feels that the rates he pays are extortionate has he not recourse under the laws of his state?

"The rules and laws of electric utility regulation are everywhere in the United States set up in some kind of governmental, state or municipal supervision. They are the rules of the game and they have been scrupulously observed in ninety-nine cases out of a hundred by the utilities, else their securities could not have been issued and sold. If the game is not going fairly, let's get the rules fixed. We don't have to disorganize the game while we find out if the man on second base got there fairly or not. All that happens then is that the man who yells for the investigation gets a lot of attention from the grandstand."

## Norfolk (Va.) Has $5,000,000 Station

THE Reeves Avenue power station of the Virginia Electric & Power Company is designed for an ultimate capacity of 90,000 kva. The recently completed 42,000-kw. section is shown in the accompanying illustrations. The converging-passage condenser is of the single-pass type and its 23 miles of tubes have a total cooling surface of 27,500 sq.ft. The Newton Park substation, indicated in the night view, is fed by four 1,000-volt, 300,000-circ.mil cables from the Reeves Avenue switch house.



## Transmission Factor of Colored Media Influenced by Temperature

By M. Luckiesh
*Director Lighting Research Laboratory,*
*National Lamp Works of General Electric Company,*
*Nela Park, Cleveland, Ohio*

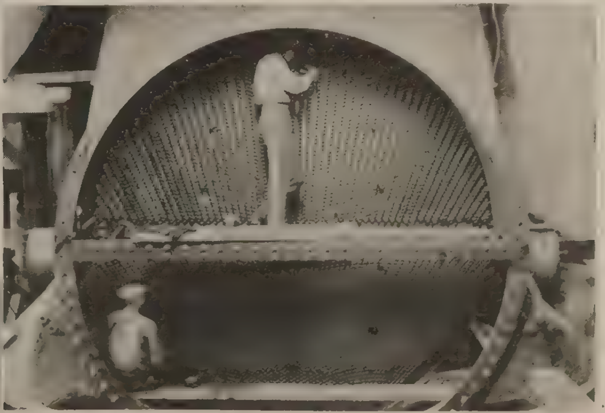
MANY years ago it was observed that the transmission factor of a deep red glass decreased with increasing temperature. Then ten commercial colored glasses were investigated and it was found that practically all of them changed in color and decreased in transmission factor when heated. However, it was found that certain blue glasses (containing cobalt) increased slightly when heated. A deep red glass (containing copper) at 660 deg. F. (350 deg. C.) transmitted only 42 per cent as much light as it did at room temperature, whereas the transmission factor of cobalt-blue glass increased 8 per cent for the same temperature change. Further work with colored gelatines and superficial coatings for lamps show that all of these colored media also change when heated. The color and transmission factor go back to normal when the medium is cooled, excepting, of course, the cases where fading has actually taken place under the action of the heat or light to which the specimen was subjected.

These results are of interest in connection with the photometry and use of colored coatings, colored-glass bulbs and colored accessories for tungsten lamps. When measuring the luminous outputs or transmission factors of colored lamps or colored accessories our practice is to permit them to reach a stable temperature before making the measurements. To illustrate the amount of change to be expected with commercial media some results are presented herewith on red, yellow, green and blue color caps which were used with a 150-watt tungsten lamp of the usual type.

Each unit was photometered in an integrating sphere at regular intervals until the luminous output became constant, which was at the end of about twenty minutes. At that time the transmission factors of the various color caps had changed by the amounts which are shown in the following:

| | | Per Cent | | | Per Cent |
|---|---|---|---|---|---|
| Red | Decreased | 41 | Green | Decreased | 16 |
| Yellow | Decreased | 9 | Blue | Increased | 3 |

The change in color with temperatures encountered in practice is appreciable, but is not as important as the change in the transmission factor.



# 5,000,000 Kva. in Large Transformers Annually

Annual installations by power companies of transformers rated at 3,000 kva. or larger range from about 100 to 500 kva. per 1,000 kva. of generator rating, according to data courteously furnished to the Electrical World by nine prominent power companies. The returns here tabulated came from companies well diversified as to geographical situation, as to size and as to type of territory served; that is, congested urban or widely distributed, the latter demanding long transmission circuits. In generator rating they cover about a sixth of the industry. They are probably fairly representative of the upper 85 per cent of the industry, in terms of installed capacity, or 25,000,000 kva. Although 3,000 kva. was arbitrarily chosen as a lower limit, the table gives sufficient detail to permit of analysis with a higher starting point.

The approximate station rating at the end of 1926 of the companies contributing data was 5,154,000 kva. The new installations of large transformers add up to 1,262,672 kva. in 1926, 1,063,327 kva. in 1925 and 765,416 kva. in 1924. In comparing these totals of new large transformers installed during each year with the then existing generator rating allowance must be made for the annual growth of the latter. The average kilovolt-amperes of the former per thousand kilovolt-amperes of existing generators was 245 in 1926. In 1925 it may be taken roughly at 225, and in 1924 at 175, allowing for the annual change in generator rating.

As might be expected, there is a wide variation between companies and between transformer installations by the same company in different years. Type of territory seems to have little influence, high and low values coming equally from localized companies and from those serving large areas.

Averages are often an unsafe guide and inferences drawn from partial data must be used with caution. With these reservations, and assuming that the average of about 200 kva. of transformers per 1,000 kva. of generators derived from this sample may fairly be applied to the 25,000,000 kva. previously mentioned, a normal year ought to see about 5,000,000 kva. of large transformers installed by the electric power companies of the United States. This does not include installations by railways or manufacturers on their own account.

# Electrically Operated Doors for Railroad Tunnel

Extremely low temperatures, high air velocities and large quantities of moisture in the electrified Charnaduras tunnel of the Bernina Railway, Switzerland, led to continued difficulties with ice formation on tracks and contact conductors. In winter a large staff of men were employed for clearing these facilities. Electrically operated doors, opening and closing automatically, have recently been installed at each entrance. It is stated that the experiment has proved so successful, the temperature in the tunnel never falling below the freezing point, that installations of similar character are planned for use in other Swiss railway tunnels.

*Annual Additions in Transformer Capacity (Units of 3,000 kva. or Larger) in Relation to Installed Generator Rating*

| Company | Approximate 1926 Station Rating, Kva. | Additions to Transformer Installation | | | | | | | | | | | | | | | Kva. Total Transformers Installed (1924-1926, Incl.) | Average Annual Kva. Transformers | Average Annual Transformer Kva per 1,000 Kva. of Station Rating (1924-1926, Incl.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1923 | | | 1924 | | | 1925 | | | 1926 | | | 1927 (First Six Months) | | | | | |
| | | No. | Size, Kva. | Total Kva. | No. | Size, Kva. | Total Kva. | No. | Size, Kva. | Total Kva. | No. | Size, Kva. | Total Kva. | No. | Size, Kva. | Total Kva. | | | |
| A | 900,000 | 12 | 5,000 | 60,000 | 3<br>3<br>3 | 4,000<br>6,000<br>5,000 | 45,000 | 9<br>3 | 5,000<br>12,000 | 82,500 | 3<br>3<br>3<br>4 | 8,333<br>6,000<br>5,000<br>3,333 | 71,331 | 3 | 5,000 | 15,000 | 198,831<br>(a) 213,831 | 66,277<br>(a) 61,095 | 75<br>70 |
| B | 850,000 | .. | ...... | ....... | 2<br>3<br>2 | 7,500<br>5,000<br>20,000 | 70,000 | 3<br>3<br>4<br>4<br>6<br>1<br>1 | 2,500<br>3,333<br>5,000<br>7,500<br>10,500<br>14,000<br>66,667 | 211,166 | 1<br>3<br>3<br>6 | 3,600<br>7,500<br>10,500<br>10,833 | 122,598 | 7<br>2 | 3,000<br>7,500 | 36,000 | 403,764<br>(a) 439,764 | 134,588<br>(a) 125,647 | 160<br>150 |
| C | 800,000 | 6<br>6<br>6<br>6 | 3,000<br>5,000<br>10,000<br>20,000 | 228,000 | 12<br>12<br>9 | 3,000<br>5,000<br>10,000 | 186,000 | 3<br>12<br>6 | 3,000<br>5,000<br>10,000 | 129,000 | 6<br>9<br>3<br>3 | 3,000<br>5,000<br>10,000<br>25,000 | 168,000 | 18<br>6<br>3<br>3<br>(Last 6 months)<br>3<br>6<br>3<br>6<br>3<br>3<br>(12 mo. | 3,000<br>5,000<br>10,000<br>20,000<br><br>3,000<br>5,000<br>10,000<br>16,666<br>20,000<br>25,000 | 174,000<br><br><br><br><br>304,000<br><br><br><br><br><br>1927, 478,000) | 483,000<br>(a) 961,000<br>(b) 657,000 | 161,000<br>(a) 240,250<br>(b) 187,714 | 210<br>250<br>300 |
| D | 725,000 | .. | ...... | ....... | 5<br>1 | 4,000<br>8,500 | 28,500 | 6<br>4<br>11 | 4,000<br>6,000<br>8,500 | 141,500 | 1<br>6<br>8<br>3 | 4,000<br>6,000<br>7,000<br>8,500 | 121,500 | 6<br>1 | 6,000<br>7,000 | 43,000 | 291,500<br>(a) 334,500 | 97,167<br>(a) 95,571 | 135<br>130 |
| E | 650,000 | .. | ...... | ....... | 20<br>4 | 3,750<br>20,000 | 155,000 | 6<br>3 | 3,750<br>4,000 | 34,500 | 12<br>12 | 3,750<br>20,000 | 45,000 | .. | ...... | ....... | 234,500 | 78,167 | 125 |
| F | 600,000 | .. | ...... | ....... | 6<br>2<br>1<br>2 | 3,750<br>3,333<br>11,500<br>4,000 | 48,666 | 7<br>10<br>3<br>3<br>9 | 3,750<br>11,500<br>4,000<br>3,333<br>15,000 | 298,249 | 5<br>7<br>6<br>6<br>6<br>18 | 3,750<br>4,000<br>10,000<br>3,333<br>11,500<br>15,000 | 465,748 | 9<br>5 | 4,000<br>3,750 | 54,750 | 812,663<br>(a) 867,413 | 270,888<br>(a) 247,832 | 450<br>400 |
| G | 375,000 | .. | ...... | ....... | 8 | 10,000 | 80,000 | 14<br>7 | 3,333<br>10,000 | 116,662 | 15<br>2<br>13<br>1 | 3,333<br>6,000<br>10,000<br>20,000 | 211,995 | 2 | 3,000 | 6,000 | 408,657<br>(a) 414,657 | 136,219<br>(a) 118,473 | 360<br>310 |
| H | 160,000 | .. | ...... | ....... | 17 | ...... | 155,250 | 4 | ...... | 49,750 | 3 | ...... | 32,500 | .. | ...... | ....... | 237,500 | 79,167 | 490 |
| I | 90,000 | .. | ...... | ....... | . | ...... | ....... | .. | ...... | ....... | 3 | 8,000 | 24,000 | .. | ...... | ....... | 24,000 | 8,000 | 90 |

(a) Including 1927. (b) Including first six months of 1927.

# Quality Industrial Lighting*

### Glare a serious factor in manufacturing output considerations. Illumination standards offer basis for analysis of existing conditions. Comparative data indicate value of plan

By Arthur A. Brainerd
*Philadelphia Electric Company, Philadelphia, Pa.*

THE effect of glare, both direct and reflected, on production is a very serious item in many manufacturing operations. Direct glare from bare "Mazda" C lamps on drop cords is, of course, a very common occurrence. An illustration of such a condition is offered in Fig. 1, which shows the appearance of the infants' hosiery division of the Reid Hosiery Company. The improvement indicated in Fig. 2 was secured largely during a correction of glare values. In this case removal of direct glare resulted in a decrease in labor turnover from 43 per cent per month to almost nothing. Direct glare from poorly planned systems of RLM units had also resulted in many complaints. This became so serious in the case of Jacquard looms that it finally became necessary to cover the openings of the reflectors with a diffusing cover glass before the union officials would allow a change in lighting.

The reduction of reflected glare to a low value undoubtedly had much to do with the increase in speed of production in the machine shop of the American Metal Works. The same is true to an even greater degree in the Decorative Lamp & Shade Company's woodworking shop, and the B. Wilmsen Company. In all these cases great care was taken to reduce this glare to a minimum.

*Figs. 1 and 2—Before and after views in mill manufacturing infants' hosiery*

Correction of glare conditions in this plant practically eliminated a labor turnover of 43 per cent per month. At the same time the output was increased 6.25 per cent.

The tests here recounted were of such a nature that it was impossible to separate the variable quantities. General observations throughout the tests, however, indicate that the measurement of reflected glare and its influence on productive operations would make a very profitable subject for future research studies.

There is also reason to believe that the present open type of steel reflectors introduces a high degree of both direct and reflected glare, especially when extremely high intensities are used.

Localized general lighting becomes almost out of the question in many cases when lamps of 200 watts or larger are used in connection with RLM domes or "Glassteel" diffusers. In the case of the Sidebotham mills, however, where we are at present experimenting with foot-candle intensities varying from 40 to 50, the operators experience no discomfort, since the illumination is totally indirect. In fact, they are enthusiastic over the arrangements. In the same location the glare from "Glassteel" diffusers becomes very annoying at 20 foot-candles. Illumination intensities of the order given above could hardly be used in a room with such low ceiling height with open reflectors.

There seems to be no question that before we can profitably carry industrial illumination to intensities of 30 foot-candles or over there must be developed some new form of lighting units that will retain the efficiency and rugged character of the RLM dome and still have much better diffusing qualities.

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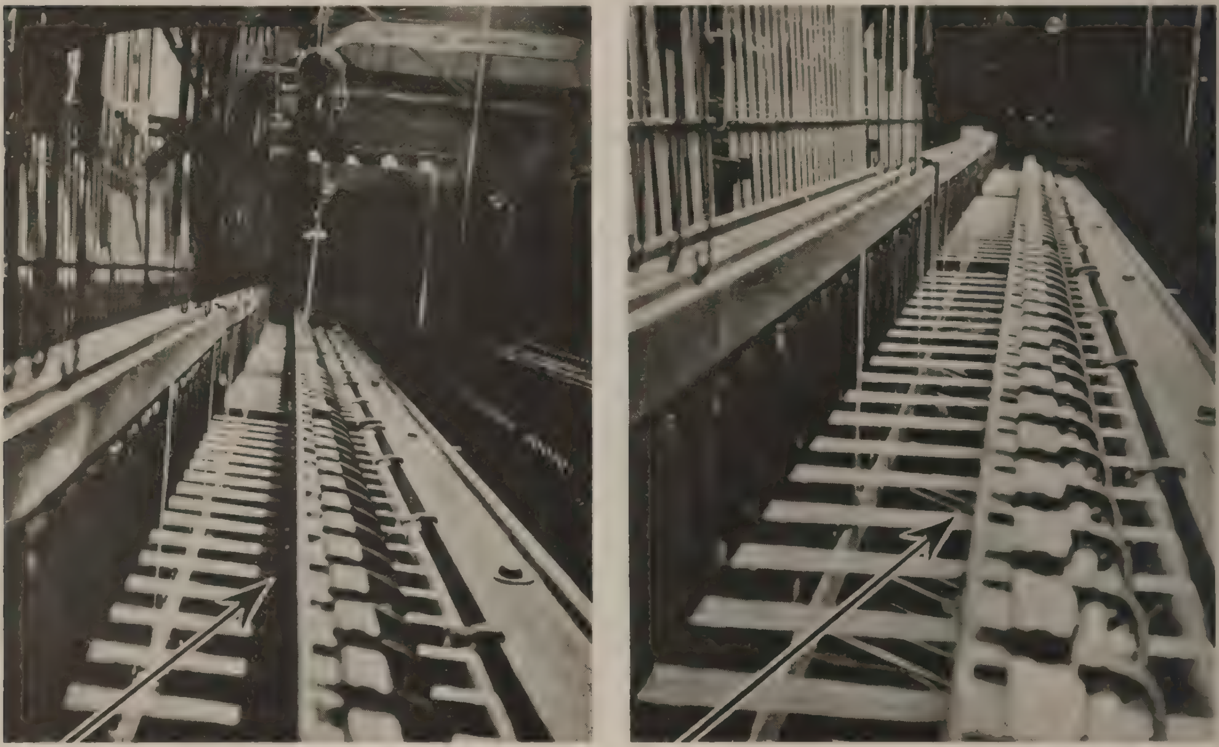
**The second and final part of an abstract of Mr. Brainerd's paper "Quality Measurements in Industrial Lighting Calculations," which received the James H. McGraw N.E.L.A. award for merit. The first installment appeared in the Feb. 4, 1928, issue of "Electrical World" and outlined the basic problems of industrial illumination.*

The purpose of this discussion is not intended to discount the value of adequate illumination intensity, but merely to call attention to the fact that intensity is only one of several things to be considered. The accompanying curves show the effect of increasing the intensity of illumination both on over-all production and speed of handwork. In the case of the American Metal Works the remarkable rise in the speed of handwork is probably due to the fact that there were no facilities available to determine accurately the percentage of handwork that depended upon manual skill and not on seeing. It will be noted that in both cases both the over-all increase in production and the increase in speed of handwork closely follow Fechner's law.



*Figs. 3 and 4—Tape loom before and after installation of good lighting*

Eliminating the sharp shadows, indicated by the arrow in Fig. 3, increased production 7.7 per cent, although the illumination intensity was increased only 1.1 foot-candles. Later the illumination intensity was increased to 12, 20, 30 and 40 foot-candles, but no increase in output was noted above 12.

There is no doubt that the prevailing illumination intensities of 1 to 5 foot-candles are ridiculously low. They must be raised appreciably before production can attain its maximum, but proper attention must first be given to improving the quality of the illumination.

On the other hand, a series of studies conducted at the John Sidebotham plant (see Figs. 3 and 4 above) covering a period of nearly two years seemed to indicate that there was no justification from the production standpoint for using illumination intensities higher than 12 to 20 foot-candles. Five different levels of illumination—8, 12, 20, 30 and 40 foot-candles were used in this test, and as the system was totally indirect, the items of glare and shadow were eliminated entirely.

*Value of Product and Production.*—In laying out a system of productive illumination we must never lose sight of the fact that money spent for good lighting is to be considered as an investment rather than an overhead expense, and the amount of profit made in a given area in a given space of time will determine to a certain extent the amount of money that can profitably be invested in lighting. Consulting the tabulation, it is quite evident that a manufacturer of high-grade silk hosiery can consistently spend far more money for illumination than a manufacturer of cheap dress goods. In one case investigated, the Shen Manufacturing Company, a preliminary test indicated a possible increase of 15 per cent in production at an increased operating cost equivalent to 12.65 per cent of the payroll. Such an investment would be a business venture of doubtful value and it would be futile to recommend any such course of action.

In view of these facts it would seem reasonable to establish a certain percentage of the payroll as a maximum that could safely be invested in good lighting under standardized conditions. To be sure, a large percentage of the plants today are operating on some sort of a piece-rate basis, but the benefit of having a contented force of workers who are easily supervised is a real item to be considered, not to mention the reduction in overhead which an increase in production always brings about.

*Height and Spacing.*—In determining height and spacing it is quite evident that as far as increase in production and decrease in spoilage are concerned the working area alone is to be considered and an average room intensity in any plant is meaningless. If we mount overhead units in such a position as properly to illuminate machine tools to a 20 foot-candle intensity throughout the working area, which may be a circle 4 ft. or more in diameter, it is quite obvious that there will be sufficient illumination in the aisles. Such an intensity will provide sufficient illumination for reading micrometers and steel scales. As long as the worker does not normally lift his eyes outside of the high-intensity area, it is clear that a high foot-candle value in the passageways is useless. Mounting height of 8 ft. will be found sufficient when outlets are equipped with 150-watt bowl enameled lamps in RLM domes.

*Method of Predicting Production Increases.*—Our present knowledge of the application of light to manufacturing operations is far from complete and in many cases we are obliged to depend more on personal judgment than on any definite method of analysis when we prepare plans for productive lighting. There is a wealth of excellent lighting equipment on the market the possibilities of which we have failed to make use of. Moreover, when selling good lighting to industrial executives, we talk increased production, but when pinned down to facts we cannot predict with any degree of assurance just what good lighting will do in any particular industry.

*Figs. 5 and 6—Inspection perch in plush mill*

Replacing clear lamps with bowl enameled increased production 42 per cent with only 25 per cent increase in foot-candle intensity. Note softness of shadows as indicated by arrow in Fig. 6.

For the purpose, therefore, of reducing lighting recommendations to a more exact basis, even though the method is far from being scientifically accurate, it may be well worth while to set up some sort of empirical formulas that will best harmonize with the results secured in the investigations under consideration. First let us list separately each item that affects the character of the lighting installation and assign to each an arbitrary value.

Experience has shown that sales of better lighting may be divided into three distinct classes.

1. The customer has fair illumination and wishes to install the best that can be had.
2. The present installation is bad and the customer will consider only fair illumination.
3. The present installation is very bad and the customer wishes the best illumination.

For purposes of estimation let us assume that fair illumination will produce approximately one-half the increase in speed of handwork that can be secured when the lighting has been brought to the very highest standard that our present-day knowledge of lighting affords.

The factors that determine the degree to which speed of handwork is influenced by illumination are variation factor, density of shadows, reflection characteristics of the surface, background contrast, visual angle of objects viewed and amount and character of natural illumination.

If the existing system of lighting is bad, let us assume that if the variation factor is over 3, fair lighting by reducing this factor will increase speed of hand operations 5 per cent and excellent lighting 10 per cent.

If, on the other hand, the variation factor lies between 2.25 and 3, fair illumination would effect no increase in speed and excellent illumination only 5 per cent increase. When this factor is below 2.25, no appreciable increase in production is to be expected by reducing it, except under extreme conditions.

In order that we may have some specific standards for use in our calculations, poor, fair and excellent illumination are defined as follows:

| | |
|---|---|
| Visual angle above 3 | |
| Bad | Below 3 foot-candles |
| Fair | 3–7 foot-candles |
| Excellent | Above 7 foot-candles |
| Visual angle 1.1 to 3 | |
| Bad | Below 5 foot-candles |
| Fair | 4–9 foot-candles |
| Excellent | Above 9 foot-candles |
| Visual angle below 1.1 | |
| Bad | Below 7 foot-candles |
| Fair | 7–14 foot-candles |
| Excellent | Above 14 foot-candles |

No installation of bare lamps less than 16 ft. from the floor is considered good illumination. When the walls and ceiling are exceptionally light experience shows that the net effect on night operation is equivalent to fair natural illumination.

Referring to Table II, page 251, Feb. 4, 1928, ELECTRICAL WORLD, it will be noted that all factors referred to have been assigned arbitrary constants, corresponding to the different conditions under consideration. No claim is made for the absolute accuracy of these constants, but it must be recognized that the results secured from their application correspond very closely with the actual results secured from production tests.

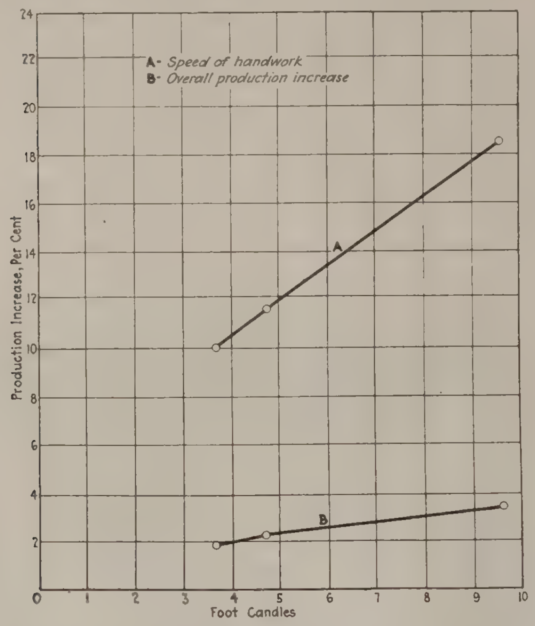


*Fig. 7—Variation of production with illumination intensity; webbing looms Manning J. Smith Belting Company*

Take, for example, the case of the Realart Silk Hosiery Company, and let us analyze the case as follows:

| | |
|---|---|
| Old illumination | Fair (7.2 foot-candles) |
| New illumination | Excellent |
| Variation factor | 2.2, add 0 per cent |
| Shadows | Dense, add 5 per cent |
| Reflections | Specular, add 5 per cent |
| Background contrast | 33 per cent, add 5 per cent |
| Visual angle | 0.532, add 4 per cent |
| Natural illumination | Fair, add 5 per cent |
| Total estimated increase in speed of handwork production | 24 per cent |

Substituting in the equation previously given,* we have

$$\left(\frac{M_2 m_1}{M_1 m_2} - 1\right) \times 100 = 24$$

$$\left(\frac{M_2 \times 26.8}{73.2 \times m_2} - 1\right) \times 100 = 24$$

$$\frac{M_2}{m_2} = 3.39$$

$$M_2 - 3.39 m_2 = O, \text{ and } M_2 + m_2 = 100$$

Solving, $M_2 = 77.1$ and $m_2 = 22.9$

Estimated increase in production

$$\frac{77.1 - 73.2}{73.2} \times 100 = 5.33$$

This system of analysis was first applied in one case, before the old system of illumination was changed, in an effort to determine whether or not the conditions justified the expense of a test. With the constants then in use an increase in production of 6 per cent was estimated. Actual increase in production, according to factory records, was 5.75.

For daytime operation the above estimate for increase in speed of handwork would be 5 per cent lower, since the natural illumination is fair and the shadows medium.

If the original illumination had been bad from the standpoint of intensity, all of the constants except that for shadows would have been doubled. Experience shows that a mere softening of shadows may be expected to bring about soon an increase in speed of handwork of the order of 7.5 per cent.

Two other checks on the accuracy of the system were made before the present series of constants was completed. One was the case of the Sidebotham mills, where 7.5 per cent increase in production was predicted and the test showed 7.7 per cent. The other case was that of the M. J. Smith Company, where 5 per cent was predicted and 3.74 per cent measured.

The results attained in applying this method to seven installations were indicated in Table II (ELECTRICAL WORLD, Feb. 4, 1928, p. 251). Using the arbitrary standards, it will be seen that of these fourteen cases the estimate was low in seven and high in seven. The average percentage of error is +6.66 for the fourteen cases studied.

The range of error in all but two cases is within reasonable bounds in view of the large number of variables involved. In the case of the M. J. Smith Company the error in percentage seems large, but the over-all increase in production in this case is so small that the chances of error were unusually great in spite of all precautions taken in securing accurate data. This method of analysis, however, would have quickly shown the lighting engineer that production increase should not be stressed in attempting to sell better lighting in this instance.

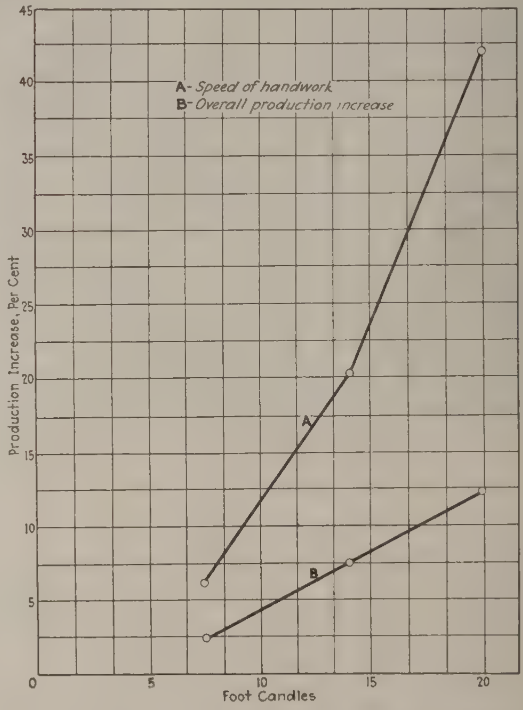


*Fig. 8—Variation of production with illumination intensity; turret lathe American Metal Works*

In the case of the John Sidebotham mills, it is probable

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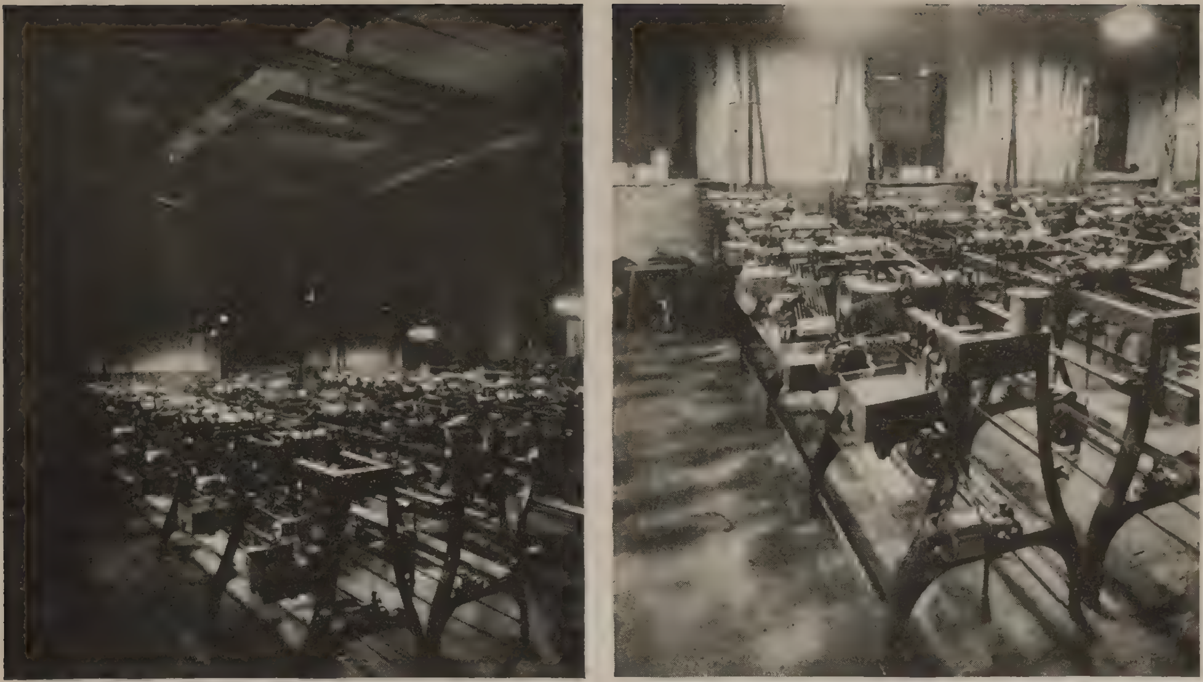
*ELECTRICAL WORLD, page 249, Feb. 4, 1928.



*Figs. 9 and 10—Before and after views of wire drawing machines in plant manufacturing Christmas tree tinsel*

Note extreme glare conditions under old system. Good lighting increased the output of this plant 16 per cent.

that the indirect system of illumination would by its superior quality increase production to a much greater degree than the same intensity of direct lighting. Since no other installation of indirect illumination was available for comparison, there was no basis for making this allowance.

In general this method of calculation has proved quite valuable in practice and where records for checking are available the error is practically always less than 25 per cent. An experienced lighting engineer by exercising personal judgment in the use of the constants can in most cases arrive at an even closer estimate than a rigid use of the system will give.

The ultimate aim of all such research is to classify industrial lighting conditions so definitely that a lighting engineer will be able to approach a factory executive with sufficient information at hand to enable him to predict, within a reasonable percentage of error, the economic saving that can be expected from a scientific lighting system.

However much we may talk of improved morale, decreased labor turnover and decreased accidents, increase in production is the most powerful argument for better lighting that we can put forward and one of the easiest to demonstrate by actual test.

From the data recorded in this paper it is evident that in the design of industrial lighting such items as variation, factor, shadows, reflection, background contrast, visual angle and natural illumination are fully as important as mere foot-candle intensity, and probably more important. Instead of leaving these items to mere personal judgment, some method should be developed that will enable us to allow for these features quantitatively.

The method of estimation here described is intended only for an approximation. In many cases it has been possible to arrive at a fairly accurate value for the portion factor, shadows, reflection, background contrast, speed of vision and not solely on manual skill. No attempt has been made, however, to separate visual acuity and ability to sustain speed of vision. The remarkable increase in speed of handwork noted in some machine operations was undoubtedly due in part to the fact that the eyes were required to work only for a small portion of the time.

All the factors considered in the empirical method of prediction are capable of exact measurement, but it will probably be several years before this research is completed. Dr. Ferree and Dr. Rand have already measured the variation of speed of vision with different visual angles and background contrasts.

A complete analysis of these items will no doubt result in a much more accurate method of calculation. Since considerable time may elapse before such research is completed, this system is offered as a possible method of at once placing such estimates on a definite basis and also as a step toward some final formula for predetermining the increase in production to be derived from good illumination.

## Microphone Control of Traffic Lights

THE city of Baltimore has recently placed in service a trial installation of motorist-controlled traffic lights. The signal light is said to solve satisfactorily the twofold problem of safeguarding and facilitating the traffic movement, an accomplishment which automatic signals operating at definite predetermined time intervals fail to do.

The development is particularly adapted to duty at the intersection of a busy highway with a road of relatively low traffic density. A three-color, red, green and yellow system is used. The normal indication for traffic on the main road is green and on the side road red. These signals remain constant until an automobile approaches the intersection from the side road. A microphone is located in advance of the crossing on the side road on each side of the main highway. The motorist, forced to slow down by the red signal, passes the microphone at low speed and in doing so sounds his horn to clear the signal. This sets a time relay in operation, causing the signal to change successively from red to yellow and to green, with inverse indications for the main highway. The green signal is held automatically for a predetermined number of seconds and the system is then returned to its original indication by relay actions.

# Utility Finances House Wiring for Contractors

SOME FIFTY electrical contractors in St. Louis have taken advantage of the Union Electric Light & Power Company's offer to finance house-wiring contracts and thereby assisted in bringing electric service to unwired houses. Under this co-operative arrangement, the electrical contractor may install wiring and fixtures in houses already built, and, upon satisfactory completion of the work, obtain prompt payment from the company, which, in turn, will collect from the purchaser in monthly payments. This agreement covers the installation of wiring and fixtures in homes already built or the installation of additional wiring and fixtures, but, so far, does not cover fixture work only.

The plan operates as follows: Upon developing a prospect for wiring and fixture work, the contractor forwards to the company's office a service and credit inquiry form completely filled out with the necessary information as to the purchaser's location, nature and cost of work, credit data and so forth. The company immediately investigates and notifies the contractor as soon as credit and availability of service have been established. This is usually completed within 24 hours after receipt of the inquiry from the contractor.

Upon completion of wiring and fixture installation, and after such work has been inspected and approved by the municipal authorities, the contractor sends to the company's office:

(a) Contract for the wiring and fixtures completely filled out in ink and signed by the purchaser and the contractor.

(b) Initial payment of at least one-twelfth of the face value of the contract.

(c) Contractor's bill for work made out for the face value of the contract, less 8 per cent.

If the contractor desires that his money be forwarded by mail, an assignment of claims for payment on the back of the contract is signed by him prior to forwarding the contract to the company's office. The contractor, however, does not secure the purchaser's signature to the order for financing the payment which is on the back of the contract, but a representative of the company secures this signature after the contract has been turned over to the company and the work has been completed to the customer's satisfaction. Contracts are approved for payment to the contractor after the purchaser's signature to the order for financing payment and the approval of the municipal authorities have been checked.

As will be seen from the conditions of the plan, the Union Electric Light & Power Company makes a charge of only 8 per cent to cover its bookkeeping, inspection,

UNION ELECTRIC LIGHT & POWER CO.
12TH & LOCUST STREETS
ST. LOUIS, MO.

*House-Wiring Service and Credit Information**
*Provided Utility by Contractors*

Address of premises to be wired; nature of premises (house, flat or apartment); number of customers in the building to be served; and number of sockets to be installed.

If special electric equipment such as electric range is to be installed, a notation is made under remarks.

CREDIT DATA

Total cost of wiring and fixtures ($); full name of person who will sign wiring order; this person's telephone number; is above person owner of premises; address of other property owned by above; to what address should bills be mailed; whether applicant is using or has used electric service and where.

If above person is not owner of the premises, the following information is also given: Occupation, place of employment; references (names and addresses of two parties now extending credit); name and address of owner of the premises; name of contractor; address of contractor; and contractor's telephone.

---

*Furnished on 8½ x 11 form with blanks for filling in.

*Information* Given and Requested by Distribution Department on Availability of Service*

Address (floor); name; nature of premises; telephone.

INFORMATION WANTED

Is service available for . . . ; consumer waiting? (yes or no); signature; date; and time.

Information received (date and time).

ELECTRICAL DISTRIBUTION DEPARTMENT DATA

Consumer at above location? (yes or no); name; load; city inspection; city permits; meter out; extension; lateral; space; necessary to send out; on extension for; contract in for.

Signature; date, and time.

---

*4 x 8½ form with blanks for information.

*Outline of Credit Inquiry* Sent to Accounting Department for Report*

UNION ELECTRIC LIGHT & POWER CO.

CREDIT INQUIRY

Address to be wired; nature of premises; amount of wiring and fixture; work to be financed ($); name (owner or tenant); address; telephone; will service account be in above name (yes or no); other property owned, occupation; place of employment; whether applicant has used or is using service and where.

REFERENCES

Parties now extending credit (names and addresses).

CREDIT DEPARTMENT REPORT

Remarks; signature; date and time.

---

*Printed on 4 x 8½ slip with blanks for filling in.

*Nature of Notice* Sent to Contractor to Proceed to Wire*

UNION ELECTRIC LIGHT & POWER CO.

Replying to your inquiry of . . . as to availability of electric service for . . . kw. at premises . . . street and approval of credit in amount $ . . . for electric wiring and fixtures to be installed in above premises under a contract to be signed by . . . you are advised as follows: . . .

Note:—In cases where service is available and credit is approved, we will accept order for financing of wiring and fixture installation during duration of House Wiring Campaign.

Such order will not be accepted: (1) in locations where electric service is not available; or (2) in cases in which credit is not approved; or (3) when order is received by us after close of House Wiring Campaign.

---

*Printed on 8½ x 11 sheet with sufficient space where blanks are indicated for filling in.

collection and other carrying costs. The six features of the contract are:

Contractor shall install outlets for connection of electric service and meter loop for installation of meter at points approved by Union Electric Light & Power Company.

Purchaser agrees that the cutting of walls, floors, baseboard, etc., is a necessary part of the work to be performed under this agreement, and contractor shall be responsible only for unnecessary damage to buildings or decorations.

Purchaser shall locate all outlets before installation hereunder is started, and contractor shall not be required to change location of outlets or fixtures after the work is started.

Purchaser agrees that failure to meet any payment, when due, shall render the installment feature hereof void, and the remaining balance shall become due and payable immediately.

In consideration of company advancing payment due contractor by purchaser for installation made upon above premises, purchaser agrees to contract for and use, or to have tenants contract for and use, the electric service of the company in the premises covered by this order for at least one year and until all payments to company as herein provided shall have been made.

It is agreed by purchaser that, in accepting this order for financing payment to contractor, company assumes no responsibility or liability for the performance or lack of performance by contractor of his obligations under the aforementioned contract for installation of wiring and fixtures, and purchaser agrees to hold the company harmless for all damages due to defective work or material or other causes resulting from performance of contractor's obligations.

Note: The form for electric wiring and fixtures carries thereon an order for financing payment, which is signed by the purchaser, and an assignment of claims for payment, which is signed by the contractor.

## Commercial Lighting Yields Largest Return on Cambridge Rate

THE rate base of the Cambridge (Mass.) Electric Light Company computed on 1926 operations and determined on the reproduction-cost-less-depreciation theory is $8,035,469, according to recent testimony of Edward J. Cheney, New York, consulting engineer for the company in its recent rate case before the Massachusetts Department of Public Utilities. During that year the company sold 53,675,929 kw.-hr., of which 14,115,232 kw.-hr. was for metered lighting service and 34,576,077 kw.-hr. for general power uses. About 150,000 persons reside in the territory supplied by the company either directly or at wholesale. The accompanying table gives the revenue, allocated expense and amount of return on each class of business during the year above named. The total amount available for return, surplus and contingencies was 8.274 per cent of the rate base. In the determination of the rate base, the total physical property value was found to be $6,210,469; organization, $275,000; going concern value, $1,100,000, and working capital, $450,000.

RETURN AND COST TO SERVE CAMBRIDGE BUSINESS DATA FOR YEAR 1926

| Class of Service | Rate Base 12/31/26 | Revenue | Allocated Expense | Amount for Return | Percentage Return on Rate Base |
|---|---|---|---|---|---|
| Residential lighting...... | $2,224,175 | $510,811 | $365,368 | $145,443 | 6.539 |
| Commercial lighting..... | 1,451,349 | 487,631 | 238,154 | 249,447 | 17.189 |
| Domestic and commercial refrigerating and cooking.................. | 68,151 | 13,890 | 11,140 | 2,840 | 4.167 |
| Primary lighting Belmont and Harvard University | 575,124 | 73,114 | 84,970 | *11,856 | *2.061 |
| Power.................. | 2,853,558 | 818,506 | 565,153 | 253,353 | 8.878 |
| Municipal street lighting. | 863,112 | 120,335 | 103,050 | 17,285 | 2.003 |
| Totals............... | $8,035,469 | 2,024,377 | 1,367,835 | 656,542 | 8.170 |
| Adjustment for miscellaneous income .. | | ..... | ... | 8,306 | ..... |
| Total amount available for return, surplus and contingencies........... | ......... | ........ | ........ | $664,848 | 8.274 |

*Loss.

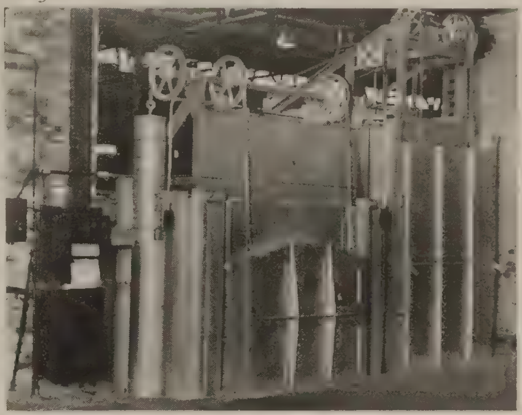
# Large Carburizing Furnace Secures Recuperative Economies

By W. J. Diederichs

*Industrial Heating Engineer*
*Westinghouse Electric & Manufacturing Company*

A LARGE, single-end, box type furnace and a recuperating chamber, both of special design, have been combined as a unit for the carburizing and normalizing of machine tool parts with notable operating economies.

The furnace has an electrical input of 81 kw. for operation on 220-volt, three-phase power supply. By means of a switch the input can be reduced to 27 kw. for use during holding periods. Heating elements are located on the side walls, in the arch and on the floor between the channels, thus insuring uniform heat application during long heating periods. Alloy guards are provided for the side elements in order to protect them from any possibility of injury, even though work were to roll off a tray. The floor elements are protected by alloy floor plates. The recuperating chamber is designed to permit the trays of work to be carried at two levels, one above the other. The door of the recuperating chamber, as indicated in the illustration, is built in two sections and provided with a latching mechanism to make it possible to move the top half alone or the united parts as a single door.



*Furnace-recuperative-chamber unit offers operating savings*

In operating the furnace a loaded tray with cold charge is placed on the upper deck of the recuperating chamber. A heated charge is removed from the furnace at 1,650 deg. F. and immediately charged onto the lower deck of the recuperating chamber. Transfer of heat takes place to such an extent that while a charge in the furnace is being heated the cold charge in the recuperating chamber has been preheated to 600 deg. F. or more. The cooling charge is then removed from the bottom deck, to be replaced as rapidly as possible by a fresh hot charge from the furnace; the preheated charge from the upper deck is charged into the furnace and a fresh cold charge is placed on the upper deck. The manipulation of these trays as indicated above is rapid and efficient due to the use of the special crane.

The equipment is designed to handle 3,000 lb. of gross carburizing charge, or 3,000 lb. of net material to be normalized, per tray. The heating cycles vary considerably, depending upon the nature of the work in hand. Based upon average procedure, the following results are typical of those attained:

The power consumption for carrying out a twelve-hour carburizing cycle on a 3,000-lb. charge at 1,650 deg. F. is 400 kw.-hours, which is equivalent to a gross economy of 7.5 lb. per kilowatt-hour.

The power consumption for carrying out a normalizing heat on a 3,000 lb. charge at 1,650 deg. F., requiring approximately nine hours in the furnace, is 340 kw.-hours which is equivalent to a net economy of 8.8 lb. per kilowatt-hour.

# Simplification of Carbon Brushes

## Multiplicity of grades, sizes and styles of brushes puts unnecessary burden upon manufacturer and user. Simplification offers possible saving of 50 per cent

By E. A. Williford
*Manager Carbon Sales Division National Carbon Company, Cleveland, Ohio*

SINCE the introduction of carbon material as a current-collecting device on commutators and slip rings the determination of the size of these carbon brushes has been left entirely to the discretion of the designing engineer. So far as can be ascertained no class in electrical machine design at any of our technical colleges lays any stress upon the selection of the carbon brushes other than on the basis of friction and carrying capacity. The size of the brush is usually determined by its supposed carrying capacity, the length being chosen either on the basis of a space factor or to be as long as possible consistent with general appearance. As a result, this has led to literally thousands of sizes and styles of carbon brushes, for which there is no engineering justification. To make this situation more complex, there are probably 500 grades of brushes available on the American market from which the designing engineer may make his selection, thus multiplying the possible combinations of brush grade, brush size and brush style almost without limit.

### Brushes Made From Buyer's Specifications

As a result all carbon brushes have to be manufactured to the purchaser's specification on a special order at the time the customer orders his material. There is no such thing as shipment from stock in case of carbon brushes except in a few minor instances. This leads to small-quantity production, on which there are required from six to thirteen machine set-ups on orders ranging anywhere from two brushes up. It is impossible for the brush manufacturer to make up brushes in small quantities except at exorbitant costs, and this has led to the very bad practice of selling a small quantity of brushes below manufacturing costs rather than asking the customer to pay what look like an unwarranted charge.

Moreover, the customer in need of immediate delivery of brushes must wait until this very necessary accessory can be manufactured especially for him and, in many cases, the complete specifications are lacking, leaving entirely too much to the guesswork of the brush manufacturer. If for any reason brushes made up do not fit the brush-holder or the machine for which they are purchased they are a total loss, as they cannot be reprocessed and supplied on some subsequent order. Under these conditions it can readily be seen that industry is bearing a rather heavy burden of wastefulness owing to the multiplicity of sizes and styles of carbon brushes and brush shunts.

The real limiting factor in the selection of a commutator brush is commutation. The only dimension of the brush that has any effect on commutation is the thickness. Even here some latitude is possible, since commutation depends largely upon the number of coils short-circuited at one time, and hence the thickness of a brush may vary by almost as much as the width of the commutator segment without changing the number of short-circuited coils. The width of the brush is determined by the carrying capacity of that particular grade and the demand governed by the output of the machine. This carrying capacity of carbon brushes is a decidedly indefinite quality and is usually based upon safe operating temperatures secured in operation of a well-designed machine. The heating due to commutated current in the coils and that due to friction of the brushes sliding on the commutator are far more important in limiting the carrying capacity of the brush than the heating due to the load current itself. Considerable latitude, therefore, may be given on this matter of carrying capacity. For instance, four brushes 1¼ in. wide may carry the same current which may have been carried in the past by five brushes 1⅛ in. wide. The selection of the length of the brush concerns the length of wear almost exclusively and, in the interests of simplification, broad concessions should be made in this dimension.

### Many Styles of Shunt Attachments

There are many styles of shunt attachment, almost any one of which is satisfactory for the use to which it is put. Where a brush-lifting device is required, such as for rotary converters starting from the alternating-current side, this matter could be simplified by an exchange of patents, as it is doubtful if there is any real engineering advantage in one form over that of another. They all do the work for which they are designed, and it would seem that the commercial advantage of fewer types of such mechanism should far outweigh any engineer's ideas as to the advantage of his novel idea. The length of shunt and style of terminal could be particularly well

## Ban on Power Export Costly to Public

"THE inability to sell, at any price, such surplus power as we may have from time to time is a very great drawback to our industrial development. Whenever a power plant is built it must be built larger than is immediately needed, and under the present conditions the service is obliged to go absolutely to waste until local customers absorb it. This means that the people of Maine pay more for their power in the average year than they would do if this waste power could be sold, no matter at what price it is sold."

*From a statement to stockholders by* Walter S. Wyman, *President Central Maine Power Company.*

standardized in two or three lengths and perhaps seven or eight styles of terminals for practically all applications larger than fractional-horsepower motors.

The advantages to be gained through simplification would accrue largely to the brush consumer; he would have a much smaller inventory to carry as spare parts in his store room; the interest charges on this investment would be reduced; he could secure quicker delivery of materials which he needs; he would be able to order the few styles he requires in larger quantities and save perhaps as much as 50 per cent in the unit cost of such brushes; brushes could be catalogued so that one particular size and style of brush would bear this standard catalog number, specifications of which would be known to all brush manufacturers and motor generator manufacturers, leaving only the necessity of specifying the grade that the consumer feels to be best adapted to his application. There are very few distributors in the brush business today due to the fact that it is not an economical proposition to stock brushes of so many varying types and qualities. If these styles were reduced to a smaller number brushes could be carried in stock by electrical jobbers for distribution to the small consumer and to isolated industries, such as coal mines.

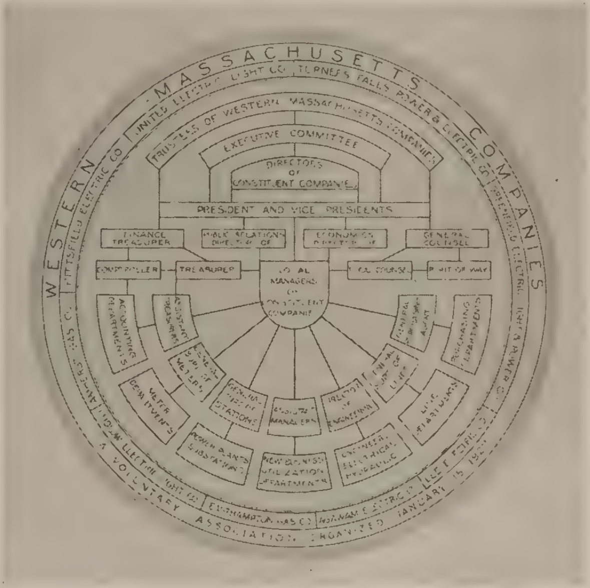
The motor and generator manufacturers would have fewer styles of brush-holders, thereby reducing their own inventory charges and simplifying the stock problem. They would have greater interchangeability of brushes for different types of machines and would not need to place orders for brushes so far in advance, as they now must do in order to secure prompt deliveries. These savings in the cost of machines would undoubtedly be passed on to the ultimate consumer, but with some compensation to the manufacturers themselves.

The brush manufacturer would benefit chiefly to the extent of eliminating the risk and waste to which he is now subjected in making up every order after the receipt of the customer's order itself. He would be able to mold individually the most important sizes of brushes, resulting in a more uniform product at a lower cost, which, in turn, would be passed on to the motor and generator manufacturers and to the brush consumers. Brushes could be placed in stock and shipped promptly upon receipt of customers' orders. Where brushes have been ordered through error on the part of some customer, they could be placed back in stock by the brush manufacturer instead of being scrapped, as now is done. Mass production would replace the present small order type of production and enable the American manufacturer to compete with the foreign manufacturer in foreign markets.

## Realizing Flexibility in a Holding Company "Set-Up"

EARLY in 1927 a number of closely affiliated gas and electric utilities serving the Connecticut Valley and other parts of western Massachusetts organized a voluntary association designated as the Western Massachusetts Companies. These now include the Turners Falls Power & Electric Company, United Electric Light Company (Springfield), Greenfield Electric Light & Power Company, Pittsfield Electric Company, Amherst Gas Company, Ludlow Electric Light Company, Easthampton Gas Company, Agawam Electric Company and Lee Electric Company. The operation of these properties, with combined assets over $36,000,000 has been centralized and co-ordinated along the lines illustrated in the accompanying chart, the general policy being to maintain the individuality of local administration hitherto enjoyed by these constituents, along with their pooled financial, equipment, operating, executive and other resources.

The chart is practically self-explanatory. The trustees administer the association on behalf of the stockholders of the constituent companies, the immediate conduct of affairs being in the hands of an executive committee working in harmony with the directors of the local properties and through the president and vice-presidents of the holding organization. The administration of each constituent property centers in its local or resident manager, through whom contact is made with the headquarters staff officers and executives of the association. General jurisdiction over local company departments is exercised by specialist executives available to local managers on the one hand and over local departments on the other. The treasurers and comptrollers contact through the local managers with the subsidiary properties and also by direct line with the accounting departments of the constituent companies. The director of economics and engineering exercises the functions of a technical consultant for the association and its properties besides having executive charge of all electrical and hydraulic engineering activities with specialist executives reporting to him. These examples and examination of the chart will show that an unusually flexible and compact organization has been set up to allow the utmost freedom of co-operation between the officers and specialists of the association and of the constituent utility companies.


WESTERN MASSACHUSETTS COMPANIES
UNITED ELECTRIC LIGHT CO.
TURNERS FALLS POWER & ELECTRIC CO.
GREENFIELD ELECTRIC LIGHT & POWER CO.
PITTSFIELD ELECTRIC CO.
AMHERST GAS CO.
LUDLOW ELECTRIC LIGHT CO.
EASTHAMPTON GAS CO.
AGAWAM ELECTRIC CO.
LEE ELECTRIC CO.
A VOLUNTARY ASSOCIATION ORGANIZED JANUARY 15, 1927
TRUSTEES OF WESTERN MASSACHUSETTS COMPANIES
EXECUTIVE COMMITTEE
DIRECTORS OF CONSTITUENT COMPANIES
PRESIDENT AND VICE PRESIDENTS
FINANCE TREASURER
PUBLIC RELATIONS DIRECTOR OF
ECONOMICS DIRECTOR OF
GENERAL COUNSEL
COMPTROLLER
TREASURER
LOCAL MANAGERS OF CONSTITUENT COMPANIES
LOCAL COUNSEL
RIGHT OF WAY
ACCOUNTING DEPARTMENTS
ASSISTANT TREASURERS
GENERAL SUPT. OF METERS
METER DEPARTMENTS
GENERAL SUPT. OF STATIONS
POWER PLANTS SUBSTATIONS
ASSISTANT MANAGERS
NEW BUSINESS UTILIZATION DEPARTMENTS
DIRECTOR OF ENGINEERING
ENGINEER ELECTRICAL HYDRAULIC
GENERAL SUPT. OF LINES
LINE DEPARTMENTS
GENERAL PURCHASING AGENT
PURCHASING DEPARTMENTS

*Maximum flexibility in administration and advisory functions is attained by this set-up*

The chart is functional in its arrangement, and in some cases the same individual fills an office in a constituent company that he occupies in the association. Thus, the director of engineering indicated on the chart for each local company holds this post in the association general staff. The size and make-up of the local staff depend on the conditions in each local company.

# Letters from Our Readers

## *Price Cutting the Seller's Fault*

*To the Editor of* Electrical World:

Apropos of Earl Whitehorne's article in the Feb. 18 issue of Electrical World, entitled "Who Pays the Cost of Price Cutting?" the following is the reaction of a comparative newcomer in the ranks of the purchasing agents:

I hold no brief for those purchasing agents who are "beating down price levels by ingenious methods of induced competition." Such tactics will continue so long as the manufacturers "weakly submit to this pressure," but I seriously question the efficacy of the remedy proposed by Mr. Whitehorne, namely, the elimination of the secrecy of bids. My experience has been that the practice of requesting sealed bids has done more toward eliminating the unethical tactics of manufacturers' representatives than any other single consideration, for only a purchasing agent knows of the hundred and one subtle devices that are used in an effort to worm out of him the low bid price. Where sealed bids are used the purchasing agent has no other alternative than to give the order to the low bidder, quality of material and delivery being equal. To throw the bids open to examination by a competitor is to invite collusion between manufacturers, leading to efforts to make the buyer pay all that the traffic will bear.

Mr. Whitehorne's Utopian one-price system will hardly commend itself to any fair-minded buyer, for the simple reason that such a system is seldom if ever based upon the costs of the most efficient unit in a given branch of industry, but rather upon the costs of the more inefficient. The buyer is, therefore, forced to pay for the high costs inherent in obsolete machinery, worn-out manufacturing methods, slipshod cost accounting, topheavy overhead and inefficient distribution.

What, then, is the remedy for the admitted evils of price cutting? Quite frankly, I feel that the initiative should be taken by the manufacturers themselves, in desisting from their unethical practices of stealing business from their more efficient competitors by a ruthless cutting of prices. The inefficient manufacturer who cannot compete with his more efficient competitor has only one alternative to falling by the wayside, and that is to lower his costs. There is plenty of room for this in 90 per cent of electrical manufacturing plants.

Furthermore, the manufacturers should employ a few good salesmen rather than a flock of mediocre order takers. The right kind of selling organization would be able to evaluate such intangibles as better quality, prompt service, longer life, etc., in terms of dollars and cents, which is, after all, the deciding factor in a hard-headed, clear-thinking executive's mind. The purchasing agent would then buy not on the basis of price alone, but with due consideration for the other factors above mentioned.

I have no objection to showing a bidder the other prices when he is asked to reduce his price, provided that the identity of the bidder is not revealed, for to reveal the identity of the bidder is a breach of confidence of which the manufacturers themselves would be the last ones to approve. It seems to me that the personality of the purchasing agent is the governing factor, for I have yet to recall an instance where my word was questioned when I have offered an order to a bidder at a lower price.

My company pursues a liberal policy in its dealings with manufacturers, and has this year voluntarily granted an increase in prices for high-tension, paper-insulated cables in order that the manufacturers may be assured of a reasonable profit on their product and be able to set aside funds for research, but we do not propose to be coerced into paying higher prices than conditions warrant. David Williams.

1121 Teller Ave.,
New York City.

## *Maintenance of Transformers and Circuit Breakers at Industrial Plants*

*To the Editor of* Electrical World:

In an editorial in the Feb. 18, 1928, issue of the Electrical World you asked the question "Who should take care of the maintenance of transformers and circuit breakers at the plants of industrial customers?" In hundreds of small industrial plants that are electrically operated this problem more often than not remains unsolved, but comparatively little trouble is caused, on the whole, mainly owing to the remarkable reliability of the type of electrical equipment usually installed in such plants. In several cases where I have installed such equipment I have made an effort to get the power company to adopt some schedule for maintenance of the apparatus, arranging for the customer to pay the cost. In cases where the plant is large enough to maintain its own electrical staff this of course has not been necessary. The power company has frequently agreed, has never accepted the responsibility, but has awaited the call of the customer, who knows little or nothing as to the amount of maintenance necessary. In fairness it must be said that some power companies, although they are far too much in the minority, adopt a really constructive attitude and maintain the equipment not only in theory but in practice.

For the last few years circuit breakers with higher interrupting capacities have been installed and the trend in protection equipment has been toward overcurrent relays with battery-operated, direct-current trip coils. Such equipment can maintain its operating superiority only through proper maintenance. The writer's interest lies mainly in the fact that equipment which has been specified and installed may appear to the owner to be unsatisfactory even though its failure was due to improper maintenance.

You say in your editorial that it is a duty of the electric light and power company to maintain such apparatus and you further add that it takes but little persuasion to convince the customer that the power company should do the job. In this you are absolutely right, and when it can also be said that such maintenance work can be performed at no cost to the power company, but actually can be made to yield a fair and legitimate profit, the industry is missing an opportunity to capitalize on service reliability through proper maintenance of apparatus. May I not suggest that power companies following some such plan write of their experiences for the benefit of and as a guide to other companies to make such a practice more widespread. Engineer.

New York, N. Y.

[The author has submitted sufficient reasons for withholding his identity to justify our complying with his request.—Editor.]

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Tests of a 12,000-kw. Zoelly Steam Turbine.*—Investigation of the operating characteristics of a Zoelly steam turbine operating under a pressure of 285 lb. per square inch and a temperature of 662 deg. F. at 3,000 r.p.m. was undertaken recently. The machine comprises ten simple impulse wheels with diameters ranging from 51 to 69 in. Results indicate a minimum steam consumption of 9.6 lb. per kilowatt-hour.—*Engineer* (*England*), Feb. 17, 1928.

## *Transmission, Substations and Distribution*

*The Transmission of Alternating Current.*—W. B. Woodhouse.—The adoption of the four-phase system for alternating-current transmission as a means of reducing the number of wires necessary for balanced protection, with other incidental but important advantages, is offered by the author. Comparative figures for two overhead lines bearing equal loads with equal efficiencies, one of four-phase construction and the other a three-phase, six-wire line, offer some interesting information regarding the mechanical properties of the conductors necessary to carry the load. A reduction of 18.5 per cent in the total mechanical loading of the line is indicated with four-phase design and it is stated that this will result in a proportionately greater reduction of the cost of the support and that the transmission line as a whole will be substantially cheapened on both accounts. The author concludes that the facility with which a three-phase system can be transformed into a four-phase system is such that four-phase high-pressure transmission may be combined with a three-phase generation and three-phase distribution without difficulty or undue complication, and the system of transmission may therefore be considered separately.—*Electrical Review* (*England*), Feb. 17, 1928.

*Calculating Sag of Wires for Unequally High Suspension Points.*—G. Schmidt.—The methods generally used for the calculation of mechanical tension and sag in wires when stretched out between equally high supports are only approximately correct. Mathematical proof is given for this statement, and the problem is further developed to be applicable to unequally high supporting points, resorting to catenary or chain-line equations. The influence of exact calculation does not become apparent until actual examples are computed. It is of great value for the safety of the line to determine the exact but unequal stresses in the lower and upper support, to have full assurance that they stay within safe limits. Many methods and tabulations, which have been published lately, including supposedly authoritative ones for the calculation of wire sags, are stated to require corrections to give exact values.—*Elektrotechnische Zeitchrift*, Feb. 9, 1928.

*Cable Conductor Losses.*—C. G. Watson.—The author has devised a method for readily estimating conductor losses taking into account the maximum demand charge as well as the unit charge. On this basis one part of the total value of the loss will be the loss of the system peak multiplied by the cost per kilowatt of maximum demand, but as the maximum load of a cable does not always coincide with the system peak and as it is convenient to use the maximum current as a basis for calculation a correction factor is needed. This factor is said to be the square of the ratio between the current in the cable at the time of the system peak and the maximum current. Illustrative examples tend to prove the contention of the author in connection with the ideas developed in the formulas and charts.—*Electrical Review* (*England*), Feb. 24, 1928.

*Graphic Calculation of Reactors.*—O. Gramisch.—The design of air-core, current-limiting reactance coils can be largely reduced to a simple graphical method by means of alignment charts given in this article. Such charts have been constructed for the size of the (copper) conductor, for the heating under short circuit, for the dimensions of the coil, and for the inductance. The practical solution of the problem of a given reactor for certain inductance, current and time values is not definite. Several designs must be laid out to find the most economical type. This procedure is illustrated by the actual design of a reactor for a 1,000-kva. transformer, using alternately formulas and alignment charts.—*Elektrotechnik und Maschinenbau*, Jan. 29, 1928.

## *Units, Measurements and Instruments*

*Construction of Great Falls-Winnipeg 110-Kv. Transmission Line.*—J. C. D. Taylor.—The problems involved in the distribution of material for the construction of this 70-mile transmission line through two distinct types of country are considered by the author in the first of a series of articles. The details of the organization for the distribution of men and material has received particular attention. An unusual feature of the work was involved in the construction of a 12-mile narrow gage track for the transportation of materials and consisting of 6-in. trees bolted to road ties for use in connection with grooved wheel cars. The motive power was furnished by horses. The character of the ground was such that this was the most economical and desirable way of accomplishing the transport of line materials.—*Electrical News* (*Canada*), March 1, 1928.

## *Motors and Control*

*Phenomena Under a Carbon Commutator Brush.*—H. Lutz.—It is a known fact that the ohmic resistance between a carbon brush and commutator is larger when the machine is running than when it is standing still. Unavoidable irregularities on the surface of the commutator and the carbon particles continually ground off cause the brushes to be more or less in motion at all times. The size of these fine particles of carbon varies between $10^{-3}$ to $10^{-6}$ mm. or about 100 to 1,000 times the size of a carbon atom. Ionization and free electrons will occur under the brush. Contact between brush and commutator will only be point-contact, so that voltage drop will only depend upon the current and not the current density. Several small brushes or one wide brush with undercuts will give a better performance, according to the author, since there are more contact points. Reference is made in the paper to many previously published statements, which apparently agree with the author's recent experimental findings.—*Elektrotechnik und Maschinenbau*, Jan. 29, 1928.

*Developments in Electric Pumping.*—Blake R. Vanleer.—A general review of the subject of pumping has been made in connection with a discussion of the recently developed deep well turbine pump. The author has reviewed the advantages and service requirements which have led to the use of this type of equipment and has emphasized design and test features. A deep well turbine pump, while relatively inefficient, offers unusual features in that the motors may be mounted at the ground level, while the runners are attached to the shaft operating within the well at such intervals as may be desirable.—*Electrical West*, March 1, 1928.

*Fifteen-Ton Electro-Hydraulic Ingot Casting Crane.*—This crane comprises a motor-driven traveling carriage from the center of which rises a vertical pivot which acts as a fixed ram of a hydraulic center. This cylinder, which surrounds the ram, carries the main portion of the crane. The body of the crane has thus both a vertical and circular motion around the central pivot. It consists structurally of two main girders secured to the hydraulic cylinder surrounding the pivot by four sloping ties of steel plate. The operation of this equipment involves the control of six motors, namely, two motors for traveling, one for each of the duties of raising the crane, turning it, reversing the ladle and tipping it. The two traveling motors are controlled by an automatic contactor, which assures a steadily progressive start without reference to the manipulation of the starting handle. The latter, having to deal only with very small currents, is easily moved. The lifting controller is operated by a lever and the connections are so made that the load follows the movement of the hand of the operator. —*Engineer* (*England*), March 2, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*Very High Direct-Current Voltages.* —Erwin Marx.—For general testing purposes, the production of cathode and X-rays, dust precipitation, cable tests and many other research investigations very high sustained direct-current voltages are required. The author shows how, with relatively low potential transformers, a many times higher direct-current voltage can be easily obtained, with the aid of suitable vacuum rectifying tubes and high-voltage condenser batteries. A small 100-kv. transformer can thus readily produce 600 kv. direct-current to ground. In fact, the potential multiplication can be carried readily to a factor of 10, making it possible to obtain 1,000,000 volts direct-current from a 100-kv. testing transformer.—*Elektrotechnische Zeitschrift*, Feb. 9, 1928.

*Some Principles Governing the Choice and Utilization of Permanent-Magnet Steels.*—Raymond L. Sanford. The addition of substantial percentages of cobalt to the composition of permanent-magnet steels leads to markedly superior qualities. The cost of cobalt steels may be several times that of the older types, however, and their use is warranted only under certain circumstances. Criteria for the comparison of the quality of magnet steels are discussed, and the conditions under which the use of the more expensive steels are justified are outlined. Cobalt steels are superior in quality to tungsten and chromium steels, but this superiority can only be utilized by means of appropriate designs. The mere substitution to cobalt steel without change in design will usually lead to disappointing results. Magnets can be stabilized against permanent deterioriation from transient demagnetizing fields by partial demagnetization. The cobalt steels can be stabilized by this method to a greater degree than the steels having lower values of coercive force.—No. 567, *Scientific Papers of the Bureau of Standards.*

*High-Voltage Reactors.*—L. Kropff. —In the discussion of general requirements of current-limiting reactors, some simple formulas are given to calculate size and number of turns required for any given condition. It is shown that the customary design, which is fully satisfactory for up to 6,000 volts, cannot be used economically for much higher voltages, since the mere lengthening of the creepage distances would lead to impossible dimensions. For use in feeder circuits of 30 kv. or more a new design for reactors has proved very satisfactory. Double section disk coils, porcelain spacers and the decidedly novel use of porcelain tension bolts with ball socket ferrules are the outstanding features of this new design. To eliminate static charges on the metallic clamping pieces, they are connected electrically to the ends of the winding. The conductor is made of ribbon copper, insulated with mica, which insures against dust troubles or winding "shorts" due to foreign metal parts. Reactors of this design will safely withstand a testing voltage of four times rated voltage.—*Siemens Zeitschrift*, January, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*Fatigue Studies of Telephone Cable Sheath Alloys*—John R. Townsend.— A discussion of mechanical and metallographical characteristics of fatigue failure of telephone cable sheath and the development of machines to duplicate service conditions. The correlation between the characteristics of service failures and laboratory failures is stressed. The special precautions necessary to carry out fatigue tests on soft metals is outlined. Fatigue failure of lead and the lead antimony alloys covered by this paper is by intergranular failure, and in the case of the lead antimony alloys repeated stress appears to reduce the solid solubility of antimony in lead, producing a widened grain boundary as viewed under the microscope. The type of fatigue test described is sensitive to very slight changes in composition and heat treatment for a particular class of material.—*Reprint B-285 Bell Telephone Laboratories.*

*Generator for Audio Currents of Adjustable Frequency with Piezo-Electric Stabilization.*—August Hund.—A beat-frequency generator for producing audio currents which are practically sinusoidal is described by the author. The frequency is adjustable and stabilized by means of a piezo-electric quartz disk and can be directly read off on a scale. The piezo-electric control makes it possible to reset the calibration for the frequency, for almost any B voltage on the tubes producing the two high-frequency currents which beat with each other. The resetting can be carried on without any standard by means of the filament rheostat common to both oscillator tubes. The slow visible vibrations on the meter for the anode current of the piezo-electric oscillator are utilized for the resetting of the scale. A thermostatic control is provided for very accurate work. Two filter detector circuits are described for obtaining audio currents of a good wave shape and keeping any high-frequency currents away from the load branch. A specially designed power amplifier is also mentioned.—*No. 569, Scientific Papers of the Bureau of Standards.*

## *Traction*

*New Railway Car Lighting System.* —L. Dreyfus.—All hitherto known systems for electric lighting of railway cars provided with axle-driven generator and storage battery require a complex regulating apparatus to keep the lamp voltage constant at widely varying train speeds. The author has developed a new system, in which the generator is of such design that it makes any external or additional voltage regulator unnecessary. This has been accomplished by a machine with a double field and three pairs of small, fixed brushes on the commutator. An 18-volt, 9 amp.-hour auxiliary battery (fourteen alkaline cells) maintains the excitation field essential for the operation of this generator. The arrangement of the two counteracting fields and their connection to the six brushes is such as to maintain a practically constant potential of 24 volts on the lamp circuit and a 30 per cent higher voltage for the charging of the main alkaline car battery. The control panel contains only an automatic double-throw switch for "standstill" and "travel," a combined voltage and over-voltage relay, both of exceedingly simple and robust design, and four adjusting resistors. The generator is positively driven by bevel gears.—*Elektrotechnik und Maschinenbau,* Feb. 5, 1928.

## *Miscellaneous*

*Waste Heat Recovery.*—A discussion of steam generation by waste heat. No reference is made to regenerative processes, air heating or similar expedients, the discussion being limited to certain definite aspects of steam generation by waste heat. The author states that despite economic factors there still appears to be some hesitation in the general adoption of waste heat boiler plants and that the reasons may be summarized as follows: Incomplete knowledge of the exact scope of waste heat recovery, particularly of its influence on fuel consumption and its general effect on the primary process; a tendency to lay too much stress on the troubles met with in pioneer plants installed before the principles governing the subject were properly understood; the practice in certain quarters of overstressing the possibilities of the generation; engineers responsible for the design and operation of furnaces, retort settings, internal combustion engines, etc., have confused waste heat with wasted heat, the latter being a potential reflection on their products. Considerations are largely devoted to steel plants, carbonizing processes and marine engines.—*Engineering (England)*, Feb. 24, 1928.

# News of the Industry

## Tennessee Tax Illegal

*Commission's Imposition of One Mill per Kilowatt-Hour on Power Generated in Hydro Plants Upset by State Court, Along with Recapture Clause*

HOLDING that although the Tennessee Eastern Electric Company must apply to the Railroad and Public Utilities Commission of that state for a certificate of convenience and necessity before proceeding with hydro-electric developments on the Holston River, none the less the commission's attempt to impose a tax or rental of one mill per kilowatt-hour of generated electricity on the output of hydro-electric companies is unconstitutional, the Chancery Court at Nashville handed down last week an opinion of far-reaching importance to the power industry of Tennessee and other states.

The court held that the Legislature has not conferred the taxing power upon the utilities commission; that the commission is not legally empowered to require the applicant for a certificate of convenience and necessity to agree to surrender its property at the end of 50 years under terms to be set out in such certificate; that the water-power value of the company's property must be included in the rate base, not on the basis of the cost at the time of acquisition, but on the basis of the present or existing value at the time the rate is to be fixed, and that the commission cannot exercise jurisdiction over the assignment, transference or alienation of the certificates of convenience and necessity to the exclusion of court authority.

Though in other matters the commission was upheld in its general jurisdiction over the power company and its right to issue certificates, require public hearings, fix rates, and generally oversee the development and distribution of power, the opinion is obviously a victory for the complainant power company, as the imposition of the one-mill tax or rental, the recapture clause and the jurisdiction claimed over assignments of the certificates were the sections of the commission's order from which the complainant was seeking relief.

## Radio Bill Becomes a Law

After weeks of uncertainty and delay in Congress, President Coolidge on Wednesday signed the radio bill, passed by the Senate on March 24, after previous acceptance by the House, and it became law, effective at once. In addition to the provision extending for a year the life of the Federal Radio Commission as a control body and the clause providing for "equal" distribution of radio service to the five zones and "equitable" distribution among the states within the respective zones in accordance with population, the bill provides that broadcasting licenses shall be issued for not to exceed three months, instead of three years as at present, and other classes of licenses for not longer than one year, instead of five as under the existing law. Indications are that the new law will materially curtail the number of licenses and the power enjoyed by big radio centers like New York and Chicago. Unused wave lengths, time or station power can, however, be allocated elsewhere than to the zone originally entitled to them. The new license provisions are to terminate Jan. 1, 1930.

## Elihu Thomson Attains His Seventy-fifth Birthday

THURSDAY of this week was the seventy-fifth birthday of Elihu Thomson, consulting engineer for the General Electric Company at its Lynn works. Dr. Thomson passed the anniversary quietly with his family at his home in Swampscott, Mass., but many letters and telegrams of congratulation reached him. Among the numerous honors that have been bestowed upon him in the course of his career have been the presidency of the American Institute of Electrical Engineers, the Grand Prix award, the Rumford, Edison, Elliott Cresson, John Fritz, Hughes, Kelvin and Franklin medals of American and foreign societies, and honorary membership in the National Electric Light Association. A special resolution in honor of Dr. Thomson was passed by the association's executive committee at a session on Thursday.

## New Permits Granted by Federal Power Board

*One for White River, Ark.—License for St. Croix Falls, Wis.—Applications for Sites on Roanoke, Flint and Salt Rivers*

A PRELIMINARY permit for the White River Power Company of Little Rock, Ark., was authorized at a meeting of the Federal Power Commission held March 26. The company's plan provides for the construction near Cotter of a storage dam 226 ft. high. Other dams and power houses below Cotter, on the White River and on its Buffalo and North Forks, are planned. It is estimated that 70,000 hp. of primary power will be made available. It is planned to install 165,000 hp. A conflicting application by the Ozarks Hydro-Electric Company was withdrawn recently.

The application of the Western Washington Electric Light & Power Company for a preliminary permit on North River in Washington also was authorized. It is planned to install 40,000 hp.

A license was authorized for the St. Croix Falls Improvement Company covering a project on the St. Croix River in Wisconsin. It is proposed to install 66,500 hp. at Kettle River Rapids and at Nevere.

A license was granted to the Citizens' Light, Power & Water Company covering a constructed project on Ketchikan Creek in Alaska. The plant has an installation of 2,500 hp. A preliminary permit covering a proposed development on Ward Cove Creek, near Ketchikan, Alaska, was also authorized. The applicants are H. G. McCain and five others, all of Ketchikan.

The permit covering the project of Julian H. DeCoster of Idaho Falls and Steve Meikle of Victor, Idaho, on Palisade Creek was authorized. The applicants are required to determine the feasibility of storing water in the upper and lower Palisade lakes. It is planned to install 9,000 hp.

The Bunker Hill & Sullivan Mining & Concentrating Company was authorized to construct a 350-hp. project on Deadwood River, Idaho.

As no additional water rights are likely to be granted soon on Seepe and Piru Creeks by the California authorities, the commission rescinded its action in authorizing a preliminary permit for the Ventura Power Corporation.

The Roanoke River Power Company of Richmond, Va., has applied to the Federal Power Commission for a license covering a project on Roanoke River near Buggs Island. It is proposed to construct a dam 80 ft. high to create a reservoir with 240,000 acre-feet capacity. The reservoir would extend upstream for 23 miles. It is planned to install 70,200 hp. and to construct a transmission line to connect with the system of the Appalachian Power Company. The primary capacity of the project is 8,900 hp.

J. J. Williams, O. M. Heard, W. E. Grubbs, P. F. Fitzgibbons and Dr. J. A. Ward of Cordele, Ga., have applied for a license covering a project on Flint River. It is proposed to install four units of 3,600 hp. each. The license, if issued, is to be transferred to Crisp County. The power is for public use.

John L. Fish of Lakeside, Ariz., has applied for a license covering a project on Salt River, Gila County, Ariz. It is proposed to install 24,000 hp. capacity.

The Southern Sierras Power Company, of Riverside, Calif., has applied for a license covering a transmission line 13 miles long over public lands in San Bernardino County. The Western States Gas & Electric Company of San Francisco has applied for a license covering a transmission line from Camino to the tramway of the Michigan-California Lumber Company.

The City of Sand Point, Idaho, has applied for a preliminary permit covering a site on Priest River, in Bonner County, Idaho. It is proposed to construct four dams and power houses with an installed capacity of 10,000 hp.

# House Committee Reports Its Shoals Bill

## New Measure Differs Only Slightly from the Norris Bill Adopted by Senate, and Final Agreement Is Now Predicted—Leatherwood on Boulder Dam Bill

BY A VOTE of seventeen to four, the House military affairs committee on Wednesday, March 28, ordered a favorable report on a bill for government operation of Muscle Shoals which is so closely in agreement with the principle of the Norris resolution, already adopted by the Senate, that, if it is passed by the House, there is little doubt that differences between the two measures can be ironed out easily, thus assuring legislation at this session. The House committee bill, fathered by Representative Morin, the chairman, sets up a government corporation to be administered by a bipartisan commission of five members appointed by the President to operate Muscle Shoals, producing fertilizer and selling surplus power, instead of leaving operations to the Secretaries of War and Agriculture, as the Norris bill did. This is the principal difference. The government corporation to be set up will be capitalized at $10,000,000. Fertilizer manufactured is to be distributed equally among the states, territories and possessions.

Indications point clearly to passage of the committee bill by the House. The same influences which actuated the Senate majority in adopting the Norris resolution are being felt in the House—the promise of cheaper fertilizer for the farmers in an election year, the fact that no private offer for Muscle Shoals remains before Congress and utter weariness with the entire subject. These are sufficient, it is confidently believed, to overcome any opposition to government operation as a principle. Furthermore it is believed President Coolidge will sign a government operation bill to dispose of Muscle Shoals if one is presented to him.

The bill reported out by the House committee Wednesday was to be formally reported to the House before the end of the week. With that accomplished, the chairman had been instructed to inform the rules committee that a rule to give the bill privileged status for action is sought. If this is granted, as is held certain, the bill probably will be voted upon in the House within the next four weeks.

Before voting upon the government operation bill, the House committee Wednesday took from the table for reconsideration the Madden bill embodying the bid of the American Cyanamid Company, which measure has been vigorously advocated by the American Farm Bureau Federation. A new recapture clause offered Monday in a letter to the committee was incorporated in the bill, but the measure, thus revised, was voted down by twelve to five, four members not voting. The Norris resolution was taken from the table and the committee bill was substituted for everything after the enacting clause.

It has not been decided whether the minority in the committee will submit a dissenting report to the House advocating substitution of the Madden bill. Representative Hill of Alabama, who voted against the committee bill, expressed his conviction that the appropriation of $10,000,000 in wholly insufficient, that the bill does not mean cheap fertilizer for the farmers, and that far from taking the matter out of the hands of Congress and assuring continuous operations at Muscle Shoals, it means that Congress must be consulted virtually every year and asked for additional money, which may or may not be given.

### Leatherwood on Boulder Dam

An extensive minority report on the Boulder Dam bill has been submitted by Representative Leatherwood of Utah, who sums up his arguments as follows:

> It proposes a serious invasion of state sovereignty in turning the Colorado River over to the federal bureaucracy. It accomplishes nothing immediately but the assurance of prolonged litigation between the states and the federal government. It is not a flood control project but a power project, wherein flood control is delayed indefinitely and subordinated to power development. It creates and invites international complications with the Republic of Mexico. Congress is asked to authorize at once the risking of the taxpayers' funds in an engineering experiment in the face of warnings that the project has had insufficient engineering studies and should be reviewed by the country's ablest engineers. It inaugurates a new socialistic principle in government expenditure—that the government may enter business whenever there is a promise that by so doing it may make a government undertaking 'self-supporting and financially solvent.' In this instance all known facts point to almost certain loss on the government's venture into business. Aside from flood control, the needs upon which the project is supposed to be based—more water for irrigation and domestic use in California, a market eager for power, improvement of navigation—are largely non-existent or can be just as well served by any other dam on the Colorado River. I find that not a single one of the major representations as to the project is true; that it has been promoted by political methods and not on its merits.

The bill authorizing the Federal Power Commission to employ its own personnel was rejected in the House by the close vote of 179 to 168. It is known that the Senate committee favors the bill and that it has a chance to pass the Senate. An effort probably will be made to attach the measure to some other legislation, with the possibility that it may be brought before the House again this session for another vote. The principal argument advanced against the measure was that it would make possible the building up of a new bureau.

## New York-Paris Telephone Is Inaugurated

Transoceanic telephone communication between the United States and Europe was extended on Wednesday to France, conversation between New York and Paris being carried on with complete success. Sending and receiving circuits were connected with a loud speaker, and four hundred employees of the American Telephone & Telegraph Company in that company's assembly room heard the speeches made by President W. S. Gifford at the New York end and Maurice Bokanowski, French Minister of Commerce and Industry, at Paris.

## Rate-Base Pleas Delay Work, Says Bay State Board

Declaring that the contentions of many companies on behalf of the reproduction-cost rate base retard its work, the Massachusetts Department of Public Utilities submitted a report to the Legislature on March 21 replying to inquiries of the House as to the rate-regulating situation in the state and set forth that ample authority exists to enable the commission to regulate rates within the time available. Between April 26, 1926, and March 15 last the board has held 445 public hearings, made 563 orders and findings and four special reports.

In answer to an inquiry as to the advisability of establishing a zone system of rates in the territory of the Boston Edison Company, the commission stated that evidence taken by it in recent cases puts it in a position to bring about the establishment of such rates if it deems them just. The statute giving the board the right to initiate rate inquires has aided the commission's power of suggestion to companies whose rates appear to it to be open to reduction. The report points out that voluntary reductions have either been made by a number of leading companies or that cases are pending on the board's docket for their consideration.

## Aftermath of the Disaster at Los Angeles

*One of the Generators Left Standing on Site of Plant No. 2 May Be Salvaged—How the Edison Company's 220-Kv. Vincent Line Proved Its Worth*

INVESTIGATION into the condition of the two 17,500-kw. General Electric turbines which were the only parts of Los Angeles' municipal plant No. 2 left after the waters let loose by the failure of the St. Francis Dam had receded indicates that one of them will probably be salvaged but that the other is in very bad shape and the possibility of repair is doubtful. No plans for rebuilding plant No. 2 have yet been announced, and it is said that should work begin immediately, it would require at least a year to complete it. Engineering testimony so far elicited points to the unstable character of the rock forming the foundation of St. Francis Dam as the cause of the disaster.

Information which was received just too late for last week's news recounts that after the flood had left the mouth of San Francisquito Canyon, headed for the ocean, it crossed the two 220-kv. Big Creek lines of the Edison company. Nine towers were torn down in the west line. This line was repaired and in operation by 5 p.m. March 16, three days after the flood. The East Big Creek line, immediately adjacent to the west line, had three towers destroyed. This line was put back into operation March 19. The third, or Vincent, 220-kv. line was not affected. To provide for just such emergencies as existed during and after this flood this third line had been built by the Edison company over a new right-of-way entirely separate from the original two lines. When the original two lines went out the hydro load was immediately transferred to the Vincent line.

The Saugus switching station of the Southern California Edison Company at the mouth of San Francisquito Canyon was put out of commission temporarily. Service to Santa Barbara and Ventura Counties was interrupted when this switching station went off the line. The Edison company had 300 men on the ground before daybreak Tuesday morning, March 13, and had built a temporary line around the Saugus switching station to serve these two counties before business opened up in these communities.

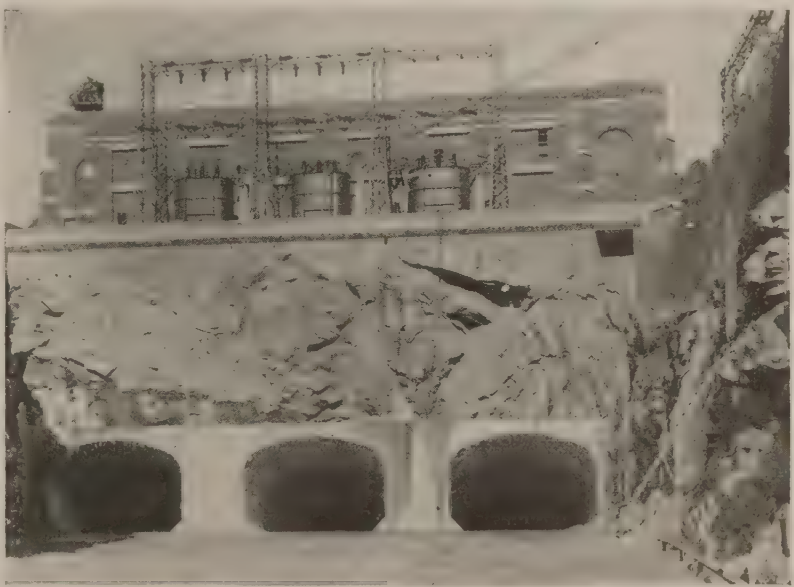
On a mesa immediately adjacent to the bed of the Santa Clara River, down which stream the floodwaters raged, the Edison company had a construction camp of 178 men. This camp was about 22 miles away from the St. Francis Dam. The floodwaters covered this tableland and destroyed the camp. Of the 178 men in the camp, 42 have been found dead and 42 were still missing when this account was prepared. Ninety-four escaped alive. C. W. English lost his life and B. D. Haugh suffered a broken leg and serious internal injuries when the airplane in which they were flying to reconnoiter the affected area crashed on a mountain peak in the vicinity of St. Francis Dam. These men were both connected with the operating department of the Edison company.

A resolution of the Board of Water and Power Commissioners of Los Angeles expressing its sympathy for the loss of life by employees of the Southern California Edison Company and expressing "appreciation and gratitude" to the company was made March 14. The Edison company's monetary loss will not exceed $100,000. That of city bureau property is now put at $5,000,000.

## Floods in Sacramento Valley Do No Serious Harm

Heavy seasonal rains in central and northern California lasting from March 22 to 26 brought flood conditions to many Sacramento Valley points and caused the Pacific Gas & Electric Company and the Great Western Power Company some inconvenience. All storage reservoirs are spilling heavily, but no damage of any consequence to structures other than canals and flumes has been reported. One small power plant belonging to the Pacific Gas & Electric Company had three feet of water over the power-house floor, but little damage was done to the generator and other equipment. Some of the reclaimed areas in the Sacramento Valley are flooded, but service interruptions of the two power companies have been local and only minor in character. Ability of the companies to maintain power service to drainage pumps was the means of saving crops on many thousands of acres of reclaimed land in valley regions.

## Bellows Falls (Vt.) Hydro Plant on Line



THE new 60,000-hp. hydro-electric station of the New England Power Association on the Connecticut River at Bellows Falls, Vt., was phased into the system on March 27. The development includes a generating plant with three 20,000-hp. vertical single-runner Francis-type waterwheels, each directly connected to a 17,000-kva., three-phase, 60-cycle generator. The project required raising the old dam and providing additional spillway and canal facilities, as well as the construction of a new power house. The dam is of the gravity-section concrete type, 620 ft. long, with two bays equipped with roller gates, each with a height of 18 ft. The canal is 1,700 ft. long. The operating head is 60 ft.

Energy is generated at 6,600 volts and stepped up to 66 kv. and 110 kv. for transmission. Connections operated at 44,000 volts feed north into New Hampshire and Vermont, connecting with the system of the Vermont Hydro-Electric Corporation at Charlestown, N. H. The 66-kv. substation ties south in Vermont to Putney and Vernon. From the 110-kv. substation a 60-mile, double-circuit steel-tower line on private right-of-way delivers energy to an important switching station at Pratt's Junction, Mass., from which point 66-kv. lines radiate to load centers in New Hampshire, Massachusetts and Rhode Island.

Work was begun in May, 1926, the New England Power Construction Company acting as engineer and the Sherman Power Construction Company, Worcester, Mass., as contractor.

# Purchases and Mergers

*Atlantic Public Utilities Changes Hands —New Insull Company Organized— Dothan, Ala., Will Sell Plant for $2,000,000—Many Small Transactions*

CHASE & GILBERT, Boston, have acquired the Atlantic Public Utilities from Charles W. Young & Sons of Boston and will manage these properties henceforth. Besides water companies, the group includes the Provincetown (Mass.) Light & Power Company, Indiana Light & Power Company, General Utilities Company, Ohio Northern Public Service Company, Shenandoah River Power Company, Brookville (Ind.) Electric Company and the Colby Light & Power Company of New Sweden, Me.

The Illinois Commerce Committee has before it the application of the Super-Power Company of Illinois to organize a fourteen-million-dollar electrical power corporation to function with Insull interests. The petition discloses plans to purchase the property of the Powerton Electric Generating Company, involving affiliation with the Commonwealth Edison, Illinois Power & Light, Public Service of Northern Illinois and Central Illinois Public Service companies.

Consolidation of nine public utility companies in Missouri, Kansas, Nebraska, Oklahoma and Alabama into the Central States Edison Company was announced on March 28. Electric light and power companies included are Gasconade Power Company, Hermann, Mo.; the North Kansas Power & Light Company, the Beatrice (Neb.) Power Company, the Gulf Utilities Company and the Foley (Ala.) Light & Power Company.

Dothan, Ala., whose municipal power system has had various vicissitudes, voted recently by 1,174 to 671 to authorize the City Council to sell the municipal electric and water properties for $2,000,000. No offers were pending. The Alabama Power Company was not a bidder at that price. In June of last year the city voted by 710 to 672 against selling the electric plant to the Gulf Electric Company, a subsidiary of the Alabama Power.

Barton, Vt., has agreed to purchase the one-man power plant owned and operated in that town for 20 years by Dr. E. M. Nichols for $117,000. The Public Utilities Corporation had offered a better price for the plant without success. Voters decided to operate it as a municipal property and will issue bonds to cover the purchase price. Dr. Nichols bought the property in 1908, when it had 30 customers, for $2,800. It now has 103 miles of transmission lines.

A certificate has been filed at Albany under which the New York State Electric Corporation merges the Georgetown Electric Lighting Company.

According to Fred L. Santway of Theresa, N. Y., president of the Hydro-Electric Power Company, approximately $75,000 will be spent there this summer in development work to combine the Hydro-Electric, the Snell and the Makepeace Power companies, which will then be sold to the St. Lawrence Utilities Company.

Alleged attempts by undetermined interests to obtain options on the property of twelve independent electric utilities on the Eastern Shore of Maryland, with the promise of lower rates through the transmission of energy from the Conowingo Dam, are being investigated by the Public Service Commission of Maryland. The communities concerned are Cecilton, Millington, Betterton, Chestertown, Church Hill, Centerville, Queenstown, Easton, Oxford, Trappe, St. Michaels and Claiborne.

The Southern Ohio Electric Company of Athens, Ohio, has petitioned the Public Utilities Commission for permission to buy the Hocking Power Company of Nelsonville for $530,826 and the Mutual Electric Company of Pomeroy for $65,455.

By a special election in Emmetsburg, Iowa, the Municipal Utilities Company of Des Moines has been authorized, by a vote of 941 to 366, to install and operate an electric plant to cost $147,000. The Des Moines concern, which is in effect a financing corporation, agrees to turn the plant over to the municipality when earnings have paid for the original cost and maintenance. The Iowa Public Service Company unsuccessfully sought a franchise in Emmetsburg.

The citizens at Ashby, Minn., cast an almost unanimous vote in favor of selling the Ashby lighting plant to the Otter Tail Power Company.

The Central Public Service Corporation has bought the electric distribution system of the Worcester Lumber Company at Chassell, Mich. This purchase is for the Houghton County Electric Light Company.

Purchase by the Dakota Public Service Company from the Northern Utilities Corporation of the electric property at Cleveland, N. D., has been approved, as has the purchase by M. A. Erickson of Rugby of electric properties at Souris and Westhope from Victor Frykman and the Condit & Son Electric Company respectively.

The village of Lushton has sold its distribution system to the Iowa-Nebraska Light & Power Company, from which it has been buying wholesale. The company will reduce lighting rates and offer a new service for range and refrigeration.

Approval of the Kansas Public Service Commission has been granted for the sale of the municipal electric light and power plant at Coldwater to the Western Light & Power Corporation, Salina. Sale of the Natoma (Kan.) municipal distribution system to the Kansas Power Company, Topeka, has been agreed upon by the City Council. The city will retain title to the power-house property. Negotiations have been completed for the sale to the Kansas Utilities Company, Fort Scott, of the municipal plant and distribution system of Toronto, Kan. Buildings are not included.

Citizens of Atwood, Kan., have voted to sell to the Central Kansas Power Company, with headquarters at Hays, the city's electric plant and distribution system.

The electric plants at West Union and Salem, West Va., have been sold by the Mountain State Utilities Corporation to the Monongahela-West Penn Public Service Company of Fairmont.

Rio Grande City, Falfurrias, La Pryor, Palacios, Waelder and Flatonia are listed by the Central Power & Light Company as the Texas towns where existing properties were acquired by it in 1927.

The electric light and other utilities at Caddo, Tex., have been sold to S. R. Morgan of Little Rock, Ark., for $75,000.

Option on the sale of the Kellogg (Idaho) Power & Water Company for $250,000 to an unnamed Eastern syndicate was announced by President J. S. Ramage at Spokane, Wash., recently. A distribution system at Kellogg, in the Idaho Panhandle mining district, and a small generating station are involved.

A holding company to be known as the Stevens County Public Service Corporation is being organized at Spokane, Wash., to hold the common stock of the Stevens County Power & Light Company, A. H. Sperry, president of both, announces.

Sale of the Capitola Company, supplying energy to Capitola, Calif., to the Public Utilities California Corporation, a W. B. Foshay company, has been sanctioned by the California Railroad Commission.

Application has been made to the California Railroad Commission by the Pacific Gas & Electric Company for permission to merge the properties of the El Dorado Power Company, the Western States Gas & Electric Company and the Coast Valleys Gas & Electric Company with its system and for the acquired utilities to abandon public utility service. Control of these companies was purchased from the Byllesby interests by Pacific Gas in May, 1927.

Fifteen Pennsylvania power companies, all owned by the Potomac Edison Company, with headquarters at Hagerstown, Md., have been consolidated. The new company, which includes the Waynesboro Electric Company and fourteen township companies in Franklin, Fulton, Adams and Bedford Counties, will be known as the South Pennsylvania Power Company and will continue to be controlled by the Potomac Edison.

## Great Western Is to Purchase Feather River Company

The Great Western Power Company of California has applied to the Railroad Commission for authority to take over control of the Feather River Power Company, whose Bucks Creek plant on the Feather River is scheduled for completion by July 1. The application provides that a controlling stock interest in the Feather River Power Company is to be purchased by the Western Power Corporation of New York but shall be conveyed at the original purchase price to the Great Western Power Company of California on or before the expiration of two years.

The properties of the Feather River Power Company are valued at approximately $9,000,000 and consist of the Bucks Creek hydro-electric development with a 55,000-hp. plant which will utilize water from a 110,000-acre-ft. storage reservoir under a head of 2,561 ft. At the time the Bucks Creek development was started the Great Western Power Company contracted to purchase the entire output of the plant for a period of 35 years, at the expiration of which period the plant was to become the property of the Great Western.

## Connecticut Light & Power Adds to Hartford Office

Effective tomorrow, April 1, the engineering, merchandise sales and advertising staffs of the Connecticut Light & Power Company, as differentiated from the company's operating organizations, will move from Waterbury to 36 Pearl Street, Hartford, which has for some time been the headquarters of the president, treasurer and general financial interests of this utility and the Connecticut Electric Service Company.

## Rocky Mountain Men Sponsor Underground-Stream Survey

With a view to enhancing the value of agricultural resources and at the same time developing a substantial power load, the electric utility companies of Colorado, New Mexico and Wyoming will undertake a survey of the underground streams in their territory. This ambitious movement was launched at a joint conference of the Colorado Utilities Association and the Rocky Mountain Division of the National Electric Light Association held at Colorado Springs on March 19 and 20. While the public utilities are sponsoring the project and will largely direct it, the actual work of making the survey will be undertaken by the Colorado State Agricultural College under the supervision of President Charles A. Lory. The utility men of the Rocky Mountain States believe that this project will give a great impetus to rural-line extension and development and create heavy pumping load in at least a dozen localities.

Utility men from half a dozen Western states attended the meeting, and every phase of their industries received attention. Meetings were conducted by various chairmen, who used questionnaires, to which those in attendance responded with expressions of their views and experiences. Engineering commercial surveys, the value of national association committee research, local committee work, the tendency away from hydro-electric to steam-electric generating, overhead systems, inductive co-ordination, meters, underground systems, high-pressure turbines and the use of powdered-coal fuel were the engineering topics. V. L. Board, Public Service Company of Colorado, led the discussion of public relations, followed by H. S. Sands, who spoke on co-operation with educational institutions, and George H. Shaw. Meetings of the Commercial and Accounting Sections were also held, under G. B. Buck and Harry Adler, respective chairmen.

## Minnesota Governor Opposes Backus Plans for Border

Governor Theodore Christianson of Minnesota has joined in the opposition to the construction of a series of dams on the Minnesota-Ontario border as proposed by E. W. Backus of the Backus-Brooks Company, Minneapolis. The Governor, in a letter to the secretary of the state Izaak Walton league, declares: "I do not favor the exploitation of publicly owned water and lands of this region for hydro-electric purposes by any private interests."

A state survey of Minnesota's power potentialities on the basis of which legislation fully protecting the public's rights should be drawn is advocated by State Auditor Ray P. Chase. With engineering facts as a basis, the state should then set about to determine what waters could be best utilized for industrial or power purposes and which should be retained in their primeval conditions for recreational purposes, he said, adding:

"It has been the history of Minnesota that in some instances applications for authority to construct dams have not been filed until after the dams were constructed and the power plants in operation. Of what avail is it to talk of public rights after those rights are gone? The Federal Power Commission requires that any applicant company comply with all of the state's laws before an application is granted. The commission declares that it does not claim and never has claimed authority to dispose of the use and ownership of public waters, but thus far it has been unable to find any statute of Minnesota requiring the consent of the state as a condition precedent to the construction of dams impounding the waters of the streams of this state."

## Maryland Utility Men Meet in Baltimore

In addressing the members of the Maryland Utilities Association at the sixth annual convention, held in Baltimore, March 23, and referring to the federal investigation, Governor Albert C. Ritchie of Maryland stated that he perceived no indication that the utilities of the country were trying to take advantage of the public. Public ownership of the securities of these companies, and hence of the companies, was, he said, the greatest safeguard of the public interests. The relation between the utilities that want to serve and those whom they desire to serve was seen by the Governor as constantly improving.

The electric light and power, gas, water and transportation groups met separately in the morning session and jointly in the afternoon. Following the committee reports on meters and rural development, Earl Whitehorne, commercial editor of the ELECTRICAL WORLD, outlined the economic and promotional factors involved in the present inadequate development of the national domestic consumption of electrical energy. L. S. Storrs, managing director American Electric Railway Association; Major Alexander Forward, managing director American Gas Association, and Major H. S. Bennion, director of engineering, National Electric Light Association, referred to some of the problems confronting their respective industries. Major Bennion stressed the fallacies entertained by those uninformed on interconnection, with particular reference to the economic inadvisability of power transmission over great distances, and gave figures showing the limited amount of power involved in interstate transmission.

President H. B. Potter presided. The officers elected for the coming year are: President, H. T. Connolly, Washington, Baltimore & Annapolis Electric Railroad Company; vice-president, H. A. Brooks, Potomac Electric Power Company; treasurer, R. E. Towne, Potomac Edison Company; secretary, David Kinneau, United Railways & Electric Company.

## Ontario Premier Tells of the Hydro's Problems

In a discussion on hydro-electric estimates in the Ontario Legislature recently Premier Ferguson forecast the complete utilization of Ontario's water-power resources within a few years. Even allowing for a possible increase of 500,000 hp. on the Ottawa River should the questions now before the Supreme Court be decided in favor of the province, a possible 1,000,000 hp. from the St. Lawrence development and a possible 500,000 hp. from additional diversions at Niagara Falls which might be arranged by international treaty, the Premier thought that, with the power consumption of the province increasing each year by 100,000 hp., it would not be long until all available power would be utilized. "There is delay over which we have no control in connection with the St. Lawrence development," said the Premier. "It is now four years since we filed at Ottawa our plans for power development." He had asked Premier King for the report made to the Ottawa government by the National Advisory Council, but, as the matter had an international aspect, Mr. King had declined to make the report public.

Experiments were being made, according to Mr. Ferguson, with what he called a "booster system." Should these work out successfully, the Hydro system might, the Premier thought, be able to transport power with comparatively small loss from sources in northern Ontario which are wholly within the control of the province. Otherwise it would have to depend on the boundary sources owned jointly with Quebec or with the United States.

A vote of $1,250,000 for transmission and distribution lines on the Ottawa system was passed, as was one of $350,000 for transformer stations. A great increase in the load being carried on the Georgian Bay system, particularly between Waubaushene and Midland, and 62 miles of rural extension on that system accounted for a vote of $75,000 for that district. Approximately one million dollars will be spent on the Niagara system this year.

## Ontario Hydro Statistics Put Before Legislature

Provincial Treasurer J. D. Monteith told the Ontario Legislature the other day that the total horsepower in use by the Ontario Hydro-Electric Power Commission was now 1,600,000, with another million available. The Hydro paid into the treasury in 1927 for interest $7,848,043, Mr. Monteith said. The commission fulfilled its undertaking in regard to debt retirement, making a payment of $1,338,567, which represented its share of the $3,000,000 required on this account. "The finances of the Hydro are today in a very strong position," the Minister declared. "It has met all its obligations and even widened its usefulness by annual expansion."

The total available undeveloped power

in the province was estimated at 5,000,000 hp. The number of miles of transmission lines is 7,066. In 1927 807 miles of rural transmission lines were constructed, and the government contributed $1,100,000 in rural bonuses on this account. The entire debt of the province at the end of the fiscal year 1927 was $147,485,906, and the number of homes served by the Hydro-Electric Power Commission was 420,000.

## Work for Utilities by Commission Men Criticised

Governor F. R. Zimmerman of Wisconsin has sent a letter to the Wisconsin Railroad Commission condemning the practice of permitting employees of that body to work for public utility companies. He even suggests that all commission employees be requested to sign contracts that they will not upon leaving the commission enter public utility employment for a period of one year. The Governor's letter was prompted by a report made to the Legislature by the Railroad Commission in which the latter listed a large number of employees who were doing outside work for the public utilities and also listed a number of commission employees who later were permanently employed by public utility companies.

## Peek Tells of His Researches Into Lightning Phenomena

Tests with artificial lightning on small models in the Pittsfield, (Mass.) laboratory of the General Electric Company reveal that there is always a protected cone about a tall building or lightning rod, F. W. Peek, Jr., consulting engineer of the company in charge of high-voltage investigations, declared at New York on March 22 in a talk before members of the American Institute of Electrical Engineers. The radius of this protected area extends from the base of the building a distance of two to four times the height of the building, depending upon the altitude of the storm cloud. The chance of another building in this protected area being struck depends upon whether or not it extends above an imaginary line drawn from the top of the taller building to the edge of the protected area, Mr. Peek said. How these laboratory experiments were borne out in a natural electrical storm over New York last August when the New York World building was struck was described.

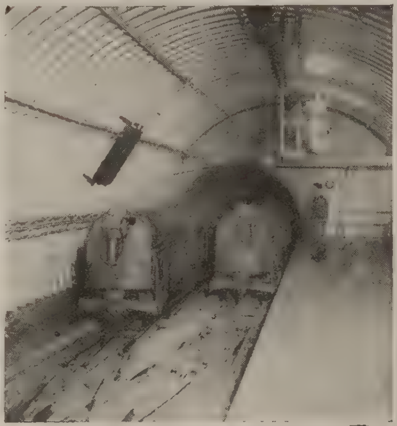
These laboratory experiments have progressed so successfully, according to Mr. Peek, that the protected-area plan has already been adopted in the safeguarding of oil-storage tanks in southern California. Several tall rods, placed near the outside of the big oil reservoirs, provide overlapping protected areas and thus greatly reduce the hazard of conflagrations from lightning flashes.

Another point touched on by Mr. Peek was that a cathode-ray oscillograph had been constructed in the laboratory by which lightning has been made to "write its autobiography" with a pencil of electrons on a photographic film. The lightning flash not only records itself but sets the device in operation, causing it to work automatically and at the correct time, although the flash may last but a few millionths of a second.

## Briefer News

**New High-Tension Line Under Way for Washington Water Power Company.**—A 110-kv., 40-mile transmission line is being built by the Washington Water Power Company from its Long Lake power station to the East Side substation at Spokane. The line is of two-pole construction and will give increased capacity from the power station to Spokane and the Cœur d'Alene mining district of northern Idaho.

**London Has Miniature Mail-Tube Railway.**—In a tube railway recently built by the General Post Office of London, England, trains carrying mail run without a driver between Mount Pleasant, Whitechapel and Paddington at the rate of 35 miles an hour. The trains are operated by electricity from a control room in the Post Office. It is the first tube system of its kind.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**Highway Authorities and Transmission Lines.**—The right of highway authorities to supervise construction of power transmission lines on public roads is at issue in Iowa, where a permanent injunction has been obtained in Kossuth County to prevent the Central States Electric Company from erecting a line not in accordance with specifications made by the county engineer. Similar suits are pending in Pocahontas and Greene Counties.

**Chats Falls (Quebec) Hydro Plant to Start with 30,000 Hp.**—Plans have been announced for the development of the Quebec side of Chats Falls, on the Ottawa River, one of the few remaining major power sites in the Ottawa district. Plans of the Chats Falls Power Company, as filed with the Quebec government, call for an initial development of 30,000 hp. in two 15,000-hp. units. The site has a potential development of about 90,000 hp. It is also probable that High Falls, on the Lievre River, also in the Ottawa district, will be developed in the near future. The power rights at this site are owned by the Maclaren Lumber Company of Buckingham, Quebec.

**Oklahoma Gas & Electric Company Dedicates New Office Building.**—On Saturday, March 24, the new office building of the Oklahoma Gas & Electric Company at Oklahoma City was thrown open to inspection by the public, who thronged its offices, salesrooms and auditorium. The building, at Main and Harvey Streets, is of steel and stone and rises six stories. It is so designed that an additional six stories can be added in accordance with the architect's plan illustrated in the Electrical World for March 19, 1927 (page 623.)

**Electricity Brings Prosperity to North Carolina Mines.**—Completion by the Carolina Power & Light Company of a 47-mile, 60,000-volt transmission line from Asheville to Spruce Pine, N. C., at a cost put at more than half a million dollars, has, local reports say, brought a boom to the mining community reached, which had previously only about 75 kw. connected. In three months many mining industries have doubled their capacity and new industries have gone in.

**American Committee for Tokyo Conference Organized.**—Engineering leaders from many parts of the United States met at Washington on March 22 and formulated preliminary plans for participation in the World Engineering Congress which will be held next year in Tokyo. Officers elected for the American committee were: Honorary chairman, Herbert Hoover; chairman, Elmer A. Sperry; vice-chairman and chairman of the executive committee, John W. Lieb; vice-chairmen, C. E. Grunsky and C. E. Kettering; executive secretary, Maurice Holland. The Japanese Ambassador, Tsuneo Matsudarja, and Dr. Sperry addressed the engineers at a dinner following the meeting.

**Miller Rubber Company at Akron Now Completely Electrified.**—Installation of a new cooling plant for the Miller Rubber Company, Akron, Ohio, has been carried out by the Northern Ohio Power & Light Company. In addition, the company's engineers have supervised the entire electrification of the Miller factories, which cover 35 acres of ground. A substation of six 2,000-kw. transformers, with necessary switching equipment, has been erected and two 750-kw. synchronous motor-generator sets have been installed. An outdoor switching and transformer substation receives 22,000-volt, three-phase, 60-cycle power from the utility company, which is stepped down to 2,200 volts. The Miller plant now consumes electrical energy at the estimated rate of approximately 32,190,000 kw.-hr. annually.

Transmission Line Will Cross Big Muddy in Single Span.—The Central Illinois Public Service Company's 33,000-volt transmission line has been completed from the West Frankfort substation to Royalton, as far west as Freeman Junction, and from Royalton to the edge of Big Muddy River. The Big Muddy will be crossed at this point by a 1,015-ft. span. The 11,000-volt transmission line to Louisville has been completed, as has also the Teutopolis-Montrose 11,000-volt line.

Northwest Accounting Section Meets at Portland.—Committee reports, a thought-provoking discussion of published financial statements and the presentation by L. J. Pierce of a different conception of public relations and the accountant's responsibility therein than has prevailed were the principal features of the meeting of the Accounting Section, Northwest Electric Light and Power Association, at Portland, Ore., on March 12. F. W. Brownell, chairman of the section, outlined a broadened scope of activity.

Michigan Companies Establish Farm Electrification Research Fellowship. — Substantial recognition of the progress that Michigan State College is making in adapting electric power to the work of farms in the state has come in the form of an offer from the Detroit Edison Company and the Consumers Power Company of a fund for the establishment of a farm electrification research fellowship. With this offer came the tender of a second fund for the equipping and operating of a farm electrification demonstration truck to be sent out through the state this coming summer and fall under the direction of the Michigan State College. The fellowship fund is to be $2,000 a year for two years while the truck demonstration fund is $2,500. The fellowship will be awarded to a graduate engineer —preferably to an agricultural engineer.

Ultimate Production of 170,000 Hp. on Roanoke River Prophesied.—Ultimate development on the Roanoke River in Virginia of approximately 170,000 hp. is a prophecy based on the announcement that the Roanoke River Power Company of Richmond has applied to the Federal Power Commission for permission to construct a dam and power station on the Roanoke that will develop 70,200 hp., with transmission lines tied in with those of the Appalachian Power Company. The proposed power plant, at Buggs Island, is a few miles above the upper power site owned by the Virginia Electric & Power Company. The latter owns four power sites on the Roanoke, only one of which, at Roanoke Rapids, N. C., is developed. The three others are below the site of the Roanoke River Power Company's proposed plant, and it is thought that at least one of them may be developed by the Virginia Electric in the next two or three years. The Roanoke Rapids plant furnishes about 8,000 hp., and the three undeveloped sites are thought to be capable of producing 30,000 hp. each. Thus when all the Virginia Electric & Power Company's sites are developed that company will have available from the river nearly 100,000 hp., which, added to the Roanoke company's 70,000 hp., gives the top figure hoped for.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

Southwestern Division, N. E. L. A.—Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. A. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Institute of Electrical Engineers — Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Arizona Utilities Association—Prescott, Ariz., April 26-28.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

Eastern Association of Electrical Inspectors Has New Officers.—A recent election by ballot for officers of the Eastern Association of Electrical Inspectors resulted as follows: President, C. S. Cahaskie, New York; first vice-president, W. C. Field, Springfield, Mass.; second vice-president, J. P. Rohan, Hartford, Conn.; third vice-president, R. M. Nesbitt, Philadelphia; treasurer, A. W. Hopkins, Springfield. The new secretary is R. Walker, 16 Court Street, Brooklyn. The association voted by a large majority to unite in the formation of an international association.

Montana Power Company's New Dams.—Completion of the dam and power plant of the Montana Power Company at Black Eagle Falls of the Missouri River is noted in the company's just issued 1927 report. The cost was $1,680,000, 10 per cent under the estimate. This plant utilizes to its full capacity under existing circumstances the first of the series of three falls of the Missouri River near the city of Great Falls and is the company's sixth development on the Missouri. The dam at the outlet of Mystic Lake was also completed, raising the level of the lake 20 ft., increasing the storage and permitting the use of the generating facilities there at full capacity during a longer period of each year.

Arkansas Power & Light Completes Maguire Substation. — The Cullendale substation of the Arkansas Power & Light Company, recently completed at a cost of a half million dollars, has been named Maguire substation as a tribute to the late W. C. Maguire, who was a member of the Arkansas Power & Light Company organization for many years. It is situated 3 miles south of Camden and contains four 1,667-kva. transformers, stepping down the voltage from 110,000 to 33,000. The station is operated by remote control. With the transmission lines from the Louisiana line and the rebuilding of the 66,000-volt line from Pine Bluff to carry 110,000 volts, an investment by the utility company of about $750,000 is represented.

Hearing Given on Cooper's Clark's Fork Hydro Plans.—Application for the development of 265,600 hp. at "Z" canyon, on the Clark's Fork branch of the Columbia River in northeastern Washington, has been heard at Newport, Wash., by Major John S. Butler of Seattle, representing the Federal Power Commission. The cost is estimated at $17,600,000. No conflict arose in the testimony of county officials, the Columbia Basin project officials and local residents. The Pend Oreille Lead & Zinc Company, however, claimed prior right in behalf of its proposed development of a site at Metaline Falls, just above the "Z" canyon site. The mining company's site would be flooded by Cooper's development. (See ELECTRICAL WORLD, March 3, page 474.)

GREAT NORTHERN POWER COMPANY WILL START FIRST UNIT IN APRIL.—The project of the Great Northern Power Company, which hopes ultimately to develop 160,000 hp. on streams in Snohomish County, Wash., and wants to serve the city of Seattle until the Skagit plant is able to carry all the load, is going ahead, according to the president of the company, J. E. Wickstrom. A 1,200-hp. unit at Gold Bar is to go into service in April, with 40 per cent of the output already contracted for. A primary rate of 2 cents for the first 5,000 kw.-hr., with a large-power rate of $22 a horsepower, is predicted when the new development gets under way. The company will go into new territory, Mr. Wickstrom says, and not compete either with the city of Seattle or the Puget Sound Power & Light Company.

SASKATCHEWAN GOVERNMENT AIMS AT PUBLIC OWNERSHIP.—Through legislation to be introduced at the present session of the Provincial Legislature the Saskatchewan government will seek authority to construct and operate central electric power plants, erect high-tension transmission lines and transformers, expropriate existing power plants and transmission lines and other equipment at its replacement value and sell energy, electrical appliances and equipment to urban and rural dwellers. George Spence, Minister of Railways, Labor and Industries, made this announcement, which met with general support in the Legislature. In the meantime the Montreal Engineering Company is going ahead with the construction of more than 300 miles of transmission lines in the province this year. In the neighboring Province of Alberta another 500 miles of line will be built.

NEW ST. LOUIS STREET-LIGHTING CONTRACT GOES TO WESTINGHOUSE.—A contract amounting to $2,250,000, said to be the largest single award ever made for a street-lighting improvement, has been made with the Westinghouse Manufacturing & Electric Company by the city of St. Louis. The contract is the fourth to be awarded in connection with the city's eight-million-dollar street-lighting project, and the area to be lighted includes the downtown district as well as a number of thoroughfares intersecting the city. The Westinghouse company will furnish the equipment, which will include 4,500 hollow-spun granite standards of special design with a height on the major thoroughfares of 24 ft. and supporting twin lighting units. Single-light standards having a height of 18 ft. or of 13 ft. will be installed on the streets which carry lighter traffic. The installation must be completed on Dec. 8.

# Commission Rulings

CONDITIONS MODIFYING OBLIGATION OF COMPANY TO EXTEND SERVICE.—Setting up two principles—first, that an electric utility should extend its lines to render service within the territory which the company undertakes to serve if the extension can be made without placing any undue burden on the company's other patrons; second, that it should not be required to make a comparatively large investment necessary for service to a group of new patrons without some assurance of reasonably adequate revenue for a definite length of time—the Maine Public Utilities Commission ordered the Central Maine Power Company to extend a 2,300-volt line about 6 miles to serve complainants living in a fairly prosperous and well-settled community within the company's territory, on condition that an adequate gross annual revenue fixed by the commission be guaranteed for five years. Subject to the payment of this guaranty, rates were to be in accordance with the company's published schedule.

PRINCIPLES GOVERNING APPROVAL OF CONSOLIDATIONS.—In granting authority to the Central Maine Power Company to absorb the Bethel Light Company, the Black Stream Electric Company, the Fryeburg Electric Light Company and the Western Maine Power Company, the Maine Public Utilities Commission reiterated a former statement of the considerations which govern it in passing upon such applications. These are: (1) the legal right of the purchaser of the new corporation or utility to acquire and hold the property affected by the consolidation; (2) the probable effect of the consolidation with reference to service in the territory affected; (3) the probable consequences of the sale, so far as the interest of the public is concerned with reference to rates, and any other particulars by which the public might be affected, including: (a) petitioner's capacity to serve its present territory, (b) to meet its obligations to present security holders, (c) improvement of service, diminution of cost of management and operation.

COOKING RATE MUST NOT BE EXTENDED TO OTHER USES BY MEANS OF RANGE OUTLETS.—The North Dakota Board of Railroad Commissioners has ordered discontinued the practice of the Otter Tail Power Company at Devil's Lake of offering a special rate for stoves having outlets for other electric appliances such as flatirons and washing machines, thus obtaining the low cooking rate for energy used by these. The decision resulted from the protest of a steam laundry and other consumers that they were paying far more for power than domestic consumers paid for electricity for cooking and other uses. The cooking rate was shown to be 4 cents per kilowatt-hour, while the power rate paid by the protestants began at 7.77 cents, grading downward. A low rate for cooking to develop business was held by the commission to be a sound practice. It was further held, however, that "the consumers of Devil's Lake and other cities who have purchased and operate electric ranges upon representations by the utilities that they could attach all appliances and obtain preferential rates have been made parties to a practice which we believe results in discrimination." The commission added: "We respectfully direct the attention of the electric utilities to this recommendation and request their earnest consideration with a view to voluntarily taking action. Should the desired result remain unaccomplished, we shall have no alternative but to investigate upon our own motion." A solution suggested by the board but not incorporated in its order was that three separate rates be substituted for the cooking rate now in use. The first would be the present cooking rate and would apply to stoves having no outlets to which appliances could be attached; the second would be a rate for electric stoves with such outlets and would cover energy used for such appliances as well as for cooking; the third would be a combination lighting and cooking rate and would apply to all energy used in the household. It was specified that the rate for the second class of service should compare favorably with the power rate.

# Recent Court Decisions

POLICE POWER OF STATE UPHELD IN OKLAHOMA.—The Oklahoma Supreme Court, in Galbreath vs. Oklahoma Natural Gas Company, has sustained the power of the commission to modify as to rates the terms of a contract or franchise made by a municipality with a public utility. The suit was filed originally on behalf of the city of Tulsa and various citizens, but the city and all except three of the individual complainants withdrew. The plaintiffs sought recovery of large sums of money which it was alleged had been collected from Tulsa citizens in violation of the contract with the company after the commission had authorized an increase in the rate. The Supreme Court, quoting the state constitution, said: "The Corporation Commission has power to regulate the charges for public services by municipal corporations. Such power is inherent in the state and is a necessary attribute of sovereignty."

INSTRUCTION IN DAMAGE SUIT REQUIRING PLAINTIFF TO PROVE ABSENCE OF CONTRIBUTORY NEGLIGENCE HELD ERROR.—Declaring that in federal courts the burden of proving contributory negligence is on defendant, whether or not the trial is held in a state holding that the burden is on plaintiff, and that an instruction in the trial court requiring plaintiff to prove the absence of such negligence by the preponderance of evidence was erroneous, the United States Circuit Court of Appeals in West Virginia reversed a verdict for the defendant in Dunagan vs. Appalachian Power Company, a suit asking damages for the death of a man who had charge of an electric fan in a stable and endeavored to stop a leakage of electricity by pulling a switch on a pole outdoors. Evidence showing that after the accident the company grounded a fence which was supposed to have produced a short circuit through the victim's body was properly excluded, the federal court held; but an instruction to the effect that the defendant was not negligent if the lines were properly constructed and equipped was erroneous in ignoring the duty of inspection. (23 F. [2d] 395.)*

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *G. C. Ward Named Executive Vice-President*

George C. Ward, vice-president in charge of engineering and construction for the Southern California Edison Company, was made executive vice-president at the recent annual meeting of the board of directors. Though born and educated in the East, Mr. Ward's chief engineering achievements have been tied in with the development of the great hydro-electric potentialities of California, his adopted state. Since 1912, when the Big Creek-San Joaquin River project of the Southern California Edison Company was first conceived, he has been actively interested in the work and his guiding hand has been apparent from the very beginning. His outstanding accomplishment in connection with this enormous task was the successful completion of the 13-mile Florence Lake tunnel through the solid granite of the Sierras. In recognition of his endeavors he was presented with a bronze medallion by the United States Chamber of Commerce in December, 1925.

*G. C. Ward*

Mr. Ward was born in White Plains, N. Y., and after being graduated from Phillips Andover Academy he engaged in railroad location and survey work for the Raquette Lake Railroad in New York State. Until 1906 he was continuously connected with railroad and bridge building and it was during this period that he became associated with Collis P. Huntington and Henry E. Huntington. It was at the instigation of Henry E. that he transferred his interests to California. When the Pacific Light & Power Corporation, of which he was vice-president, was consolidated with the Southern California Edison Company Mr. Ward became vice-president.

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Selby Summers has resigned his position with the distribution engineering department of the Utica (N. Y.) Gas & Electric Company to enter the engineering department of the New York Power & Light Corporation at Schenectady.

Samuel Insull, Jr., has been elected a director of the Commonwealth Edison Company, Chicago, to fill the vacancy caused by the recent death of Watson F. Blair.

T. S. Sloan, formerly connected with the Central Georgia Power Company, Macon, has resigned to become division manager of the Georgia Power Company at Rome.

Hon. Mayland Morse, formerly Assistant Attorney-General of New Hampshire, has been appointed a member of the Public Service Commission of that state.

Owen D. Young, chairman of the board of directors of the General Electric Company, sailed for Europe March 24 abroad the French liner *Paris* for his annual pleasure trip abroad. Most of his visit will be spent in England.

Lawrence Palk, formerly assistant to the president and secretary of the Winnipeg Electric Company, Winnipeg, Man., has been appointed assistant general manager in charge of executive matters. Mr. Palk will continue in the capacity of secretary.

Herbert Southworth has been appointed superintendent of the Bristol County (R. I.) Gas & Electric Company, succeeding Abel Reynolds, who recently became general manager and treasurer of the New England Water, Light & Power Associates. Mr. Southworth was formerly employed by the New England Telephone & Telegraph Company at Providence, and since 1923 has been an engineer in the power sales department of the Narragansett Electric Lighting Company of that city.

Prof. H. B. Walker, head of the department of agricultural engineering at Kansas State Agricultural College, Manhattan, and since 1910 a member of the faculty of that institution, has resigned to accept a similar position with the agricultural branch of the University of California at Davis. He will leave Kansas June 1. Professor Walker has taken a most active interest in the work of the Kansas Committee on Relation of Electricity to Agriculture since its formation, serving as secretary and treasurer from the time the committee was organized. With the establishment of the rural electrical laboratory, embracing nine electrified farms near Larned, Kan., Professor Walker was also made state supervisor of the committee. Active in many projects involving a mutuality of interest between power companies and agricultural leaders, Professor Walker has come to be well known to the public utility industry of the Middle West.

## *William Baurhyte Resigns*

William Baurhyte, president of the Los Angeles Gas & Electric Corporation for the past four years, has resigned, effective March 31. Mr. Baurhyte's retirement as chief executive of the Los Angeles utility brings to a close an association which covered a period of 25 years. Starting in the office of second vice-president, he retained that position until 1913, when he assumed the duties of vice-president. Mr. Baurhyte's valuable services won the recognition of the company's officials and in 1921 he was named vice-president and general manager. When the office of president became vacant through the retirement of W. B. Cline, in the spring of 1924, Mr. Baurhyte was the logical selection for a successor. Mr. Baurhyte was also a member of the board of directors. Addison B. Day, executive vice-president and general manager, has been named president.

*William Baurhyte*

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J. H. Henderson, who served as commerce counsel of the Iowa Railroad Commission from 1911 to 1927, when he was succeeded by Dwight N. Lewis, has been reappointed to that position. Mr. Lewis recently resigned.

Robert B. Grove, assistant secretary of the United Electric Light & Power Company, New York, since 1925, has been elected secretary to succeed the late William J. Meyers. Mr. Grove has been identified with the United organization since 1907 and has served successfully as draftsman, general assistant in the engineering department, assistant to the electrical engineer, assistant to the vice-president and general manager and assistant secretary. When he was made assistant secretary, in 1925, he retained his former title and duties as assistant to the vice-president and general manager, in which capacity he still serves. Mr. Grove has always been an ardent worker for the National Electric Light Association, at the present time being vice-chairman of the Accounting National Section, secretary of the lamp committee, assistant traffic manager and a member of the industrial relations committee.

Edgar L. Hartpence has been elected vice-president of the Acme Wire Company, New Haven, Conn., to succeed Leonard S. Taylor. Mr. Hartpence also succeeds Victor M. Tyler as general manager. Mr. Tyler, however, continues as president of the company.

George F. Mitchell, treasurer of the Midland Utilities Company, Chicago, since its formation, five years ago, was elected a vice-president at a meeting of the board of directors, and William A. Sauer, comptroller during that period, has also been elected to a vice-presidency. Both these new executives have also been elected to the board of directors.

E. Ogden Ketting, formerly assistant secretary of the Commonwealth Edison Company and for several years secretary to Samuel Insull, president, has left for England to become joint managing director of Insull, Son & Company, Ltd., of London. He has also been elected a vice-president of Insull, Son & Company, Inc., of Chicago and New York.

Kinsey M. Robinson, engineer for the Payette division of the Idaho Power Company, has been appointed manager of that division to succeed J. D. Orr, who has been transferred to the Twin Falls division. Mr. Robinson has been identified with the Idaho Power Company and its predecessor, the Idaho-Oregon Light & Power Company, since 1911.

L. B. Harvey has been elected president of the Porcelain Insulator Corporation, Lima, N. Y., succeeding his father, W. F. Harvey, whose death was announced in these columns several months ago. Mr. Harvey is a graduate of Georgetown University and since leaving college has spent the greater part of his time with the Porcelain Insulator Corporation in various capacities.

John L. Burns, formerly assistant to president of the United Gas Improvement Company, Philadelphia, has been promoted to the position of manager of the insurance and personnel department of the company. Mr. Burns became identified with the United Gas Improvement Company in 1926, when Arthur W. Thompson was named president of that utility. Previously he had been associated with Mr. Thompson for twenty years in public utility work.

C. H. Spiehler, mechanical engineer of the Columbia Engineering & Management Corporation for the past year and a half, is now in charge of the engineering staff for the electrical properties of that corporation with headquarters in Cincinnati. Following graduation from the Massachusetts Institute of Technology in 1908, Mr. Spiehler joined the Rochester Railway & Light Company in the capacity of heating engineer. Two years later he removed to Dayton, Ohio, where he became affiliated with the Dayton Power & Light Company, at first as heating engineer, subsequently as mechanical engineer and then as superintendent of power stations. He entered the employ of the Columbia Engineering & Management Corporation in August, 1926.

## *O. J. Shaw Resigns*

O. J. Shaw has resigned as vice-president of the Iowa-Nebraska Light & Power Company to devote his time to private interests. He is president of the Lincoln Oil Company and Lincoln Insulating Company. He will retain offices in the headquarters building at Lincoln and will remain in an advisory capacity with the company.

*O. J. Shaw*

Mr. Shaw has been connected with Lincoln public utilities for the past eighteen years, starting as head of the electric lighting department of the Lincoln Traction Company. Subsequently he became assistant secretary and later was placed in charge of the overhead distribution system, power plant operation and steam heating system. Then he was made secretary and in 1919 general manager, the position he occupied when the United Light & Power interests took over the property. Following the consolidation of the Lincoln Traction with the Lincoln Gas & Electric Mr. Shaw became general manager of the Lincoln Public Service Company, predecessor of the Iowa-Nebraska Light & Power Company. Previous to his experience in Lincoln Mr. Shaw was manager of plants at Aurora and Harvard. He graduated from the electrical engineering department of the University of Nebraska in 1907.

Edward L. Gay has been appointed manager of the Keene district of the Public Service Company of New Hampshire, succeeding the late Ralph D. Smith. Mr. Gay is a native of Keene and has been in the employ of the Keene district company most of his business life. He entered the service as a bookkeeper, in time becoming assistant treasurer, and later devoting his time to handling the securities of the Public Service Company in the Keene district.

## Obituary

James E. Johnson, president of the Canton Electric Light & Power Company, Canton, N. Y., died suddenly March 18 at his winter residence in St. Petersburg, Fla.

George L. Gibson, formerly purchasing agent of the Rutland (Vt.) Railway, Light & Power Company, Clyde River Power Company, Hortonia Power Company and Vermont Hydro-Electric Corporation, died at Rutland March 25 at the age of 54.

Wolcott Remington, vice-president and director of the Thomson Electric Welding Company, Lynn, Mass., died at Lynn March 20 following an illness of a week. He was a graduate of the Massachusetts Institute of Technology. Mr. Remington was cited by the British Government and given a medal of honor for his services in the World War in munitions production.

Gaetano Lanza, engineer, died at his home in Philadelphia March 21 in his 79th year. Dr. Lanza was for 40 years affiliated with the teaching staff of the Massachusetts Institute of Technology, in 1911 having become professor emeritus of mechanics. He was born in Boston and received his education in Virginia. Before his connection with the Massachusetts Institute of Technology Dr. Lanza was assistant instructor at the University of Virginia.

E. W. Cameron, electrical engineer of Buffalo, N. Y., died suddenly March 18 while on a visit to New York. Mr. Cameron was 55 years of age.

William F. M. Goss, formerly dean of the College of Engineering at the University of Illinois and president of the Railway Car Manufacturers' Association for ten years, died March 23 at the Waldorf-Astoria Hotel, New York. Dr. Goss is probably best known to the electrical industry for his work as a member and later as chief engineer of the Chicago Association of Commerce committee on smoke nuisance and the electrification of railroad terminals in Chicago. In the course of his academic career he organized the department of practical mechanics at Purdue University, with which institution he was connected for seventeen years, being dean of the engineering school for a large portion of that time. In 1907 he became dean of the College of Engineering of the University of Illinois, but ten years later he severed his connection with that faculty to take up the duties of president of the Railway Car Manufacturers' Association. Dr. Goss was quite active in association work, having been a president of the American Society of Mechanical Engineers, a fellow of the American Association for the Advancement of Science, a member of the Society for the Promotion of Engineering Education and of other engineering associations. He was a native of Massachusetts and a graduate of the Massachusetts Institute of Technology.

# Financial and Statistical News

### *Price Levels Unchanged Few Discount Bonds*

FEW changes of any importance took place in the prices of power and light common stocks during the week, market interest being centered, for the moment, in more speculative issues. Prices have been firm, however, with the trend upward.

Power and light company bonds have been firm with several price rises. A feature of these issues is the exceedingly large proportion of prices showing a premium. Discount bonds are becoming difficult to find.

### Engineers Public Service Leads New Issues

During the past week the Engineers Public Service Company issued 320,000 shares of $5 dividend convertible preferred stock at $100 per share to yield 5 per cent. Proceeds will be applied with other funds toward the retirement of the entire outstanding 311,662 shares of $7 dividend preferred stock at $110 per share and accrued dividends. This refinancing plan will effect a reduction in annual preferred dividend requirements of $581,634.

Gold debentures of the Iowa Public Service Company were offered at 95 and accrued interest, to yield about 5.30 per cent, a piece of financing involving a total of $1,500,000.

The United Public Utilities Company issued 35,000 shares of $6 dividend series preferred stock at $94.50 per share and accrued dividends, yielding about 6.35 per cent.

The North Continent Utilities Corporation made an offering of first lien and refunding gold bonds, series A, totaling $3,500,000, the price being 97 and interest, to yield about 5.75 per cent.

One foreign issue appeared during the week, the million-and-a-half-dollar loan floated by the Municipal Gas & Electric Corporation of Recklinghausen, Germany. The offering was in the form of first mortgage twenty-year sinking fund 7 per cent gold bonds.

DUQUESNE LIGHT STOCKHOLDERS APPROVE CHANGES IN SET-UP.—Stockholders of the Duquesne Light Company approved the changes in capitalization outlined in the Jan. 21 issue of the ELECTRICAL WORLD. They voted to change the authorized common stock from 250,000 shares (par $100) to 1,000,000 shares of no par value. At the same time they increased the number of shares to 4,000,000. There was also approved an issue of 5 per cent cumulative first preferred stock amounting to $50,000,000.

### *Critical Investor Buys Utility Stocks*

ONE of the largest and most critical institutional investors in America—the Sun Life Assurance Company of Canada, with assets of more than $400,000,000—evidently has few misgivings about the standing of American public utility company securities. In its list of holdings appear common stocks of such companies as Commonwealth Edison, Consolidated Gas of New York, Detroit Edison and Public Service of New Jersey, totaling $21,299,903. The same list shows $20,573,445 of preferred stocks, the great bulk of which are of United States utilities. Its utility bond holdings total $27,114,464, of which at least $17,000,000 are bonds of public utilities in the United States.

## January Revenue Establishes New Peak

### Energy Output for Electric Light and Power Companies Close to 6,700,000,000 Kw.-Hr.—Revenue $172,400,000, Increase of 3.9 per Cent Over December Earnings

A CONTINUOUS upward trend is reflected in reports of operations of electric light and power companies for January. The energy output, 6,699,748,000 kw.-hr., was nearly as great as in December, notwithstanding the seasonal decrease in the lighting load. The operating revenue rose to $172,400,000, computed for 100 per cent of the industry by including estimates for missing reports. This is 3.9 per cent in excess of the earnings for December and thus establishes a new record. The returns also indicate an increase of 7 per cent compared with January, 1927, which is rather better than the average increase in October, November and December. Operating expenses, exclusive of interest, taxes, depreciation or deductions for sinking funds, amounted to $66,200,000; the increase in this item over January, 1927, was 4.6 per cent and was

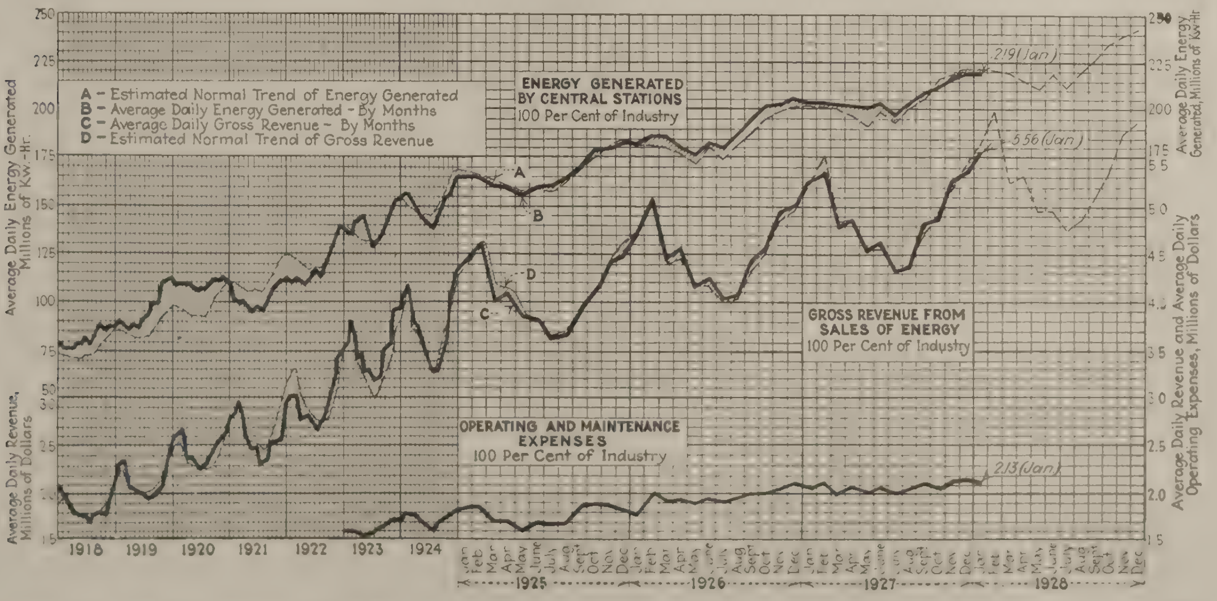

*Table I—Generation and Distribution of Central-Station Energy in the United States*

(100 Per Cent of the Industry)

| Month | Kw.-Hr. Generated Monthly * | | | Estimated Distribution of Energy Generated | | | | | | | | | | Energy Purchased by Public Utilities for Resale, Kw.-Hr. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total Energy Consumption by Central-Station Customers, Kw.-Hr. | | Energy Consumed for Lighting, Kw.-Hr. | | Energy Consumed for Power, Kw.-Hr. | | Energy Sold to Electric Railways, Kw.-Hr. | | Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr. | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Oct... | 6,577,566 | 6,174,959 | +6.5 | 5,413,566 | 4,982,959 | 1,372,000 | 1,262,000 | 3,485,566 | 3,172,959 | 556,000 | 548,000 | 1,164,000 | 1,192,000 | 1,290,000 | 1,240,000 |
| Nov.. | 6,517,713 | 6,063,784 | +7.4 | 5,365,713 | 4,990,784 | 1,400,000 | 1,310,000 | 3,406,713 | 3,129,784 | 559,000 | 551,000 | 1,152,000 | 1,073,000 | 1,269,000 | 1,200,000 |
| Dec... | 6,815,234 | 6,375,500 | +6.9 | 5,609,234 | 5,247,500 | 1,500,000 | 1,400,000 | 3,479,234 | 3,226,500 | 630,000 | 621,000 | 1,206,000 | 1,128,000 | 1,270,000 | 1,182,000 |
| | 1928 | 1927 | | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 |
| Jan... | 6,699,748 | †6,303,199 | †+6.3 | 5,514,748 | 5,188,199 | 1,493,000 | 1,395,000 | 3,446,748 | 3,170,199 | 575,000 | 623,000 | 1,185,000 | 1,115,000 | 1,350,000 | 1,190,000 |

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.

thus relatively smaller than the increase in operating revenue.

Taking into account the growth of the electric light and power industry, as established by statistics covering a considerable number of years, and taking into account also the cycle of seasonal changes as determined from the monthly figures for the past five years, it is possible to estimate the normal income for each month. As shown on the chart, the actual earnings for January are within 2 per cent of the estimated normal.

The increase of revenue for January, 1928, over that for January, 1927, was not confined to any one region, as is evident from the following table:

| Region | Per Cent Increase |
|---|---|
| New England | 7.3 |
| Atlantic | 6.4 |
| North Central | 6.8 |
| South Central | 7.2 |
| Western | 5.1 |

The regional increases in energy output followed very closely the ratios prevailing in December. The greatest gain was in the West South Central States, where the output was 20 per cent greater than in January of last year. In the South Atlantic States the increase was 15 per cent. In other parts of the country the gains were smaller, running down to 1 per cent in New England. The output in the Mountain States, chiefly from water power, showed a decrease of 3 per cent, while the Coast showed a change from 6 per cent increase in December to 8 per cent in January.

As in December, the output by the use of water power constituted about 39 per cent of the total; 4,108,994,000 kw.-hr. were generated from fuel, requiring the consumption of 3,304,126 tons of coal, 551,756 barrels of fuel oil and 4,893,386,000 cu.ft. of natural gas,

## Associated Gas & Electric Plans Refunding Program

A new 4½ per cent issue of twenty-year debentures of the Associated Gas & Electric Company, amounting to $50,000,000, is being offered directly to the company's security holders, each holder of record March 22 being entitled to subscribe for $20 par of debentures for each share of stock or each $100 principal amount of registered convertible securities held. Proceeds will be used to refund the 5½ per cent and 6 per cent convertible debentures outstanding and in addition to provide funds for the retirement of the preferred stocks of subsidiary companies and for the acquisition of new properties.

## General Electric Earned $6.41 Net on Common

Net profits of the General Electric Company for 1927 increased nearly 5 per cent to $48,799,489, although orders received during the year declined 5 per cent. Orders totaled $309,784,623, against $327,400,207 in 1926. Unfilled orders at the end of 1927 were $68,916,000, against $72,297,000, also a decrease of 5 per cent. Net sales billed during the year were $312,603,772, against $326,974,104. The income accounts for the past two years show total income of $51,547,687, against $49,657,295 in 1926.

Selling prices of the company's prod-

*Table II—Central-Station Financial Operations for Four Mouths in the United States*

(100 Per Cent of the Industry)

| Month | Total Gross Revenue from Sale of Energy† | | | Estimated Distribution of Gross Revenue | | | | | | | | Total Operating and Maintenance Expenses‡ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lighting Customers | | Power Customers | | Electric Railways | | Other Public Utilities | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Oct...... | $150,800 | $141,800 | +6.4 | $88,700 | $84,100 | $45,900 | $42,000 | $4,600 | $4,600 | $11,600 | $11,100 | $64,450 | $62,950 |
| Nov..... | 158,200 | 148,300 | +6.7 | 94,300 | 89,100 | 47,400 | 43,200 | 5,000 | 4,900 | 11,500 | 11,100 | 64,300 | 62,450 |
| Dec...... | 165,900 | 154,400 | +7.4 | 100,300 | 94,400 | 48,700 | 43,800 | 5,100 | 5,000 | 11,800 | 11,200 | 68,800 | 63,700 |
| | 1928 | 1927 | | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 |
| Jan...... | 172,000 | 161,100 | +7.0 | 103,100 | 99,200 | 51,700 | 45,200 | 5,800 | 5,700 | 11,800 | 11,000 | 66,200 | 63,300 |

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.

‡Do not include interest, taxes, depreciation or sinking fund.

*Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

| Month | Energy Generated | | | | | | Fuel Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hydro-Plants | | | Fuel Power Plants | | | Coal | | | Oil | | | Gas | | |
| | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Short Tons | 1926 Short Tons | Per Cent Increase | 1927 Barrels | 1926 Barrels | Per Cent Increase | 1927 Thousands of Cubic Feet | 1926 Thousands of Cubic Feet | Per Cent Increase |
| Oct....... | 2,350,030 | 2,122,336 | +10.7 | 4,227,536 | 4,052,623 | +4.3 | 3,332,729 | 3,317,113 | +0.5 | 483,554 | 879,929 | —45.1 | 6,424,859 | 4,872,740 | +31.8 |
| Nov....... | 2,466,092 | 2,193,093 | +12.4 | 4,051,621 | 3,870,691 | +4.7 | 3,236,107 | 3,193,212 | +1.3 | 484,261 | 926,916 | —47.5 | 5,630,302 | 3,975,408 | +41.5 |
| Dec....... | 2,701,622 | 2,377,175 | +13.6 | 4,113,612 | 3,998,325 | +2.9 | 3,339,363 | 3,406,140 | —1.9 | 624,271 | 769,518 | —18.9 | 4,805,064 | 3,685,611 | +30.4 |
| | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | |
| Jan....... | 2,590,804 | 2,331,140 | +11.1 | 4,108,944 | 3,972,059 | +3.4 | 3,304,426 | 3,365,461 | —1.8 | 551,756 | 786,062 | —29.9 | 4,893,386 | 3,900,868 | +25.4 |

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

ucts continued downward during 1927 as a result of improved manufacturing methods and keen competition in the industry, according to the annual report just issued.

The balance sheet of the company shows current assets of $252,668,341 and current liabilities of $33,147,449. General reserve was $30,158,263, against $27,696,551 a year previous, and the profit and loss surplus was $115,096,616.

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COLORADO UTILITY RETIRES PREFERRED.—First steps have been taken toward the retirement of the outstanding 7 per cent preferred stock of the Public Service Company of Colorado with an offer to convert owners' holdings into preferred or common stocks of the Cities Service Company, the parent organization. Public Service stock will be accepted at 110 as payment for Cities Service shares at their market prices. Approximately $6,400,000 of Public Service 7 per cent preferred is now outstanding and it is believed that as soon as the present offer is withdrawn a call will be issued for the unconverted balance. The stock is callable at 110 on 45 days' notice.

# Many Stockholders Added to Public Service of New Jersey

AN INCREASE of 8.1 per cent in gross earnings, against a 12.2 per cent growth the previous year, is disclosed in the annual report of the Public Service Corporation of New Jersey. Net earnings, however, due to an improvement in the operating ratio, are up 11.3 per cent, against 9.4 per cent in 1926. Gross earnings of the system have reached the huge total of $115,005,908, and total assets are $615,460,097.

The corporation reports a very substantial increase in business during the year. Sale of electric current during 1927, exclusive of current furnished the Public Service Railway Company, amounted to 1,233,984,052 kw.-hr., which is an increase of 142,234,480 kw.-hr., or 13.03 per cent. The gain in meters was 77,716, making a total of 781,959 in service at the end of the year. This total exceeds the number of gas meters for the first time. Power sales amounted to 770,756,047 kw.-hr., a gain of 11.36 per cent, while commercial light gained 16.71 per cent and sales for municipal lighting 9.65 per cent. Maximum load amounted to 435,500 kw., against 415,000 kw. in 1926. One of the new contracts is with the Holland tunnels.

Analysis of the Public Service Corporation's earnings statement shows a balance of $9,302,163 earned on common stock. This is the equivalent of $2.30 per share on stock outstanding at the end of the year. A dividend of $2 was paid on common shares.

Capital adjustments during the year include the issue of 576,338 shares of no par common stock, $32,542,100 of 6 per cent cumulative preferred and $3,800 of 7 per cent cumulative preferred stock. Five additional issues of 6 per cent cumulative preferred stock were also authorized. Both these were offered to shareholders and the unsold balance was marketed under the company's popular ownership plan. The corporation purchased during the year 1,975,000 shares of Public Service Electric &

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday March 27 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 79 | 72 | 81 |
| Ala. Pwr., $7 com. pf.—no par | 113¾ | 114½ | 115½ |
| Allis Chalmers Mfg., 6% com. | 121¼ | 115⅛ | 125 |
| Aluminum Co. of Amer., com. | 126¾ | 120 | 136 |
| Aluminum Co. of Amer., 6% pf | 109⅛ | 105⅛ | 109⅛ |
| Amer. & Foreign Pwr., 7% pf.—no par | 106⅛ | 105⅛ | 108⅞ |
| Amer. & Foreign Pwr., com.—no par | 23¾ | 22⅞ | 27⅞ |
| Amer. Bosch Magneto, com.—no par | 24⅜ | 15⅞ | 24⅞ |
| Amer. Brown Boveri Elec.† | 13⅞ | 10¼ | 18 |
| Amer. Brown Boveri Elec., pf. $7 | 50½ | 46½ | 63 |
| Amer. Gas & Elec., 6% pf.—no par | k109 | 106¾ | 109 |
| Amer. Gas & Elec., com. †—no par | 137½ | 117½ | 145 |
| Amer. Lt. & Trac., 6% pf. | 113 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 194½ | 170 | 195 |
| Amer. Pwr. & Lt., 6% pf. | 106⅛ | 104 | 109⅞ |
| Amer. Pwr. & Lt., com. †—no par | 80⅞ | 62½ | 83 |
| Amer. Pub. Serv., 7% pf. | a 97½ | 99 | 101 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | 94⅛ | 90 | 95 |
| Amer. Pub. Utilities, 7% pr. pf. | 100 | 94 | 101 |
| Amer. Pub. Utilities, com. | k 60 | 60 | 65 |
| Amer. States Sec., A | a 6⅞ | 4 | 7 |
| Amer. States Sec., B | a 6⅞ | 4⅞ | 7 |
| Amer. Superpwr., 6% ptc pf.—25 | k 30 | 28⅛ | 30⅛ |
| Amer. Superpwr., 6% 1st pf | l 103¼ | .... | .... |
| Amer. Sup. pwr., Class A†—no par | 42¾ | 37 | 42⅞ |
| Amer. Sup. pwr., Class B†—no par | 43½ | 37¾ | 43⅞ |
| Amer. Wtr. Wks. & Elec., 6% pf. | k103½ | 101½ | 105 |
| Amer. W.W. & E., com. new—no par | 57 | 52¼ | 61 |
| Anaconda Copper cap. $3 | 56⅞ | 53¾ | 59⅞ |
| Appalachian Electric Pwr., 7% pf. | 108 | 108½ | 110 |
| Arkansas Pwr. & Lt., 7% pf | 107½ | 108 | 109¾ |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 95 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 48½ | 47 | 51⅛ |
| BABCOCK & WILCOX, 7% com. | 117 | 117½ | 124¾ |
| Binghamton L., H. & P., $6 pf. | 107 | 102 | 106½ |
| Birmingham Elec., pf.—$7—no par. | 109 | 109½ | 111 |
| Blackstone Valley G. & E., 6% pf. | m106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | 165 | 132 | 169¾ |
| Blaw-Knox, com.† | i103½ | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f218 | .... | .... |
| Brazilian Trac., Lt. & Pwr., com., new | f 56 | .... | .... |
| Broad River Pwr., 7% pf | 107 | 105 | 107½ |
| Brooklyn Edison, 8% com. | 229 | 206⅞ | 235⅞ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26½ | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 37½ | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | k 98½ | 98 | 101 |
| California Ry. & Pwr., 7% pf. | k135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l110 | 109 | 110½ |
| Central & S. W. Util., $7 pf.—no par | a103½ | 99⅛ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a107½ | 103½ | 108 |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 105 | 107 |
| Central Ill. Pub. Serv., $6 pf | a100 | 97⅞ | 100 |
| Central Ind. Pwr., 7% pf. | a 99½ | 95 | 99¾ |
| Central Maine Power, 6% pf. | 96 | 96 | 98 |
| Central Maine Power, 7% | 108 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 106 | 104½ | 105½ |
| Central States Elec., 7% pf. | 112½ | 104¼ | 114 |
| Century Elec., 6% com. | b140 | 140 | 145 |
| Cincinnati Gas & Elec., 5% com. | g 98½ | 97½ | 99¼ |
| Cities Service, $6 pf.—no par | l 99½ | 87 | 94½ |
| Cities Service, pf. B—no par | l 9⅛ | 8 | 8⅞ |
| Cities Service, pf. BB—no par | l 94 | 80½ | 86 |
| Cities Service, com.—20 ex. div. | l 57⅛ | 40⅞ | 58¾ |
| Cities Service, Bks. Shrs.—10 ex. div. | l 28⅛ | 22⅞ | 27 |
| Cities Service Pwr. & Lt., 7% pf | k106⅛ | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf. | k 98 | 95 | 100 |
| Cleveland Elec. Illg., 6% pf. | 112 | 113 | 115⅛ |
| Cleveland Elec. Illg., 10% com. | 390 | 350 | 410 |
| Columbia Gas & Elec., 6% pf. | 108⅛ | 107⅞ | 110⅞ |
| Columbia G. & E. com. $5—no par. | 92 | 89⅛ | 97⅞ |
| Columbus Elec. & Pwr., $2 com.—no par | k 72 | 66 | 72 |
| Columbus Elec. & Pwr., 7% | 113½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 107 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 107½ | .... | .... |
| Columbus Ry., P. & Lt. com.—no par | k115 | .... | .... |
| Commonwealth Edison, 8% com. | a179 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 104⅞ | 102⅛ | 104⅞ |
| Commonw'th Pwr., $2, com.—no par | 73¾ | 62¾ | 74⅞ |
| Conn. Lt. & Pwr., 8% pf. | 120 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 116 | 118 | 121 |
| Cons. Gas of N. Y., pf. | 104¾ | 101¼ | 104¾ |
| Cons. Gas of N. Y., com. $5—no par. | 140⅞ | 119⅞ | 142¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111½ | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e111 | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e104¾ | 100⅛ | 104⅞ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 72½ | 67¼ | 73 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | ... | ... |
| Consumers Pwr., 6% pf. | 104¾ | 105½ | 106½ |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 106 | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par. | k230 | 240 | 265 |
| Crocker Wheeler, com.† | 35 | 24 | 30 |
| Crocker Wheeler, 7% pf. | 92 | 77 | 90 |
| DALLAS PWR. & LT., 7% pf. | 110½ | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108 | 108½ | 109½ |
| Derby Gas & Elec., 7% pf | 99 | 96 | 100½ |
| Detroit Edison, 8% com. | k181¾ | 166½ | 194¾ |
| Dubilier Condenser, com.—no par. | k 3 | 2¾ | 3¾ |
| Duke Pwr., cap | k140 | 130 | 145 |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 111 | 112½ |
| Eastern New York Util. com. | m 65 | .. | .. |
| Eastern States Pwr. $7, com. | 12¾ | 11¾ | 15¾ |
| Eastern States Pwr., pf | k 97 | 98 | 99 |
| East. Tex. Elec., 7% pf | 107 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d270 | 252 | 280 |
| El Paso Elec. 7% pf. | 113 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l109¾ | 108⅛ | 111⅞ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 91½ | 76 | 95⅞ |
| Electric Household Util.† | a 20⅞ | 13½ | 24 |
| Elec. Investors, 6% pf.—no par | 102 | 101 | 103½ |
| Elec. Investors, com.†—no par | 46⅞ | 40⅛ | 48⅞ |
| Elec. Pwr. & Lt., ctfs. pf | k108 | 106½ | 110½ |
| Elec. Pwr. & Lt., ctfs., 40% pd | m125½ | 120¾ | 125½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 38¼ | 28¾ | 39⅝ |
| Elec. Refrig. cap.† | 16⅞ | 11⅛ | 17½ |
| Elec. Ry. Securities, com.—no par | 6½ | .. | .. |
| Elec. St. Battery com. $5.25—no par | 78¾ | 69 | 79¾ |
| Elmira Wtr., Lt. & R.R., 7% pf | k106½ | 104 | 107 |
| Empire Pwr., ptc.† | 31¾ | 27½ | 35⅝ |
| Engr. Pub. Serv. $7, pf.—no par | 110¼ | 107 | 110¼ |
| Engr. Pub. Serv., com.—no par | 41⅞ | 33 | 42½ |
| Eureka Vacuum Cleaner, com. $4—no par | 73½ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | k108 | 104 | 110 |
| F.-M., com.—$3—no par | 36¼ | 32½ | 40¼ |
| Federal Lt. & Trac., com $1.40 | 51 | 42 | 55 |
| Federal Lt. & Trac., $6 pf.—no par | 103½ | 98 | 105 |
| Florida Pwr. & Lt., 7% pf. | 105½ | 104⅞ | 107¾ |
| Ft. Worth Pwr. & Lt., 7% pf. | l114½ | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf. | 78 | 75 | 78 |
| Galveston-Houston Elec., com. | 32½ | 31⅞ | 35¾ |
| General Cable, Cl. A | 76¼ | 56 | 84¾ |
| Gen. Elec. $3 com.—no par | 149¼ | 124 | 149¾ |
| Gen. Elec., special—6% | 11⅞ | 11¼ | 11⅜ |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 41 | 35½ | 43½ |
| Gen. G. & E. (Del.) pf. A $8—no par | k124 | 122¼ | 126½ |
| Gen. G. & E. (Del.) pf. A $7—no par. | k113 | 108½ | 113½ |
| Gen. G. & E. (Del.) pf. B $7. | k106 | 105½ | 108 |
| Gen. Pub. Serv., $7 cum. pf., no par. | k117 | 110 | 120 |
| Gen. Pub. Serv., com., no par | 21 | 16⅞ | 21 |
| General Public Utilities, $7 pf. | 98½ | 98 | 99 |
| Ga. Lt., Pwr. & Rys., com. | k 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf | h104 | .... | .... |
| IDAHO PWR., 7% pf. | 104½ | 109 | 110½ |
| Ill. No. Utilities, 6% pf. | k 96 | 96 | 98 |
| Ill. Pwr. & Lt., 7% pf. | 105 | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 105 | 102 | 107¾ |
| Indianapolis Pwr. & Lt., $7 pf. | 103 | 100 | 105 |
| Ingersoll Rand com. | k 91 | 90 | 94 |
| Int. Combus. Engr., com. $2—no par | 50¾ | 45¾ | 55⅞ |
| Int. Combustion Engr., 7% pf | k102 | 103 | 105½ |
| Int. Util., Class A—$3.50—no par. | 47½ | 45 | 51½ |
| Int. Utilities, Class B—no par | 8⅞ | 6½ | 10½ |
| Interstate Pwr., pf.—$7—no par | 102 | 99 | 103 |
| Interstate Pub. Serv., 7% pf. | 104½ | 103 | 106 |
| Iowa Ry. & Lt., 7% pf. | k101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 107 | 105 | 107 |
| Johns-Manville com.†—no par | 115¾ | 111½ | 125 |
| Johns-Manville, 7% pf | 113 | 111½ | 113½ |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 24. lBid price Wednesday, March 28. mLatest quotations available. †Dividend rate variable.

# *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

**(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)**

| Companies | Bid Price Tuesday March 27 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | 113½ | 111½ | 113½ |
| Kansas Gas & Elec., 7% pf. | l109½ | 107 | 109 |
| Kentucky Hydro-Elec., 7% pf. | a104¼ | 102 | 104¼ |
| Kentucky Sec., 6% pf. | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | k103 | 100 | 103 |
| LACLEDE GAS LT., 10% com. | k220 | 200 | 260 |
| Lehigh Pwr Sec., com.—no par | 26½ | 19¾ | 27⅝ |
| Long Island Ltg., 7% pf. | 111 | 110⅜ | 112½ |
| Long Island Ltg., 6% pf. | 107 | 107 | 108½ |
| Long Island Ltg., com.†—no par | k178 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | h109½ | 105¼ | 109½ |
| Louisville Gas & Elec., cl. A. $1.75 | 30¾ | 28 | 31⅞ |
| MAN. ELEC. SUPPLY, cap. $5—no par | 56½ | 50 | 61 |
| Manilla Elec., com.†—no par | m 47 | 45¾ | 50 |
| Maytag Mfg, com.50—no par | 32½ | 30 | 34¼ |
| Memphis P. & L., pf.—$7—no par | k108 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 107½ | 103 | 107½ |
| Metropolitan Ed., pf.—$7—no par | 109 | 109 | 111 |
| Metropolitan Ed., com. $5—no par. | k150 | 125 | 155 |
| Middle West Utilities, 7% pf. | a123 | 116½ | 124½ |
| Middle West Util., 7% pr. lien | a126 | 125 | 129¼ |
| Middle West Util., com. $7—no par | a134 | 123½ | 135 |
| Midland Utilities, pr. ln. 6% pf. | a 95 | 94½ | 97 |
| Midland Utilities, 6% pf. A | a 90¾ | 89⅞ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k104 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | k100 | 98 | 101⅝ |
| Minn. Pwr. & Lt., 7% pf. | l108½ | 107 | 109 |
| Miss. River Pwr., 6% pf. | k108 | 94 | 109½ |
| Miss. River Pwr., 3% com. | 108 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k107½ | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | k104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 30⅜ | 29½ | 31½ |
| Montana Pwr., 5% com. | 159 | 102¼ | 167¼ |
| Montreal Pwr., 7¾% com. | f 93 | .... | .... |
| Mountain States Pwr., 7% pf. | k104 | 97 | 105 |
| Mountain States Pwr., com.† | 17 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109½ | 98 | 110½ |
| National Elec. Pwr., A† | a 31¾ | 27½ | 32¾ |
| National Lt., Ht. & Pwr., com | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | k 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 109⅛ | 108½ | 111 |
| National Pwr. & Lt., com.†—no par. | 27¼ | 21⅞ | 27⅝ |
| National Pub. Serv., 7% pf. | 100½ | 99 | 103 |
| National Pub. Serv., 7% ptc., pf | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 26 | 22 | 27½ |
| National Pub. Serv., B com.—no par | 28⅛ | 24⅛ | 30 |
| Nebraska Pwr., 7% pf. | l112 | 110 | 111½ |
| Nevada-Calif. Elec., com. | k 38 | 33¼ | 42 |
| New Brunswick Pwr., 4% pf. | k 62 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k108 | 98⅛ | 109½ |
| New Eng. Pub. Serv., pf. $7 | k106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 107½ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | k103½ | 101 | 104 |
| New York Power & Light, 7% pf. | 115½ | .... | .... |
| New York Power & Light, 8% pf. | m114 | .... | .... |
| Newport News & Hampton Ry., Gas & Elec., 5% com. | m109 | 110 | 115 |
| Newport News & Hampton Ry., Gas & Elec., 7% pf. | m109 | 110 | 115 |
| Niagara Falls Pwr., 7% pf.—25 | 28½ | 27¾ | 28¾ |
| No. Amer., 6% pf.—50 | k 53¼ | 53¼ | 55 |
| No. Amer., com.—10 | 65 | 58⅞ | 67 |
| No. Amer. Edison, $6 pf.—no par | 103⅞ | 102½ | 105⅞ |
| No. Caro. Pub. Serv., pf.—$7—no par | m109 | 93 | 105 |
| Northeastern Pwr., com. | 22½ | 19¾ | 23 |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 26½ | 18 | 27½ |
| No. Ont. Lt. & Pwr., 6% pf. | k 99 | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No States Pwr. (Del.), 7% pf. | 109⅞ | 108⅛ | 109⅞ |
| No. State Pwr. (Del.), 8% com. | 135⅛ | 123 | 136⅛ |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 16 | .... | .... |
| OHIO BRASS, com. B $4—no par. | 100 | 89 | 100½ |
| Ohio Brass, 6% pf. | k107 | 106 | 111 |
| Ohio Pwr., 6% pf | 106½ | 104 | 107½ |
| Ohio Pub. Serv., $6 pf. | k102½ | 95 | 102 |
| Ohio Pub. Serv., 7% pf. | 112 | 109 | 111¾ |
| Ohio River Edison, 7% pf. | 108½ | 106 | 109¼ |
| Oklahoma Gas & Elec., 7% pf. | 113½ | 106 | 114 |
| PACIFIC Gas & ELEC., 6% pf. | 28⅛ | 26⅛ | 28⅝ |
| Pacific Gas & Elec., 8% new com. | 47½ | 43½ | 49⅞ |
| Pacific Pwr. & Lt., 7% pf. | l110 | 106 | 109½ |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 80⅛ | 79⅝ | 82 |
| Penn-Ohio Edison, 6% pf. no par | k 94½ | 93½ | 96 |
| Penn-Ohio Edison, 7% pf. | 108 | 106¼ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109½ | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l109½ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 71¼ | 68 | 72½ |
| Phila. Co., 5% pf.—50 | k 46 | 45½ | 48⅛ |
| Phila. Co., 6% pf.—50 | 56 | 52 | 56 |
| Phila. Co., com.—50 | k150 | 129½ | 163 |
| Phila. Elec., 8% com.—25 | c 59⅛ | 55½ | 60 |
| Portland Elec. Pwr., 7% pf. | 102½ | 100 | 104¼ |
| Portland Elec. Pwr., 6% pf. | 94 | 78 | 6 |
| Portland Elec. Pwr., 6% 2d pf. | 80 | 55 | 88 |
| Portland Elec. Pwr., com. | 51 | .... | .... |
| Potomac Elec. Power, 6% pf. | j112½ | .... | .... |
| Pwr. Sec., pf.—no par | k 65 | 50 | 68 |
| Pwr. Sec., com.—no par | k 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | l105 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 107 | 103⅞ | 107½ |
| Pub. Serv. of N. J., 7% pf. | 120 | 118 | 120⅜ |
| Pub. Serv. of N. J., $2 com. no par | 47⅞ | 41½ | 47⅞ |
| Pub. Serv. of No. Ill., 6% pf. | a115 | 110 | 115 |
| Pub. Serv. of No. Ill., 7% pf. | a119¾ | 119 | 121 |
| P. S. of No. Ill., com. $8—no par | a172 | 159¼ | 180 |
| Pub. Serv. of No. Ill., $8 com. | a174 | 159⅞ | 180 |
| Pub. Serv. of Okla., 7% pr. ln. | k106½ | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109½ | 108 | 110⅛ |
| Puget Sound Pwr. & Lt., 7% pf. | 109½ | 109 | 113 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 99 | 92 | 99½ |
| Puget Sound Pwr. & Lt., com. | 57⅛ | 34⅛ | 63½ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 56½ | 54½ | 57⅜ |
| Radio Corp. of Amer., com.—no par. | 169 | 85¼ | 169 |
| Rhode Island Public Service, pf. $2—no par | 31¾ | 30⅛ | 31¾ |
| Rochester Gas & Elec. 6% pf. D | 105 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105½ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | k116 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | 7 | 4¼ | 7⅛ |
| Sierra Pacific Elec., 2% com. | 35¼ | 29 | 38¾ |
| Sioux City Gas & Elec., 7% pf. | 107½ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 109½ | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 89½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 46⅛ | 40⅛ | 48 |
| So. Calif. Edison, 8% pf. | k 47 | 38⅛ | 41 |
| So. Calif. Edison, 7% pf. | k 29 | 27⅛ | 29½ |
| So. Calif. Edison, 6% pf. | 27⅛ | 25¾ | 27½ |
| So. Calif. Edison, 8% com. | 47¾ | 43½ | 48⅛ |
| Southern Cities Utilities, 7% pf. | 86 | 75 | 86 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 91 | 88 | 92½ |
| Southwestern Pwr. & Lt., 7% pf. | k111½ | 103 | 113 |
| Standard Gas & Elec., 8% pf. | 67¾ | 65 | 68 |
| Standard Gas & Elec., 7% pr. pf. | 114¾ | 110½ | 114¾ |
| Standard G. & E., com. $3.50 | 64 | 57⅞ | 66⅞ |
| Standard Power & Light, com. | 39 | 29½ | 45 |
| Standard Pwr. & Lt., 7% pf. | k105 | 103⅞ | 106½ |
| Staten Island Edison, pf.—$6—no par | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | 164 | 162 | 175 |
| Syracuse Lighting, 7% pf. | k110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | k 65 | 62 | 65 |
| Tenn. Elec. Pwr., 6% pf. | 103 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 108½ | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 10 | .... | .... |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | l114½ | 113¼ | 115 |
| Tide Water Pwr., 8% pf. | 112 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 124¾ | 112⅞ | 134 |
| Toledo Edison, 7% pf. | l109½ | .... | .... |
| Toledo Edison, 6% pf. | k104½ | 95 | 105 |
| Toledo Edison, 6% com. | k145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | k 94 | 96 | 102 |
| UNITED GAS & ELEC., 7% pf. | 95 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c120 | 111¼ | 120¾ |
| United Lt. & Pwr., pf.—$4—no par | k 55 | 49 | 56½ |
| United Lt. & Pwr., pf.—$6 50—no par | a101 | 95 | 101 |
| United L. & P., com. A .48—no par. | a 22 | 14 | 22 |
| United L. & P., com. B .48—no par. | k 25 | 19 | 25 |
| Utah Pwr. & Lt., 7% pf. | l112½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101 | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 32 | 28½ | 34½ |
| Utilities Pwr. & Lt., com. B $1—no par | k 23⅞ | 18½ | 26⅛ |
| VERMONT HYDRO-ELEC., 7% pf. | k100 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | k110½ | 108 | 111 |
| WAGNER ELEC., 7% pf. | b101½ | 96½ | 102 |
| Wagner Elec., com.—no par | b 55½ | 37½ | 55½ |
| Washington Ry. & Elec., 5% com. | j485 | .... | .... |
| Washington Ry. & Elec., 7% pf. | j103¼ | .... | .... |
| Washington Wtr. Pwr., 8% com. | k227 | 175 | 235 |
| West Penn Elec., 7% pf. | 114 | 109¼ | 114⅞ |
| West Penn Elec., Cl. A $7 | 109⅞ | 106½ | 110⅞ |
| West Penn Pwr., 7% pf. | 115¾ | 114⅞ | 116⅞ |
| West Penn Pwr., 6% pf. | 110 | 109¾ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | k 95 | 94 | 100 |
| Western Pwr., 7% pf | k103 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 100 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 102⅞ | 88⅛ | 105½ |
| Weston Elec. Instrument, Cl. A $2—no par | k 32 | 30⅛ | 34¼ |
| Weston Elec. Instrument, com.—no par | 12⅞ | 12⅛ | 14½ |
| Wheeling Elec., 6% pf. | k105 | 95 | 104 |
| Worthington Pump, 7% pf. A | k 49 | 46⅛ | 55 |
| Worthington Pump, 6% B | k 43 | 41 | 49½ |
| Worthington Pump, com. | 29½ | 28 | 34½ |
| YALE & TOWNE com. $5—25. | 71 | 68⅛ | 75 |

**Stock Exchange:** *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, March 24. *l*Bid price Wednesday, March 28. *m*Latest quotations available. †Dividend rate variable.

Gas Company and a number of issues of lessor companies.

At the end of 1927 there were 89,769 accounts on the stock ledgers of the corporation, against 67,303, and there were in addition, 18,912 open accounts, indicating an unusually wide distribution of shareholders.

Puget Sound Company Plans Retirement of 7 Per Cent Issue.—At a meeting to be held May 2 stockholders of the Puget Sound Power & Light Company will vote on a proposal to redeem $10,000,000 of 7 per cent prior preferred stock at $110 a share. This will be made possible through the issuance of 110,000 shares of new $5 cumulative no par prior preferred stock. Any required balance will be provided by an additional issue of $6 preferred.

## Southern California Edison Votes Change in Set-Up

Stockholders of the Southern California Edison Company, at their annual meeting, March 16, approved an increase in the company's preferred and a decrease in its common stock. The proposal to issue $5,000,000 par-value common stock to employees at not less than par ($25) was also approved. It was decided to decrease the authorized amount of common stock from $125,000,000 to $100,000,000 and to increase the amount of preferred "C" stock from $20,000,000 to $45,000,000.

Of the 6,345,773 shares of stock outstanding, 4,762,173 shares, or some 74 per cent of the total, were voted at the meeting, either in person or by proxy. Only 500 shares of stock voted against the proposal to change the authorized common and preferred stocks, but 600 shares of stock objected to offering common stock to employees.

British Cable and Radio Companies Merge. — Britain's Eastern Telegraph Company and associated companies and the Marconi Wireless Telegraph Company have jointly announced a provisional fusion in the form of a holding company, provided the companies negotiate an agreement with the British and Dominion Governments and the shareholders approve, cables Commercial Attaché William L. Cooper, London, to the Department of Commerce. The holding company is capitalized at £53,700,000 of 5½ per cent preference and 7½ per cent ordinary shares.

# Business News and Market Conditions

## The Electrical Unions and Armored Cable

Rumors have been circulated in the trade that the electrical workers' unions will not permit the use of armored cable in New York. A committee of manufacturers conferred with H. H. Broach, vice-president of the International Electrical Workers' Union, relative to this, and Mr. Broach recently appeared at the district attorney's office, Bronx County, in response to a subpœna issued because of a complaint against such interference. On both occasions Mr. Broach stated that the unions would not take any action to prevent their members from installing armored cable.

The board of governors of the National Electrical Manufacturers' Association has approved recommendations presented by its labor committee as follows:

1. That you urge all members of Nema not already members of the League for Industrial Rights to take out membership in that organization immediately.
2. That all member companies having trouble with organized labor, in so far as it affects the free distribution of their products, at once notify the labor committee of Nema for such action as may seem best, and that the matter may be brought to the attention of other members of Nema.
3. That our representatives on the executive committee of the National Electric Light Association lay before that committee the facts in reference to existing labor conditions and their effect on the industry.
4. That our representatives on the board of governors of the Society for Electrical Development (which is the co-ordinating organization of the entire electrical industry) lay before that board the facts in regard to existing labor conditions, discussing with such representatives from other branches of the electrical industry the situation in detail and its effects on restricting the development of the entire industry.
5. That representatives on the above organizations report to the board of governors of Nema for action at the next meeting.
6. Your labor committee believes that every right and proper step should be taken by Nema to protect the electrical manufacturing industry in the unrestricted distribution of its goods so that an open and free market may be maintained.

## Activity Slightly Above Last Year

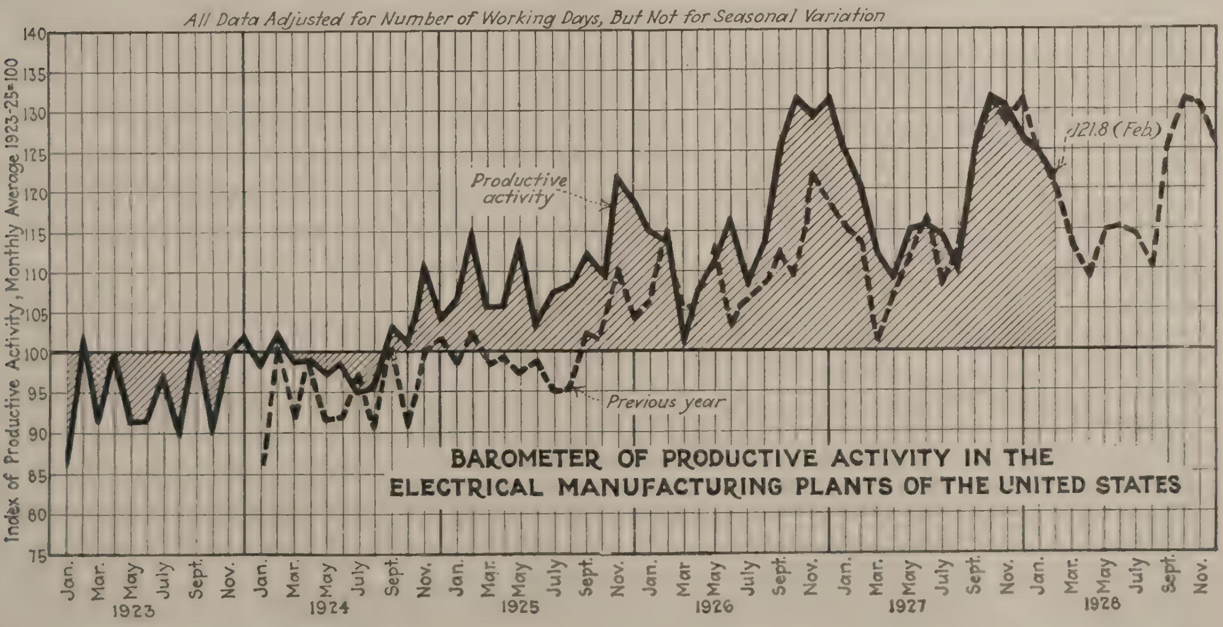
### Production in Electrical Manufacturing Plants Holding Up Well—February Rate of Operations 1.2 Per Cent Over 1927

DURING February the electrical manufacturing plants of the nation reported that productive operations were slightly below those of January, but were slightly above those of February last year. Although the operations of the electrical manufacturing plants during the past few months at times have been under those of the same month in the year previous, yet the volume of production for the twelve-month period ended during the current February was about 1 per cent over that during a similar period ending with February last year. The operations of the larger electrical manufacturing companies appear to be holding up materially better than the smaller companies. The February rate of production of the smaller companies was 12.3 per cent under the peak reached last October, while that of the larger companies was actually 4 per cent above the rate of production reported for last October.

The index of activity in the electrical manufacturing industry based on consumption of electrical energy stands at 121.8 for February, as compared with 124.7 for January and 131.3 for the peak month of October. Comparative indexes of productive activity referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days are as follows:

| | |
|---|---|
| February, 1928 | 121.8 |
| January, 1928 | 124.7 |
| December, 1927 | 125.4 |
| October, 1927 (peak month) | 131.3 |
| February, 1927 | 120.5 |
| February, 1926 | 113.8 |

While past history would indicate that it is perfectly normal for the electrical manufacturing plants to reduce their rate of operations gradually from October to about April, general industry in the nation appears to reach its low point normally in December, the first quarter of the year usually witnessing a material increase in activity. This increase during the current year was slightly below that of the first quarter of 1927, but appears to have exceeded that of both 1925 and 1926. The February operations of general industry were about 16.2 per cent over those of last December.



BAROMETER OF PRODUCTIVE ACTIVITY IN THE ELECTRICAL MANUFACTURING PLANTS OF THE UNITED STATES

## *Delinquent Electrical Accounts*

(Data Supplied by National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

| Division | February 1927 | February 1928 | Per Cent Increase or Decrease | Two Months 1927 | Two Months 1928 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | 318 | 301 | —5.35 | 690 | 561 | —18.7 |
| Middle and Southern Atlantic | 149 | 183 | +22.8 | 286 | 342 | +19.6 |
| New England | 152 | 121 | —20.4 | 264 | 254 | —3.78 |
| Pacific Coast | 9 | 6 | —33.3 | 34 | 17 | —50 |
| Central | 877 | 796 | —9.24 | 1,644 | 1,594 | —3.04 |
| Total | 1,505 | 1,407 | —6.51 | 2,918 | 2,788 | —5.14 |

TOTAL AMOUNTS REPORTED

| Division | February 1927 | February 1928 | Per Cent Increase or Decrease | Two Months 1927 | Two Months 1928 | Per Cent Increase or Decrease |
|---|---|---|---|---|---|---|
| New York | $51,216 | $39,083 | —23.6 | $113,509 | $88,610 | —21.9 |
| Middle and Southern Atlantic States | 20,052 | 27,912 | +39.2 | 34,341 | 45,423 | +32.3 |
| New England | 21,327 | 15,948 | —25.2 | 31,935 | 30,722 | —3.80 |
| Pacific Coast | 2,664 | 1,187 | —55.4 | 3,818 | 3,120 | —18.2 |
| Central | 111,024 | 100,558 | —9.43 | 202,728 | 201,313 | —0.70 |
| Total | $206,883 | $184,688 | —10.5 | $386,331 | $369,188 | —4.44 |

AVERAGE AMOUNTS

| | February 1927 | February 1928 | Two Months 1927 | Two Months 1928 |
|---|---|---|---|---|
| New York | $161 | $129 | $328 | $319 |
| Middle and Southern Atlantic States | 134 | 152 | 238 | 262 |
| New England | 140 | 131 | 234 | 242 |
| Pacific Coast | 296 | 197 | 424 | 372 |
| Central | 127 | 126 | 247 | 252 |

## Hoist Manufacturers Hold Annual Meeting

At the annual meeting of the Electric Hoist Manufacturers Association, held in New York on March 15, N. A. Hall of the Sprague hoist division, Shepard Electric Crane & Hoist Company, New York, was elected chairman of the association, and H. J. Fuller of the Yale & Towne Manufacturing Company, Stamford, Conn., was elected vice-chairman. The American Engineering Company of Philadelphia and the Chisholm-Moore Manufacturing Company of Cleveland were elected to membership. Reports which were submitted at the meeting indicate that electric hoists are now being used in 95 industries. In addition to the regular statistical work of the association, which includes the gathering of information monthly regarding the number and value of hoists ordered, segregated under standard rating sizes, and value of shipments, there has been inaugurated a plan for the collection of information regarding inquiries for hoist quotations. An effort is being made by the association to determine what relation exists between inquiries and orders.

# Market Conditions

BUYING in New England is being well sustained with a good demand recorded for motors. A number of electric furnace orders are pending final approval. A prominent manufacturer states that New England business has shown a steady growth and, with the exception of 1920, sales for the last year are greater than in any other year. In the Eastern district the demand for motors was strong and central-station companies continue to buy substation equipment. One order for transformers amounted to $270,000. The volume of sales is satisfactory in the Southeast and is spread over the entire territory. A considerable amount of industrial business is in immediate prospect.

Inquiries are good but sales are off in the St. Louis district. Industrial buying improves in the Middle West and there is little change in general business conditions. On the Pacific Coast industrial ordering is active, although in the Seattle district motor orders are low, with good prospects for future business. Many street-lighting projects are reported. A 200-ton paper mill to cost $6,500,000 is being planned by the Zellerbach interests.

### *Big Demand for Copper Both Here and Abroad*

An enormous demand for copper, which developed to its fullest extent on Tuesday, was the feature of the metal markets. The other non-ferrous metals were fairly quiet, with prices generally well maintained. The copper market, which has been little better than average for the last month, and extremely dull in the East and in the Middle West for many weeks before that, gradually improved until Tuesday, when an avalanche of orders quickly brought every seller up to the full 14⅛-cent Valley quotation. Total sales for the week ended Wednesday have exceeded those of any week since that of Dec. 8, 1926.

Good inquiry and active buying have characterized the domestic lead markets.

NEW YORK METAL MARKET PRICES

| | Mar. 21, 1928 Cents per Pound | Mar. 28, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 13.78¾ | 13.90 |
| Lead, Am. S. & R. price | 6 | 6 |
| Antimony | 10¼ | 9¾ |
| Nickel, ingot | 35 | 35 |
| Zinc spots | 6.0½ | 6.046 |
| Tin, Straits | 53¾ | 53 |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper price March 28, 1928, 15¾ cents.

Small premiums over the contract price of the American Smelting & Refining Company, which has remained at 6 cents New York, have been obtained, but the tonnage is not sufficiently large to be reflected in quotations. The leading interest, however, during the last two days has been unwilling to entertain business at the 6-cent level for delivery beyond April.

### *Volume of Sales Satisfactory in the Southeast*

Individual orders placed in the Southeast are small. The demand is virtually from the entire territory and the total volume of business is satisfactory. One company in Georgia ordered creosoted pine poles amounting to $3,400 and bare copper wire amounting to $1,800, while two small companies in the same state ordered line construction materials amounting to $2,500 and $1,000, respectively. One of the larger central-station companies received an order for 72 electric ranges for an apartment house installation and the order for 72 electric refrigerators for the same installation is pending and will undoubtedly be placed during the coming week. The same company also received an order for sixteen refrigerators for an apartment house.

Inquiries, rather than orders, constitute the principal activity in industrial lines, but a considerable amount of business is in more or less immediate prospect. Two medium-sized textile mills in the Carolinas, using large amounts of process steam, are contemplating the purchase of steam turbines. An order was received for $1,000 worth of inside wiring materials for a Georgia fertilizer plant addition. A "white-way" system and additional street lights will be installed at Brunswick, Ga.

Construction items are as follows: The Central Georgia Power Company will extend its 11,000-volt line to the American Clay Company, and install a 300-kva. substation. The Alabama Power Company is acquiring the municipal power plant at Athens, Ala. The Atlantic Ice & Coal Company, Atlanta, Ga., plans a cold storage plant at Buena Vista, Ga. The Chase Bag Company, Memphis, Tenn., plans the installation of a plant addition which is to cost $115,000. The Tubize Artificial Silk Company, Hopewell, Va., plans a new mill to cost $1,000,000. The Orange Textile Mills, Inc., Orange, Va., plans a new mill, to cost $100,000. The Shenandoah Milling Company, Shenandoah, Va., plans a hydro-electric plant on the Shenandoah River to cost $250,000. The Appalachian Electric Power Company plans a substation in the Williamson district, to cost $150,000. The Mississippi Power & Light Company plans a transmission line from Lexington to Durant, Miss. The Carolina Power & Light Company plans a transmission line from Canton to Asheville, with branch to Greenville, S. C., about 70 miles, to operate at 110,000 volts and to cost $250,000. Hickory, N. C., Montgomery, Ala., and Union City, Tenn., are planning ornamental street-lighting systems.

### *Strong Demand for Motors in Eastern District*

Motor sales are decidedly active in the Eastern district. Iron and steel mills, dye and chemical interests, textile mills, metal-working plants, paper mills and the automobile industry are prominent in the demand for equipment. The business in turbine units also is improving and the outlook is encouraging. A dye manufacturing company in New Jersey has placed an order for motors totaling $35,000. A yeast manufacturing concern has contracted for a turbo-generator to cost over $20,000. Chemical interests in West Virginia and Tennessee, now engaged in plant expansion, are in the market for motors and kindred equipment and are expected to place orders at an early date. A shipbuilding company in New Jersey is constructing two large vessels for the Panama Railroad and, while decision is still pending, it is anticipated that electric turbine units will be selected for operation. Business in fractional-horsepower motors is holding up well.

Central-station companies are continuing the purchase of substation equipment. A metropolitan utility has contracted for a quantity of oil circuit breakers and regulators for a local substation. A company in New Jersey has divided an order for 27 transformers, 4,000 kva. each, among three manufacturers, at a total cost of $270,000. Another company placed an order for transformers amounting to $55,000 and for regulators to cost $65,000. A New Jersey utility also has signed a contract for a quantity of high-tension insulators. The demand for insulators has been very sluggish during the past few weeks and still continues spotty. Wire and cable business is lagging, although the prospects for sizable commitments are better. A manufacturer of street-lighting equipment reports an awakening in this line and a number of municipalities in the Eastern district are showing an inclination to make purchases.

Both central station and industrial accounts are fairly active at Philadelphia, although sales are on a reduced basis as compared with this time a year ago. Some of the Pennsylvania power concerns are expected to make early purchases of line equipment and apparatus for substation service. Industrial motors are moving quite actively.

Immediate construction projects in the Eastern district include the following: The A. P. W. Paper Company, Albany, N. Y., plans an addition to cost $1,000,000. The Cortland (N. Y.) County Lighting Company plans line extensions at Preble, Solon and vicinity. The Lockport Light, Heat & Power Company will install a system at Middleport. Albert D. Smith & Company, New York, will build a window shade plant on Staten Island to cost $100,000. The Great Atlantic & Pacific Tea Company, Jersey City, N. J., plans a baking and refrigerating plant at Altoona, Pa., to cost $350,000. A. Schottland, Inc., Paterson, N. J., plans a silk mill at Staunton, Va., to cost $200,000. The Trenton Potteries Company, Trenton, N. J., will build an addition to cost $100,000. Newark, N. J., plans an ornamental lighting system on Hawthorne Avenue. The American Electric Power Company will build transmission lines to Atlantic City and in the vicinity of Wilmington, Del. The Hazleton Heights Silk Company, Hazleton, Pa., plans a mill at Clinton, S. C., to cost $100,000.

### *Industrial Buying Improves in Middle West*

Industrial plant buying is improving in the Middle West. Little change in general business conditions is noted. The automotive and steel industries continue to show improvement. Several of the railroads have placed large orders for equipment, while car loadings indicate a considerable movement of commodities. Utility companies are actively engaged in construction work. An order was placed for 350,000 lb. of copper bar, one for 150,000 lb. of solder and one for 500,000 lb. of triple-braid weatherproof wire. Jobbers' sales are normal. Business is not generally as good in the electrical jobbing line as it was last month at this time.

Construction projects are as follows: The Central Illinois Public Service Company plans an ice plant at Bluford, Ill., to cost $100,000. The Park Air Line Company, St. Louis, plans an aircraft manufacturing plant at East St. Louis, Ill., to cost $100,000. The Fleischmann Company, Chicago, will build a yeast plant at Pekin, Ill., to cost $450,000. Logansport, Ind., plans extensions in its electric power plant. The Iowa Soap Company, Burlington, Iowa, plans a power plant in connection with an addition to its factory to cost $100,000. The Consumers Power Company will build an addition to its steam plant at Grand Rapids, Mich. Willmar, Minn., plans extensions in its municipal power plant. Haskins Brothers & Company, Omaha, Neb., will build an addition to its soap-manufacturing plant, to cost $100,000. The Akron Rubber Reclaiming Company, Barberton, Ohio, will take bids for a new mill at East St. Louis, Ill., to be operated by the Midwest Rubber Reclaiming Company, a subsidiary, to cost about $175,000. The Consolidated Water Power & Paper Company plans an addition to its paper mill at Appleton, Wis., to cost $350,000. The Central Illinois Public Service Company, Springfield, Ill., will serve Laclede, Watson, Mason, Edgewood, Rosamond, Forest City, Topeka, Bishop, Ledford, Rohrer and Dorans. Belleville, Wis., plans an extension of its 6,600-volt line and the construction of a small substation. Janesville, Wis., plans to rebuild the transmission line on the south shore of Lake Ripley. The Wisconsin Power & Light Company, Madison, Wis., plans a transmission line at Clintonville and in the Baraboo district and reconstruction of the line extending from Reedsburg to Pardeeville. Glenview, Ill., Deer River, Grand Rapids and Waseca, Minn., and Lincoln, Neb., plan ornamental lighting systems.

### *Buying in New England Is Well Sustained*

The sales volume in the New England district indicates that buying is steady with increasing symptoms of strength. Particularly is this true of the movement in small motors, which reached an encouraging total of over $50,000. Central-station supplies are moving in small lots and prospects for continued activity are good in view of a number of link-ups planned in Maine and Massachusetts. Wire orders are coming in regularly, and portable electric tools have received some attention. Switch and control apparatus orders have fallen off temporarily and transformers are quiet.

Electric furnaces are being considered by a number of plants and a number of orders are pending final approval. Electric street lighting is active and a list of appropriations amounting to over $100,000 is being considered by a prominent manufacturer. One company states that New England business over the past year was greater than at any time since 1920. Contracts awarded last week reached a total of over $11,000,000. Construction projects are as follows: A hospital under state aid will be erected in Waltham, Mass., at a cost of $1,000,000, and the Boston Ice Company plans an ice plant in Dorchester.

### *Industrial Ordering Active on Pacific Coast*

A week's steady rain on the Pacific Coast has prevented serious crop losses owing to an otherwise dry spring. There are only 42 in. of snow at Summit, the normal being 115 in. Various orders now under consideration include a 100-ton electric crane for Los Angeles, 650 pieces of copper busbars for Glendale, a traffic signal system for Santa Cruz and street lighting projects for Belmont, Willows, Oakland, etc. Industrial ordering is good, comprising such varied business as $3,000 worth of motors for a lumber company, three motion-picture motor-generator sets amounting to $6,000, 100 washing machine motors, 250 mixing machine motors, a gas-engine-driven arc welding set for a steel company and a complete traffic control system for San Jose. Power company ordering is rather quiet, being limited to maintenance material and supply stock orders. The outstanding machinery order covers two heavy-duty circuit breakers, valued at $3,000 each, for the Bay district.

Although prospects for future business are reported exceptionally bright by Seattle jobbers, sales were at a minimum and were the smallest for any week since the first of the year. A few scattered motor orders, small sizes only, were placed by irrigation companies and orchards. The Puget Sound Power & Light Company placed an order for twelve 75,000-volt oil switches and the city of Seattle issued a call for bids for clearing 700 acres of land for the Diablo reservoir site of the Skagit hydro-electric project. The city of Seattle also called for bids for street lights on Union and other streets, costing in excess of $400,000. Longview, Wash., plans extension of street lights to cost $25,000 and Oregon City during March will award a contract for a system on four streets. The Western Cold Storage Company, Wenatchee, will purchase 350 hp. in motors for one of its plants. The Zellerbach interests are planning a 200-ton paper mill to cost approximately $6,500,000 and to operate in conjunction with the 100-ton pulp mill at Hoquiam now under construction.

Construction projects are as follows: The Salt River Valley Water Users' Association, Phoenix, Ariz., plans an 8,000-kw. hydro-electric power plant in the Stewart Mountain district. The San Diego Gas & Electric Company has approved plans for a substation at Oceanside, Calif. The E. H. Edwards Company, South San Francisco, Calif., will build an addition to its wire rope plant to cost $100,000. The Apple Growers' Cold Storage Company, Watsonville, Calif., will build a cold storage plant to cost $250,000. The Walsenburg Creamery Company, Walsenburg, Colo., plans a cold storage plant. The Midland Counties Public Service Corporation will make extensions in substations and transmission lines at San Luis Obispo, Calif., to cost $30,000. The Southern Colorado Power Company will make extensions in its power plant at Lamar, Colo., and will construct a transmission line from Las Animas to Lamar. Richmond, Sacramento, Orlando, Salinas, Los Angeles and Yreka, Calif., plan installation of ornamental lighting systems.

### *Inquiries Good But Sales Off in St. Louis District*

Manufacturers in the St. Louis district report a slight increase in the demand for stock apparatus. The only important orders placed were one for a lot of eight oil well motors amounting to $75,000, and another for an electric locomotive for one of the Southern railroads at a cost of $28,000. Jobbers report business quiet, but several large jobs are being figured.

Construction projects are as follows: The Southwestern Gas & Electric Company, Shreveport, La., plans a steam power plant on the Little River, near Horatio, Ark., to cost $1,500,000. The Hollywood Public Utilities Company, Shreveport, La., plans a power plant. Marshall, Mo., has voted $80,000 in bonds for an addition to its municipal power plant. The Stewart Inso Board Company, St. Joseph, Mo., will build an addition to its plant to cost $200,000. The New State Ice Company, Oklahoma City, Okla., will build an ice plant on West Main Street. The Southwestern Light & Power Company has acquired the municipal power plant at Thomas, Okla. The Myers-Spalti Manufacturing Company, Houston, Tex., will build an addition to its furniture factory to cost $200,000. The Crystal Oil Refining Corporation, Shreveport, La., plans a new refinery at Monahans, Tex., to cost $350,000. Olton, Tex., plans a municipal power plant. The Texas Utilities Company will build a transmission line from Slaton to Tahoka, Tex., to cost $50,000. Clayton, Noel and St. Joseph, Mo., and Fort Worth and Burnett, Tex., plan ornamental lighting systems.

# Activities of the Trade

## Bryant Company Acquires Hemco Manufacturing

The plant, real estate, equipment and patents of the Hemco Electric Manufacturing Company of Bridgeport, manufacturer of molded sockets, plates and other composition parts for electrical fittings, has been taken over by the Bryant Electric Manufacturing Company, Bridgeport, Conn. The acquired plant covers 2¾ acres with 70,000 sq.ft. of floor area.

The Hemco products will be made under the same trade name, but the plant will be operated under the Bryant name, and its products will continue to be distributed by former Hemco distributors and also by all Bryant distributors. The line also will be increased. The Bryant company is taking over the entire personnel, including E. B. McKinley, president of the Hemco company.

## Joslyn Company Takes Over American Jobbers Supply

The Joslyn Company, Eastern division of the Joslyn Manufacturing & Supply Company, has taken over the interests of the American Jobbers Supply Company of New York with branch offices located in Philadelphia, Boston, and Baltimore. The Joslyn Company will continue to sell the same lines of material formerly sold by the American Jobbers Supply Company, consisting of the Seyler Manufacturing Company's pole line hardware and specialties, the Porcelain Insulator Corporation's "Pinco" high-voltage porcelain insulators, and the Joslyn Manufacturing & Supply Company's poles and complete pole line materials and construction tools.

The Joslyn Company has crossarm factories and complete warehouse stocks of hardware and other supplies at Rutherford, N. J. and Baltimore, Md. E. L. Morier, who was formerly Eastern vice-president of the Naugle Pole & Tie Company, Chicago, has been appointed general manager of the Joslyn Company.

## Babcock & Wilcox Gets Order for Deepwater Boilers

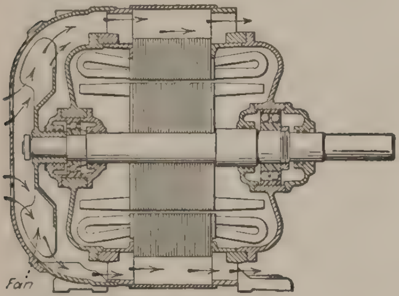
Stevens & Wood, Inc., New York, acting as agents for the American Gas & Electric Company and the United Gas Improvement Company, have placed an order with the Babcock & Wilcox Company for six high-pressure boilers for the new Deepwater plant. Four of these units are standard boilers, 53 sections wide, each section being eight tubes, 3¼ in. in diameter and 20 ft. long, the sections being connected to a forged steel drum 4 in. thick, 52 in. internal diameter and 50 ft. 3 in. long. The heating surface of each unit is 9,623 sq.ft. The boilers are to be equipped with Babcock & Wilcox convection superheaters designed to give an ultimate steam temperature of 725 deg. when the boiler is operating at a rate of 331,000 lb. of steam per hour. The boilers will also be equipped with Babcock & Wilcox wrought steel return bend economizers of the steaming type. Each economizer will contain 18,326 sq.ft. of heating surface.

Two of the units are reheat boilers, the boiler sections having the same size and arrangement of heating surface, and are identical with the standard boilers. The superheaters are of the convection type designed to give an ultimate steam temperature of 725 deg. when the boilers are delivering 290,000 lb. of steam per hour. The reheater elements are of the Babcock & Wilcox wrought steel return bend construction, designed to reheat a maximum of 419,000 lb. of steam per hour at an initial pressure of 385 lb., and a temperature of 487 deg. to an ultimate temperature of 775 deg. The reheat boilers are to be equipped with Babcock & Wilcox wrought steel return bend economizers containing 4,763 sq.ft. of heating surface each. Both standard and reheat boilers are built for a working pressure of 1,350 lb.

# New Equipment Available

## Air-Jacketed Motor

An air-jacketed motor, for use where dust, fumes and moisture are present in sufficient quantities to necessitate protection to the motor, has been developed by the Wagner Electric Corporation, St. Louis. The entire motor, as shown in the illustration, is surrounded by a jacket open at both ends with fan blades on a shaft extension, between the sealed motor and its outer jacket. The only clearance between rotating and stationary parts of the motor is in the bearing housing. The motors are new in external construction only, the company stating that no change has been made in the electrical principles. The end shield is made of cast iron, rib-reinforced, and has a substantial grating which protects the fan and provides an opening for incoming ventilating air. The center shield is made of heavy sheet steel held in place by slot head bolts. The fan is of one-piece construction. The conduit box is mountable in four positions. The exposed outer rim of the stator is deeply grooved to increase radiation surface, and the stator laminæ are welded together to lessen vibration and reduce magnetic noises.



*Inclosed motor with air jacket and ventilating fan*

The motors have a double row of ball bearings, self-aligning in one end plate and deep groove in the other to take end thrust. Bearings are grease lubricated and sealed in a dustproof housing. The shafts are made slightly longer than those for standard motors to permit mounting the fan. Single-phase repulsion-induction motors may be had in sizes from 1 hp. to 20 hp. and polyphase squirrel cage motors in sizes from 2 hp. to 30 hp. These motors are designed for a temperature rise not to exceed 50 deg. C. and to meet all A.I.E.E. and N.E.L.A. standards.

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MICROAMMETER.—A microammeter of the semi-suspended type is being marketed by the Rawson Electrical Instrument Company, Cambridge, Mass. This instrument is furnished to meet the demand for a portable calibrated meter reading excessively small current values. In this device, known as the type 503, full scale sensitivity is obtained with a current of 0.5 microampere. The scale is about 5 in. long, each division representing 0.005 microampere.

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## Stroboscope

An electrically operated stroboscope, for determining the angle of lag of synchronous machine rotors under load, has been devised by engineers of the General Electric Company. The new device employs no moving parts or tachometers. It operates by means of a small neon-gas lamp, which gives flashes of light lasting less than one-fifty-thousandth of a second each, and thus illuminates a white line on a stroboscopic disk fixed to the rotor shaft of the machine under test, for so short a time that the line appears to be standing still. Fixed concentrically with the disk, and just outside its circumference, is a stationary scale marked in electrical degrees, and upon this the white line acts as a pointer, giving a direct reading of rotor displacement.

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## Stoker

Each section of the new Riley superstoker made by the Riley Stoker Corporation, Worcester, Mass., is provided with a damper which is under the control of the operator so that he may supply more or less air, dependent on the fuel conditions at any particular point throughout the length of the stoker. These dampers are controlled from the side wall of the boiler. In the front wall construction means for admitting air over the top of the fuel bed has been provided and is under the control of the operator. The control consists of a sliding damper which is operated by a hand lever at the front of the stoker. Another improvement in the Riley super-stoker over the old design is in the grate block construction. A large diameter and long stroke plunger is used, the disadvantage of a large plunger being overcome by using four grate blocks at the front of the stoker of narrower width and then widening out the remaining grate blocks. This construction is said to give higher capacity and far greater pick-up and flexibility.

The clinker grinding operating mechanism has been redesigned to provide a more variable means of control. The drive for the double roll clinker grinder is so arranged that either or both rolls can be operated as desired. There is also a variable speed provision consisting of a cam which permits the driving pawl of the ratchet to engage one, two or three teeth as desired. The control for the ratchet pawl is independent for either grinder roll so that the speed of one roll can be varied independently of the other.

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## Heavy-Duty Oil Circuit Breaker for Indoor Service

The type "O-55" circuit breaker for generating station service, built in 4,000, 5,000 and 6,000 amp. capacities at 15,000 volts, with a rupturing capacity of 2,500,000 kva. at 15,000 volts, has been added to the line of the Westinghouse Electric & Manufacturing Company. The breaker units are mounted in a concrete structure with barriers between the units which are supported from the top plate that also carries the operating mechanism. This method of mounting places the barrier walls in compression, utilizing their maximum strength. The breaker is said to be of high mechanical strength. The condenser type terminals are used to pass the conductors through the main base. The contacts are of parallel path construction. The arcing contacts protecting the main contacts are finger and wedge type, easily renewable and heavier than on lighter breakers to take care of increased rupturing capacity.

*Detail of contacts on type O-55 heavy-duty oil circuit breaker*

The electric mechanism consists of a double solenoid designed so that the pull of the closing mechanism closely matches the effort required to close the breaker units at all points of the closing stroke. This gives adequate speed of closing for synchronizing, and at the same time keeps down stresses within the structure. The electric mechanism is equipped with rotary type auxiliary switches for indicating, interlocking and control purposes. A control relay panel is also included in the closing mechanism. The control relay removes the energy from the electric mechanism immediately upon the completion of the closing stroke. The mechanism is mechanically full-automatic; that is, it cannot be held closed, either electrically or mechanically, if the tripping relays disengage the trigger.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued March 6, 1928)

1,661,703. Electrolytic Rectifier; C. E. Ogden, Cincinnati, Ohio. App. filed Aug. 6, 1926.

1,661,712. Electrical Appliance; P. Van Wagner, New York, N. Y. App. filed July 31, 1924. Ground cap for a tube or rod.

1,661,740. Apparatus for Effecting Energization Control of an Electric Circuit; E. R. Stoekle, Milwaukee, Wis. App. filed Aug. 13, 1921.

1,661,776. Storage-Battery Charge Indicator; T. J. Strouse, Pottstown, Pa. App. filed Aug. 13, 1926.

1,661,795. Double-Throw Switch; H. J. L. Frank, Detroit, Mich. App. filed Sept. 4, 1923. With interlocking cover.

1,661,823. Insulator; K. A. Hawley, New York, N. Y. App. filed June 4, 1921. Grading means for high tension insulators.

1,661,824. Motor-Driven Sewing Machine; M. Hemleb, Elizabeth, N. J. App. filed May 19, 1925.

1,661,841. Regulating System; G. R. McDonald, Schenectady, N. Y. App. filed Aug. 30, 1926. For controlling the division of load between two sources of current.

1,661,842. Electric Furnace; J. L. McFarland, Schenectady, N. Y. App. filed June 16, 1927. Means for supporting and securing the resistor.

1,661,850. Electrical System; D. C. Prince, Schenectady, N. Y. App. filed May 18, 1925. An arrangement comprising an electron discharge device for interchanging power between direct and alternating current systems.

1,661,854. Storage-Battery Device; F. C. Ridgely, Detroit, Mich. App. filed Feb. 20, 1925. For holding oil, grease, etc., under a battery post.

1,661,862. Electric Heater; W. N. Vanatta, Ontario, Cal. App. filed Dec. 29, 1924. Means for protecting electric heaters from overheating.

1,661,883. Electric-Ship-Propulsion Installation; E. D. Dickinson, Lynn, Mass. App. filed July 19, 1922.

1,661,902. Feed-Wire Support; N. A. Michaelson, Uniontown, Pa. App. filed May 27, 1927. Supporting device for feed wire of a trolley wire.

1,661,909. Electric Clock; C. E. Prince, Burchetts Green, England. App. filed Aug. 6, 1924.

1,661,913. Battery Tester; J. Taylor, Chicago, Ill. App. filed Jan. 22, 1927.

1,661,923. Rotary Rectifier; C. M. Clay, Mexico, Mo. App. filed June 2, 1923.

1,661,928. Electric Lamp; W. Dawson, London, England. App. filed May 23, 1927. Multiple filament type.

1,661,945. Dry Cell; W. F. Hendry, Ossining, N. Y. App. filed Jan. 23, 1924.

1,661,970. Electric Welding Machine; F. L. Sessions, Lakewood, Ohio. App. filed Jan. 13, 1923. For welding longitudinal seams in thin wall drums or the like.

1,661,994. Automatic Porch Light; G. H. Brown, Nevada, Mo. App. filed Oct. 22, 1921.

1,662,027. Tungsten Product and Its Manufacture; A. de Graaff, Eindhoven, Netherlands. App. filed April 24, 1928. To prevent the sagging of a tungsten filament.

1,662,031. Electrically Heated Device; F. H. McCormick, Glen Ellyn, Ill. App. filed Sept. 11, 1925. Such as ovens in which suitable mechanism is provided for automatic heat control.

1,662,045. Lamp-Making Machine; F. W. Patterson, Arlington, N. J. App. filed April 22, 1924.

(Issued March 13, 1928)

1,662,055. Connecting Device; H. P. Chandler, Mansfield, Ohio. App. filed May 13, 1925. For making temporary connections to a conductor.

1,662,071. Regulating System; E. C. Manderfeid, Boonton, N. J. App. filed Aug. 4, 1926. To regulate mechanical or electrical characteristics, as for example, speed, frequency or voltage.

1,662,075. Electrolytic Rectifier; A. B. Muntyan, Amsterdam, Netherlands. App. filed Oct. 15, 1924.

1,662,083, 1,662,084, 1,662,085. Electric Regulator; H. M. Stoller, Mountain Lakes, N. J. Apps. filed Aug. 4, 1926. For regulating the speed or frequency of dynamo electric machines.

1,662,107. High-Tension Electric Cable; L. Emanueli, Milan, Italy. App. filed Sept. 1, 1925. Of the type in which the strands of the conductor are supported by a hollow metallic core and through which oil flows and impregnates the insulation that surrounds the conductor.

1,662,114. Flashing and Regulating Apparatus for Discharge Tube Display; F. Hotchner, Los Angeles, Calif. App. filed March 9, 1927.

1,662,122. Pressure Actuated Circuit Control; I. E. McCabe, Chicago, Ill. App. filed Feb. 11, 1922.

1,662,132. Inductance Apparatus; B. J. Simmons, Stillwater, Minn. App. filed Nov. 16, 1925. A compound electromagnetic cycle.

1,662,149. Electric-Furnace Voltage Control; A. E. Greene, Medina, Wash. App. filed Jan. 3, 1913.

1,662,174. Electromagnetic Relay; E. W. Seeger, Milwaukee, Wis. App. filed May 17, 1920. Responsive to undulating currents.

1,662,233. Trolley Wheel Carrier; C. W. Brown, Los Angeles, Calif. App. filed Dec. 15, 1924.

1,662,243. Controller for Electric Motors; C. T. Evans, Milwaukee, Wis. App. filed May 8, 1922. For direct current motors.

1,662,245. Yieldable Connecter for Electric Cables; C. M. Goodrich, Windsor, Ont., Can. App. filed June 14, 1927. For suspending high tension electric cables from the arms of towers and other overhead supports.

1,662,252. Electric Regulator; E. R. Morton, New York, N. Y. App. filed March 12, 1925. Electron tube regulator for electric generators.

1,662,275. Switch Box; J. L. Lane, Chicago, Ill. App. filed May 19, 1924. With safety locking device.

1,662,334. Street Light Fixture; F. B. Reberg, Casper, Wyo. App. filed Nov. 24, 1924. Bracket suspension for street-hood bodies for street lighting.

1,662,335. Spring Socket Terminal; L. Reichold, Winsted, Conn. App. filed Nov. 26, 1926. For use with the quick detachable jack and plug connections for portable electrical utensils.

1,662,346. Battery Terminal Clamp; R. B. Stewart, Crows Landing, Calif. App. filed Nov. 19, 1925.

1,662,349. Storage Battery; G. K. Thompson, Summit, N. J. App. filed Aug. 31, 1923.

1,662,366. Automatic Electric Service System; M. C. Cosgray, Sandusky, Ohio, App. filed April 23, 1923. An auxiliary source of supply of electric energy that will be automatically connected when the main supply falls below a predetermined amount.

1,662,369. Arc Welding System; J. Kjekstad, Brooklyn, N. Y. App. filed Aug. 1, 1918. Applicable to both carbon arc welding and to metallic arc welding.

1,662,383. Electrolytic Rectifier; W. H. Grimditch and J. N. Hunsberger, Jr., Philadelphia, Pa. App. filed Feb. 18, 1927.

1,662,434. Control Mechanism; M. W. Palmer, New York, N. Y. App. filed Jan. 4, 1927. Automatically operating controlling mechanism whereby the voltage in a line may be maintained within very close limits.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Santiago, Chile (No. 30,300), for storage batteries.

Purchase is desired in Panama City, Panama (No. 30,235), of electric dishwashers.

Purchase and agency are desired in Amsterdam, Netherlands (No. 30,236), for dishwashers, potato peelers, ice-cream freezers and other electric kitchen equipment for hotels, hospitals and steamships and electric refrigerators.

Purchase and agency are desired in Hamburg, Germany (No. 30,241), for electric laundry machinery.

An agency is desired in Barcelona, Spain (No. 30,254), for oil burners with motor and compressor.

# New Trade Literature

MOTORS—"Lincoln 'Linc-Weld' Motors" is the title of a bulletin issued by the Lincoln Electric Company, Cleveland, in which it describes its "Linc-Weld" method of motor construction, showing in detail the use of welded steel. An illustration is given showing a phantom view of a standard Lincoln "Linc-Weld" motor. Attention is called to its automatic induction controller, the "Linc-Weld" switch-start motor, and the stable arc welder.

MOTORS, STARTERS AND TRANSFORMER RATIO ADJUSTERS.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-808A, GEA-137A, GEA-467A and GEA-147B, describing and illustrating respectively its forms RA and RL totally inclosed fan-cooled induction motors "500 series," types TS and QS "6000 series" synchronous motors for mounting on compressor shafts, CR7022 automatic starters for slip-ring motors and power transformer ratio adjusters.

WATT-HOUR METER. — The Sangamo Electric Company, Springfield, Ill., has issued a bulletin in which it describes and illustrates the Sangamo type HC watt-hour meter. Illustrations show the construction of this new meter. Included is a table of train ratios and disk constants and a series of curves showing the meter accuracy with change in load, change in temperature, change in voltage and change in frequency.

ELECTRIC RANGES AND PANELBOARDS.—The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, has issued catalog No. 302A, covering its new "Consolette" electric ranges. Illustrations showing the various types of the ranges are given and a description of the construction of the "Consolette" range is included. The company also is distributing a bulletin on the "Little Sentry" line of panelboards with or without arrangements for branch circuit tumbler switches, recommended for residences, apartment buildings, schools, small stores and factories and similar places having from four to twelve branch circuits.

RAILWAY EQUIPMENT. — Bulletins GEA-797, GEA-872, GEA-921 and GEA-951 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively the repair of commutators of railway and industrial-haulage motors, drum type controllers for railway service, better lubrication for G-E 265 railway motors and the "Mazda" C short-circuiting lamp and socket for 600-volt railway circuits.

METER RECORDS.—"What Can You Do in Fifteen Seconds" is the title of a catalog issued by the Kardex division of the Remington Rand Business Service, Inc., 374 Broadway, New York City, covering its meter record system. How the Erie County Electric Company applies the method to its system is described. Attention is called to the fact that the record is not only a meter record but also serves as an address record and a test record. A complete description of the system is included and a sample of the cards used are attached to the catalog.

NEON TUBES AND ACCESSORIES.—The New Jersey Neon Light & Power Corporation, Camden, N. J., has issued a catalog covering "Neon" tubes and "Neon" accessories for sign work.

POLE LINE MATERIAL.—A catalog issued by the Oliver Iron & Steel Corporation, South Tenth and Muriel Streets, Pittsburgh, Pa., covers a condensed listing of Oliver pole line hardware and construction specialties. The various products listed are all illustrated and described.

CABLE RACKS AND SWITCHES.—The Metropolitan Device Corporation, 1250 Atlantic Avenue, Brooklyn, N. Y., is distributing a bulletin in which it describes and illustrates its cable racks for manhole, vault, station wall and service box mounting, and other underground distribution devices. Photographs show some special cable vault installations. The company has also issued a pamphlet covering meter service switches, the accessible main fuse type with testing facilities and accessible branch fuses combined.

RECORDING INSTRUMENTS AND LIMIT SWITCH. — Bulletin GEA-927 issued by the General Electric Company, Schenectady, N. Y., covers its type CP-4 and CP-5 alternating-current portable recording instruments. The company is also distributing bulletin GEA-914, describing the CR9441-LS424A limit switch for use on control circuits only.

# Electrical World

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## *Why Should Municipal Plants Be Exempt from Supervision?*

WHAT is there so sacrosanct about the business of government, and especially municipal government, that its exponents are moved to insist that government shall be a law unto itself and that it shall not be subject to constant scrutiny and examination? Government is the greatest business in the country, and yet in most instances it is the most poorly conducted. Whence, then, the cry "Touch not mine anointed"? Regulation and supervision are exercised over all public utility corporations except the vast majority of those municipally owned and operated. To the latter are granted indulgences, so to speak, and they receive preference over utilities otherwise owned. Why? Surely not because they give a better service or because their affairs are managed with more scrupulous regard for the rights of the public. On the contrary, they are, if anything, more remiss than ordinary corporations in rendering an account of their stewardship to their stockholders—that is, to the public. Men who are elected or appointed to public office seem to forget that they are servants, not masters, and that powers of office are a public trust.

Consider the catastrophe which overtook the inhabitants in the San Francisquito Valley of California recently by the failure of the St. Francis Dam. Hundreds of lives were lost because of the derelictions of municipal engineers whose work was not subject to state supervision. When a few years ago some dams failed in San Diego County the Legislature of California passed a law requiring supervision and inspection of dams by the State Engineer. When the measure was first introduced it provided for supervision of all dams, but a proviso was later slipped in at the instigation of lobbyists (mark the word and by whom they were employed) exempting municipalities having their own engineering departments. When a public utility company erects a dam in California the work is subject to the approval and continuous inspection of the State Engineer and also of the Public Service Commission. The dam erected by the Los Angeles municipal Water and Power Department was never inspected by any one but itself.

This incident also brings up some question regarding the Boulder Canyon Dam on the Colorado River. There are engineers who feel that the Boulder Canyon project has not received careful scrutiny from engineers not interested directly in it. There are others who, in the light of the St. Francis Dam failure, point to the enormous hazards involved in holding back such an immense quantity of water by a single dam of huge proportions. Before the government spends hundreds of millions at Boulder Canyon would it not be well to give further thought to the entire matter—first, to determine whether the engineering plans and the location are all that is claimed and, second, to ascertain whether it might not be better to impound the water of the Colorado in a number of smaller dams, one of which could be built near Needles for immediate protection and the others erected farther upstream than Black Canyon? Certainly, the experience in the San Francisquito Valley should cause very serious inquiry and thought to be given to the Boulder Canyon project, which will impound 720 times as much water as was unloosed by the failure of the St. Francis Dam.

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## *"Legalizing" Preferreds and Debentures*

UTILITY preferred stocks, notes and debentures are commencing to enter the door of the "legals" in New York State by the terms of the Wales law, passed by the Legislature in its closing days. This law is but another step taken in recognition of the necessity of widening the field of available investment of funds by regulated institutional investors. By its terms life insurance companies — long restricted to real estate mortgages, corporation mortgage bonds and various government obligations—may now invest in the preferred and guaranteed stocks and in the notes of corporations whose earning history is satisfactory as defined by the law.

While they are not referred to specifically, an examination of the securities coming within the provisions of the law discloses that many preferred stocks and debentures of electric light and power companies—both holding and operating—are thus "legalized." To those who are observant this is as it should be. For the untarnished record of preferred stocks in this industry, as well as the even stronger position of the debentures, has long recommended these securities to the discriminating institutional investor who was free to purchase them. Note, for example, the investment list of the Sun Life Assurance Company of Canada as mentioned in these columns last week. This company is well known in the United States for its careful study and keen judgment in investing its funds, and its list shows large amounts of American utility debentures, preferred stocks and even common stocks.

As in the case of legalizing bonds for savings banks and trust funds, so this move has an effect on the yield rate at which securities affected by it may be issued. The total volume of money released to flow into these channels is not very large, comparatively, but the effect of the law was immediately felt in Wall Street. At least one issue then in negotiation between company and banker was increased in price to take advantage of the new tone of the debenture and preferred market which resulted from the law's passage.

From the standpoint of the insured, laws like this will allow insurance companies to invest in securities of higher yield and thus keep down the rates for insurance. From the standpoint of the companies whose security prices are affected by this increased demand from the insurance companies, the new law indirectly makes it possible to obtain funds from unsecured obligations and preferred stocks at lower yield. But it must be remembered that the primary object of the law was the one stated first, and that certain utilities may benefit in the second way is due to the fact of their past record of performance having placed their securities in a preferred class, now officially labeled "safe." It is a record which deserves to be, and doubtless will be, maintained and zealously defended, and all companies will have this additional inducement to shape their financial structures and formulate their financial policies along lines that will enable them to qualify their securities among the "legals."

* * * *

## *Blame for Cable Failures*

WHO is to blame? This is often a difficult question to answer, resulting in sharp differences of opinion even in the accidents of ordinary life. When it is a case of electrical trouble or failure, the answer is particularly difficult because so often the results of such failure destroy the evidence. A striking instance is the failure of a high-voltage underground cable, a most serious form of trouble, the means of preventing which is the constant study of manufacturers and operating engineers. When the cause of this type of failure is sought there is little use in examining the cable. The blow-out usually destroys the path over which it starts, and deductions in explanation are subject to great uncertainty.

To the discussion of the cause of cable failure there are two principal parties—the operating company and the manufacturer. Each would like to think the other to blame. The search for evidence is largely controlled by the operator. He is immediately on the job and has available the operating history immediately preceding the accident. The manufacturer, if he comes in at all at this stage, hears about it some time afterward, and he must content himself with such information as the operator gives him. He can ask the conditions of operation, and it is, of course, recognized that disturbances of other character in the operation of a large system may lead to the failure of cables which would probably show normal life under normal conditions of operation. This is the refuge of the manufacturer in the face of the accusing finger of the operator.

There is another important factor in this question. The operating companies are organized in several well-known national associations. The manufacturers, however, owing to their competitive relationship, have no such common ground on which they can seek measures of mutual protection against the frequent claim of the operating companies that cable failures are largely due to defects of manufacture. The National Electric Light Association has published through a number of years the records of cable failures in which some attempt is made to segregate these failures as due to cable defects or to operating conditions. In addition, similar data are given as to joint failures. Some of these reports are accompanied by quite definite suggestion that many of the cable failures are to be laid at the door of the manufacturer. The manufacturer replies: "Some perhaps, but not so many as you think."

A close study of the N.E.L.A reports for the years 1923-1926 seems to yield somewhat more light on these differences than appears on the surface. For example, of the total cable failures reported, those due to injuries under service conditions are double in number those classified by operating companies as due to defective cables. There is at least some likelihood that many failures ascribed to deterioration, defective workmanship and "X" wax are in reality due to manufacturing defects; if this were so, the number of these failures should be practically independent of the particular operating company on whose system the cable operates. From the data this is by no means so, and in fact it may be seen that if a company has a great number of total failures or a great many operating failures, this condition is accompanied in almost all cases by a large number of cable failures. It is also possible to correlate the reports on joint failures in such a way as to indicate that a portion of the defects attributed to manufacture in all probability are the results of joint failures. From which it might be argued with some force by the manufacturer that attention to general operating conditions and to general methods of installation in the direction of improvement would probably also result in a reduction of failures classified as due to manufacture.

* * * *

## *Sanity in Station Design*

IT IS well to appraise values in power-station design at frequent intervals. The time is ripe for a study of dollar economy based on the costs and performances of new stations that embody departures from past practices and that differ one from another in many features. Total energy cost at the switchboard, and not thermal economy, is the ultimate gage of merit. Complexity, automatic equipment, large units, reserve lines of defense, purpose of station, labor cost and many other items offer themselves for study. Automatic equipment is justified only as it reduces labor costs and improves performance—it is expensive, adds to the complication of the plant, requires high-grade maintenance men and must justify its use on an economic basis. The craze for high thermal economy leads to the use of high pressures, high temperatures, two fluids, reheating, preheated air, special furnaces and other things which are good only as their use reduces the total cost of generating energy during the normal life of the station. Fuel is too cheap to permit of glorified design at the expense of station costs.

Then on the electrical side there is a large amount of money spent for double buses and breakers, protective devices, reserve auxiliary and excitation supplies, switch houses and other items which may or may not be justified for each power station. No property can use a standard station design without spending money to excess, but, on the other hand, no property can without losing money make individual station designs as regards details of equipment which depart from standard.

Simplicity, reliability, minimum labor in cost and volume, lowest over-all cost of energy, suitability for service conditions and ease in operation and maintenance are the important factors in power stations. With many now in operation that have a 100 per cent cost variation per unit of capacity and with every conceivable type and arrangement of equipment installed, it would be well worth while to appraise the operating plants so that new designs could benefit. Any defensive position which might be taken by plant engineers to cover errors and inconsistencies must give way to a constructive attempt to make new stations better and cheaper through the use of the experience available. Past mistakes are forgivable, but they should not be repeated.

## *Electric Homes for Egyptian Ones*

IN ANCIENT times men built homes of wood, brick and stone by hand labor and with crude methods of construction. Even today our homes are the crudest and least efficient assemblies of these ancient materials and afford a sad commentary on the lack of initiative among modern builders and home owners. Home building follows Egyptian practices despite the advent of iron and cement and the development of skyscraper architecture. For housebuilding purposes metal pieces welded together, with fireproof fillers for walls and partitions, offer a means to get comfort and beauty at low cost. Fireproof structures of infinite variety can be built of modern materials in the modern way, and the current attempts to introduce these ideas to home owners should be encouraged by the electrical industry.

A steel-frame house with a solidly grounded neutral of bare metal offers attractive possibilities for reducing wiring costs. Methods of wiring and of installing illumination could utilize the advantages that pertain to a grounded structure. Whether heated by electricity or fuel, this type of home could have insulated walls and partitions that would save heat energy in cold weather, and in warm weather air refrigeration would be placed within the bounds of possibility. With the insulated, ventilated and flexible home possible by the employment of modern materials and construction practices there is no valid reason why the American home should remain either a square wooden box, a stone pile or a mound of unsightly bricks. Fondness for the antique can be carried to extremes.

* * * *

## *Effect of the New Radio Law*

CONGRESS has passed the radio bill. The President has signed it. It is the law. The electrical industry is wondering just what it means. The electrical industry is interested because radio is fast becoming an energy-consuming appliance important to the power companies, because many electrical manufacturers are making radio parts or sets, because electrical jobbers and dealers are selling radio merchandise, and because electrical contractors are installing radio wiring. Electrical men, therefore, have a valuable stake in the prosperity of the radio industry and are concerned over what the effect of the new law may be.

In a word, the life of the Federal Radio Commission has been extended one year, but there has been imposed upon the commissioners an amendment that demands that each zone shall have an equal number of stations, an equal amount of power and an equal number of wave channels and that within zones these shall be allocated according to the population of the states within the zone.

[illegible] the technical standpoint it is a difficult situation. No one would think of demanding that there be an equal mileage of railroads in every zone, or an equal production of electric power, or an equal number of telephones. No one would ask that there be an equal number of letter carriers. This is now required of radio, however, despite the obvious fact that broadcasting studios must naturally be located where artists are available and that therefore the great studios of New York and Chicago are providing programs of a quality that cannot be achieved in smaller communities.

But, on the other hand, it is also a fact that New York or Chicago stations, even with superpower, cannot carry into distant Southern and Western states. It is for this reason that the networks have been organized. It is also true that these networks are not yet extensive enough to enable the entire United States to enjoy the advantage of the big-city programs. It is this condition that the new legislation proposes to overcome. What will be the effect of this law? The commission is now endeavoring to solve the intricate problems of its application.

It may influence the expansion of chain broadcasting from the big studios by wire to more new and modern stations that eventually will cover the entire country. It may lead to the organizing of more good studios in smaller cities across the map. In any event, the program should provide for the continuing development of high-powered broadcasting that guarantees good service in warm weather. For, after all, what the public wants and what the electrical industry wants is just good reception of the best possible programs available in every home—at all seasons, no matter where. This should be the aim.

* * * *

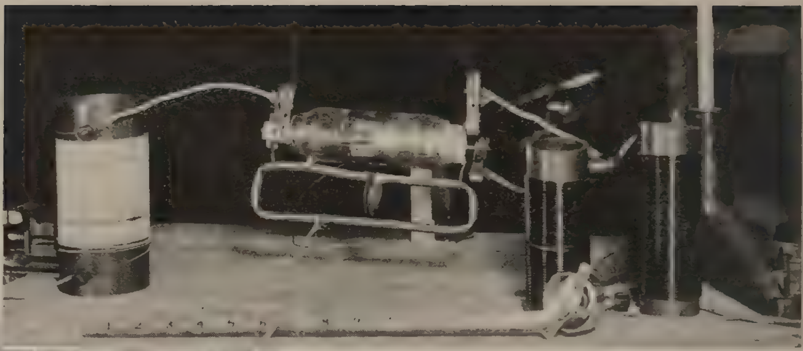
## *Conductor Movements Influence Line Design*

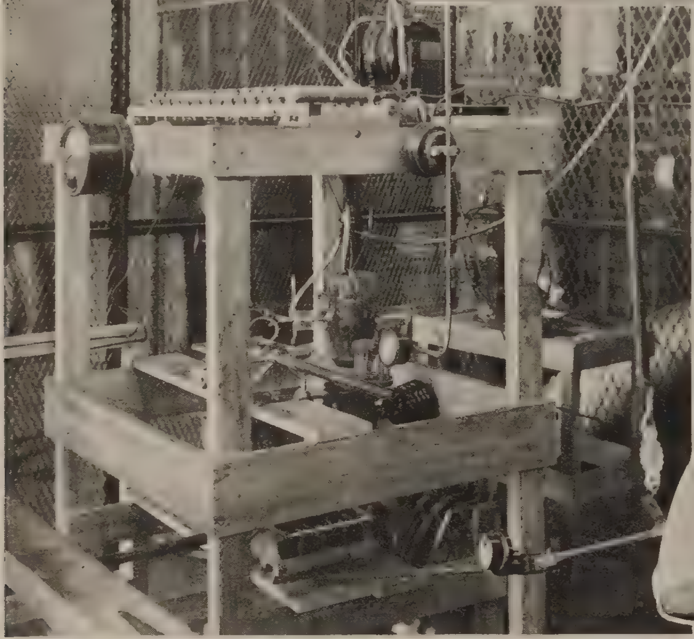
TESTS conducted by the Bureau of Power and Light of Los Angeles to determine movements of overhead conductors under short-circuit conditions revealed conductor movements which indicate that short-circuit forces are a factor that must be taken into consideration in overhead-line design. Virtually no information was available on the subject when the bureau undertook its investigation, and the results of its tests should prove of great value to the industry.

Efforts to calculate conductor movements proved unsatisfactory, and full-scale tests had to be resorted to. Tests were made at night when sufficient generator and transformer capacity was available to supply the high short-circuit currents necessary. Conductor movements were measured by an ingenious photographic method which gave a graph of the actual path followed by the conductors. On a 150-ft. span with No. 4/0 conductor, spaced 4 feet and strung under a tension of 10,400 pounds, the maximum throw of the conductors from their original position was 4.07 feet with a short-circuit current of 12,700 amperes maintained for 1.05 seconds. Numerous other tests were made, but this one example serves to indicate the very violent movement of conductors to be expected under what may be called normal conditions obtaining on a 2,400-volt distribution circuit within a few blocks of a substation.

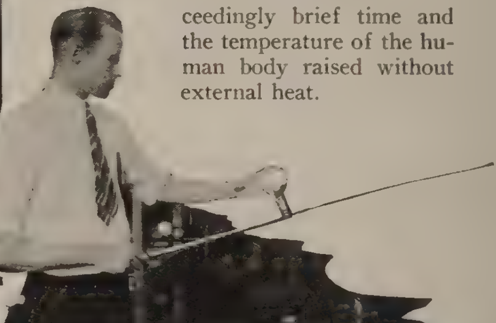
Span length, conductor size and spacing, tension and short-circuit current are the principal factors to be considered in conductor movement under short-circuit forces. Length of spans, conductor size and spacing and tension have been determined in the past largely without regard for conductor movements due to heavy short-circuit currents, but it is now evident that this latter factor must have careful consideration also. Load conditions will largely determine conductor size, and there are physical and economic limits which are soon reached as spans are reduced in length and wire spacing is increased. The obvious remedies, then, that suggest themselves are limiting of short-circuit currents by the use of current-limiting reactors, breaking systems up into smaller loosely coupled units, underground distribution, and some mechanical means of preventing conductors from being violently repelled and coming together on the back switch.

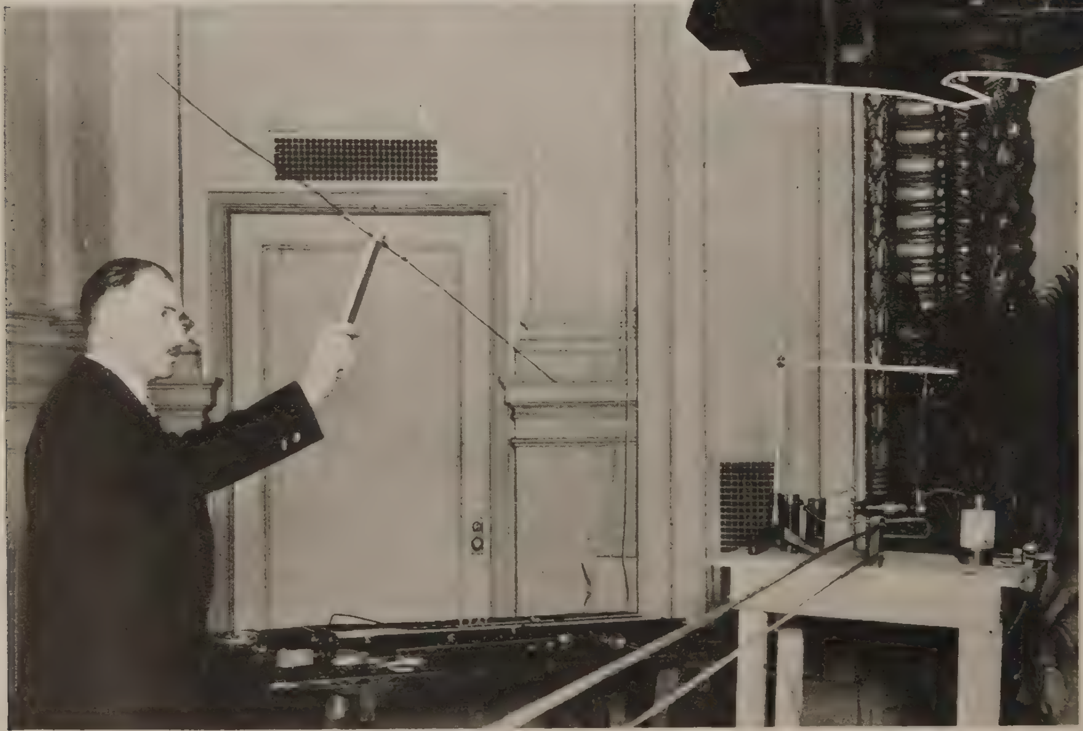
# *Short-Wave Power Transmission*





HIGH-FREQUENCY, vacuum-tube oscillators of the designs illustrated have recently been developed in the laboratories of two American manufacturers. Standard filament lamps and neon-filled tubes may be lighted through contact with isolated conductors of such length as to offer resonant response to the transmitted waves. Food may be brought to a "cooked" condition in exceedingly brief time and the temperature of the human body raised without external heat.





# Loaded High-Voltage Cables

Calculations on 132,000-volt cable for long-distance transmission. Shunt vs. series loading considered and method of calculation outlined

By A. F. PUCHSTEIN
*Assistant Professor of Electrical Engineering, Ohio State University*

THE recent installation of two 132,000-volt cables, which was announced in the ELECTRICAL WORLD for Sept. 3, raises some interesting questions as to what may be expected from such circuits when used for longer distances. At present the circumstances necessary to make such an installation economically feasible do not exist. It is believed, however, that a review of some of the problems met with and the possibilities of loading will be of interest.

Information previously published indicates that these cables have an insulation thickness of $\frac{2}{3}\frac{3}{2}$ in. The conductors are hollow with an area of 600,000 circ.mil. The external diameter is 3.1 in. The rating is about 90,000 kva. at a carrying capacity of about 300 amp. The resistance of a conductor is about 0.095 ohm and the capacitance 0.366 mfd., both per mile. The cable requires a charging current of 10.5 amp., or 2,400 kva. per mile at 60 cycles.

Obviously, this cable cannot be used for distances greater than roughly 30 miles, because the charging current would then exceed the carrying capacity. What, then, would happen in the case of distances of, say, 100 or 200 miles? Even if the cost can be reduced sufficiently, it will not be possible to use cable under this condition, unless a way can be found to reduce the capacitance or unless some form of compensation is employed. There is not much hope of reducing the former, hence recourse must be had to the latter. Compensation would be desirable even if the inductivity of the insulation used could be reduced to unity.

For this purpose the use of shunted reactors connected at intervals across the line is most suitable for all distances. The idea was proposed by Bradley for use with overhead lines about 29 years ago and S. P. Thompson for telephone circuits about 33 years ago. Such inductances serve to neutralize the effects of line capacities. The action is best if the coils are not too far apart. Spacings of the order of 25 miles would be suitable. Bradley's scheme was never used because the low capacitance of overhead lines made it unnecessary. The Thompson idea was never used in communication work because series loading gives more nearly equal attenuations at the different frequencies. Shunt loading is not affected by voltage variations.

In power cables we are concerned with only a single frequency and the defects of shunt loading do not trouble, whereas its advantages make it a possibility. The growing use of power cables seems destined to revive this type of loading. No coils suitable for this purpose have been developed, but no difficulty is expected. Such a coil would be similar to a high-tension transformer with a core specially designed to require a large magnetizing current and the secondary winding omitted. This would be accomplished by using a core material of higher reluctance than customary or by including an air gap in the magnetic circuit.

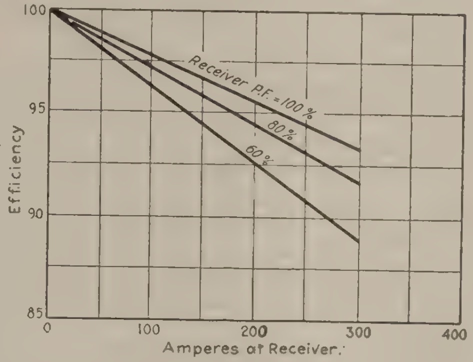


*Fig. 1—Efficiency of 200-mile, three-phase, 132,000-volt, 600,000-circ.mil cable devoid of capacitance and leakance*

An alternative arrangement would be to use step-down transformers to feed reactors or synchronous motors, but either of these would be less efficient and more expensive. The delivered voltage can be regulated by synchronous motors in the usual way, keeping in mind the lower reactance of cables as compared with overhead lines. When necessary for purposes of regulation enough series reactance may be added artificially.

TABLE I—CALCULATED PERFORMANCE OF A 200-MILE, THREE-PHASE, 132,000-VOLT, 600,000-CIRC.MIL CABLE

| | | | |
|---|---|---|---|
| Receive current in amperes | 0 | $120\underline{\vert 36^\circ 50'}$ | $240\underline{\vert 36^\circ 50'}$ |
| Current at generator end in amperes. | $2{,}090\underline{\vert 94^\circ 41'}$ | $2{,}030\underline{\vert 91^\circ 30'}$ | $1{,}990\underline{\vert 88^\circ 30}$ |
| Voltage to neutral at generator end. | $78{,}200\underline{\vert 14^\circ 30'}$ | $78{,}800\underline{\vert 13^\circ 30'}$ | $82{,}000\underline{\vert 12^\circ\ 0}$ |
| Kva. per conductor at generator end | 164,000 | 160,000 | 163,000 |
| Kva per conductor at receiver end | 0 | 9,400 | 18,800 |
| Kw. per conductor at generator end.. | 27,900 | 33,100 | 39,800 |
| Kw. per conductor at receiver end | 0 | 7,510 | 15,000 |
| Efficiency in per cent | 0 | 25.8 | 37.8 |
| Regulation in per cent............ | 0 | 0.8 | 5.0 |

TABLE II—APPROXIMATE PERFORMANCE OF A SHUNT-LOADED, 200-MILE, THREE-PHASE, 132,000-VOLT, 600,000-CIRC.MIL CABLE

| Receiver current....... | 0 | 120 | | | 240 | | |
|---|---|---|---|---|---|---|---|
| Receiver power factor... | ..... | 0 6 | 0 8 | 1.0 | 0.6 | 0.8 | 1.0 |
| Kw. per phase at receiver | 0 | 5,640 | 7,510 | 9,400 | 11,300 | 15,000 | 18,800 |
| Reactive kva. per phase at receiver........... | 0 | 7,510 | 5,640 | 0 | 15,000 | 11,300 | 0 |
| Approx. line input, kw... | 4,900 | 10,800 | 12,700 | 14,600 | 17,300 | 21,000 | 24,800 |
| Approx. line input, kva... | 4,900 | 13,200 | 14,200 | 14,600 | 22,900 | 23,900 | 24,800 |
| Approx. efficiency, per cent .. .. ......... | 0 | 52.1 | 59.1 | 64 5 | 65.2 | 71.5 | 75.8 |
| Approx. regulation, per cent................ | 0 | 1.8 | 2.3 | 3.0 | 3.7 | 4.9 | 6.0 |

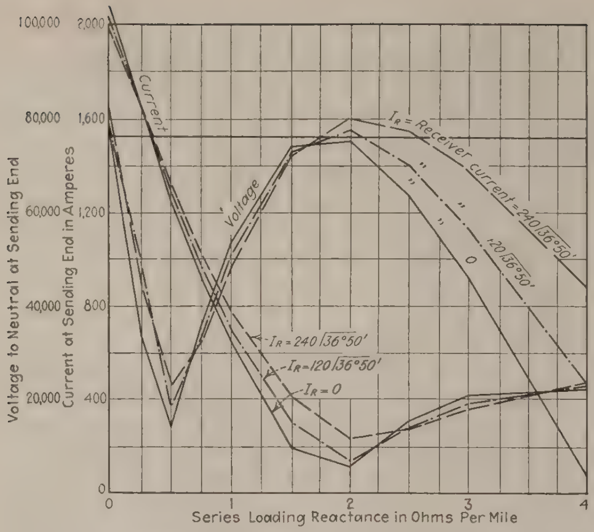


*Fig. 2—Calculated performance of 600,000-circ.mil series loaded power cable for different receiver loads at 132,000 volts and 80 per cent power factor. Distance 200 miles*

In order to give some idea of the results to be expected from a 200-mile length of the above cable, the following results are offered:

Table I shows the principal items of performance of the unloaded cable when delivering, respectively, 0, 120 and 240 amp. at 132,000 volts for a lagging power factor of 80 per cent. Observe the large values of current and power at the sending end and the low efficiency. The current at the sending end is about seven times the carrying capacity.

If there were no capacitance or if it were neutralized without loss so that the cable would behave as an ordinary "short" line, the efficiency under different conditions would be as shown in Fig. 1. This represents the ideal that would be attained if the application could be made without introducing new losses.

When shunt loading is applied, the coils take the place of the larger part of the generating capacity that would be required for the plain cable, with the added advantage that they supply the charging current at points along the line where it is needed. This current does not then need to travel over the line. When considered in the same way as transformers, the total rating of coils needed per conductor would be about $13{,}200 \div \sqrt{3} \times 2{,}090 =$ 159,000 kva. The losses in such coils would not be as great as in the corresponding transformers, because there is no secondary winding. A 3 per cent loss based on the kilovolt-ampere rating, or 4,900 kw., would be a conservative figure. The exact total loss between generator and receiver may be found from the longer lines theory. For the present purpose it is sufficient to take

$$\textit{Line Input} = \frac{\textit{Line Output}}{\textit{Efficiency From Fig. 1}} + \text{Total Coil Loss}$$

The values so obtained will not differ seriously from the correct figures. The results when using this approximate calculation are as given in Table II. The kilovolt-amperes at the generator end were taken as the quadrature sum of the reactive kilovolt-amperes at the receiver end and the sum of the kilowatts necessary to cover the receiver load, line copper loss due to receiver load current, and coil losses. This neglects the line copper losses due to the coil loss current, although in this example they would be appreciable. The efficiency is

TABLE III—CONSTANTS OF THREE-PHASE, 132,000-VOLT, 600,000-CIRC.MIL SERIES LOADED POWER CABLE

| Reactance Per Conductor, Ohms Per Mile | Attenuation Constant | Wave-Length, Constant | Propagation Velocity, Miles Per Second | Wave-Length, Miles | Surge Impedance, Ohms |
|---|---|---|---|---|---|
| 0.00 | 0.00256 | 0.00256 | 147,000 | 2,450 | 2.62\|45° |
| 0.25 | 0.00115 | 0.00595 | 63,900 | 1,065 | 44.0 \|10°25' |
| 0.50 | 0.000785 | 0.00834 | 45,100 | 752 | 60.7 \| 5°23' |
| 0.75 | 0.000644 | 0.0102 | 37,000 | 616 | 73.9 \| 3°37' |
| 1.00 | 0.000556 | 0.0117 | 32,200 | 536 | 85.2 \| 2°43' |
| 1.50 | 0.000458 | 0.0144 | 26,100 | 435 | 105.0 \| 1°49' |
| 2.00 | 0.000348 | 0.0166 | 22,700 | 378 | 120.0 \| 1°22' |
| 2.50 | 0.000332 | 0.0186 | 20,300 | 338 | 135.0 \| 1° 5' |
| 3.00 | 0.000322 | 0.0204 | 18,500 | 308 | 148.0 \| 0°55' |
| 4.00 | 0.000280 | 0.0235 | 16,000 | 267 | 170.0 \| 0°41' |

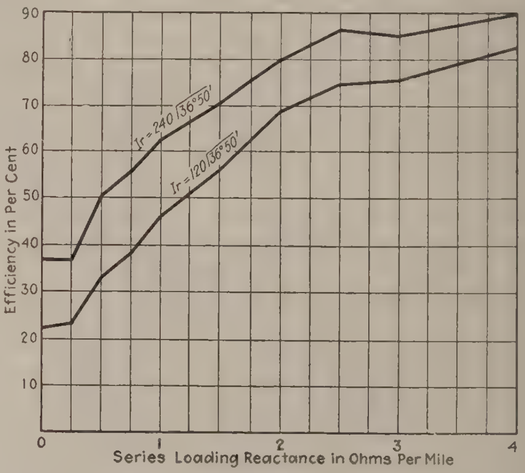


*Fig. 3—Calculated efficiency of 132,000-volt series-loaded power cable*

TABLE IV—CALCULATED PERFORMANCE OF 600,000-CIRC.MIL SERIES-LOADED POWER CABLE FOR DIFFERENT RECEIVER LOADS AT $\frac{132{,}000}{\sqrt{3}}$ = 76,200 VOLTS AND 80 PER CENT POWER FACTOR. DISTANCE 200 MILES

| | Receiver Current = 0 Amp. | | | | Receiver Current = 120\|36°50' Amp. | | | | | Receiver Current = 240\|36°50' Amp. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loading Reactance in Ohms Per Mile | Sending Voltage | Sending Current | Sending Kva. | Sending Kw. | Sending Voltage | Sending Current | Sending Kva. | Sending Kw. | Efficiency | Sending Voltage | Sending Current | Sending Kva. | Sending Kw. | Efficiency |
| 0 | 78,200 | 2,090 | 164,000 | 27,900 | 78,800 | 2,030 | 160,000 | 33,100 | 22.1 | 82,000 | 1,990 | 163,000 | 39,800 | 37.8 |
| 0.25 | 33,500 | 1,660 | 55,600 | 22,500 | 48,800 | 1,660 | 73,400 | 31,600 | 23.2 | 44,200 | 1,670 | 81,500 | 40,000 | 36.6 |
| 0.50 | 13,700 | 1,260 | 17,300 | 15,400 | 17,200 | 1,280 | 22,000 | 21,900 | 33.4 | 22,500 | 1,308 | 29,400 | 28,800 | 50.8 |
| 0.75 | 35,800 | 928 | 33,200 | 12,100 | 33,500 | 975 | 32,700 | 19,100 | 38.2 | 33,000 | 1,025 | 33,800 | 26,200 | 55.9 |
| 1.0 | 53,300 | 648 | 34,500 | 9,040 | 50,300 | 715 | 35,000 | 15,900 | 46.2 | 48,300 | 785 | 37,900 | 23,500 | 62.3 |
| 1.5 | 73,900 | 200 | 14,800 | 5,570 | 72,800 | 305 | 22,200 | 13,000 | 56.3 | 71,900 | 416 | 29,900 | 20,800 | 70.4 |
| 2.0 | 75,400 | 120 | 9,050 | 3,180 | 77,500 | 143 | 11,100 | 10,700 | 68.4 | 80,000 | 234 | 18,700 | 18,400 | 79.6 |
| 2.5 | 64,000 | 310 | 19,840 | 2,560 | 70,500 | 275 | 19,400 | 9,870 | 74.1 | 77,500 | 274 | 21,200 | 17,500 | 86.1 |
| 3.0 | 46,100 | 414 | 19,100 | 2,080 | 57,000 | 380 | 21,700 | 9,690 | 75.5 | 69,000 | 361 | 24,900 | 17,200 | 85.1 |
| 4.0 | 3,840 | 448 | 1,716 | 1,612 | 24,000 | 453 | 10,870 | 8,880 | 82.4 | 44,300 | 460 | 20,400 | 16,300 | 89.8 |

markedly less than for a "short" line, but is roughly double that of the plain cable.

When the capacitance is neutralized, the regulation may be calculated in the same way as for a short line. The actual figure will be modified by the power current necessary to supply the coil losses. This factor was neglected in Table II.

The results show that shunt loading is capable of considerably improving the efficiency. It equalizes the current so that it is brought within the carrying capacity at all points. The generating capacity that would otherwise be necessary to charge the cable is replaced by cheaper apparatus in the form of loading coils. There is practically no Ferranti effect and cables may in this way be used for voltages and distances that would be impracticable otherwise. It is beyond the scope of this article to discuss the relative merits of coils and synchronous motors.

### SERIES LOADING FOR POWER CABLES

Although this scheme has never been proposed for improving the performance of power cables, it is instructive to compare the results with those previously given. The calculations were made under the assumption that the application introduces no additional losses. The figures represent the highest theoretically attainable values for ideal coils having no copper or core losses. Fig. 3 shows that the efficiency increases markedly with increase in reactance, reaching values above 80 per cent, but this would be considerably reduced if the coil losses were taken into account. The current is not uniform along the line and greatly exceeds the carrying capacity in certain regions. The voltage, also, will not be uniform along the line. These two factors are the fatal objection to this type of loading. It is effective only after the length of line exceeds a certain value, roughly about 100 miles. The total coil rating required is very considerable and is quite comparable with that needed for shunt loading. With nine coils per wave length, which are necessary to approximate a smooth line, the coil spacing would not need to be much less than 25 miles, although when spaced so far apart the coils would have to carry a considerable difference of potential. Fig. 2 shows the relation between sending-end voltage and current for three different receiver loads with different values of loading reactance. Such a cable would be cable of giving a good regulation under certain conditions. The principal constants are given in Table III.

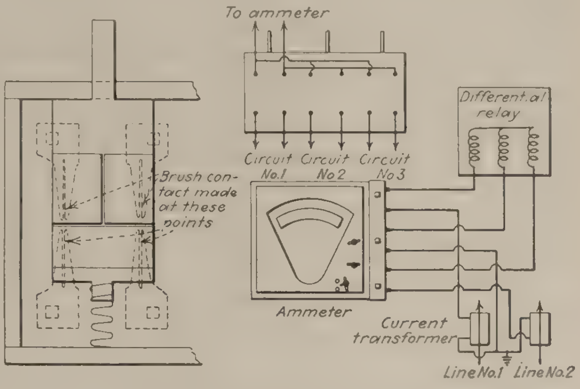
# Three-Circuit Ammeter Switch

By JAMES C. JACKSON

*Detroit Edison Company, Detroit, Mich.*

ANY change in routine-test methods or equipment which reduces the number of pieces of apparatus that must be carried is appreciated by the field test man. One ammeter, and in some cases two, is eliminated from certain routine tests on the system of the Detroit Edison Company by the connector switch here described.

This piece of apparatus was designed to enable testers in the relay division to read the current in any one of the three circuits of a General Electric type PD 3 differential relay on the same ammeter. The device, as shown in the accompanying illustrations, consists merely of three push switches, normally holding the transformer secondaries closed, so designed and connected that the ammeter is cut into any one of three circuits by depressing the proper key. The switches are mounted in a bakelite box as shown. The test circuit for which the device was made is shown in the drawing. Tests are usually made with the lines dead, and currents of 200 to 400 amp., at about seven volts, obtained from a loading transformer are passed in series through the primaries of current transformers on like phases of the two lines. Under this condition there should be equal currents in the holding coils of the relay and no current in the dif-



*Design and connections of three-circuit ammeter switch*

*Three-circuit switch and manner of attachment to ammeter* ferential coil. These three readings are taken on the ammeter by depressing the keys in turn. The device may be connected into the secondary circuits of live lines and used in the same way.

This ammeter switch may be used for many other purposes than that for which it was originally designed. Among these uses are: Taking readings in three phases to determine unbalance; with current transformers on two conductors of a three-phase line to determine the current in the third conductor by depressing two keys together; or, by using a single-phase power-factor meter, the power factor of a balanced three-phase load may be arrived at by determining the angular relations between the currents in two conductors and any one voltage between phases. To these suggested uses many more might be added, their number being limited only by the ingenuity of the operator. It is apparent, also, that the number of switches in the box may be changed according to the variety of uses for which the device is contemplated.

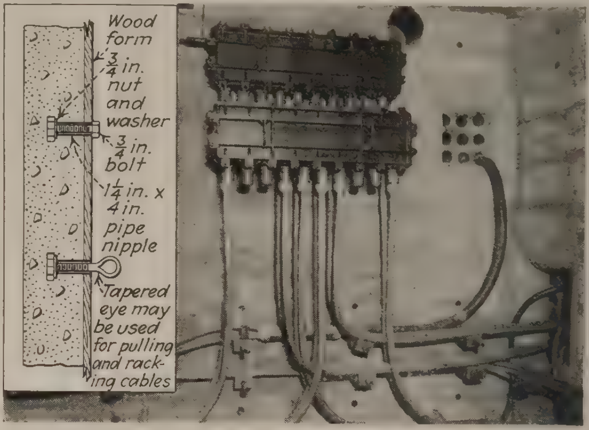
## Cables Racked on Iron-Pipe Supports

By T. W. Swartz

*Assistant Engineer Underground Department,*
*Northwestern Electric Company, Portland, Ore.*

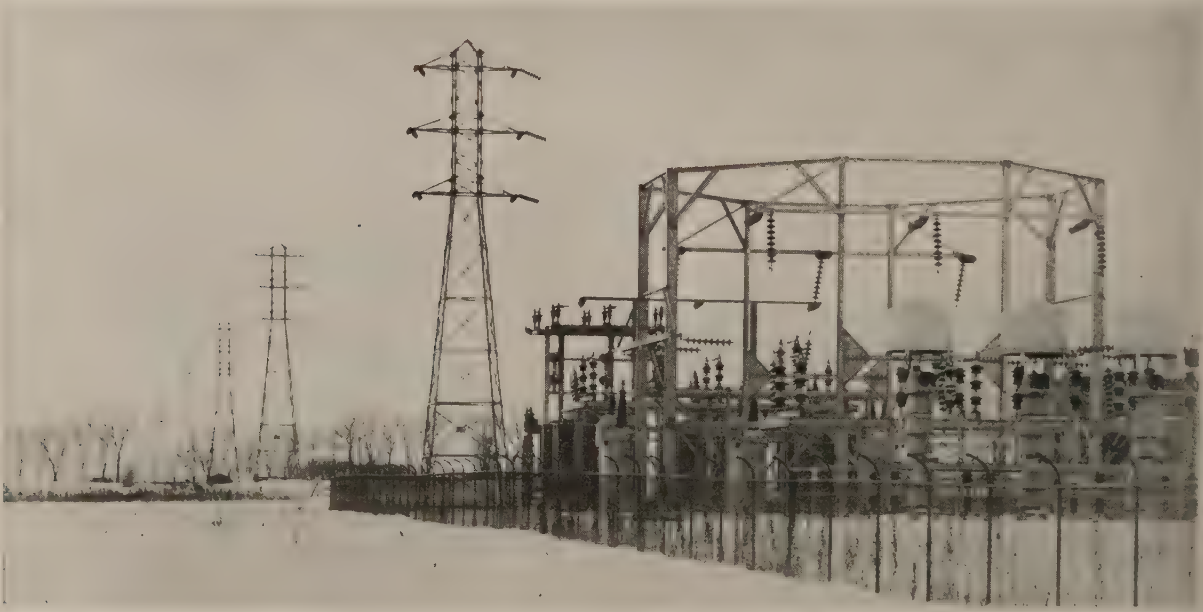
ECONOMY, flexibility and time saved in rigging have led the Northwestern Electric Company, Portland, Ore., to rack cables in vaults as shown in the accompanying illustrations. Black iron pipe nipples $1\frac{1}{4}$ in. x 4 in. are imbedded in the vault walls at the time the concrete is poured. Into these nipples are inserted 1-in. x 14-in. pieces of pipe for supporting the cables. Grooved wood blocks are slipped over these long nipples to provide a bearing for the lead cables. The imbedded nipples are spaced 8 in. or 10 in. vertically, depending upon the voltage of the cable to be racked. Horizontally they are spaced 2 ft. to 3 ft., depending upon the size and type of cable.

A $\frac{3}{4}$-in. bolt with nut and washer support the nipples in the form work while concrete is being poured. The bolt later is removed, leaving the nut imbedded in the concrete. A tapered eye threaded for the $\frac{3}{4}$-in. nut is used to great advantage during pulling and racking cables and for moving heavy equipment about the vault. This feature has saved at least 50 per cent of the time formerly required for setting up to pull cable.


Wood form
$\frac{3}{4}$ in. nut and washer
$\frac{3}{4}$ in. bolt
$1\frac{1}{4}$ in. x 4 in. pipe nipple
Tapered eye may be used for pulling and racking cables

*Method of supporting nipples for cable rack while concrete is poured and view of iron pipe hangers placed in imbedded nipples*

## Octagonal Frame Permits Various Bus Arrangements



On the Northern States Power Company's system as well as other properties of the Byllesby Engineering & Management Corporation may be seen this type of switching structure. It has the advantages that lines can be brought in and dead-ended from any direction and still permits the buses to be run in directions most desirable for the switch and transformer layout.

# Void Formation in Cables

### Quality of insulation apparently not limited by present materials. Relations between contraction, viscosity and compound temperature

By W. N. Eddy

*Director Electrical Research Laboratory*
*Simplex Wire & Cable Company, Boston, Mass.*

Cable research has established that premature failure of high-voltage cables is usually caused by the presence of voids within the impregnated paper insulation. Under sufficient stress these voids are ionized. Because of the resulting evolution of gas within the voids, the formation and ionization of additional voids may become cumulative, resulting in failure of the insulation. The purpose of this article is to show the influence on the void formation of the viscosity-contraction-temperature characteristics of the impregnating compound and to suggest that the insulation quality of cables for 25- to 75-kv. working pressure can be materially improved by a more general application of these fundamental relations.

Prior to the saturation or original filling of the paper with compound, all moisture has presumably been removed from the paper and its air content reduced to a low value. Complete submersion of the insulation for a suitable time at a suitable temperature in a properly dried and "degassed" compound follows. Economy demands a saturation period as short as may be required to accomplish the purpose. The necessary penetration time depends principally on the compound pressure, the paper "air resistance," compound viscosity and to some extent the nature of the compound. The nature of the paper fiber is practically negligible in its influence as compared with the predominating importance of the air resistance characteristics.

TABLE I—RELATIVE PENETRATION OF DIFFERENT COMPOUNDS AT THE SAME VISCOSITY

All tests at atmospheric pressure five minutes in duration, using 7-mil manila paper, of air resistance = 14 sec./300 cc. Viscosity of each compound at time of test, 66 seconds Saybolt.

| Compound | Penetration in Mils | Penetration in Per Cent of Rosin Oil Blend |
|---|---|---|
| Blend of rosin and cylinder oil | 140 | 100 |
| Transformer oil No. 1 | 133 | 95 |
| Petrolatum No. 3 | 126 | 90 |
| Cylinder oil No. 2 | 119 | 85 |
| Cylinder oil No. 4 | 119 | 85 |
| Petrolatum No. 4 | 112 | 80 |
| Cut-back petrolatum No. 1 | 105 | 75 |
| Cylinder oil No. 3 | 98 | 70 |
| Rosin oil No. 1 | 98 | 70 |

In general, the penetration and viscosity charts and table indicate that the selection of a proper saturating procedure is almost entirely dependent on certain physical characteristics of both paper and compound. No change in any of the related variables should be made without considering the effect on the others.

At atmospheric pressure and room temperature a typical insulating oil can take into solution air equal to about 10 per cent of the oil volume. The solubility of air in such oil increases in direct proportion to the absolute pressure. On this basis, if the oil is properly treated before the saturation, its air content should be below 0.3 per cent at the beginning of saturation. In like manner, the residual air in the insulation at the start should not exceed 2 per cent of the space to be filled with compound. Therefore, if no air is admitted during

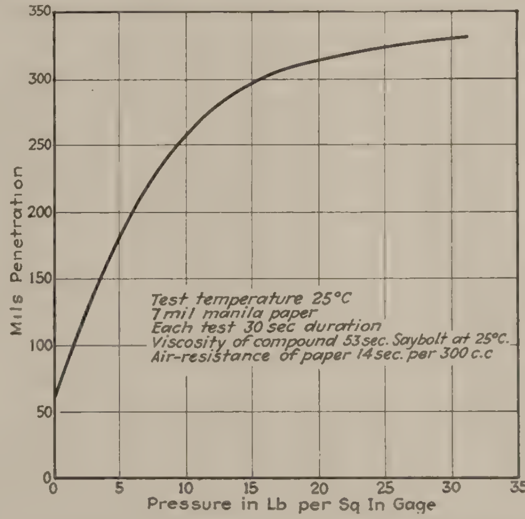


*Fig. 1—Effect of pressure on compound penetration*

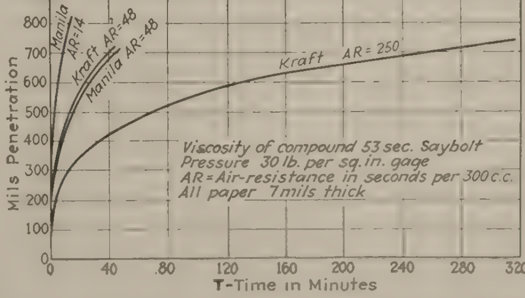


*Fig. 2—Compound penetration through wood pulp and manila papers*

At 600 mils the penetration through the wood pulp is 4,300 per cent slower than with manila. The two middle curves indicate that the difference between the other curves is due to air resistance rather than to type of fiber. All the penetration-time curves are approximately parabolic with an exponent of about 0.26.

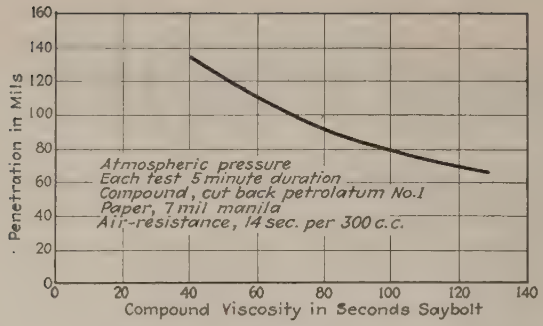


*Fig. 3—Effect of compound viscosity on penetration through manila*

While the viscosity of any compound can be decreased by raising the saturating temperature, this method of improving penetration is limited by the increased deterioration of the compound at the higher temperature. Both viscosity and deterioration at the saturating temperature are important factors in selecting an impregnating compound.

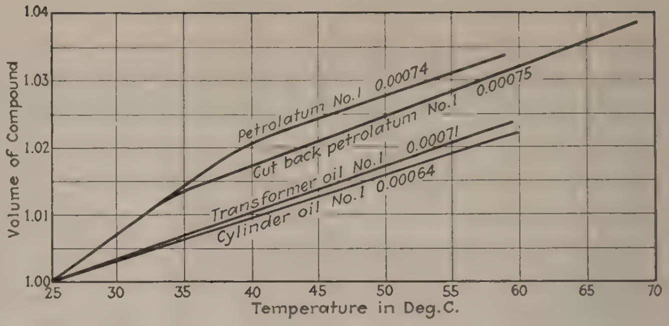


*Fig. 4—Volume-temperature characteristics of typical compounds*

Change of volume with temperature is approximately uniform for all the compounds above 40 deg. C., but the rate of the two petrolatums doubles at their approximate solidification temperature and maintains that rate down to 25 deg. This disadvantage is but slightly improved by "cutting back" with a thin oil. The contraction is more than ten times that of paper, copper or lead.

saturation, the air content of the insulation should not exceed 2.5 per cent of the compound volume. If the compound is put under air pressure during saturation the air content of the insulation may reach 10 per cent or more, but need not exceed 3 per cent if done properly. It therefore seems a reasonable assumption that voids will be present at the end of the saturation only if the time of saturation is insufficient for complete penetration. All air values are at atmospheric pressure.

### Contraction During Cooling

After saturation the compound temperature and hence that of the cable is lowered. As the compound cools it decreases in volume, and more compound must work in through the insulation from the excess compound around the cable to prevent the formation of voids in the insulation. The volume-temperature characteristics of a few representative compounds are shown in Fig. 4.

While no complete curves can be given at this time for compounds containing rosin or rosin oil, determinations of the total expansion between 25 and 80 deg. C. indicate that such compounds show about 10 per cent less contraction than those without rosin.

As the compound cools, it also gradually stiffens, or increases in viscosity. Some viscosity-temperature curves for several typical compounds are shown in Fig. 5. From these data it may be concluded that when the shrinkage is more rapid than the movement of the compounds through the insulation voids will begin to form in the insulation, that when it is not more rapid no voids will be formed, and when it is less rapid any voids already formed will be decreased in size.

It is difficult to see how the air content of the compound, if it does not exceed 10 per cent, can do more than merely fill the voids when they form. In a cable of modern impregnation the air content of the compound should not in itself be the cause of void formation.

The denseness of the paper insulation apparently influences void formation through segregation of compound and movement of compound. If the voids are caused by compound shrinkage, the void content per unit volume of insulation will be directly proportional to the amount of compound per unit volume. If relatively large interstices are included in the paper arrangement, the segregation at these points will produce a void formation that may easily be double that throughout the remainder of the insulation, as the ratio of compound to total insulation is usually around 50 per cent. Under some conditions, the only voids present may be at these points. While such segregation may be caused by excessively loose taping, probably the most familiar instance is along the inside edges of the fillers in three-conductor belted cable. This is the usual location of *X* when found. Incidentally, this suggests that the well-known greater ionization and shorter life of three-conductor belted cable compared with single conductor or shielded three-conductor is due to the same cause. If so, this constitutes the principal limitation of three-conductor belted cable for other than medium voltages.

Decreased denseness of paper insulation should also favor void elimination. This can be accomplished by looser taping and by decreasing the air resistance of the paper, but with a realization that the latter method

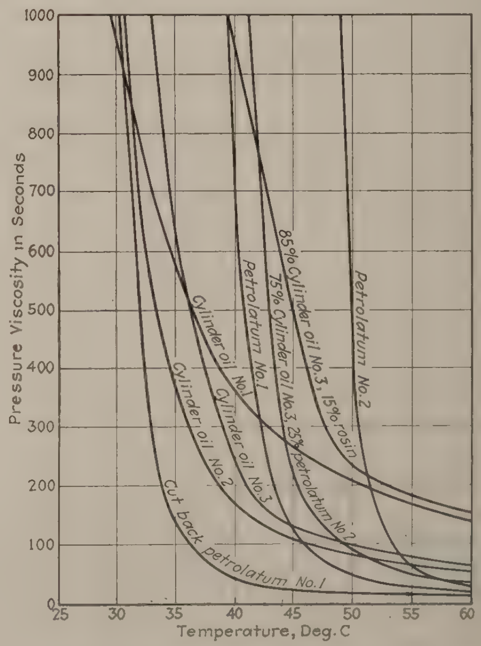


*Fig. 5—Viscosity-temperature curves for typical compounds*

While none of these compounds plotted shows a definite solidification temperature like water, their viscosity increases very rapidly below the critical temperature, which is generally more definite with petrolatums than with cylinder oils.

appears more favorable, since the former is liable to cause undue concentration of compound.

Fig. 6 shows the influence of the viscosity and contraction characteristics of Figs. 5 and 4 upon the formation of voids during the cooling period. While these curves have certain definite limitations, they afford an interesting comparison of types of compound and cooling rates. The cooling curves *A* and *B* were assumed as reasonably representative of a high and low rate of cooling respectively. In the factory tanks the cooling rate can be somewhat controlled by water jackets in the tank walls and circulation of compound through cooling coils.

TABLE II—VOID VOLUME IN COMPLETED CABLE

All weighings made after overflow of compound had ceased.
All cable saturated with cut-back petrolatum No. 1

| Test Temperature in Deg. C. | Compound Expelled from Sample in CC. | Volume of Voids at 25 Deg. C in Per Cent of Total Compound Volume |
|---|---|---|
| 3/350,000 circ. mil $\frac{10\text{x}5\text{ in.}}{32}$ | | |
| 40 | 0 | |
| 60 | 7.78 | 2.4 |
| 80 | 15.50 | |
| 100 | 15.42 | |
| 1/2/0 $\frac{9\text{ in.}}{32}$ | | |
| 40 | .31 | |
| 60 | 1.17 | |
| 80 | 1.19 | |
| 100 | 1.16 | 1.0 |
| 1/750,000 circ. mil $\frac{24\text{ in.}}{32}$ | | |
| 55 | 10.4 | |
| 68 | 5.5 | 0.9 |

The compound shrinkage curves were derived by combination of the cooling curve with the volume-temperature relations of Fig. 4, and the compound movement curves were derived by combination of the cooling curve with the viscosity-temperature curve of Fig. 5. (See Appendix I.)

Comparison of the *A* and *B* curves of Fig. 6 indicates the danger of selecting the rate and duration of the cooling period without proper consideration of the compound viscosity and contraction. It is evident that the acceleration of compound penetration or movement by pressure (Fig. 1) is applicable to the cooling period as well as saturation. The obvious limitation of the curves of Fig. 6 is that the compound movement is based on viscosity tests rather than movement through actual insulation. While this is no objection when merely comparing compounds or cooling curves, it prevents direct application of the curves to practice. Thus, while Fig. 6 shows *A*1 to eliminate voids at 200 hours, against 400 hours for *A*3, the real significance of the comparison is that for that particular cooling rate and the same type of cable *A*1 should eliminate voids in half the time taken by *A*3.

### DETERMINING VOID VOLUME

A possible simple method of determining void volume without the laborious collection of movement data through insulation is to ascertain the void volume resulting from a certain compound and a known impregnation procedure, and to adjust the scale of the movement curve so the height of the shaded area will agree with the known void volume. Then if the contraction and the movement scales are kept relatively the same, and if the movement of the compound through the insulation is assumed proportional to its movement through the viscosimeter, the curves should represent actual conditions, no matter what the compound or cooling rate. However, any change in the type of cable or size of cross-section would necessitate another void determination and adjustment of the movement scale.

A simple and direct method of void volume determination suggests itself: A short sample, say 12 in., of the completed cable with one end sealed and the other open is kept in a vertical position with the open end up at, say, 40 deg. C. until compound has ceased to flow from the open end. The procedure is then repeated at, say, 60 deg. C., etc. The compound overflowing at each temperature is weighed and the void volume is readily calculated from these observations. The method has several sources of error, but seems worthy of consideration. A few preliminary determinations are given in Table II. (See also Appendix II.)

The difference shown above between single and three-conductor cable is of incidental interest, in connection

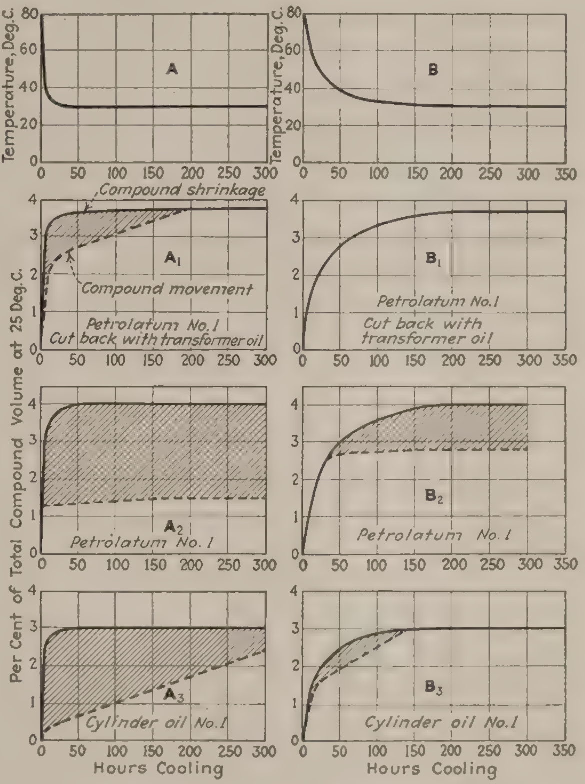


*Fig. 6—Relative shrinkage and movement of three compounds at two rates of cooling*

As the solid curves, subscripts 1-3, represent the compound shrinkage and the dotted curves the compound movement in through the insulation, voids must form whenever the latter is below the former; i.e., whenever the movement lags behind the shrinkage. All shaded portions represent the presence of voids, the difference between the curves at any particular time being the void volume at that time. With the cooling rate *A*, while the shrinkage of the cut-back petrolatum *A*1 exceeds the movement at first, the shrinkage ceases at constant temperature, while the movement continues, finally overtaking the shrinkage and filling the voids at 200 hours. If the cooling period were terminated when the temperature become constant, there would be a void volume of 0.4 per cent of the total compound volume, while a continuation of the cooling period at constant temperature would eliminate the voids.

The greater stiffness of the petrolatum *A*2 at the lower temperatures makes its movement so slight in this range that no reduction in void volume is appreciable, regardless of the length of the cool. This cable should contain materially more voids than *A*1.

The cylinder oil *A*3 shows the effect of its flatter viscosity curve (of Fig. 5). Its movement, though relatively less at first, exceeds *A*1 at 30 deg. C,, with the prospect of ultimate void elimination.

The effect of the slower rate of cooling, *B* curves, is that the void formation is materially decreased with all three compounds, although the petrolatum, *B*2, still shows no indication of eventual void elimination. It is clear that the cut-back petrolatum and the cylinder oil could be stopped as soon as their temperature became constant.

with the common experience as to ionization and life. All agree in indicating more voids in the three-conductor cable, probably because of the filling.

When cable cools in service the relation of compound viscosity and contraction in forming voids is much as shown in Fig. 6, with the following exceptions: (1) The rate of cooling in service may be more rapid than in the factory on account of the smaller mass of compound involved, which gives greater void formation; (2) even voids existing only during cooling mean ionization and incipient trouble; (3) coolings after lead expansion are more liable to produce voids because the total volume within the sheath has been increased without increase in compound volume, and (4) sheath expansion, by lowering the pressure "behind" the compound, may materially decrease the inward movement of the compound and therefore cause void formation in the interior of the insulation.

Thus it appears that it is insufficient to select a combination of compound, rate and duration of cooling, etc., that will result in freedom from voids after the cooling. The ability of such a cable to pass acceptance tests would not guarantee satisfactory life. It is also evident that whatever the operator can do to decrease the range and abruptness of temperature variations will reduce his cable failures, and that the use of a thin oil in joints under pressure should reduce the liability of void formation in the cable.

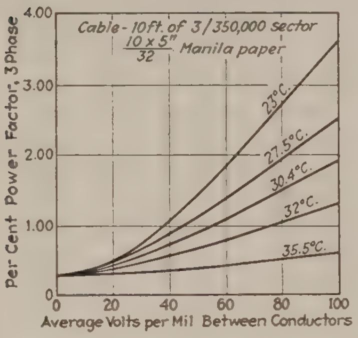


*Fig. 7 — Power-factor-voltage curves of three-conductor cable*

Void conditions improved by increase of temperature

### Test Data Reconciled by Variation in Compounds

It is of extreme importance to determine the quality of cable without subjecting several thousand feet to several years' service. The most important tests of this kind in present use are the overvoltage life test and the power-factor-voltage or ionization test. The former has been found to be a reasonably reliable indication of cable quality, but has the disadvantage of being slow and destructive to the cable tested. The second is reasonably quick and is not destructive, but does not always agree with the life test.

The principal differences between such tests and service conditions are (a) the test temperature changes are less severe; (b) the test cable is usually open at both ends. These reduce the chances of voids being produced during the test, especially by expansion of the sheath.

Application of the above viscosity-contraction relations to these tests is of considerable aid in properly interpreting them. For instance, these relations would indicate that relatively small temperature changes between 25 and 35 deg. C. should have material influence on the voids in the insulation and, therefore, on the ionization and life tests.

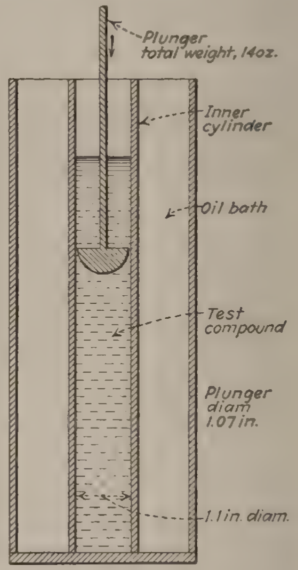


*Fig. 8 — Viscosimeter for compound testing*

As no satisfactory equipment could be found for this purpose, this apparatus was developed. The inner cylinder was filled with compound and the outer chamber with an oil bath for temperature equalization. As the plunger descends by gravity the compound is forced up through the annular clearance between the plunger and the inner cylinder, and the plunger was arranged to energize a recording voltmeter at the end of its travel, permitting tests to be started during the day and completed at night without attendance.

The power-factor-voltage curves on three-conductor cable saturated with cut back petrolatum shown in Fig. 7 indicate that increase of temperature from 24 to 35 deg. C. materially improves the void conditions in the insulation.

In determining the effect of similar temperature changes on the life, it should first be noted that the actual insulation temperature of a so-called room temperature life test may be 35 deg. C. at a test voltage between two and three times the operating voltage. Table III gives some temperatures actually obtained.

The elementary viscosity-contraction-temperature relations suggest that a decrease of life test temperature of only a few degrees ought to decrease the cable life by increasing the void content. The figures of Table IV show that a decrease in temperature of only 5 deg. C. is often sufficient to decrease the life 30 per cent. It would be expected that this influence of temperature would vary for different compounds, according to their viscosity-temperature characteristic. While such tests are in progress no results can yet be reported. It is suggested that this may account, at least in part, for occasional disagreement between the ionization test and the life test, especially with cable of different compounds or manufacture. The life test temperature

TABLE III—REPRESENTATIVE TEMPERATURES OF OVERVOLTAGE LIFE TEST SAMPLES

| All Samples 10 ft. Under Lead | Deg. C. Ambient | Deg. C. Sheath | Deg. C. Conductor* |
|---|---|---|---|
| A—3/350,000 $\frac{10\times5}{32}$ after twenty hours, at 70 kv. three-phase | 21 | 30 | 38 |
| B—3/350,000 $\frac{10\times5}{32}$ after twenty hours, at 70 kv. three-phase | 21.5 | 34 | 44 |
| C—1/ 2/0 9/32 in. after 30 hours, at 45 kv....... | 23 | 28 | 33 |

*Temperature determined by conductor resistance. Other temperatures by thermometer.

TABLE IV—INFLUENCE OF TEMPERATURE ON LIFE

All samples 10 ft. under lead, manila paper.
All temperatures the average of conductor and sheath.

| Sample No. | Cable | Ambient | Temp. | Test Voltage, Kv. | Time on Test, Hours |
|---|---|---|---|---|---|
| 1 | 3/350,000 $\frac{10\times5}{32}$ | Running water | 23 deg. C. | 70 | 20 |
| | | Running water | 29 | 89 | 20 |
| | | Ice pack | 17 | 89 | 2* |
| 2 | Same as No. 1 | Room | 34† | 89 | 66* |
| 3 | Same as No. 1 | Melting ice | 17–24 | 89 | 28* |
| 4 | 2/0 9/32 | Room | 29‡ | 45 | 220* |
| 5 | Same as No. 4 | Running water | 23 | 45 | 30* |

*—Cable failure. †—Sheath temperature 29 deg. C. ‡—Sheath temperature 27 deg. C.
All cables of same dimensions received same saturation.

## *Appendix I—Derivation of the Curves of Fig. 6*

The compound shrinkage curves were derived by combination of the cooling curve with the volume-temperature relations of Fig. 4. For any one time of cooling, the corresponding compound temperature given by the cooling curve was applied to Fig. 4 and the corresponding volume noted. By summation of the increments of volume change, the total shrinkage is determined as plotted in Fig. 6.

The compound movement curves were derived by combination of the cooling curve with the viscosity-temperature curves of Fig. 5. For any one time of cooling, the corresponding compound temperature given by the cooling curve was applied to Fig. 5 and the corresponding viscosity noted. The viscosity is given on Fig. 5 as the time necessary for a given volume of compound to flow through a given orifice. Therefore, the reciprocal of this figure should be directly proportional to the rate of flow (volume per unit time) of the compound. While this figure is not the rate of flow through actual insulation, it should be relative and, therefore, suitable for comparisons of compounds and cooling rates. A figure proportional to the total flow can be obtained from summation of the increments of the change in rate of flow. This represents the total movement throughout the period of cooling that is permitted by the insulation denseness and the compound viscosity.

Before this can be compared with the compound shrinkage as in Fig. 6, a proper proportionality factor must be determined. This was done by assuming a definite void content of 0.9 per cent after 50 hours of *A* cooling with the cut-back petrolatum. This is believed to be sufficiently representative for comparison of compounds and cooling rates. The same factor was, of course, used for all the other curves.

When the permissible movement as determined above was less than the shrinkage, it was plotted as the actual movement. When it was greater than the shrinkage, the actual movement was assumed equal to latter and so plotted on Fig. 6. It is physically impossible for the compound to move into the insulation faster than the compound shrinks.

## *Appendix II—Determination of Void Content of Completed Cable*

The figures given in Table II were determined by assuming that (1) the compound expansion and contraction follow the relation given by Fig. 4; (2) all overflow from the sample is caused by expansion of compound; (3) when the compound begins to overflow from the sample the voids are eliminated—filled by expansion. This, of course, will not be true if the air content exceeds 10 per cent.

While the exactness of the last assumption may be questionable, it will at least serve for a few preliminary comparisons.

Let $C_0$ = total cubic-centimeters of compound overflowing below temperature 1.

$\Delta C$ = total cubic-centimeters of compound overflowing between temperatures 1 and 2.

$V_1$ = volume of compound in sample at temperature 1 in terms of the volume at 25 deg. C.

$V_2$ = volume of compound in sample at temperature 2 in terms of the volume at 25 deg. C.

Both $V_1$ and $V_2$ are read off the curves of Fig. 4, knowing the compound and the temperatures.

Total volume of compound in sample

$$= \frac{\Delta C}{V_2 - V_1}$$

Expansion below temperature 1 =

$$\frac{C_0\,(V_2 - V_1)}{\Delta C}$$

Volume at beginning of overflow =

$$V_1 - \frac{C_0\,(V_2 - V_1)}{\Delta C}$$

Therefore, void volume at 25 deg. C. in per cent of total compound volume =

$$\left[\left(V_1 - \frac{C_0\,(V_2 - V_1)}{\Delta C}\right) - 1\right] \times 100$$

The void content in per cent of the total insulation will be approximately half or less of the figures given in Table II.

One advantage of this method is that the sample dimensions are not necessary, the only necessary determinations being the quantity of compound expelled and the temperatures. Determinations need only be made at two temperatures. Those given in Table II at additional temperatures are of interest in showing how closely the overflow follows the relation of Fig. 4.

may be 5 to 10 deg. C. higher than the ionization tests and the resulting influence on the void condition may be different for different compounds used in the samples of cables tested.

While the overvoltage life test is generally believed to give a reasonably reliable indication of life in service, the curves of Fig. 6 suggest that there might be some compounds that would be voidless in the cable at the constant temperature of the life test, but would form voids during the cooling periods experienced in service. In such a case, the life test would not give a reliable indication of the insulation quality. It may be found that the reliability of the life test can be improved by a suitable periodic variation of the temperature. In general, it is believed that further investigation of the life and ionization tests along these lines may add materially to the usefulness of both tests. It may even be found that the principal difficulty with the latter test is merely lack of proper interpretation.

### CONCLUSIONS

It has probably been noted that no attempt has been made to include in the above data any conclusive proof of the influence of the compound viscosity-contraction-temperature relations on the service of the cable or even on the overvoltage life test. Such proof to be conclusive must include extensive tests on cable comparing compounds, impregnating procedures, etc. As available data of this nature are not sufficiently complete to be conclusive, it has been thought best to omit them altogether. It can be said, however, that such data as have been collected to date, including several different compounds and impregnating procedures, confirm the suggested controlling influence of the above-mentioned compound characteristics on the insulation quality.

The question of rosin or no rosin in the impregnating compound has received considerable attention for years without any generally accepted conclusion being reached. It has been said that the principal advantage of a rosin content is that the compound is less easily displaced by the dielectric stress. If this is true, a properly saturated cable should need no rosin, since the compound could not be displaced anyway. This may be one reason why it is so difficult to get a conclusive story, either in favor of rosin or against it.

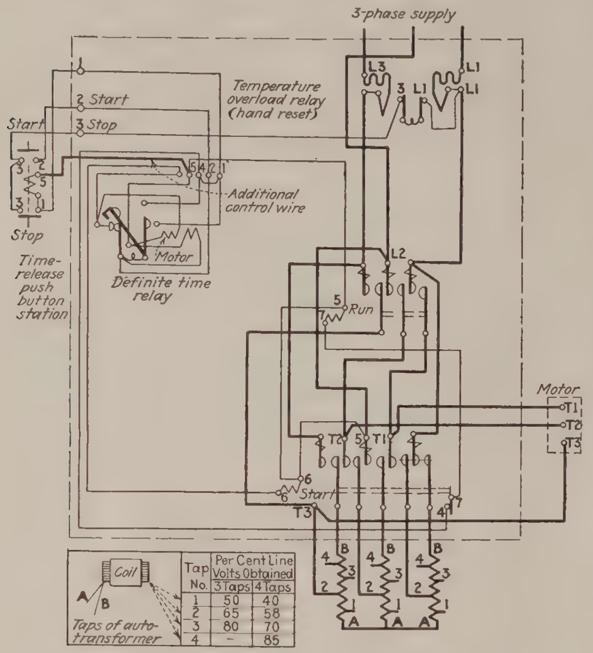
The test results given and discussed above suggest, in general (1) that the quality of impregnated paper insulation is not yet limited by the type of materials in use; (2) that material improvement in insulation quality can be obtained by more proper application of the fundamental relations between the contraction, viscosity and temperature of the compound, and (3) that, therefore, these relations should be more completely determined by research work.

It is believed that a more general understanding of these relations among all concerned will go far toward rationalizing the manufacture and use of impregnated paper insulation.

# Time-Delay Undervoltage Device Minimizes Interruptions

By L. C. Hardesty
*Industrial Control Engineering Department*
*General Electric Company*

A DEVELOPMENT in push-button stations controlling standard magnetic starters and incorporating a time-delay element makes it unnecessary to add time-delay attachments to the starters themselves. The application of such a station to the reduced-voltage type of starting compensator requires consideration of several factors. If a connection is made, using the standard wiring of the compensator, and a voltage dip occurs, the compensator contacts will open, and, if voltage returns before the push-button station trips, the starting contactor on the compensator will close, and the compensator will go through the regular starting sequence, as it would if the motor were being started from rest.



| Tap No. | Per Cent Line Volts Obtained | |
|---|---|---|
| | 3 Taps | 4 Taps |
| 1 | 50 | 40 |
| 2 | 65 | 58 |
| 3 | 80 | 70 |
| 4 | – | 85 |

*Standard low-voltage automatic compensator equipped with time-release control*

The substitution of a standard time-release push-button switch for the usual start-stop type and the addition of but one control wire between the switch and the definite-time relay permits adaptation of standard automatic compensator to time-release characteristics.

This dropping back to reduced voltage on a voltage dip might, in some cases, be objectionable. The amount of inconvenience would depend on the compensator tap used and the amount of load on the motor. If the motor were driving one of a series of belt conveyors, and it should be thrown back on partial voltage, the speed might be reduced enough to cause a perceptible pile-up of material on the belt. In such cases, a slight speed reduction on the motor might be objectionable, but it is probable that, in the majority of instances, a slight speed reduction after a voltage dip would not cause any difficulty.

In cases of trouble, however, the standard automatic compensator can be used by adding but one control wire. The accompanying diagram shows the connections of standard low-voltage automatic compensator equipped with a time-release push-button station. If a voltage dip occurs, the "run" contactor will open, but if voltage returns before the push-button station trips, the "run" contactor will close again, putting full voltage back on the motor.

# Cable Sheath Troubles at Duct Edges

By C. H. Shaw
*Engineer Distribution and Installation Department,*
*New York Edison Company*

ONE OF the most common sources of trouble in the operation of underground cables is the abrasion of the lead sheath of the cables at the point where they emerge from the conduits in the manholes. The daily change in load results in a heating and a subsequent cooling of the conductors of the cable, which causes expansion and contraction that produces an abrasion at the duct edge usually at both ends of every cable section.

In existing systems, where adequate provision has not been made for taking care of the expansion of the feeder cables, it is a difficult matter to eliminate this duct edge condition. Many engineers of underground distribution systems have failed to realize that this abrasion is largely a function of the design and method of installation of the cables in the manholes. If the manholes are constructed of such a shape that an even movement of the cable is permissible during its expansion cycle and if the cables are trained and supported on the manhole walls in a proper manner there will be little or no cause for worry as to the condition of the cables at the duct edge.

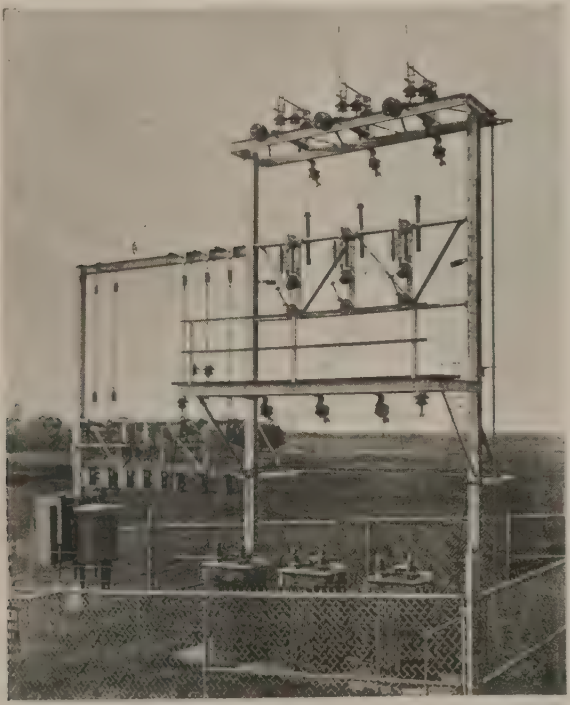
The following data have been prepared indicating the relatively insignificant importance of duct edge injury on one of the largest underground cable systems in the world, that of the New York Edison Company. On the system in question the amount of low-tension feeder cables has increased from 3,400,000 ft. at the end of 1922 to 5,200,000 ft. at the end of 1927. This cable is installed in conduits with an average length of approximately 200 ft. each, and therefore represents more than 55,000 duct edge exposures:

| Point of Trouble | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 |
|---|---|---|---|---|---|---|
| At splice | 29 | 6 | 2 | 6 | 9 | 3 |
| Between splice and duct | 12 | 7 | 4 | 3 | 6 | 10 |
| In duct | 6 | 13 | 14 | 23 | 64 | 71 |
| At duct edge | 8 | 5 | 2 | 2 | 1 | 2 |

It will be seen that there has been an appreciable reduction in the number of troubles that have been located at the duct edge. This has been due to a continuous improvement in the general condition of the underground cable system as well as to the reconstruction of a considerable number of manholes that had been built in former years when the knowledge of cable operation was not as complete as at present and before the proper shape of manholes for this type of cable installation had been determined. Incidentally, the unusually large number of failures of cable in duct that are indicated in the above tabulation have been due to mechanical injury from sources outside the duct line, such as bull points, etc., and do not indicate any decrease in the quality of the cable insulation. In all of the years there have, of course, been some cases of mechanical injury included in the figures for trouble "in duct." Practically all of the cables described in the preceding paragraph have been protected with zinc fairleaders at the duct edge. It is probable that the average life of the cables installed in the conduit system exceeds ten years. It is probably impossible to determine in one month, or even in one year, that a new type of manhole design or method of cable racking is entirely satisfactory. There have been placed on the market for the past few years a large number of different types of duct edge protectors. Their installation in existing systems would call for the reconstruction of the duct lines and the same results could be secured for a redesign of the manholes. In new conduit lines about to be constructed there is no need for the use of these devices if the manholes are arranged so as to provide adequate expansion space for the cables. If the manholes, in the ordinary parlance of the underground cable manhole, could be classified as expansion chambers, rather than as manholes, it is probable that much more attention could be given to providing for adequate expansion and contraction of the cables than has heretofore been provided in most underground conduit systems.

## Economy in Small Substation

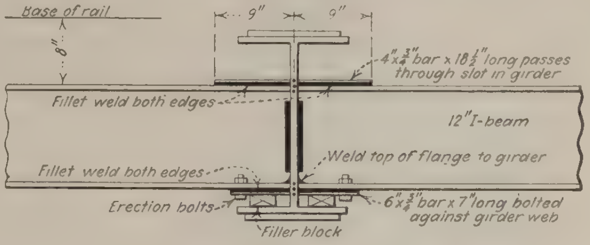
SIMPLICITY and low cost are the distinguishing features of this substation, through which the Wisconsin Public Service Corporation serves the village of Lena, Wis. The primary feed is at 13,800 volts and the secondary output is taken off by one 2,300-volt line and a street lighting circuit. The equipment includes three 75-kva. transformers and a 10-kva. street-lighting regulator. The meter is contained in the box at the left and the instrument transformers may be discerned mounted in the left bay. The use of fused cutouts in place of breakers is to be noted. The substation, with the exception of transformer and instrument equipment, was furnished by the Railway & Industrial Engineering Company.



*Simplified design reduces installation cost*

## Electric Welding Cuts Steel Bridge Tonnage One-Third

BY THE use of electric welding the amount of steel required in a Boston & Maine Railroad bridge 175 ft. long now being built at Chicopee Falls, Mass., has been reduced at least 33.3 per cent, according to Gilbert D. Fish, consulting engineer Westinghouse Electric & Manufacturing Company. The design for welding calls for but 80 tons of steel. More than half the saving is in reduction of connection material; only about 25 per cent of the joints have gusset plates, and these gussets are only about one-fifth as large as those needed for riveted joints. Most of the remaining saving is about equally divided between reduction of tension members due to eliminating allowance for holes and reduction of stringers due to continuity through floor beams. No channels were used. Slot welds $\frac{1}{2}$ in. square in section connect the members to the gussets, and 1.5 in. of one slot is about equivalent to one $\frac{7}{8}$-in. rivet in single shear. Triangular fillet welds assist the slot welds and the value of a $\frac{3}{8}$-in. fillet weld is about one-half that of a $\frac{1}{2}$-in. x $\frac{1}{2}$-in. slot weld.


Base of rail
8"
9"
9"
4"x$\frac{3}{4}$" bar x 18$\frac{1}{2}$" long passes through slot in girder
Fillet weld both edges
12" I-beam
Weld top of flange to girder
Fillet weld both edges
Erection bolts
6"x$\frac{3}{4}$" bar x 7" long bolted against girder web
Filler block

*Typical welding of stringers to floor beam*

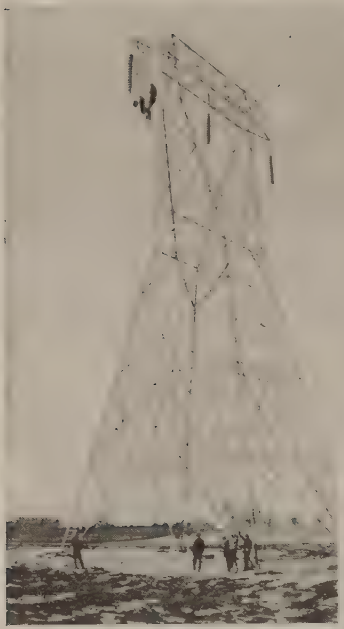
The shear connection for the floor beam is a triangular butt weld with $\frac{5}{8}$-in. x 18-in. minimum section. At the end joints the chord tension is developed by butt welding of flanges only and by slot and fillet welds at the splice plates. Among other welding features is the typical connection of stringers to floor beams illustrated herewith. Welding quantities are as follows:

Span of each truss, 134 ft. 8 in.; width center to center of trusses, 17 ft.; number of tracks, one; height center to center of chords, 24 ft. 8 in.; estimated man-days riveting, 50; saving in tonnage by electric welding under E-50 loading, 40 tons.

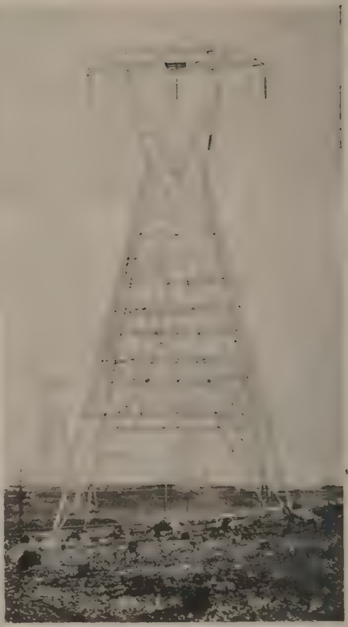
| | Shop | Field | Total |
|---|---|---|---|
| 38-in. triangular fillet, feet........ | 308 | 562 | 870 |
| Butt and slot welds, cubic inches... | 88 | 450 | 538 |
| All kinds of welds, cubic inches.... | 348 | 921 | 1,269 |

Two welders are employed for all work in shop and field, using a 200-amp. Westinghouse motor-generator set on a truck. The total estimated man-days of welding required on this job is 50. Direct-current welding only is employed. It is expected that this bridge and others to be welded in future will prove somewhat more permanent than riveted ones, because the immovability of the joints removes the chief cause of fatigue. Although weld metal is less ductile than rivet steel, a properly designed and executed welded joint should have greater endurance under stress reversals than a good riveted one, because in the case of the latter the connection members and rivets are subject to slight motions back and forth, frequently beyond the elastic limit. Another factor favoring long life for welded joints is their smoothness and absence of rivet heads, with corresponding ease of painting and lessened tendency to corrode.

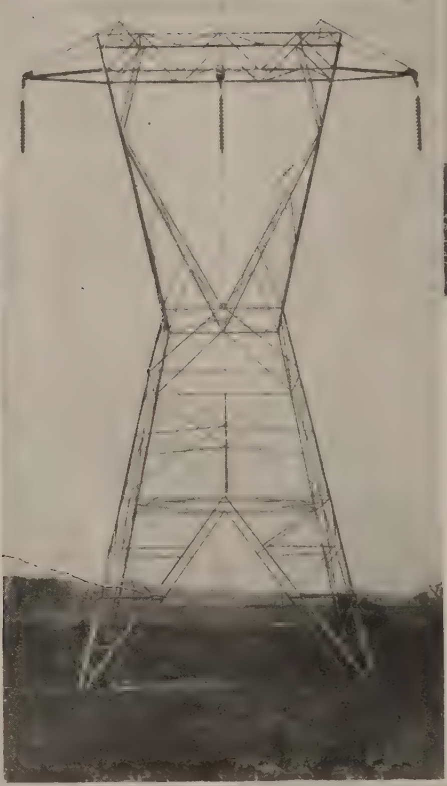
# *Conowingo Now Operating*



*Clipping in conductors on 220-kv. tower*

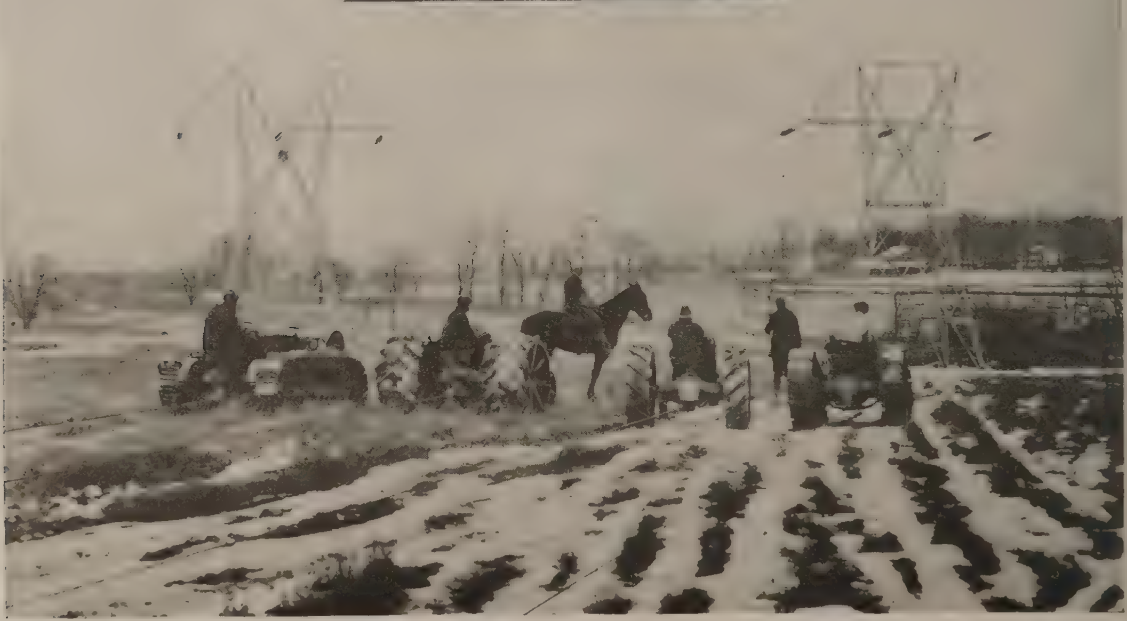


*Tangent construction on 220-kv. line*

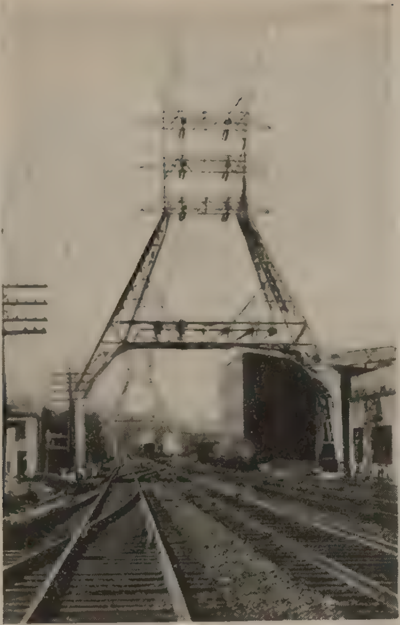


*At left—Towers are designed for strength and clearance of conductors*

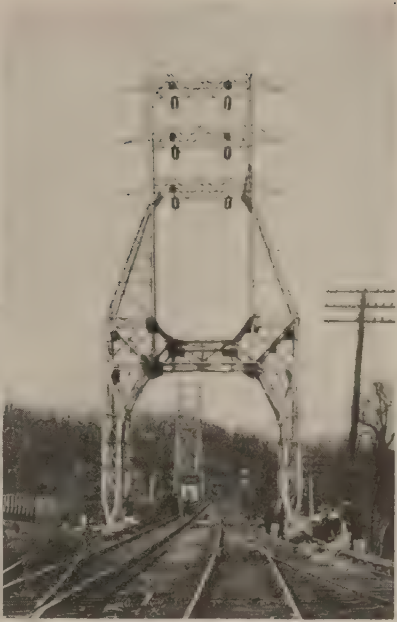
*Below—Pulling out conductors with tractors on the Conowingo line*



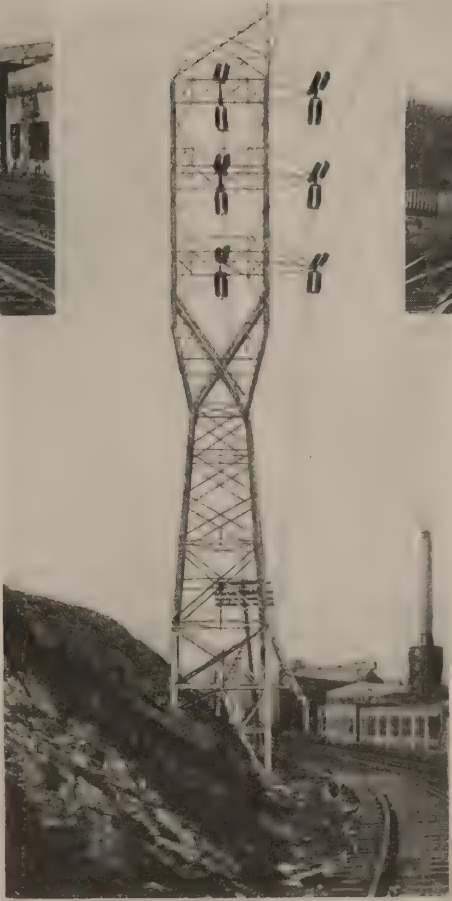
# Lines Overhang Railroad



220-kv. line over Reading Railroad



Reading Railroad used as 220-kv. right-of-way



At left — Special 220-kv. structure along Reading Railroad

Below — View of Conowingo Dam and power house

# Pointers from Alex Dow

### Points made in address before Midwest Power Conference in Chicago hit at misconceptions as to utility affairs. Costs of business and business policy outlined

THAT a wise blending of technics and economics is essential to the success of the power industry was the theme of an address made recently by Alex Dow before the Mid-West Power Conference held in Chicago. Various phases of the problem of capital costs in relation to central-station operation were discussed—not merely in the abstract, but with ample illustration drawn from the experience of the Detroit Edison Company. After discussing some of the more general problems, such as the presence in the industry of a few financial exploiters seeking only personal profit, Mr. Dow turned to certain aspects of the problem of maintaining earnings at a level corresponding with the growth in capital investment:

"The response to good economics in the power industry becomes translated into terms of bigger power earnings. If we did not sell the 800,000,000 kw.-hr.—practically without exception the people who bought that 800,000,000 kw.-hr. last year were concerns that were financially, technically and mechanically able to make their own power and would have done so if the rate had not been a factor—had we not sold this power out of the total of 1,800,000,000 kw.-hr. that we did sell, we would not have been able to give such good service or such low-rate service to other classes of customers. The actual cost would have increased in such a manner that the whole of the general public, right clear down to the smallest kind of a residential customer, would have been served less well, less liberally and almost certainly at higher cost. There would have been overhead that would have had to be distributed that wasn't necessary and wasn't brought in by this increased business. These sales were to some 360 customers; only 370 accounts to keep open, all of them prompt and payable, all of them very simple, all of them buying untransformed current and taking care of their own transformation and conversions, requiring nothing from us but occasional engineering advice, and having that given to them as honestly as we knew how. The addition of the production has meant to us a big economic advantage and that economic advantage has not been grabbed by us, but has been distributed as it ought to be, over our entire business, to the benefit of our public at large. And this business, at the lowest average rate, has always carried a good share of the profit and in many years has been the most profitable business.

#### Policy Toward Different Classes of Service

"Now, I want to point out to you that the economics of the power industry are very much affected by your policy toward the different classes of service. If you are going to serve your home community; if, in point of fact, you are going to furnish exceptional service at an acceptable price to all classes of your industry, you not only have the duty laid upon you to have your rate schedule so co-ordinated that there is no evidence and no sign of discrimination, but you have to meet the problem of dealing with the big man who can make his own current and you have got to sell to him at a price that is below his legitimate costs. He will break even with you; if you will sell to him at the price at which he thinks he can make it himself, as a rule you can do business. You cannot, of course, go trading with each individual man, and therein comes one of the difficulties of rate schedule making. If you want that backlog, if you want that increased production, if you want that justification for larger power plants and large and efficient units, you have to handle it at a rate that will be essentially competitive with what the best kind of private plant can produce the service for. You do not need, as a rule, to go below it, because the intelligent manufacturer, who does not want to run a power plant unless he has to, will give you as much as the service will cost him and give it willingly.

"There is just one objection about that. If he had to have an increase in power and he were setting up his own plant and being served by his own plant, he would begin to think about it at least six months ahead and arrange to finance it, whereas with service like ours if he wants an increase of power, he wants it yesterday and kicks because he didn't get it and we have to try to serve him just that way. That means that we have to guess what the service will require. We have to develop two or three years ahead.

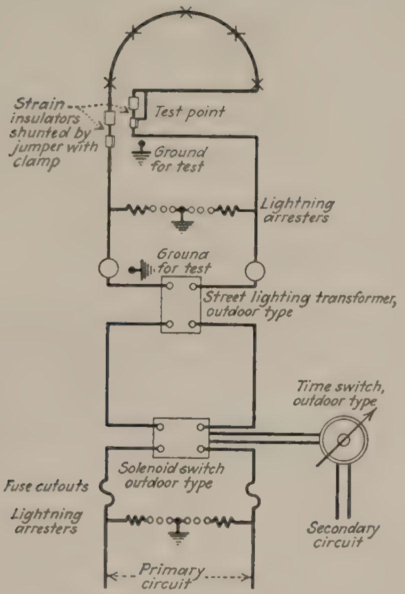
#### Case of the Small Customer

"Now, jumping for a minute to the other class of service, the smallest, most troublesome service, the small consumer—he amounts to a great deal. In our district we don't serve him nearly as much current as we would like to serve him, and we know he is buying more every year, or I should say she is buying more every year. For, after all, it is the woman in the house who controls that sort of thing. Actual earnings from that source in the last calendar year were nearly $11,000,000, and that is a nice item, amounting to about 23 per cent of our total business. But that is got from a great multiplicity of customers, say over 400,000, and it is troublesome work. It is work in which the production cost and the transmission losses are almost negligible."

Mr. Dow pointed out that the cost of fuel is relatively small in relation to some other items. "All transmission losses, all transformation standby losses, such as idle losses in the multiplicity of line transformers; the actual generating of the necessary transmission losses, plus the actual service metered to the customer; the average residence customer, do not require one-half ton of coal per annum, whereas the mere keeping of the account open at the present market rates for coal, the metering of the service, putting in a meter, the reading of the meter, the maintenance of the meter, the checking up every two or three years on the accuracy of the meter, which is imposed upon us by the public utility regulation; the following up of collections, the rendering of bills, the providing of convenient places where the bills can be paid, all that sort of business costs us roughly three times as much as the fuel.

"Of course, there is little economic back-kick from that. If you are going to benefit the ultimate consumer, who is ultimately, of course, the man who consumes service in his house, if you are going to benefit him by getting cheap power at the expense of the general taxpayer, you are barking up the wrong tree. If our fuel costs were wiped out altogether and the fuel costs given to the residential customer; in other words, if we could allocate our coal costs and collect from a beneficent government at Washington that proportion of the coal bill that represented service to the small consumer, the residence consumer in particular, if we could do that, we would be able to cut that rate 8 per cent. We know that one way to bring down the residential service rate is to encourage

## Series Circuit with Outdoor Transformers and Switches


Strain insulators shunted by jumper with clamp
Test point
Ground for test
Lightning arresters
Ground for test
Street lighting transformer, outdoor type
Time switch, outdoor type
Solenoid switch outdoor type
Fuse cutouts
Lightning arresters
Secondary circuit
Primary circuit

*Standards of West Penn System*

its use, because it is the failure to use the large investment that you must make for service when it is first installed, service afflicted with what we have for convenience called a dispersion factor; it is the difficulty of getting sufficient use of the investment that is the real limit upon the rate. If the use were doubled, the investment would not be doubled, because the form of the load curve would always of necessity be altered in a beneficial way. And that increased use is the real economic answer to the problem of serving the small consumer."

### Financial Exploiters on Wane

In the course of his address Mr. Dow also discussed the utility business from the point of view of a utility executive interested in proper methods of financing and operating properties. Some of his very pertinent comment is as follows:

"We still have with us the financial groups, to whom, especially to the newcomers in the industry, the industry is merely one of many means to make money. In other words, they measure the success of a public utility service by its contributions to their personal or group coffers, by the emoluments which they receive, directly or indirectly, by the opportunities for financial exploitation, and so on. We suffer from the activities of these groups. It is true that most of them have butted in and it is true that if they live long enough with us they either learn differently and behave in a better way or they get, metaphorically speaking, their necks broken. But we can't always be educating the people who butt in to our business.

"I have observed that in a great many recent cases the financial grabbing that has been found fault with has come from people or groups whose attitude toward public utility service at large is that of the attitude of the exploiter, the man who says, 'This thing can be dealt with thus and so, and I can close out the account with a handsome profit.'

"Now, so long as profits can be made and so long as the rules of the game make it possible that these profits may be very large and still stay inside the law, just so long will we have these raids upon us. Now, when these people, as happens occasionally, get out with a loss, a much-needed lesson is taught, and those of us who remain in the industry have a chance to clean up the mess. But there is a limit to all these things, and I am not so sure but that one of the byproducts of recent and present public interest, very much overstimulated, of course, by the political gentlemen who want to advertise themselves, will be more caution on the part of these exploiting groups.

"Present laws, without any particular assistance from legislative bodies, can be used to deal with the worst offenders. And the steadying of the utilities; that is, the forcing of them into common action, is very helpful in avoiding this kind of economic disturbance, a disturbance which results inevitably when the management of a big public service is in the interests of profit making only."

## Sign Exhibit Creates Sales

By R. B. Brown, Jr.
*Illuminating Engineer*
*Edison Electric Illuminating Company of Boston*

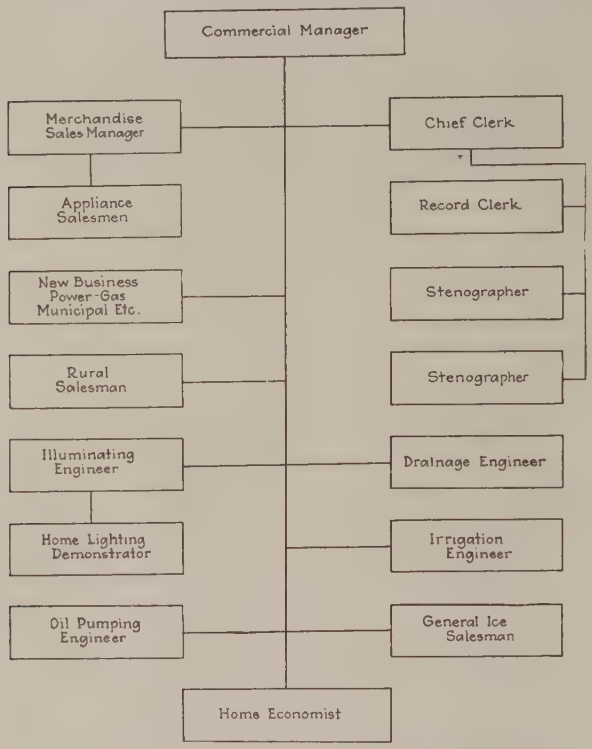
FIFTY-SEVEN electric signs with an aggregate connected load of 120 kw. were sold in the Boston Edison territory last fall during a six weeks' series of electric shows held by the company in suburban cities and towns. A total of 114 active prospects for sign business was also the fruit of the displays, and the estimated merchandising value of the signs to their manufacturers was approximately $25,000. The added revenue to the Edison company from the load represented by these 57 signs is estimated at about $8,000 a year, assuming an average run of four hours a night. The cost of the exhibit to the company was, roughly, $1,000 for the six weeks.

Two edison employees were in attendance practically all the time, the display being open to the public daily from 2 to 10 p.m. About 30 manufacturers of electric signs participated, and most of these were the owners of local sign plants, whose products thus became familiar to visitors to the shows as neighborhood commodities. The sign manufacturers co-operated by furnishing signs for the exhibit, but were put to no other expense than the cost of transportation of their products to and from the shows. Three or four manufacturers' representatives were also in regular attendance at the booth.

*Fifty-seven electric signs were sold by massed display in six weeks*

# A Flexible Commercial Department Organization

IN CARRYING out the sale of electric service to nearly 1,800 different communities, located in states from Maine to the Gulf of Mexico, the subsidiary companies of the Middle West Utilities Company naturally require a somewhat flexible sales organization. Local conditions differ in the various communities and the relations of local commercial departments with the commercial department of the Middle West Utilities Company are such that the local sales department is free to plan and carry out its sales program independently.



*Suggested organization chart for subsidiaries of Middle West Utilities Company*

The varied types of territories served are indicated by the provision for oil pumping, drainage and irrigation engineers in some departments.

With the view to providing a basis for building up a department to meet these local conditions, C. J. Eaton, commercial manager of the Middle West Utilities Company, has suggested the tentative form of commercial organization shown in the accompanying illustration. It is not intended that local departments shall be set up rigidly along these lines, but in so far as conditions permit the department will be patterned after the suggested organization.

Where a group of communities are so located geographically that sales programs can be directed and conducted from a central office the commercial department for this group is built up under the supervision of a commercial manager whose headquarters are at the general offices of that particular subsidiary. Primarily, the relations of these local commercial departments with the commercial department of the Middle West Utilities Company are such that the latter acts in an advisory and consulting capacity with the operating company in promoting the sale of electric service. Mr. Eaton states that he has found that a certain amount of standardization has made for economy and efficiency in the operation of the local departments, but such a standardization should not be carried too far as it would tend to hamper and discourage independent initiative as well as set up, in some cases, a form of organization not at all suited to the local situation.

# Electric Heat in Industry

A VALUABLE educational instrument for promoting the development of industrial electric heating has just been made available to the electrical industry. Through the combined efforts of the national industrial heating committee of the N.E.L.A. and the Detroit Edison Company a five-reel motion picture film, "Electric Heat in Industry," has been made and is being released by the committee on either a sale or rental basis.

This film, which is 4,500 ft. long and requires about 50 minutes to exhibit, covers all of the principal electric heat-treating applications, enameling, steel melting, and so forth. It has taken in nineteen different industrial plants and shows the actual operation of the latest electric heating applications installed in these manufacturing plants to effect refinements and economies in production processes. The film has been stripped of all non-essentials and the captions have been written with a view to brevity, but emphasizing the benefits to the user through savings in production costs and increased profits because of improved quality, reduction of spoilage and greater uniformity.

For the power company this film will make it possible to visualize to industrial customers what electric heating is accomplishing in other industries throughout the country. For the industrial plant which has a heat-treating problem the film will help to show how this problem has been solved elsewhere or suggests a possible improvement over the existing process.

The original picture was taken under the personal direction of H. J. Hall of the Detroit Edison Company and represents several months of intensive planning and negotiation with industrial plants before final releases could be secured. It was first shown publicly at the meeting of the American Society of Steel Treaters in Detroit last fall under the auspices of the N.E.L.A. industrial heating committee. Since then it has been exhibited at a number of other meetings and the film has already gained for itself an international reputation. Requests have been received from England and other European countries for prints of the picture.

The film is now complete and Walter H. Sammis, chairman of the N.E.L.A. national electric heating committee, has arranged schedules whereby positive prints can be purchased outright or it can be rented by power companies for a limited number of showings.

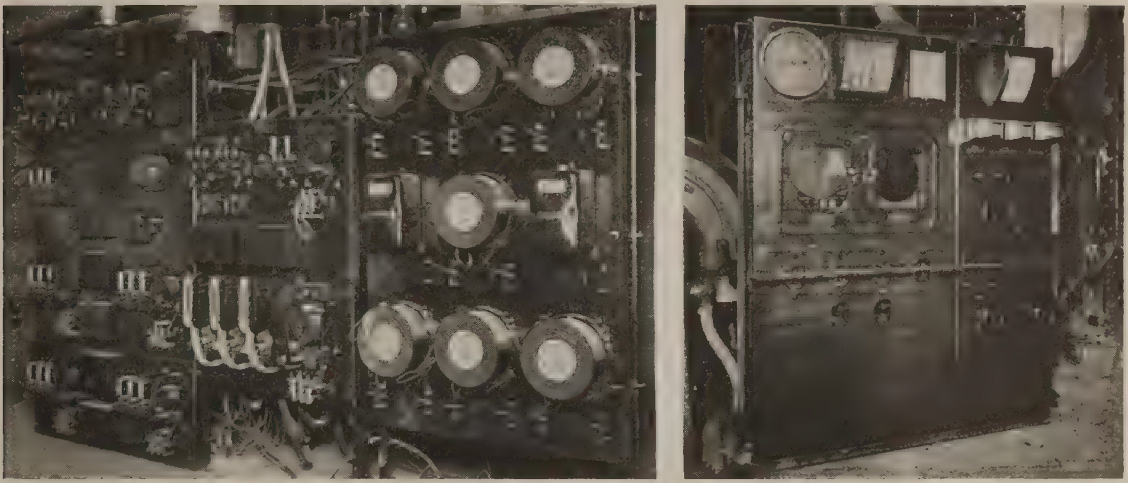
Proceeds obtained from the sale and rental of the film will be used in part to pay for the cost of its production and in part to keep the picture up to date by the addition of views of new applications as they are made from time to time. From expressions of opinions of those who have seen the picture it will prove a highly valuable means of promoting electric heating, and there are already a number of requests for showings before industrial and engineering organizations. In addition the film has been very useful in showing power company employees the extent of development of this class of load.

# Control of Boiler Auxiliaries

## Nature of operations that had to be controlled in running pulverized-coal-fired, water-walled, well-type furnaces at Buffalo and type of signaling and interlocking adopted

By W. S. Martyn

*Junior Engineer Buffalo General Electric Company, Buffalo, N. Y.*



*Control equipment for boilers in River station and heating station of Buffalo General Electric Company*

IT WAS with the thought in mind that the Charles R. Huntley steam plant of the Buffalo General Electric Company was to function mostly as a standby station that pulverized-coal-fired boiler equipment was bought.

The steam-generating equipment consists of four B. & W. cross-drum boilers, each containing 12,515 sq.ft. of heating surface, not counting the 7,100 sq.ft. in the integral superheater. This lies between the horizontal circulators and the main bank of tubes, so that the headers form a part of the third-pass baffle. The furnaces are of the Fuller-Lehigh well type, inclosed on all four sides by water walls covered with Bailey alundum blocks, which add an additional 2,044 sq.ft. of heating surface. Each well is 15 ft. 7 in. square below the burner line, but the two side walls fall away above the burners so that the furnace above this line is 24 ft. 3 in. x 15 ft. 7 inches.

The fuel-burning equipment takes coal from the green coal bunkers, located above the main boiler room aisle, through two 20-in. conductor pipes to a Richardson automatic scale, whence it empties into a small receiving bin. This bin serves the double purpose of regulating the flow of coal from the scales and holding a slight reserve to protect against minor scale troubles. From here the coal is fed to each of the two mills serving the individual boilers by two drag-chain feeders. The mills are of the vertical, air-separation, ball type, so designed that the induced stream of air rises over the grinding zone, carrying the pulverized coal along in suspension. This mixture passes through the exhauster and is then introduced into the furnace through two Calumet burners.

There are four burners per furnace, one in each furnace wall. The four flames impinge upon one another, augmenting the turbulence produced by the method of introducing the secondary air through ports at both sides of the burners. Such turbulence gives rapid combustion, which is completed well below the boiler tube bank. The gases, after three passes through the boiler, are led through a Foster economizer having 9,600 sq.ft. of surface and then discharged to the stack by a double inlet Sturtevant fan.

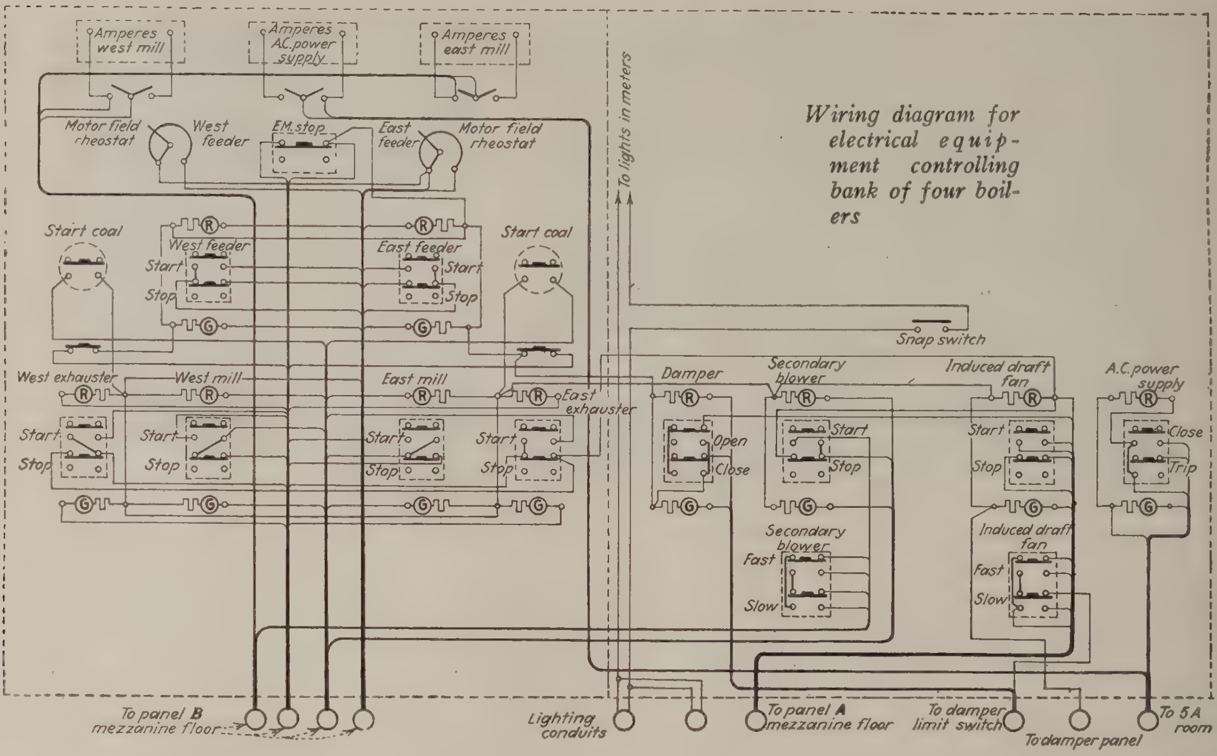
While it was conceded that small turbines would meet the requirements of the boiler auxiliaries, afford a comparatively wide speed range and develop a smooth speed curve, they were passed up in favor of electric motors because of the complications of piping, control, etc., and the difficulty of maintaining a heat balance.

It was deemed best to standardize on induction motors for auxiliary drives on account of the complexity which would arise were part of the plant's auxiliaries on the alternating-current system and part on direct current. For the same reason and because of the greater cost of high-voltage equipment an extension of the 440-volt distribution system was made. The rule to keep everything alternating current was adhered to with one exception. That was the drive for the drag-chain feeders controlling the flow of coal to each of the pulverizing mills. Motors rated at 1½ hp. were required and it is necessary that they have at least a three-to-one speed range. Inasmuch as the power demand was small the easiest solution was to install a small motor-generator set large enough to supply direct-current motors.

All motors with the exception of those driving the mill feeders are wound for 440-volt, three-phase, 25-cycle current. All squirrel-cage motors are designed for "across-the-line" starting.

Maximum flexibility of control had to be obtained without impairing the reliability of operation by the use of excessive delicate automatic paraphernalia. Interlocking of operation was considered necessary to assure proper handling of the pulverized coal.

It is imperative that the induced draft fan be in service before any attempt is made to start the blowers, lest the furnace be put under pressure, forcing an explosive mixture out into the boiler room. After the induced-draft fan has been put in operation the secondary blower can be started, or if it is desirable to run at low ratings when all of the air is supplied by the exhausters, the latter are started, for it is not necessary to have the secondary blower going to start the exhausters. Furthermore, only one exhauster need be operating. The mills can now be started. As with the exhausters, only one mill need be run, but it can only be the one whose exhauster is in motion. The feeder is the last piece of apparatus that can be thrown in and, of course, only the feeder of the mill that is rolling can be started. Between the damper at the induced-draft fan inlet and the induced-draft fan is an interlock, arranged so that it is impossible to increase the speed of the fan unless the damper is in the wide-open position. The object of this is to prevent the operator from using needless power to produce the necessary suction when he might obtain that draft by opening the damper. The reverse operation is interlocked in the same way. In case of failure of any one auxiliary, those preceding drop out of service.



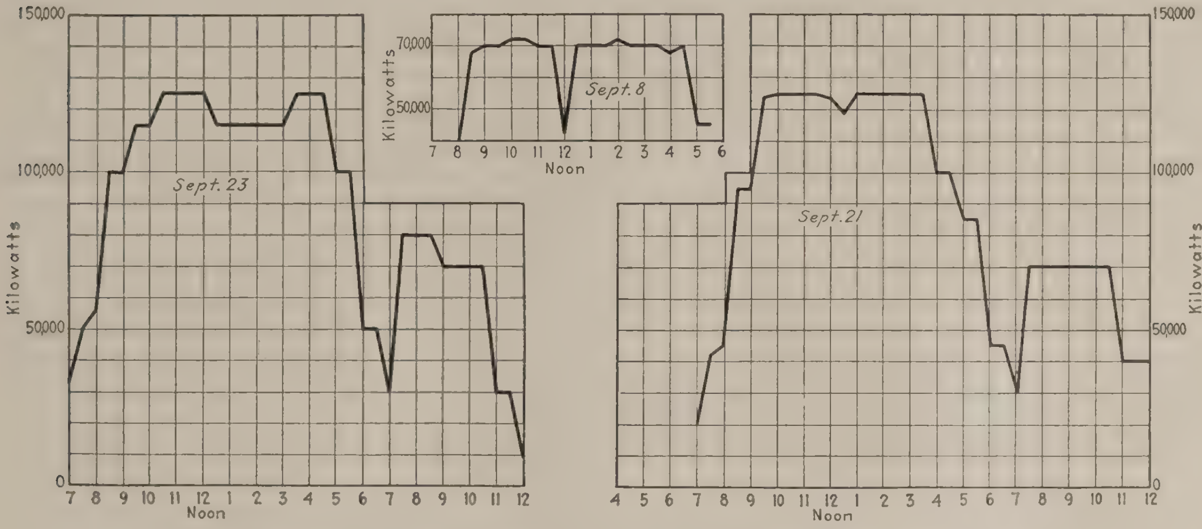
*Wiring diagram for electrical equipment controlling bank of four boilers*

There is a special condition in which the sequence mentioned is not followed. When the coal is wet and the fires are being lighted for the first time it has been found that the wet coal ignites quicker if the mixture of coal and air going to the furnace is a very rich one. The easiest way to accomplish this is to have the mill grinding before starting the exhauster, so that when the latter is started the grinding ring will contain a large amount of very fine coal and the first rush of primary air will carry a heavy charge of coal into the furnace. The normal sequence is automatically re-established immediately after starting so as to maintain full protection.

The control of all the apparatus is centered at the boiler panel. Besides carrying the push-button stations, this panel supports pressure gages, boiler meters, draft gages, $CO_2$ meter, etc., necessary for the operator's complete information. The contactor panels, resistors, controllers, temperature and low-voltage relays, watt-hour meters, etc., with the exception of the resistors and controller for the induced-draft fans, are all mounted on a mezzanine floor almost directly beneath the boiler panels. Fan controllers are motor driven. Motor-driven controllers were not used on the mills because they were so situated that a mechanical control could be very easily arranged.

The induced-draft fan, located on the economizer floor above the boiler room, is driven from either end of the shaft. On one end is a 75-hp., 375-r.p.m., squirrel-cage motor and at the other a 400-hp., wound-rotor, slip-ring motor whose synchronous speed is 750 r.p.m. The speed range is divided into fourteen intervals, the lowest speed being full-load speed on the squirrel-cage motor and the highest the full-load speed on the 400-hp. motor. In starting up it is only necessary for the operator to press the "start" button located on the boiler panel, thereby placing the smaller motor across the line. Increasing the speed is done by pressing the "fast" button, having first, of course, opened the damper to the wide-open position. This operation opens the contactors of the 75-hp. motor and puts the 400-hp. motor on the line with all the resistance in the rotor circuit. The "fast and slow" button is nothing more than a reversing switch that operates the pilot motor on the controller. This motor is equipped with a solenoid brake to avoid overtravel, while undertravel is prevented by additional copper segments, placed at the top of the drum, with connections from the "fast and slow" switch through a holding coil and the damper limit switch to the pilot motor.

The controller and control for the secondary blower motor is identical with that used on the induced-draft fan drive with the exception that it handles but one slip-ring motor rated at 100 hp. at its full load speed of 720 r.p.m. The speed range is two to one and is accomplished in thirteen steps. The exhausters are driven by 60-hp. squirrel-cage motors. A General Electric magnetic contactor operated by a push button, mounted on the turbine panel, comprises the control.



*Wide fluctuations in power demands occur at Huntley station over period of day (Sept. 8, 21 and 23, 1927)*

BOILER OPERATOR'S LOG FOR THREE DAYS

| | | |
|---|---|---|
| **Sept. 8** | | |
| | 8:00 a.m. | Lighted fire (drum pressure 100 lb.) |
| | 8:10 | On line |
| | 11:50 | Shutdown (load dropping) |
| | 12:20 p.m. | Burners relighted |
| | 12:25 | On line |
| | 4:48 | Shutdown (load dropping) |
| | 5:05 | Off line |
| **Sept. 21** | | |
| | 7:45 a.m. | Lighted fire (drum pressure 120 lb.) |
| | 7:50 | On line |
| | 9:27 | Boosted rating (cleaning stoker fires) |
| | 9:55 | Dropped rating (fires cleaned) |
| | 3:05 p.m. | Increased rating |
| | 5:07 | Dropped rating (load dropping) |
| | 5:40 | Shutdown (station dropped 45,000 kw.) |
| | 7:25 | Lighted fire (station picked up 40,000 kw.) |
| | 7:30 | On line |
| | 10:40 | Shutdown (load dropping) |
| | 11:00 | Off line |
| **Sept. 23** | | |
| | 7:25 a.m. | Lighted fire (drum pressure 195 lb.) |
| | 7:26 | On line |
| | 12:00 p.m. | Increased rating (cleaning stoker fires) |
| | 3:45 | Dropped rating (load dropping) |
| | 6:40 | Shutdown (station dropped 50,000 kw.) |
| | 7:15 | Lighted fire (station picked up 50,000 kw.) |
| | 7:20 | On line |
| | 9:40 | Shutdown (load dropping) |
| | 9:50 | Off line |

The mill motors are slip-ring induction, having a continuous rating of 125 hp. at 360 r.p.m. The speed ratio is two to one and the controller, like the others, provides thirteen steps.

The feeder motors, which are rated at 1½ hp., have a speed range from 1,800 r.p.m. (full-load speed) to 600 r.p.m., which is provided by a Ward-Leonard resistor placed in the shunt field of the motor. Thirty-three equal speed steps are thus provided.

Each feeder motor control is augmented by a signal system consisting of a light placed at the mill fed by the feeder, a gong located on the mill floor, a lockout switch situated at each feeder and necessary relays. This is done to enable the boiler operator to notify the mill man when one of the feeders is out and to designate which feeder it is. By pressing the signal button the operator causes the gong to ring and the light to appear at the troublesome feeder. The mill man upon arriving at the feeder opens the lockout switch, thereby stopping the gong (so that it may sound the alarm again if another feeder goes wrong) and extinguishing the signal light at the mill. He also puts out the indicating lamps on the panelboard which show whether the feeder is "in" or "out." When he has cleared up the trouble he closes the lockout switch and in so doing causes the "green" indicating lamp on the panelboard to light, telling the boiler operator that all is O.K. and the feeder may be restarted.

The damper control is a reversing switch connected through limit switches which prevent the motor operating after the damper has reached full-open or full-closed position. The damper-driving motor is a 1½-hp. squirrel-cage unit. This motor, like all the others, is equipped with a thermal overload relay.

The results of operation have been most gratifying. It is so simple to light a fire in the boiler and put it on the line that during some days of widely fluctuating load the boilers are often started up and shut down several times. The three charts, together with the boiler operator's log shown here, give a very good idea of how the boilers are operated. The charts are all from No. 15 boiler, tests on which were described in *Power*, issue of Nov. 22, 1927.

# Finds Exhaust Gases Impracticable for Heating

By H. C. Thuerk

*Manager Erie Lighting Company, Erie, Pa.*

ONE of the power customers of the Associated System recently investigated the possibility of installing a small power plant and generating instead of purchasing power. Careful study of both steam and Diesel-engine-driven plants showed that it would be more economical for the industrial customer who was enlarging his manufacturing facilities to continue the purchase of energy to meet additional requirements.

Among the arguments advanced for the installation of the Diesel-engine plant was the utilization of the heat units in the exhaust gases and in the jacket cooling water. It was thought that this would materially reduce the amount of fuel required for heating purposes during the winter season. An investigation showed, however, that the saving is relatively small.

In determining the amount of heat which could be recovered from the exhaust gases of the proposed oil engines the following quantities were used:

| | |
|---|---|
| Average temperature of exhaust gas, deg. F. | 600 |
| Average outside temperature, deg. F. | 50 |
| Percentage of original heat of fuel in exhaust gases | 30 |
| Temperature of steam at 5 lb. pressure, deg. F. | 228 |

It is considered good practice not to cool the gases lower than about 50 deg. F. above the saturation temperature of the steam. Lower temperature would require a much larger heat transfer surface. Assuming that the exhaust gases may be cooled to 278 deg. F. in passing through an exhaust heat boiler, then the percentage of heat available for steam generation would be

$$\frac{600-278}{600-50} \times 100 = 59 \text{ per cent}$$

Since 30 per cent of the original heat in the fuel is contained in the exhaust gases, then the proportion of the original heat of the fuel which is available for steam generation will be 30 × .59 or 18 per cent.

The following table shows the amount of steam which would be generated under both present and future load conditions of the plant by utilizing this waste heat:

| | Present Load | Future Load |
|---|---|---|
| Kilowatt-hours generated per month | 40,000 | 80,000 |
| Fuel used in gallons | 4,000 | 8,000 |
| Heat units in fuel at 18,500 B.t.u. per pound | 555,000,000 | 1,100,000,000 |
| Heat units available for steam generation | 100,000,000 | 200,000,000 |
| Pounds of steam generated at 70 per cent boiler efficiency, feed water temperature 130 deg. F. | 66,600 | 133,200 |
| Pounds of steam available for seven months | 466,200 | 932,400 |
| Tons of coal saved at 6 lb. evaporation | 39 | 78 |

It was problematical as to how much of the heat in the cooling water could be utilized. This water might be used for boiler feed water during the time the engines were in operation, but since the returns from the heating system would also be utilized for boiler feed it was apparent that cooling water could be used only to supply the losses in the heating system and additional make-up water.

It would have been possible to install a small amount of hot water radiation and return the jacket cooling water through this system. However, an auxiliary supply of hot water would be required when the engines were not running, which fact made this plan not so simple as it appeared.

If the cooling water were passed through a small hot water system the maximum saving in fuel would be computed in the following manner. If the outlet temperature of the cooling water is 130 deg. and the inside temperature of the building is 70 deg., then the heat available for heating would be

$$\frac{130-70}{130-32} \times 100 = 61 \text{ per cent}$$

Assuming that 30 per cent of the original heat in the fuel is contained in the cooling water, then the total heat which could be utilized each month is

$$555{,}000{,}000 \times 0.30 \times 30 \times 0.61 = 100{,}650{,}000 \text{ B.t.u.}$$

The coal saved during seven months would have been

$$\frac{100{,}650{,}000}{1{,}050 \times 6 \times 2{,}000} \times 7 = 56 \text{ tons}$$

This was the maximum saving possible. On account of engines not running all the time and variations in the outside temperature, it would probably not have been possible to utilize more than 60 per cent, or the equivalent of about 34 tons, during the heating season.

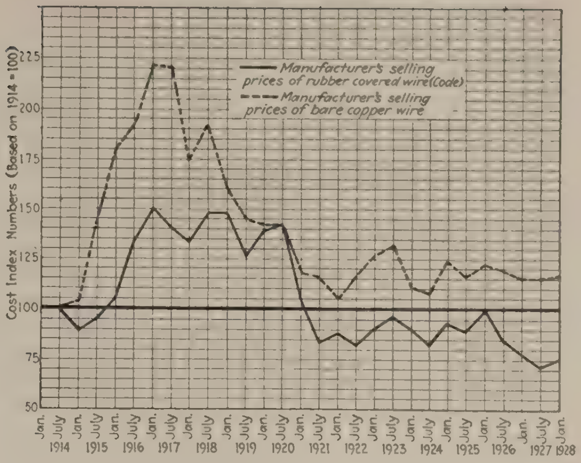
It was evident then that the maximum utilization to be expected from the waste heat in the exhaust gases and cooling water would have been equal to 73 tons of coal per year under present conditions and something less than double this amount under future conditions. Against this saving in fuel must be balanced the fixed charges and maintenance costs on the additional equipment required for utilizing the waste heat. When this was done, it was found that the net saving was so small as to make an inconsiderable difference in the total amount of coal that would have to be burned during the heating season.

# Apartment Building Floodlighted During Construction

A NEW use for floodlighting is developing in Seattle, Wash., to establish the location of a building under construction. It is worthy of wider application. The accompanying illustration shows the Marlborough apartments floodlighted with fourteen 1,000-watt units placed on nearby light poles. The building, thus brilliantly illuminated, attracted attention for some distance and was well fixed in the public mind by the time it was completed.

# Trend in Prices of Supplies

Prices virtually down to a pre-war basis. Items listed make up 60 per cent of average jobber's total sales

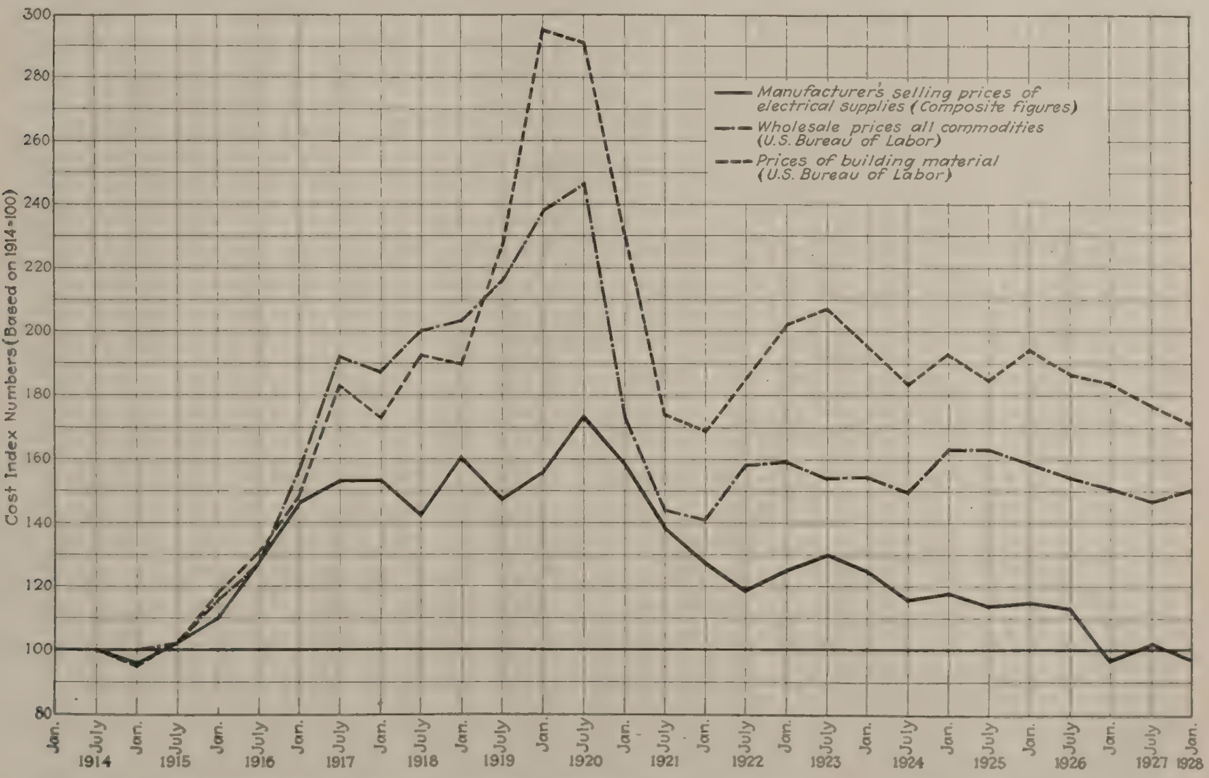


*In July, 1927, the index price of rubber-covered code wire was 71, the lowest recorded. In January, 1928, the index was 75*

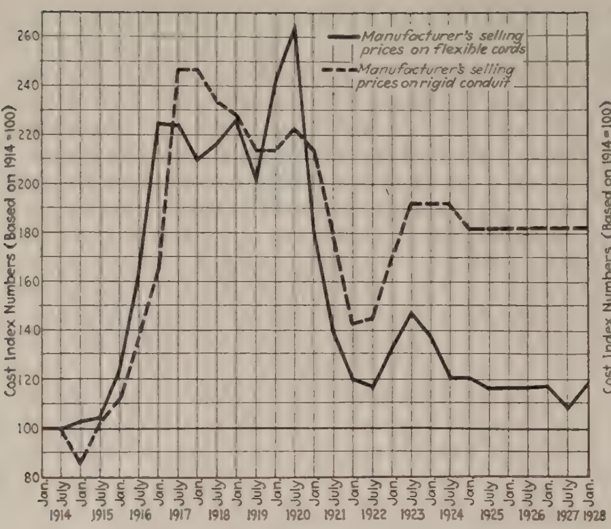
PRICE indexes of electrical materials, originally presented in the Feb. 16, 1924, issue of the ELECTRICAL WORLD, to include figures for January, 1928, are given in the accompanying table and graphs. The figures given cover manufacturers' selling prices of representative electrical commodities and were obtained from a fully authoritative source. The information is given in the form of index figures based on 1914 prices, making it possible to arrive at the manufacturers' selling price of any one of the items for any date since 1914 if the price is known for any period between 1914 and 1926. The prices are the average for the months as shown.

The index has continued to decline and the composite index number now indicates that the prices of electrical supplies are virtually down to a pre-war basis. The figures are, of course, national in character and are not influenced by local conditions which may exist or which may have existed during the period covered. The index numbers are, generally speaking, a comparison of the prices of unit quantities of a typical size, type or design of an item in each particular line representative of the whole. The index numbers, therefore, are quite accurate in showing the price movement in such items as wire, batteries, rigid conduit, tapes and compounds and standard porcelain, but there has been some difficulty in getting a true index of items that have shown marked changes in type and design during the period.

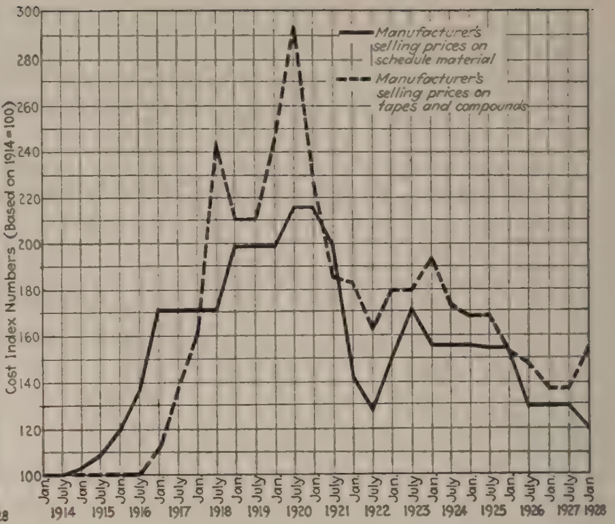
While all the items entering into the general group of commodities known as "electrical supplies" are not included in the accompanying table and diagrams the thirteen items for which data are given cover a large per-



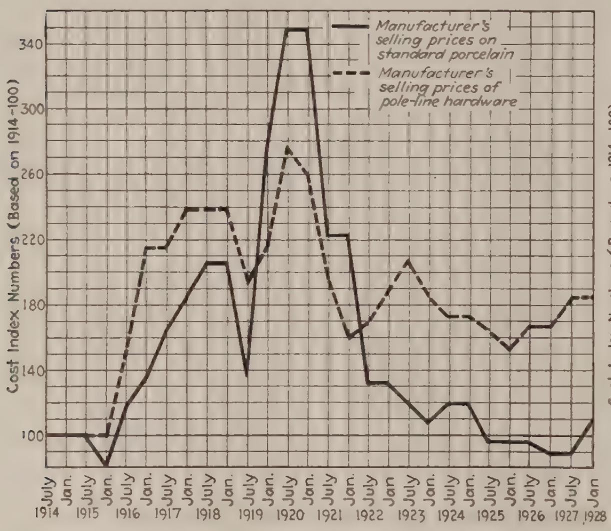
*Comparative price indexes of electrical material, all commodities and building material*



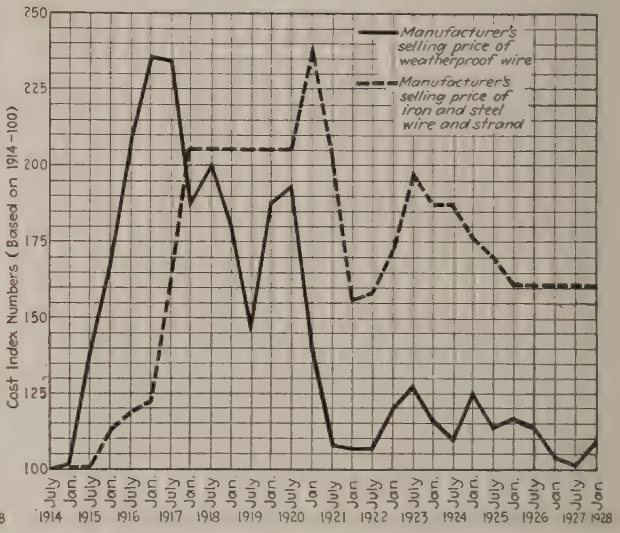
*Prices of flexible cords and rigid conduit more than doubled from 1917 to 1921. Since 1924 the index for flexible cords has been around 120 and since 1925 rigid conduit has held at 182*



*Both tapes and compounds and schedule material have registered declining prices in the last three years. In January, 1928, the index for tapes and compounds increased to 154*



*Standard porcelain prices show a steady decrease to an index of 98 in July, 1927. In January, 1928, the index was 109. Since January, 1926, pole line hardware has gradually increased to 185*

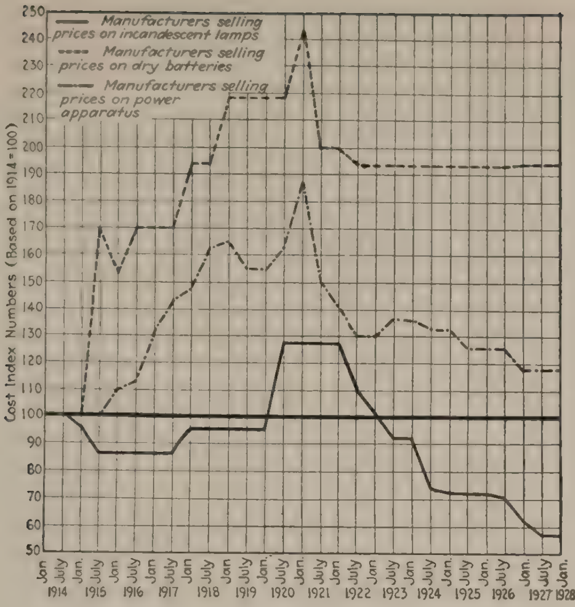


*The price of weatherproof wire in January, 1928, was only 109 per cent of that in 1914. In July, 1927, it nearly reached par. Iron and steel wire and strand has been at 161 since 1926*

*Price Index of Electrical Materials at Manufactur*

(Based on 1914 Prices = 100)

| | 1914 | —1915— | | —1916— | | —1917— | | —1918— | | —1919— | | —1920— | | —1921— | | —1922— | | —19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Year | Jan. | July | Jan. | July | Jan. | July | Jan. | July | Jan. | July | Jan. | July | Jan. | July | Jan. | July | Jan. |
| Weatherproof wire | 100 | 102 | 137 | 168 | 207 | 235 | 234 | 187 | 200 | 180 | 147 | 187 | 193 | 140 | 108 | 107 | 107 | 120 |
| Pole-line hardware | 100 | 100 | 100 | 100 | 151 | 215 | 215 | 239 | 239 | 239 | 194 | 217 | 275 | 259 | 195 | 161 | 170 | 190 |
| Iron and steel wire and strand | 100 | 101 | 101 | 112 | 118 | 122 | 163 | 205 | 205 | 205 | 205 | 205 | 205 | 237 | 202 | 156 | 158 | 172 |
| Bare copper wire | 100 | 104 | 145 | 180 | 193 | 222 | 221 | 175 | 193 | 160 | 145 | 142 | 142 | 118 | 116 | 105 | 116 | 127 |
| Power apparatus | 100 | 100 | 100 | 110 | 113 | 131 | 144 | 148 | 163 | 165 | 155 | 155 | 163 | 188 | 151 | 142 | 130 | 130 |
| Incandescent lamps | 100 | 95 | 86 | 86 | 86 | 86 | 86 | 95 | 95 | 95 | 95 | 95 | 127 | 127 | 127 | 127 | 111 | 101 |
| Dry batteries | 100 | 100 | 170 | 153 | 170 | 170 | 170 | 194 | 218 | 194 | 218 | 218 | 218 | 243 | 200 | 200 | 194 | 194 |
| Rubber-covered wire (code) | 100 | 89 | 95 | 105 | 133 | 151 | 140 | 133 | 148 | 148 | 127 | 139 | 142 | 105 | 84 | 88 | 82 | 90 |
| Flexible cords | 100 | 103 | 104 | 123 | 164 | 225 | 224 | 210 | 216 | 226 | 202 | 241 | 262 | 182 | 139 | 120 | 117 | 133 |
| Rigid conduit | 100 | 86 | 102 | 112 | 137 | 165 | 247 | 247 | 234 | 229 | 214 | 214 | 223 | 214 | 179 | 143 | 145 | 170 |
| Schedule material | 100 | 103 | 108 | 119 | 136 | 171 | 171 | 171 | 171 | 199 | 199 | 199 | 216 | 216 | 199 | 142 | 128 | 150 |
| Tapes and compounds | 100 | 100 | 100 | 100 | 100 | 111 | 137 | 161 | 243 | 211 | 211 | 246 | 292 | 228 | 186 | 183 | 163 | 180 |
| Standard porcelain | 100 | 100 | 100 | 80 | 118 | 136 | 165 | 185 | 206 | 206 | 139 | 278 | 348 | 348 | 222 | 222 | 133 | 133 |
| Electrical supplies (composite figure) | 100 | 96 | 102 | 110 | 127 | 146 | 153 | 153 | 142 | 160 | 147 | 155 | 173 | 159 | 139 | 128 | 119 | 125 |



*In January, 1928, incandescent lamp prices were only 57 per cent of the 1914 price*

centage of the electrical supplies manufactured. A somewhat higher composite index number would be obtained if more items were included, but it is estimated that the items listed comprise about 60 per cent of the average jobber's total sales. The figure given is a physical volume index and the individual indexes are weighted by the volume of sales for each item. Incandescent lamps weight the index heavily in the winter months and this item, together with rubber-covered and weatherproof wire, operated strongly to bring the index down to the pre-war level. The price of wire varies considerably in the various classes. Weatherproof wire follows very closely the prices of bare copper wire.

The extent to which the prices of electrical supplies as a whole have been held down by manufacturers since 1914, as compared with the wholesale prices of commodities and the high prices asked for building materials, is clearly shown in an accompanying illustration. During the peak year 1920 the increase in the price of electrical supplies was considerably less than that of all commodities or building material. In January, 1928, the composite figure for electrical supplies was 97, compared with 150 for all commodities and 171 for building material

*Selling Prices*

| 1924 Jan. | 1924 July | 1925 Jan. | 1925 July | 1926 Jan. | 1926 July | 1927 Jan. | 1927 July | 1928 Jan. | |
|---|---|---|---|---|---|---|---|---|---|
| 116 | 110 | 124 | 114 | 117 | 114 | 104 | 102 | 109 | Weatherproof wire |
| 185 | 173 | 173 | 164 | 153 | 167 | 167 | 185 | 185 | Pole-line hardware |
| 187 | 187 | 176 | 170 | 161 | 161 | 161 | 161 | 161 | Iron and steel wire and strand |
| 111 | 108 | 124 | 116 | 121 | 120 | 115 | 115 | 116 | Bare copper wire |
| 136 | 133 | 133 | 126 | 126 | 126 | 118 | 118 | 118 | Power apparatus |
| 92 | 74 | 72 | 72 | 72 | 71 | 62 | 57 | 57 | Incandescent lamps |
| 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | 194 | Dry batteries |
| 90 | 82 | 93 | 89 | 99 | 85 | 78 | 71 | 75 | Rubber-covered wire (code) |
| 138 | 121 | 121 | 117 | 117 | 117 | 117 | 108 | 118 | Flexible cords |
| 192 | 192 | 182 | 182 | 182 | 182 | 182 | 182 | 182 | Rigid conduit |
| 156 | 156 | 156 | 155 | 155 | 129 | 129 | 129 | 120 | Schedule material |
| 194 | 174 | 169 | 169 | 154 | 149 | 137 | 137 | 154 | Tapes and compounds |
| 108 | 120 | 120 | 97 | 97 | 97 | 89 | 89 | 109 | Standard porcelain |
| 125 | 116 | 118 | 114 | 115 | 113 | 97 | 102 | 97 | Electrical supplies (composite figure) |

# Ten Months' Sale of Electrical Farm Equipment

THAT the central-station company has a strong influence and responsibility in developing the use of electrical equipment by farm customers is shown in the results which have been attained by the Ohio Public Service Company, Elyria, Ohio, through its work in conjunction with a local farm implement dealer. As outlined on page 817 of the ELECTRICAL WORLD, April 16, 1927, the Ohio Public Service Company arranged an extensive permanent display of electrical farm equipment in the store of the Farm Implement Company in Elyria. This was followed by a series of demonstrations and the rural lines representatives of the power company invited existing and prospective farm customers to visit the display and inspect the equipment in operation. Many sales to rural customers have resulted and in the first full year's operation of this display more than $30,000 of electrical equipment has been sold. An itemized list of the apparatus sold during the first ten months is given here.

FARM EQUIPMENT SOLD IN TEN MONTHS OF DISPLAY UNDER SPONSORSHIP OF OHIO PUBLIC SERVICE COMPANY

| No. | Equipment | Value | No. | Equipment | Value |
|---|---|---|---|---|---|
| 78 | Electric water systems | $8,461.00 | 22 | Corn poppers | $54.00 |
| 10 | Electric milking machines | 432.00 | 26 | Curling irons | 45.00 |
| 2 | Cream separators | 304.00 | 2 | Heaters | 35.00 |
| 6 | Electric brooders | 90.00 | 8 | Fans | 40.00 |
| 66 | Electric washing machines | 10,080.00 | 25 | Hotplates | 75.00 |
| 2 | Ventilating fans | 70.00 | 18 | Coffee percolators | 147.00 |
| 17 | Vacuum cleaners | 551.00 | 2 | Large feed grinders | 250.00 |
| 60 | Flatirons | 325.00 | 2 | Chicken feed grinders | 45.00 |
| 55 | Toasters | 185.00 | 4 | Large irrigation systems | 8,200.00 |
| 20 | Waffle irons | 130.50 | 1 | Electric 1½-hp. motor | 129.00 |
| | | | 1 | Electric drill and saw set | 35.00 |
| | | | 20 | Christmas tree light sets | 40.00 |

Commenting on these results, J. B. Johnson, district manager of the Ohio Public Service Company, said: "This is a formidable list, but it is a very small percentage of even a fair saturation and represents only a small part of the business that can be developed. It represents the results from only one effort in one county in Ohio, but it tends to indicate what can be accomplished when a workable contact is established by the central-station company with rural customers and the farm implement dealer."

# "D.R." Plan Sells Many Appliances

THROUGH the courtesy of Stone & Webster, Inc., manager of the Electric Light & Power Company of Abington & Rockland, Mass., the results of the district representative plan of customer contact pioneered on that property are now available for 1927. Each district representative serves about 800 residential customers in an assigned territory, reading meters, attending to service matters, adjusting complaints, selling appliances and in general giving the company a living personality in his neighborhood. During 1927 the nine district representatives of the company sold $99,777 worth of electrical appliances, or an average of about $11,000 per man. The company serves a large rural territory interspersed with small towns, and its total sales of appliances in its own store were $6,628 for the year. Lamps are included in the foregoing figures. The maximum and minimum appliance sales per "D.R." were $20,453 and $6,464 respectively. These appliances add an annual energy consumption of about 391,550 kw.-hr. to the company's business. The average appliance purchases per residence customer for the year, including lamps, was $18.42. The gross profits on the appliances sold more than covered the labor of the district representatives, including meter reading and servicing. About 40 per cent of the time of these men was expended on merchandise sales during the year. In 1926 the total sales were $99,169.

# Letters from Our Readers

### *Norway Claims 2,400 Kw.-Hr. per Capita*

*To the Editor of the* Electrical World:

I have seen with interest the statistics of the electrical industry given in the Jan. 7, 1928, issue of the Electrical World and shall be glad if you will help me correct an error in the statistics.

In one of the graphic tables on page 34 it is stated by your statistician that the generated electrical energy in Norway in 1925 was only about 220 kw.-hr. per capita. We are proud that we are living in one of the best, if not the best, electrified countries in the world, and in 1925 our energy consumption was about 6,700,000,000 kw.-hr., or 2,400 kw.-hr. per capita. Twenty-five per cent of the energy was used for public utility purposes. With these figures we beat even the state of Montana, which, according to the table on page 60, had 2,020 kw.-hr. per capita (in 1927?) and is the leading state of the U. S. A.

In this connection it would be interesting to know whether the total production of energy in Montana is consumed in that state or whether a certain part of the energy is exported to other states. Trygve Hodne.

[The figures on which the chart in the Jan. 7 issue was based were subsequently published in the Electrical World, Feb. 11, 1928, together with the source of the information. The output was there given as 6,200,000,000 kw.-hr., or 2,270 kw.-hr. per capita, which figure should be used instead of that shown on the chart. The slight discrepancy between this 2,270 and 2,400 kw.-hr. quoted by Mr. Hodne (mailed Feb. 14) is apparently due to differences in information coming presumably from official sources.—Editor.]

### *Improvements in Turbo-Generators and Speculations Upon Them*

*To the Editor of the* Electrical World:

The editorial appearing on page 441 of the March 5 issue of Electrical World entitled "Improvements in Turbo-Generators and Speculations Upon Them" is very interesting and brings out one point in particular that I have been interested in for some years, although I have never had an opportunity of doing anything in this line, namely, the use of a refrigerant in connection with such units. In view of the very wide application of mechanical refrigeration to industry, which includes its use in many specialized manufacturing operations, it would seem that there should be no insurmountable difficulties in adapting refrigeration to turbo-generator design. The cooling and conditioning of air by means of mechanical refrigeration has been a reality for years, as has been the case in the cooling of other gases.

In turbo-alternators, where hydrogen gas is used as the cooling agent, such gas could be cooled through any desired range and its temperature automatically controlled within very close limits. All that the refrigerating engineer would need to know to calculate the necessary refrigerating tonnage for a given installation would be the weight of hydrogen gas circulated per unit of time and its specific heat, the range through which the gas is to be cooled and the heat equivalent of the horsepower required to circulate the gas. It is obvious, of course, that a scheme of this character could not be adopted overnight, but would require careful study and investigation, and no doubt a certain amount of experimental work would be necessary. However, any practical and economical means of maintaining the generator windings at the lower temperature levels is well worth serious consideration.

By the use of mechanical refrigeration, any practical heat head or temperature difference could be maintained between the highest temperatures of the generator and the cooling medium, with the result that large quantities of heat could be taken up.

The amount of power actually required to operate a refrigerating machine of sufficient capacity to produce the necessary cooling would be a very small percentage of the total auxiliary power required by turbo-generators and would unquestionably be an excellent return on the investment. C. T. Baker.

Atlanta, Ga.

### *Let the Seller Profit*

*To the Editor of the* Electrical World:

In commenting upon the articles you have been publishing on the subject of price cutting, there is no question in my mind that it is good policy to follow the lead of the leading automobile concern that recently was reported to have given instructions to its buying department that it must cease "hard buying" and pay a price fair to the manufacturer as well as to itself. In a recent article in the New York *Times* I made the following statement, which is to the point:

> There are, however, many other angles to the buying of merchandise that need to be considered in this general question. It is obvious that if buying were to be confined to paying the "first price" offered there would be no need of a purchasing agent.
>
> The purchasing agent is an officer of the corporation, and as such he views a purchase from general market conditions rather than as a single transaction. He has to watch the market to be sure he is not overpaying and that concerns which compete with his own are not able to buy more cheaply. He naturally is trying to get a little better quality at a price which is a little lower. And his success in this endeavor plays a large part in the success of the entire corporation.
>
> The buyer frequently has no reliable or entirely accurate information as to what the bottom price is on certain merchandise in which he is interested. Accordingly, in dealing with certain types of salesmen, the job of the purchasing agent is to smoke out the "confidential stuff." In every purchase, as I have said, he is guided by the relation of the price he is asked to pay to that paid or likely to be paid by his competitor.
>
> If a manufacturer finds himself with a big inventory and is forced to make concessions to get orders, no buyer is going to pay more than the prevailing market conditions warrant. This manufacturer speculated in covering his raw material requirements in advance, and if he did not gage the action of the market correctly that is his error.
>
> These considerations deal solely with market conditions and do not parallel the seeking of the "last drop of blood," of which sellers can rightly complain.

There is every indication of a greater degree of co-operation and mutual understanding between buyers and sellers. In no way can this be fostered better than by the realization that a fair profit for both is essential.

W. L. Chandler,
Secretary and Treasurer.
National Association of Purchasing Agents.

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Heating Trash Rack Bars Electrically.*—C. R. Reid.—In order to combat anchor or frazil ice, formed in turbulent open water in the forebay of a hydro station subject to extremely low temperatures, electrically heated trash rack bars were devised. The author reviews the installation and offers the empirical formulas utilized in developing this equipment. Performance details are included. It is stated that the best method of overcoming this ice trouble lies in the proper design of the hydraulic system above the rack bars, as a large body of quiet water will freeze over quickly and an ice covering of sufficient size will be formed to prevent the surface formation of heavy ice crystals. The ice needles either adhere to the under side of the ice covering or are remelted in the warmer water under the ice. If the velocity approach is low and the racks are set at a considerable depth, and if, in addition, the bed of the approach channel is smooth and grades down easily to the bottom of the racks or even considerably below that, frazil ice trouble should be entirely eliminated. However, when this is not possible other precautions must be taken. In the present installation a voltage of 126.5 and a current of 3,680 amp. are utilized, giving an input per cubic feet per second of 227 watts. It is stated that sufficient experience has been gained with this installation to demonstrate that just about the right amount of energy input has been provided. Severe frazil ice conditions have been handled with entire success at this plant on several occasions. The author concludes that electric heating of racks is of particular value in locations where frazil ice trouble develops quickly and is not of long duration. When such trouble is experienced more or less continuously it is suggested as being desirable to install rack bars made of tubing welded into headers and to circulate warm water through them as temperatures and conditions may require.—*Electrical News (Canada)*, March 15, 1928.

## *Heat Applications and Material Handling*

*Electric Heating and Load-Factor Improvement.*—M. O. F., England.—As a result of an analysis and investigation of available mediums for the improvement of load-factor conditions the author has concluded that the desired results can be obtained by creating a load consisting of electrically heated water storage cylinders and controlling this load from the power house or substation by inexpensive means. It is said that under certain conditions the cost of supplying hot water in this way compares very favorably with coke fuel, especially with the smaller consumer. The larger consumer may pay a little more for his hot water, but the initial expense is small, and in other ways the electric system is ideal. The electrical equipment suggested for such installation consists of a simple form of remote relay control, while the operating voltage is so low that no danger is incurred, even if bare wires are run overhead on ordinary telephone poles and insulators. This discussion, of course, refers to possibilities following the practices involved in Great Britain. The containers must be properly insulated to prevent the diffusion of the stored heat.—*World Power (England)*, March, 1928.

## *Transmission, Substations and Distribution*

*Insulating Oils for High-Voltage Cables.*—T. N. Riley and T. R. Scott.—Oils suitable for high-voltage cables are in general equally suitable for low-voltage work, according to the authors, but many of the characteristics which are of importance for high voltages are of minor importance when the stress in the dielectric is low and the range of oils available is therefore increased. Chemically, there are said to be few fundamental requirements, since it is the physical and electrical properties which determine the most suitable compound. Physically, the compound must have the properties of a lubricant in order that the paper layers may slide over each other without fracture when the cable is handled. The viscosity must be sufficiently low at the processing temperature to permit thorough impregnation of the paper. On the other hand, it must be sufficiently high at service temperatures to prevent easy drainage when the cable is laid on a slope or when it is cut for splicing. The author reviews the necessary fundamental characteristics and presents determinations arrived at through exhaustive laboratory tests. It is concluded that the physical requirements severally mentioned are essential if a well-impregnated cable is to be constructed. It is shown that the power-factor-temperature characteristic of the oil is of importance, not only in relation to the actual value of dielectric losses exhibited by the cable, but also as an index of the state of chemical and physical stability of the oil. The elimination of gas pockets in the dielectric is of vital importance, not only for preventing burning and oil oxidization, but for obtaining low thermal resistivity.—*Electrician (England)*, March 9, 1928.

*220-Kv. Lightning Arresters.*—A. L. Atherton.—The use of lightning arresters on the terminal stations of the Conowingo-Plymouth Meeting line is of interest as it constitutes a departure from the previous general conception that lightning arresters are not needed for such service, or at least that they are not economically justified at 220 kv. and also because the arresters are said to be the largest in service. The study which preceded the decision to utilize this equipment has been outlined in this discussion to determine the benefits to be secured by such protection. Consideration was given to the insulation of the proposed line station yard and apparatus. Assumptions were made as to the most severe transient likely to occur on the line. The proper arrester was selected to suit the anticipated operating voltage of the station. From the characteristics of the arrester and line and from the station layout determinations were made of the voltage which will be applied to the station equipment when such a maximum transient arrives at the station. It was found that these voltages may be potentially dangerous, but that special choke coils will reduce and may be expected to eliminate this danger. As a result of this investigation, it is indicated that there are probably many other cases in which such a study would point out hazards both of yard flashover and apparatus damage which might be avoided by some relatively minor changes in the protection scheme. —*Electric Journal*, March, 1928.

## *Units, Measurements and Instruments*

*The Neon-Electric Stroboscope.*—E. E. Steinert.—The need for a stroboscope that could be used in the study of power system stability to measure, among other things, the various displacement angles caused by different load conditions has been met by the development of the neon-electric stroboscope. This device consists of four parts: A special transformer, a condenser, a neon lamp and a disk. The transformer, condenser and neon lamp are inclosed in a case for protecting the lamp against breakage and the operator against high voltage. The only electrical connections to the case are those leading to the transformer primary, which operates from a 110-volt, 60-cycle supply and the only technique required in its operation is to place the box where the light can fall upon the disk. No tuning or adjustments are necessary. As the investigators use the disk directly not through slots or past vibrating parts an element of considerable simplicity is introduced. The element which makes this stroboscope effective is the special transformer, the secondary voltage of which is characterized by a sharp, well-defined peak. The author states that the success with which the neon-electric stroboscope has been used in recent tests is a direct result of its high degree of accuracy, which is possible only because of the extreme clearness of the image. Other features of this device are compact and rugged construction. It is said to be as portable as an ordinary voltmeter.—*General Electric Review*, March, 1928.

*Symmetrical Components.* — C. F. Wagner and R. D. Evans.—A brief review of the laws governing complex numbers precedes the development of certain theorems regarding the resolution of simple complex numbers into symmetrical groups. These developments apply largely to electrical systems involving symmetrical or balanced impedances. Illustrative examples of these theorems are offered in connection with specific examples, such as the analysis of short circuits in transmission networks. This is followed by the application to a few miscellaneous problems, some of which involve unsymmetrical impedances. The treatment is limited to three-phase systems, except that the last portion of the discussion develops some of the more important relations as applied to two- or four-phase systems. It is stated that a knowledge of the method of symmetrical components is essential for an adequate understanding of the application problems involving the magnitude and phase relation of voltages and currents under unbalanced conditions and is therefore necessary for the design of power stations from the standpoint of cricuit-breaker application, relay protection and stresses in electrical machinery. The method is particularly suitable for the analysis of the performance of rotating machinery for single-phase or unbalanced polyphase operation and has been used quite extensively in connection with the design of machinery on single-phase railway systems, particularly from the standpoint of phase-converting apparatus.—*Electric Journal,* March, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*Thickness of Photo-Electrically Active Rubidium Films.* — Herbert E. Ives and A. L. Johnsrud.—The extreme tenuity of the layer responsible for photo-electric emission offers a possible answer to what has been a long-standing question with regard to selective and normal photo-electric emission. The question is stated by the authors to be, why does the emission under certain circumstances differ for a light polarized in and perpendicular to the plane of incidence, by a factor many times greater than the ratio of the optically measured absorptions? In the light of the experiments described in this article, it appears possible that the intrinsic absorption of the extreme surface layer may differ, for light polarized in the two planes, by a very large factor, but that the total optical absorption, which is due to a relatively considerable depth of material, may not exhibit this difference. A definite orientation of surface atoms, overlying atoms randomly disposed, could result in behavior of this sort. In any event, whatever the cause of the high selective-to-normal-emission ratio, it is clear, for the subject matter considered, that any close correlation of bulk optical properties with photo-electric properties is not necessarily to be expected.—*Reprint B-282, Bell Telephone Laboratories, Inc.*

*The Deterioration of Lead Cable Sheathing by Cracking and Its Prevention.* — S. Beckinsale and H. Waterhouse.—The phenomenon of the cracking of lead cable sheathing received little attention by metallurgists until recently, according to the author, and has only been studied as a corollary to other forms of intercrystalline cracking, and, in particular, season-cracking. The results of the numerous and extensive researches into the causes and methods of prevention of season-cracking of brass and other metals appear, however, to be inapplicable to the case of cracking of lead. Because of the almost negligible elastic limit of the metal and its readiness to self-anneal at atmospheric temperature it is stated that a state of internal stress of sufficient magnitude to cause intercrystalline failure of the season-cracking type is improbable. The investigation covers microscopic and chemical determinations for suspended aërial cable, underground construction and other installations where such failures were found.—*Engineering* (*England*), March 9, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*Economical Design of Loaded Telegraph Cables.*—E. S. Heurtley.—The economical design of a cable of any given length and required transmitting speed is considered and it is shown that in general for equal performance a cable intermittently loaded is materially cheaper to manufacture than a cable loaded throughout. A brief outline of the methods employed in obtaining the results is given. The author includes a number of suggestions for reducing mechanical costs and suggests the possibility of duplex operation as a method of further minimizing expenses.—*Electrician* (*England*), March 9, 1928.

*Experiments and Observations Concerning the Ionized Regions of the Atmosphere.*—R. A. Heising.—Experiments are described by the author in which a virtual height of the reflecting ionized region was measured, using time lag between impulses arriving over a direct and reflected path. Movements of the reflecting region are plotted, showing slow rises and rapid drops. Transmission measurement curves are given, showing dependence of meter signals upon night ionization and the assistance that sunlight ionization can give. Experiments and curves are mentioned that show absorption to be one of the important factors causing poor daylight transmission in the wave length region contiguous to 214 m. It is pointed out that the absorbing region is below the refracting region and that the sky wave must make two passages through the absorbing region. According to this theory the electromagnetic waves from the sun produce the ionization in the absorbing region and part of the day ionization in the refracting region. This ionization is pictured as beginning at an altitude of about 16 miles and extending upward, and as experiencing diurnal and seasonal variations.—*Reprint B-283, Bell Telephone Laboratories, Inc.*

## *Traction*

*The Operating Costs of Electric Industrial Trucks and Motors.*—C. B. Crockett and H. J. Payne.—The authors have endeavored to show how direct and indirect costs of a materials-handling system may be classified and estimated and have applied the methods described to the question of operation of electric trucks. The direct costs of operation are here divided into fixed charges and operating charges, both of which are fully enumerated and where possible evaluated. Actual figures of cost of operation taken from several plants are presented and the savings due to truck operation pointed out. The various items entering into cost estimates have been defined in relation to the life of the trucks, battery, charging equipment, etc. As a result of this investigation the authors conclude that the effort to lower the cost of production in the mechanical handling of materials is becoming increasingly significant, but that variations in conditions render comparative cost estimates somewhat difficult; that a fairly simple classification of direct cost is possible; that in average installations the electric cost is in the neighborhood of 50 cents an operating hour; that in specific installations there is considerable variation in cost; that the influence of operating conditions is capable of being analyzed, and that indirect savings are always present, though difficult of valuation.—*Electric Vehicle,* March, 1928.

## *Miscellaneous*

*The Vacuum Slip Process of Removing Air from Clay Bodies.*—G. W. Lapp.—The author has described the fundamental considerations involved in the slip-process manufacture of plastic wet process electrical porcelain bodies. The method of manufacture has been outlined as the passage of the clay through a tank in which the air content is evacuated by boiling. The ability of the clay filter cakes to reabsorb a small amount of air insures freedom from air in the clay if the milling devices are properly designed and operated. The advantages of such a manufacturing process are outlined and the method of determining the air contents is also given. The latter involves the compression of the sample in a liquid-filled chamber. It is stated that determinations may be made by this method with an accuracy of one-hundredth of 1 per cent. This test procedure was devised by Professor Bridgeman and is stated to have been highly successful. —*Journal of the American Ceramic Society,* February, 1928.

# News of the Industry

## Massachusetts Rate Bill Postponed a Year

*State Senate Accepts Committee's Recommendation to Put Utilities Commission's Plan Over Until Next Session—Attwill Protests*

THE proposed bill of the Massachusetts Department of Public Utilities forcing electric and gas companies to accept commission regulation without appeal to the courts in case of unacceptable decisions on rates has been referred to the next session of the Legislature by the report of the Senate committee on power and light. The Senate accepted this report on Wednesday. The committee tried to draft a permissive bill but encountered so many obstacles that no agreement was possible. The constitutionality of the bill was sharply questioned in the committee discussions.

Commenting on the report of the committee, Chairman Attwill of the Massachusetts Department of Public Utilities said that the board will continue its fight to establish the principle that the public shall not be required to pay rates based on surplus earnings taken from the public through excessive charges or based on fictitious and fanciful valuations. He declared that unless in the near future the commission shall succeed in this effort, there will be no relief from extortionate charges except through public ownership.

## Protests Against Plant in the Royal Gorge Number 150

A crowded audience assembled at Pueblo, Colo., on March 29, when the application of the Public Service Company of Colorado to build a hydro-electric plant in the Royal Gorge, near Canon City, came before the Public Utilities Commission of the state at an open hearing. This application has aroused unusual interest on account of the allegation that the plant would destroy or injure the scenic beauty of the gorge, well known to travelers through that territory. One hundred and fifty formal protests against it have been registered. The project had been referred back to the state by the Federal Power Commission on account of the strong opposition, that commission saying: "The question whether or not this project should proceed in view of possible conflict with other interests seems peculiarly a matter of state concern, over the decision of which the state, having the authority, should assume the responsibility."

V. L. Board, general superintendent of the company, said that it would not go ahead in the face of opposition, but would be willing to agree to a stipulation for the exemption of sufficient water to maintain the scenic feature of the gorge. He dwelt on the cost of natural gas and coal as fuels. E. Clinton Jansen, company engineer, said that the plant could be operated without any loss to the natural beauty of its surroundings. Barton M. Jones, an engineer representing the Denver & Rio Grande Western Railroad, which is fighting the hydro project vigorously, held that the Public Service company could find other sites, naming one on the St. Vrain River.

## Santa Cruz Defeats Municipal Water and Power Scheme

The proposed municipal water and hydro-electric power project designed to make the city of Santa Cruz, Calif., tax-free in ten years was defeated by the voters on March 29. The vote stood: For, 1,774; against, 2,390. The vote was the heaviest ever recorded for the thirteen precincts of Santa Cruz. It had been proposed to erect a dam above the city to supply Santa Cruz with municipally owned water service and to sell power to local industries.

## Three Committeemen Attack Shoals Bill

### Minority Report to House Says It Involves "Enormous Waste of Public Money"—King for New Study of Boulder Dam—Utility Quiz Next Week

By Paul Wooton
Washington Correspondent of Electrical World

A VIGOROUS minority report on Muscle Shoals was submitted to the House of Representatives April 4. It was signed by Representatives Ransley of Pennsylvania, Frothingham of Massachusetts and Glynn of Connecticut. The minority report says that the corporation to be set up by the government would be "merely a start toward the goal of unlimited expenditure of government money." It attacks the provisions of the bill for fertilizer production as based on "the most expensive method." The report continues:

> No provision is made for paying back past expenditures at Muscle Shoals, which amount to over $123,500,000. The Patent Office is opened to this government corporation and the patent law, though still binding on private manufacturers, is swept aside for this corporation. The bill also authorizes the expenditure of some $37,500,000 for a new dam, and not only is no provision made for amortizing this sum, but vested rights that the State of Tennessee may possess are ignored.
>
> There were other and better bills before the committee than this one—bills which would have involved less expenditure of the people's money and been quite as effective. The War Department receives an annual rental for the water power at Muscle Shoals of $1,250,000, and the expenses are only $276,000. This is a trifle compared with the yearly revenue that could be obtained if the department were empowered to make a longer lease, but it shows that money is coming into the Treasury, that the taxpayer will be protected while waiting for a business proposition, and that there is no need of haste in accepting a bill until the right one comes before us. We object to the enormous waste of the public money involved in the present bill and to the operation in this manner by the government of what should be left to private enterprise. There is grave doubt also as to the constitutionality of this bill.

A hand in the pending Muscle Shoals legislation is being taken by the National Fertilizer Association. This body is about to issue a statement of which an advance copy has reached the Electrical World. The statement, which was to go to every senator and representative by Friday, declares that if the Norris bill shall become a law, the government will be in the fertilizer business in the fullest sense and a cardinal American principle thus be overthrown. The association asserts that of all important supplies bought by the American farmer the lowest-priced is fertilizer; that the fertilizer industry, so far from profiteering, has lost $225,000,000 since 1920 through overproduction, and that the Norris plan would utterly fail to set up a substitute and would in itself be an economic crime.

### Asks New Study of Boulder Dam

With a definite place assigned to the Boulder Dam bill on the Senate's legislative program, there is increased interest in the effort being made to require a further engineering study before final action is taken. A bill introduced by Senator King of Utah to bring about such an investigation contains the following provisions:

> The President is hereby authorized and empowered to make an investigation to determine the most economical, available and effective means for the utilization of the water resources of the Colorado River basin, including the Colorado River proper and all of its confluences and tributaries, and for this purpose the President is authorized to appoint, by and with the

advice and consent of the Senate, a commission to consist of three persons, two of whom shall be engineers of recognized standing who are not interested in any project for the use of any such water resources and another person who has a practical knowledge of hydraulics and the financing of enterprises for the use of water for irrigation and for the generation of power.

Senator King's bill goes on to particularize what the proposed investigation shall cover, including stream flow, present use of waters, silt deposit, irrigation, flood control, reservoir sites, cost of dams and other works, potential generation of power, physical relations of upper and lower basins as regards water supply, the projected all-American canal and the existing situation affecting Mexico. The bill asks for "general and comprehensive conclusions upon all factors involved," together with cost estimates.

### Utility Hearing Next Week

The Federal Trade Commission announces that its next public hearing in connection with its investigation of public utilities will be begun in Washington on Wednesday, April 11, when documents pertaining to publicity methods obtained from three large utility associations and one state utility information office will be introduced. Recent charges to the effect that the Copley Press, Inc., of Illinois and California, is controlled by utility interests will be gone into. Documents to be introduced will be from the files of the New York and Washington offices of the Joint Committee of National Utilities Associations, the geographic divisional office of the National Electric Light Association at Springfield, Ill.; the Chicago office of the Illinois Committee on Public Utilities Information, and offices of the American Gas Association, in all of which places investigators for the commission have been at work. Records in several other divisional offices of the N.E.L.A. are being examined by specially detailed men. Representatives of the various associations will be subpœnaed.

The Federal Power Commission has disapproved legislation proposed by Senator McKellar and Representative Garrett, both of Tennessee, which would remove the non-navigable tributaries of navigable streams from its jurisdiction.

# Southwestern Men Report Excellent Year

## Good Spirit and Optimism Pervade Meeting on the Gulf Coast—National and Division Officers Tell of Progress—Onken Views Present-Day Tendencies

THE Southwestern Geographic Division of the National Electric Light Association, which embraces electric public utility companies operating in the States of Oklahoma, Texas, Arkansas, Louisiana and Mississippi, held its eighth annual convention at Edgewater Gulf Hotel, Biloxi, Miss., on April 2 to 5. The attendance and spirit which pervaded the convention were excellent, owing primarily to the interest which executives have shown this year and to the excellent committee reports.

Numerous men from outside the division addressed the meetings. Prominent among the latter were President H. T. Sands and Managing Director Paul S. Clapp of the national association; W. H. Onken, Jr., editor of the ELECTRICAL WORLD; E. C. Stone of Pittsburgh, chairman of the Engineering National Section; T. O. Kennedy of Cleveland, vice-chairman of the Commercial National Section; Dean C. O. Ruggles of Ohio State University; J. F. Owens, chairman of the Public Relations National Section, and Earle W. Hodges of H. L. Doherty & Company.

Mr. Sands and Mr. Clapp told of the aims and accomplishments of the National Electric Light Association, explaining in some detail the work of the various committees and the functioning of the thirteen geographic divisions. The work of the Southwestern Division was described by E. E. Armstrong of Gulfport, Miss., president of the division. He attributed its excellent record during the past year to the men and women on the firing line and to the support which their activities merited and received from the executives of the majority of the companies in the five states.

Mr. Onken showed the great extent to which the Southwest has been benefited by the operations of the electric light and power companies and how these, relying chiefly on natural gas, oil and powdered lignite for fuel, are not greatly concerned over water power and coal. He made a plea for the coordination of agriculture and machine-operated industry in the interest of a balanced economy to insure the economic independence of the United States and presented a broad view of the farm problem and the part electricity can play in it. He touched upon the legislative situation and the present era of consolidations and mergers. The processes of consolidation, he said, must go on to the very ultimate of their economic application, and in the process there must be a scrapping of obsolete and inefficient equipment because operating margins are becoming so small that neither thrill nor benefit can be derived out of a wasted dollar.

Of the many good committee reports the most noteworthy was that of the Engineering Section. Its hundred pages were filled with practical suggestions and descriptions of electrical and other engineering applications peculiar to the Southwest. Another noteworthy move was reported by the power division of the Commercial Section. It has initiated and partly developed an excellent power reference manual to facilitate the work of the electric light and power companies in obtaining power business.

Officers for the ensuing year were elected as follows: President, J. G. Holtzclaw, Gulf States Utilities Company, Beaumont, Tex.; vice-presidents: C. R. Bertron, Jr., Houston Lighting & Power Company, Houston, Tex.; F. W. Insull, Public Service Company of Oklahoma, Tulsa; H. C. Couch, Arkansas Power & Light Company, Pine Bluff; M. T. Walker, Southwestern Gas & Electric Company, Shreveport, La.; B. E. Eaton, Mississippi Power Company, Gulfport. S. J. Ballinger, San Antonio (Tex.) Public Service Company, was re-elected as secretary.

## Federal Radio Commission Members Confirmed

Confirmation by the United States Senate of four presidential nominees to the Federal Radio Commission was finally obtained on March 30. These were O. H. Caldwell of New York, Sam Pickard of Kansas, Harold A. Lafount of Utah and Ira E. Robinson of West Virginia. Mr. Robinson was recently appointed to fill the place of the late Admiral Bullard. The other three were *ad interim* members, Mr. Caldwell having served since the commission was formed a year ago. Senator Dill again led the opposition to Mr. Caldwell's confirmation, accusing him of favoritism to the Radio Corporation of America and other interests, but the commissioner won by a vote of 36 to 35.

The commission now has its full membership of five. It has still to elect a chairman. Judge E. O. Sykes of South Carolina, the only previously confirmed member, has been acting in that capacity.

## Public Service's Substation at Union City, N. J.

The first distribution substation of so-called 1927 design was connected to the lines of the Public Service Electric & Gas Company on March 18. It is known as the Union City substation. It was designed and constructed by the Public Service Production Company and embodies several novel features. The transformer banks are separated by brick fire walls, which are not ordinarily employed in other than major installations. The arrangement of the switchboard, on the second floor of the substation, follows the standard recently adopted for transformer and low-tension-feeder panels but inaugurates a new departure in other respects. The transformers and the 4,150-volt circuits are controlled from panels arranged in front of the individual circuit-breaker positions in such a way as materially to shorten the length of conduit runs and as to provide a space between each panel for ready access to the circuit-breaker solenoids and to the wall-mounted line-drop compensators. The remaining panels in the substation are installed back to back, parallel to the low-tension-feeder panels, the rear panels being used for relays and the front panels, which are hinged, for high-tension-line control switches and indicating instruments.

The substation is situated on the side of a hill and therefore required special consideration in the layout of the outdoor equipment, it being necessary to obtain a terraced effect. Connection is to a double 26,400-volt loop, two three-phase circuits connecting the station to the Seventh Street substation, West New York, and two to the Hudson switching station, which latter is in turn connected to the Electric & Gas company's 132-kv. transmission system. The station supplies at 4,150 volts part of North Bergen Township and nearly all of Union City.

## Buffalo General Electric Company Overcomes Mishaps

How two threatened interruptions to service in Buffalo in one week found the Buffalo General Electric Company prepared for emergency and were overcome without inconvenience to the public, few citizens knowing anything about them, is thus related by a company official, at the request of the ELECTRICAL WORLD:

Work is now under way on the rewinding of armature coils in one of the 37,500-hp. generators at the Schoellkopf station of the Niagara Falls Power Company, at Niagara Falls, N. Y. One of these coils burned out early in the evening of Wednesday, March 28. It had been observed during an inspection of the armature some time ago that the coils were nearing the end of their useful life. Complete materials for the repairs were ordered at that time and were on hand at the time of the failure. The machine was promptly dismantled, the old winding was removed and is now in the process of reconstruction. It is expected that the job will be completed in about four weeks. Insulation caught fire when the failure occurred. The operator immediately turned on the water in the sprinkler system, and the fire was completely extinguished with only slight damage. There was no disturbance on the system, as differential relays cleared the generator automatically. The company took advantage of the burn-out to replace the windings with coils of improved design.

Interconnection of power sources enabled Buffalo to avoid a serious interruption on Friday, March 30. An unusually severe windstorm, accompanied by sleet, caused trouble on the transmission lines from Niagara Falls, but through interconnected lines it was possible to maintain service until the disturbance was over. Wind direction and velocity were just right to cause whipping of the lines from the William B. Rankine station, in Niagara Falls, Ontario, and the Schoellkopf station, in Niagara Falls, New York. This "jumping" of conductors occurred only on lines running north and south, lines running east and west not being affected. The Charles R. Huntley station quickly swung into action, and with a shift in the direction of the wind the trouble soon cleared.

## Ontario Hydro Reports No New Generators in 1927

*Five and a Half Millions Has Been Spent on Rural Service—Total Power Output 1,073,630 Hp., Almost Identical with That for 1926.*

THE annual report of the Ontario Hydro-Electric Power Commission, which was tabled in the provincial legislature on March 30, shows that the total capital expenditure in rural power districts is $5,569,179. Of this amount, $5,232,551 covers units in operation and $336,628 covers those in course of construction. No additional generators were placed in operation during the year, and consequently the growth in the load has reduced the margin between available generating capacity and the demand for power. The past year was the first since 1918 when no increase in generating capacity was made. The total increase in peak load was 71,500 hp., as against an increase of 56,000 hp. the previous year. All systems showed an increase in the average load. Taken on the whole, the peak loads showed an increase of about 11 per cent, which is close to the average growth established during the past ten years. The kilowatt-hours, however, did not increase in proportion.

The total power purchased and generated in the year was 1,073,630 hp., while the 1926 total was 1,072,387 hp. Operating conditions in the Niagara system, the report states, changed very little in the year. The load-dispatcher system inaugurated in 1926 was continued and developed to give the greatest possible power output for the amount of water which the commission is allowed to divert from the Niagara River. An increase of 66,000 hp. in this load, or about 11 per cent, is reported.

Dealing with the Georgian Bay system, the report states that there was an increase in the load over 1926 resulting from the increases in industrial loads and the operation of new industries. The load on the St. Lawrence system increased very rapidly during the year, and this was covered by arrangements with the Cedars Rapids Transmission Company to increase the power contract to the extent of 1,200 additional horsepower. The demands for power on the Central Ontario and Trent system show a substantial increase. Both peak and average loads in the Nipissing system showed heavy increases over the previous fiscal year.

## Gadsden on Issue Raised by Muscle Shoals Bills

Legislative invasion by the federal government of the field of private enterprise as embodied in the Muscle Shoals resolutions recently reported at Washington was discussed at Newark, N. J., on Wednesday evening by Philip H. Gadsden, vice-president of the United Gas Improvement Company and vice-chairman of the Joint Committee of National Utility Associations. Mr. Gadsden spoke before a gas conference. He said:

"Reduced to essentials the question is: Shall the federal government confine its activities to the political field, leaving its citizens free by their initiative and enterprise and self-reliance to develop the field of business? Has the time come when we can safely turn over to the government the management and control of the electric power industry, one of the chief factors in our amazing industrial development?"

## Oil Breakers Withstand a Million Volts

ON THE right are shown three 220,000-volt oil circuit breakers built by the General Electric Company for the Philadelphia Electric Company and recently subjected to a test at 1,000,000 volts. A spectacular view of a discharge at that voltage is shown on the left. The arc measured 18 ft.

## Regional Spring Programs for Institute

*Baltimore Gathering Will Discuss Dielectrics and Power Generation—New Haven Meeting Will Take Up Unusual Technical Developments in Connecticut*

DETAILS of the two spring regional meetings of the American Institute of Electrical Engineers—that of the Middle Eastern District at the Hotel Belvedere, Baltimore, April 17-20, and that of the Northeastern District at New Haven on May 9-12—have been made public. At Baltimore dielectrics and power generation will come in for special attention, and papers describing the Gould Street station of the Consolidated Gas, Electric Light & Power Company and the Conowingo plant of the Philadelphia Electric Company by engineers with these respective companies will be included. Inspection trips to the two plants just named will be made—the first on Wednesday afternoon, the second on Friday morning. On the evening of Tuesday Dr. R. W. Wood, professor of experimental physics at Johns Hopkins University, will lecture on "Sounds That Burn." Many entertainment features will be provided. The chief items in the technical sessions follow:

### TUESDAY, APRIL 17

*Afternoon.*—"Behavior of Dielectrics," R. R. Benedict, University of Wisconsin; "Thermal Method of Standardizing Dielectric-Power-Loss Measuring Equipment," J. A. Scott and H. W. Bowsman, General Electric Company, and R. R. Benedict, University of Wisconsin; "Developments in the Insulation of Coils for High-Voltage Turbo-Generators," C. H. Hill, Westinghouse Electric & Manufacturing Company; "Drying and Evacuating of Impregnated Paper Insulation," J. B. Whitehead, W. B. Kouwenhoven and F. Hamburger, Jr., Johns Hopkins University.

### WEDNESDAY, APRIL 18

*Morning.*—"Gould Street Generating Station of Consolidated Gas, Electric Light & Power Company," A. S. Loizeaux; "Design Studies for Gould Street Generating Station," F. T. Leilich, C. F. Follmer and R. C. Dannettel; "Operating Experiences at Gould Street Generating Station," A. L. Penniman and F. W. Quarles.

### THURSDAY, APRIL 19

*Morning.*—"Conowingo Hydro-Electric Development on the Susquehanna River," Alexander Wilson, 3rd; "Electrical Features of the Conowingo Generating Station and the Receiving Substations at Philadelphia," R. A. Hentz; "220-Kv. Transmission Lines for the Conowingo Development," P. H. Chase.

*Afternoon.*—"Telephone System in Connection with the Conowingo Development," W. B. Beals, Chesapeake & Potomac Telephone Company, and E. B. Tuttle, Bell Telephone Company of Pennsylvania; "Quantitative Mechanical Analysis of Power-System Transient Disturbance," R. C. Bergvall and P. H. Robinson, Westinghouse Electric & Manufacturing Company; "Superexcitation for the Synchronous Condensers for the Conowingo System," D. M. Jones, General Electric Company.

### NEW HAVEN PROGAM

One of the sessions of the New Haven meeting will be devoted to a joint symposium arranged by the committee on instruments and measurements and on protective devices. Three other sessions will be based on four unusual technical developments in the vicinity of New Haven which will be about completed by the time that the meeting is held. These are in the field of hydro-electric development, railroad and street-railway power and mercury turbines.

The Connecticut Light & Power Company is completing a development by which the excess flow of the Housatonic River will be pumped into a storage basin through utilization (a) on some occasions of a portion of the excess water power and (b) on other occasions of steam power from other points on the system. This will be the feature of an all-day inspection trip on Saturday, May 12, and will also be covered by a paper by E. J. Amberg of the Connecticut Light & Power Company. Similar papers dealing with corresponding development of other rivers in New England and the South are in preparation.

The fact that power for the trolley system of Bridgeport is being supplied exclusively by mercury-arc rectifier substations, one of which is entirely automatic, will be the subject of two papers, one by G. E. Wood of the Connecticut Company, on the principles and details of the installation, and a second by C. J. Daly of the Southern New England Telephone Company, on the handling of inductive co-ordination. To inspect the New York, New Haven & Hartford Railroad electrification—now being supplied with 25-cycle power through two variable-ratio frequency-changer sets, one of which derives power from another 25-cycle system, the second from a utility system at 60 cycles—will be the object of another inspection trip, and papers by Ludwig Encke of the railroad and E. J. Burnham of the General Electric Company will be read. C. F. Schuchart, Commonwealth Edison Company, and W. K. Vandersluis, Illinois Central Railroad, will present a paper on a similar phase of the Illinois Central electrification.

The 10,000-kva. mercury-boiler turbine being installed at the South Meadows station of the Hartford Electric Light Company will be operating before the date of the sessions, and there will be a paper describing that installation and discussion by the company officers. An inspection trip to this installation will also be made.

Besides these events, there will be another session including miscellaneous topics made up chiefly of "initial" papers by members of the district. The Friday morning session will be turned over to the branches of the Northeastern District for a student program, along the lines of that at Pittsfield in 1927. The three evenings will be devoted to a reception and dance, a banquet and a theater party, respectively. Those attending the convention are to see a complimentary performance by the Yale University department of drama at the University Theater.

For the summer convention of the Institute, to be held at Denver June 25-29, electrified railroad equipment, surge investigations, carrier current, geophysics, operation at high altitudes and engineering education will be among the topics.

## Electrification of Railroads Makes Progress in East

As already reported from time to time, several Eastern railroads are busy with electrification programs. The Pennsylvania Railroad has almost completed the overhead installation from Wilmington, Del., to Philadelphia. A trolley voltage of 11,000 will be used at first on this section of the railroad, and power will be purchased from the Philadelphia Electric Company for both this section and that from Philadelphia to West Chester.

It is now reported on good authority that the Pennsylvania has authorized further electrifications which will be made in successive steps. These include the main line from Philadelphia to Newark and the line from Philadelphia to Pittsburgh. Newark will replace Manhattan Transfer as the station where a change to the downtown New York tubes can be made. Power will be purchased by the Pennsylvania from adjacent utilities, and a large generating station is being designed by the Public Service Company of New Jersey to afford the required energy in its territory as well as to care for system load growth.

Delaware & Lackawanna commuters have offered to pay increased fares to New York if this railroad will carry out its electrification plans, and it is asserted, though not confirmed, that the project will be started soon.

The plans of the Philadelphia & Reading Railroad to electrify its line from Philadelphia to Langhorne, Pa., a distance of 24 miles, have previously been reported.

The New York Central & Hudson River Railroad has made an analysis of the economies and service advantages of electrification from New York to Albany and thence to Buffalo, and a favorable decision is expected in the near future.

The extended utility systems make possible an adequate power supply in these regions, and the use of high-voltage trolleys combined with purchased energy reduces the railroad investments very materially. In the next few months a very large electrification program for these Eastern railroads is likely to be adopted.

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## Engineering College for Los Angeles' University

Next September will see the inauguration of a college of engineering at Los Angeles, established as part of its educational equipment by the University of Southern California. This university began courses in engineering 23 years ago, and the increasing demand for technical education has now led it to set up the new college, which will provide adequately equipped laboratories and facilities. There will be five major divisions, devoted respectively to chemical, civil, electrical, mechanical and petroleum engineering. Prof. Philip S. Biegler will be the first dean as well as the head of the electrical engineering division. Four-year courses will lead to the degree of bachelor of science in any of the divisions, and masters' degrees will be awarded for graduate work.

## Southeastern Division Miami Program Adopted

Headquarters for the Miami Beach (Fla.) convention of the Southeastern Geographic Division, N.E.L.A., to be held on April 11 to 14, will be at the Roney Plaza Hotel. Main features of the program follow:

WEDNESDAY, APRIL 11

*Morning.*—President's address, Joe H. Gill; address, H. T. Sands; merchandising talk, Harrison Jones; address, John M. Hager, United States Department of Commerce.

*Afternoon.*—Committee reports.

THURSDAY, APRIL 12

*Morning.*—"Functions of the Public Relations Section," John F. Owens; "Southeastern Public Relations Section and Its Work," Jackson P. Dick; "Accomplishments of the Southeastern Engineering Section," R. W. Lamar; "How Can the Southeastern Commercial Section Be of Service?" A. B. Collins; "Accomplishments of Southeastern Accounting Section," H. W. Boozer.

*Afternoon.*—Engineering, Commercial and Accounting Section meetings.

FRIDAY, APRIL 13

*Morning.*—"Developments in the Electrical Industry," Paul S. Clapp; address, Miss Eloise Davison; "Developing Domestic and Commercial Load," Phillips B. Shaw; address, Dr. Gus W. Dyer, dean School of Economics, Vanderbilt University; "Electricity on the J. C. Penney Small Farms" and "Rural Electrification Development in the Southeast," by representatives of the Florida Power & Light Company.

## Experts Say Inadequate Foundations Caused Dam Failure

Findings of a commission of six experts appointed by Governor Young of California to investigate the cause of failure of the St. Francis Dam in southern California on March 13 are embodied in three conclusions in a report filed with the Governor. These conclusions are: (1) Failure of the dam was due to defective foundations. (2) There is nothing in the failure to indicate that the accepted theory of the gravity-type dam is in error. (3) Failure of the structure indicates the desirability of having all such structures erected and maintained under supervision and control of state authority.

The engineers report that samples of foundation taken from underneath the westerly wall quickly softened and changed to either a mush or a granular mass when immersed in water. "Unfortunately, this material," the report finds, "is of such nature that when entirely dry it is hard and rocklike in appearance and characteristics, although defective in compressive strength. With such a foundation the ultimate failure of this dam was inevitable, unless water could have been kept from reaching the foundation.

"Photographic evidence and the testimony of witnesses showed that little seepage passed through the structure of the main dam. Certain cracks developed in the main structure which possibly discharged an unimportant amount of water, not at all unusual in concrete dams. Much more important seepage is reported to have taken place through the foundation upon which the dam rested. As the water rose in the reservoir, this foundation seepage appears to have increased to a maximum of between one and two second-feet on the afternoon preceding the failure. Rumors of muddy water seeping under or around the dam before its failure are in circulation, but the commission has been unable to verify them."

A similar finding was made on Wednesday of this week by a board of engineers and geologists appointed by the Los Angeles District Attorney. This board declared that the dam should never have been built on the site selected.

## Purchases and Mergers

*Southeastern Power & Light Acquires Edisto Company in South Carolina—Absorption of Small Municipal Plants Into Company Systems Goes On*

SALE of the Edisto Public Service Company, which, with headquarters at Denmark, S. C., serves 23 rural communities in Barnwell, Bamberg, Allendale and Hampton Counties in that state with light, power, water and ice, to the Southeastern Power & Light Company is announced. The Edisto company was formerly controlled by the Atlantic Public Utilities.

The California Railroad Commission has approved the purchase by the Great Western Power Company of California of the Feather River Power Company (ELECTRICAL WORLD, March 31, page 676).

Directors of the New Bedford (Mass.) Gas & Edison Light Company are considering an offer for the utility company from the Eastern Utilities Association.

The Public Utilities Corporation has acquired the electric lines owned and operated by Dr. E. M. Nichols at Barton, Vt., which, as reported last week, the town of Barton voted to acquire and operate. Discovery that the town could not take over the utility without legislative enactment, which could not be had until January, 1929, caused the town to turn its option over to the Public Utilities Corporation, a subsidiary of the W. B. Foshay Company.

Stone & Webster have announced that a majority of the common stocks of the Blackstone Valley Gas & Electric Company, the Edison Electric Illuminating Company of Brockton, Mass., and the Electric Light & Power Company of Abington & Rockland have been deposited in exchange for shares in the Eastern Utilities Association (ELECTRICAL WORLD, March 10, page 525). The plan of merger has therefore been declared operative.

The Connecticut Power Company has announced that a recently acquired minority interest in the Union Light & Power Company, Unionville, Conn., implies no intention of obtaining control. The Union company is an independent utility.

The Southern Light & Power Company of Maryland has purchased the Millington (Md.) Electric Light & Power Company's lines and plant from C. S. Church, who recently developed the property.

Efforts to acquire the municipal electric light and power plant in Centreville, Md., together with the pole lines and equipment owned by the towns of Queenstown and Church Hill, have been renewed by J. H. Drake, vice-president of the Eastern Shore Public Service Company, who offers in writing "to pay a price in excess of $160,000 if the Public Service Commission should determine, after a thorough investigation, that the value of your property is in excess of the price we are offering."

Authority to purchase the Home Light & Power Company, serving five small communities in Henry County, Ind., from Frank Crull for $35,000 is sought by the Interstate Public Service Company.

An offer from the Inland Utilities Company of Kansas City of $155,000 for the light plant at New Albany, Miss., was rejected by a vote of 447 to 28 last week.

Further delay in getting before the Indiana Public Service Commission the plan arranging the consolidation of the Terre Haute, Indianapolis & Eastern Traction Company properties with the power-distributing properties of the Central Indiana Power Company has been occasioned by an alteration in the conditions for the exchange of securities, and many months may yet elapse before the deal is consummated.

A proposal for sale of the municipal electric plant at Monroe, S. D., to the Northern States Power Company of Sioux Falls will be submitted at a special election April 17.

The Kentucky-Tennessee Light & Power Company has bought the city light and power plant at Trezevant, Tenn., for $16,600.

Citizens of Erick, Okla., on March 27, by vote of 228 to 90, approved sale of the municipal electric light and power plant to the Southwestern Light & Power Company. Several months ago Erick voted a franchise to the company, but a proposal to sell the plant at that time failed to get the necessary 60 per cent of the vote.

The annual report of the Telluride Power Company of Utah says that control of the Big Springs Power Company and the Pahvant Power Company was taken last year.

The Canadian Hydro-Electric Corporation, which controls the hydro developments of the International Paper Company in Canada, has announced the taking over of three hydro-electric plants on the Ottawa River. Two of these, owned by the Ottawa & Hull Power Company, are at the Chaudière Falls, Hull, Quebec, and the third station, owned by the Ottawa River Power Company, is at Bryson.

## Bill to Condemn Seattle Utility Property Not Hailed

A bill has been introduced in the Seattle City Council by Councilman W. T. Campbell which provides for the city's condemning or otherwise acquiring the properties of the Puget Sound Power & Light Company. The bill has some support, in a general way, among the councilmen, but on the whole is considered untimely for any practicable purpose. The proposed measure provides an initial appropriation of $25,000 for an appraisement of the company's holdings, including its distributing system within the city and the power plants on White River, Baker River and at Snoqualmie Falls. Oliver T. Erickson, chairman of the City Council utilities committee and long a leader among municipal ownership supporters, attacks the plan as "absurd and destructive."

# Briefer News

Seven Ohio Municipal Plants Sold in 1927.—Seven municipal light plants in Ohio were sold to privately operated companies during 1927, according to a report of the Ohio Committee on Public Utility Information—Johnstown, Piketon, Waverly, Peebles, Olmsted Falls, Jefferson and Milbury. Twenty-one in all were sold in the past five years.

Colorado Electrical Men Get Together.—The third annual state-wide meeting of Colorado electrical men, under the sponsorship of the Electrical League of the state, held on March 26 at the Cosmopolitan Hotel, Denver, was addressed by B. J. Rowan, J. J. Cooper, Clyde L. Chamblin, G. B. Buck and others. C. N. Shannon led a round-table discussion on the relationship of the various groups.

United Public Service Company to Establish Headquarters at Greenville, Ohio.—The United Public Service Company has purchased the Buckeye Overall building at Central Avenue and Pearl Street, Greenville, Ohio, and will make its headquarters there, according to announcement by A. O. McDonald, general manager of the Indiana-Ohio division, which embraces eight public service companies.

Yazoo City, Miss., to Sell Power.—A ten-year contract has been drawn up between the municipal authorities of Yazoo City, Miss., and the Mississippi Utilities Company of that place by which the city will sell power to the company, which in turn expects to furnish the towns of Louise, Midnight and Silver City, thus reversing the usual procedure where public and private plants cooperate.

New Mexico Power Company Has New Plant.—The New Mexico Power Company has completed its 3,800-kw. generating plant at Dawson, built at a cost of $400,000. It replaces a plant operated by the Phelps Dodge Corporation for its coal mines and is connected with the Trinidad (Colo.) plant, controlled by the Federal Light & Traction Company, New York. The plant will burn low-grade coal in pulverized form.

Kettle Falls Plant, on the Columbia, Would Afford 260,000 Hp.—Development plans looking toward an ultimate hydro-electric generating capacity of 260,000 hp. at Kettle Falls, on the Columbia River north of Spokane, Wash., were revealed at a hearing in Spokane before Major John S. Butler, representing the Federal Power Commission. Three or four years would be required for the initial development, testimony showed, owing to the unusually large flow. The complete scheme would require eight generators. Ten stages of development are now planned with the operative head increasing gradually from 35 ft. to 75 ft. There was no opposition testimony offered in behalf of town or county officials, Columbia Basin irrigation project proponents or other power companies.

Dayton Power & Light Increasing Its Plant.—More than $600,000 will be expended for additional electric generating capacity at the Miller's Ford power house during the present year, according to O. H. Hutchings, vice-president and general manager of the Dayton Power & Light Company. Growing demands in Piqua and vicinity will require the expenditure of an additional $200,000 for the construction of a transmission line from the power plant in Dayton to Covington and Piqua.

## Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Institute of Electrical Engineers — Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Arizona Utilities Association—Prescott, Ariz., April 26-28.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A.—Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

Otter Tail Power Company's 1928 Budget.—More than $350,000 will be spent by the Otter Tail Power Company this year in improvements and expansion. Nearly two-thirds of this will be spent at Jamestown, N. D., in installing new equipment in the power station and rebuilding a turbo-generator; new waterwheels will be installed at Fergus Falls, Minn., and low-voltage lines will be built to serve ten North Dakota communities at an expense of $118,000.

Twin States Manchester-Arlington Line in Operation.—The Twin States Gas & Electric Company is distributing power from its station at Bennington, Vt., to Manchester Center, Manchester Depot, Danby and Dorset, N. H., through the recently completed 44,000-volt transmission line between Manchester, N. H., and Arlington, Vt. The first link of this line, between Bennington and Arlington, was completed in 1924.

Duke Power Company Starts Work on New Steam Plant.—The Duke Power Company has begun construction work on the first unit of its steam plant at Riverbend, on the Catawba River, 12 miles from Charlotte. The generating equipment to be used in the first unit will include two 56,000-kw. turbo-generators served by four boilers under which coal will be burned. A possible eventual installation of 450,000 kw. in this plant is announced.

Manitoba Power Company to Sell Seven Sisters Falls Energy to Provincial Government.—The Manitoba Power Company has closed a contract with the provincial government to supply 30,000 hp. annually from the company's site at Seven Sisters Falls. The contract will operate over a period of 30 years, at the end of which time the government can take over the private plant as a public utility. The power will be sold to the government at a rate of $13.80 per horsepower. A new terminal substation, costing in the neighborhood of $750,000, will be erected in Winnipeg by the Winnipeg Electric Company to take care of the production from the Seven Sisters Falls development. It will receive and distribute the additional load and effect a connection with the provincial hydro transmission system.

New Transmission Lines for Southwest Alabama.—Projects of the Alabama Power Company in the extension of its electric power system in southwest Alabama will cost approximately half a million dollars. A transmission line from Linden to Jackson, with substations at Jackson and Thomasville and the reconditioning of existing power plants in those places, will represent most of this. A 20-mile transmission line from Atmore to Bay

Minette, with a substation at the latter, is scheduled for early completion. A substation at the new state docks in Mobile is three-quarters completed.

**Luzerne County Gas & Electric Reduces Rates.**—A reduction in rates for electricity which, the company estimates, will result in a saving of about $100,000 a year to customers of the Luzerne County Gas & Electric Corporation, Kingston, Pa., is announced by A. J. Llewellyn, vice-president. The first 80 hours' use of meter capacity will still be charged for at 10 cents a kilowatt-hour, but following steps are reduced to 7 cents and 4 cents. A minimum monthly charge of $1 will be made.

**Plan Hydro Plant to Serve Cape Breton, N. S.**—Development of a large hydro-power plant at Lake Ainslie, Nova Scotia, which would cost about $1,500,000 and supply most of the power needs of Cape Breton, was urged before the provincial government recently by a delegation of citizens and county officers after conferring with engineers and the Nova Scotia Power Commission. Those interested in the project will now take up the matter with the various counties in Cape Breton, with a view to assuring a market for the power in sight.

**Holyoke Water Power Company to Build Dam on the Connecticut.**—The Holyoke Water Power Company has obtained from the United States authorities a permit to build a large hydro-electric power plant in connection with its masonry dam across the Connecticut. The plan submitted looks to four hydro-electric units having a total capacity of 40,000 hp. This installation would provide for utilization of floodwaters that now go unused during nine months of the year and would not affect the delivery of water through the hydraulic canal system. Authority is granted to make a tailrace in the rocky bed of the river and also to build a masonry wall to separate this channel from the portion of the river bed through which floodwaters naturally flow. A permit to build such a plant was granted by the Massachusetts State Department of Public Works more than a year ago.

**Further Stage Reached in British Electrification Scheme.**—A further important stage in the electrification of the suburban lines of the Southern Railway of England was reached by the completion late in March of the first stage of the Central Section scheme. The complete project is to cost $18,750,000, bringing the total expenditure to $57,500,000. The section just completed comprises the lines from London Bridge to Purley, with the Caterham and Tattenham Corner branches, and from London Bridge to Crystal Palace. Included in this section are 86 miles of track equipped with the third-rail. The second section, to be opened next June, consists of 79 miles of track, about one-half of which will be converted from the overhead wire to the third-rail system. The lines embraced are those between London Bridge and Victoria and between London Bridge and Epsom Downs. The final stage of this scheme, between Victoria and Epsom and London Bridge and Dorking North, and between the City and Wimbledon, will be opened next year.

**Cheyenne Company Builds Lighting System for Air Mail Route.**—The Pueblo-Cheyenne air mail route, approximately 200 miles long, with stops at Colorado Springs and Denver, is one of the most recent and best-lighted airways in the United States. There are 21 beacons along the way, spaced approximately 10 miles apart. Seven are operated by electricity obtained from nearby power lines, five by acetylene gas and the remainder by power units installed in the shelter house at the base of the beacon towers, like the one shown in the illustration. Six intermediate landing fields, spaced about 30 miles apart, are lighted in accordance with the latest system. Three beacons of especial interest are those on top of Castle Rock, Spruce Mountain and the water tank of the town of Nunn, on the Colorado-Wyoming border. Construction of this airway was under the direction of F. S. Peterson of the Cheyenne Light, Fuel & Power Company, which did the work.

**No Cessation of Activity in West Texas.**—Demand for electric power in the oil fields of west Texas has caused the Texas Electric Service Company to adopt plans for enlargement of its power plant at Odessa at a cost of $500,000. A 60,000-volt power transmission line extends from Odessa to the Winkler County oil fields, but immediate construction of a second line has been ordered. This will necessitate the installation of additional Diesel engines and generators in the plant and an enlargement of the main building. Last year the company was obliged three times to increase the capacity of its Odessa plant.——An extension of the power transmission line of the Texas Utilities Company from Slaton to Lamesa, approximately 60 miles, will be constructed. It will be of wooden-pole construction and will cost approximately $100,000.——Construction of a 15,000-hp. hydro-electric plant in connection with its irrigation project is proposed by the Maverick County Water Improvement District in the Eagle Pass district.——Further east an extension of the 60,000-volt transmission line of the Texas Power & Light Company from Cameron to Taylor, via Minerva, Rockdale and Thorndale, will be made. The distance is about 35 miles. The line will be of wooden-pole construction.

**Insull Companies' Rate Reductions in New England Bring Saving of $200,000.**—The Central Maine Power Company has again reduced its rate schedule, bringing a saving to customers in its eastern division of more than 10 per cent. Last month the company reduced rates in the northern section of the state. Other reductions will follow, the company says. The Public Service Company of New Hampshire has reduced rates in the past year on almost all its divisions. Reductions by the Insull companies in Maine and in New Hampshire will save customers upward of $200,000 a year.

**New England Power Offices to Be Moved to Boston.**—The entire executive offices, including the accounting and engineering departments of the New England Power Association, will be moved from Worcester to the new Batterymarch Building in Boston before Nov. 1 next. Since the organization of the New England Power Company about twenty years ago the headquarters of the management has been at Worcester, although the offices of the president and the banking interests most closely identified with the company have been at Boston. The recent acquisition by the association of the leading electric light and power utilities at Providence, Lowell and Lawrence led to the decision to centralize the managerial and allied offices at Boston, according to a statement to a representative of the Electrical World by Samuel C. Moore, vice-president and general manager. The operating headquarters of the company will continue at Worcester, with load dispatching offices at Millbury, Mass., as heretofore.

**Storage Sites for Power on Eel River, Calif.**—The geology of the Mill Creek and Elk Creek dam sites and the Round Valley reservoir site on the Middle Fork of Eel River, Mendocino County, Calif., is set forth in a report prepared by the Geological Survey. An engineering examination of Eel River made in 1922 by the Survey disclosed that its value for power was largely dependent upon the feasibility of storing the floodwaters in or near Round Valley. The most promising sites for dams were found short distances below the months of Mill Creek and Elk Creek. The present geologic report, by H. T. Stearns, shows that at the Elk Creek site the north abutment of the dam would be founded in the foot of an ancient earth slide involving an area of about a square mile. The dam could not safely be raised high enough to obtain valuable storage. The rock at the Mill Creek site, however, appears to be sound and water-tight. Round Valley has no apparent leakage. The storage capacity of Round Valley which could be developed by a dam at the Mill Creek site is greater than the annual supply of water at that place. A manuscript copy of the report may be examined at the office of the Geological Survey in Washington, D. C., or at the district office at San Francisco.

## Commission Rulings

**Allocating Cost of Service Extensions to Old and New Consumers.**—The Public Service Commission of Pennsylvania has approved an agreement whereby the Pennsylvania Power Company, instead of charging new patrons to be attached to a line originally constructed at the cost of the consumers on it a lump sum to be used to reimburse those consumers for their expense, returned to the latter 80 per cent of the money advanced by them, and all consumers on the line, including those now desiring service, agreed to pay the minimum monthly charges.

**Building of Rural Network in Territory Assigned to Another Forbidden.**—Permission to construct and operate an electrical distributing system in Sparta, Livingston County, New York, as part of a proposed network of transmission lines to serve rural communities east of Rochester, has been denied John J. O'Connell, doing business as the O'Connell Electric Company, by the New York State Public Service Commission. The commission based its action on the fact that the New York Central Electric Corporation is already equipped to serve the community. Mr. O'Connell had obtained a franchise from the Sparta Town Board under which he proposed to build a distributing line from the Niagara Power Company's line in Groveland through Sparta Township to Scottsburg. Residents and streets of Scottsburg were to be served by the transmission line. The New York Central Electric Corporation, already authorized to operate in Sparta, opposed O'Connell's petition. The company later extended its line from Sparta to Scottsburg. The commission found that business was not sufficient to warrant operation of the two companies.

**Alternating-Current Service and Competition.**—Where there is a substantial demand for alternating current, as in garages, hospitals, barber shops, stores using refrigeration, cannery industries, sawmills, woodworking plants, etc., it is mandatory on an electric utility to provide energy of this character notwithstanding the original establishment of a direct-current service by the operator. This is the spirit and intent of an order entered by the Oregon Public Service Commission in connection with the determination of operating rights in Gold Beach, Ore., and involving the interests of the J. C. Leith Electric Company and the Gold Beach Electric Corporation. The issue was whether an application for a certificate of convenience and necessity for furnishing alternating current in the Gold Beach field by the Leith utility should be granted or whether exclusive privileges should be extended to the Gold Beach Electric Corporation on condition that the latter make provisions in its published tariff for the installation of rotary converters to provide alternating current wherever direct current cannot reasonably be used. The commission held that the Gold Beach company, having filed a satisfactory tariff for alternating-current service, is now adequately serving the field and is therefore entitled to all the business in the territory.

**Refusal to Permit Recapitalization on Basis of Reproduction Cost New.**—In denying authority to the California Water Service Company to issue securities to cover the purchase of a number of water distribution systems in California on the basis of present reproduction cost new, the Railroad Commission has affirmed its long-established rule that security issues for refinancing purposes will be allowed only upon the basis of the original cost of the physical properties of public utilities less accrued depreciation but including present-day values for lands. The commission said: "If we were to base refinancing capitalization upon an estimated 'reproduction cost new,' as is urged by applicant, a situation would be created in which even slight variations in the prices of public utility materials and supplies might quickly wipe out a part, or even the whole, of the equities possessed by common-stock holders. This commission has never heretofore allowed the capitalization of potential values, nor has it permitted public utilities after a period of operation to refinance or recapitalize their properties upon such a basis that the outstanding securities thereof would be increased to reflect an alleged 'going-concern value' claimed to have been established subsequent to the construction of the properties in question. If, in the present instance, this purchaser desires to pay, or does in fact pay, more than the amount realized from the sale of the securities herein authorized for the properties or stock of the several companies here in question, the difference between said amount and such price as the vendee may actually pay must therefore be obtained in some manner other than through the issuance of such authorized securities."

**Illinois Commission Recognizes Distinction Between Refrigeration Service and Range and Heater Service.**—The Illinois Commerce Commission has reversed a previous order (Electrical World, Jan. 4, page 122) in which it directed that service to electric refrigerators should be rendered at the rate for heating and cooking. That decision was based upon a consideration of the character of electric refrigerator load and its effect upon the general system load. At a rehearing evidence was introduced by the Illinois Northern Utilities Company to show that its heating and cooking rate was devised to make electric service attractive where gas was not available and to develop load even if it were necessary to forego for a time a fair rate of return. A higher rate would exceed the value of the service and limit very materially the development of this class of business. It was the contention of the utility that the average customer can obtain refrigeration at reasonable rates through the purchase of ice and that the company is therefore under no obligation to render domestic refrigeration service on the same basis as electric heating and cooking. The commission accepted this view and found (1) that the schedule for domestic electric heating and cooking as charged by the petitioner is lower than might reasonably be charged if all factors and costs, including fixed charges, were included; (2) that the rates charged for domestic electric heating and cooking are apparently not a burden on the other classes of service; (3) that the voluntary offer of a rate that is less than compensatory for a certain class of service does not justify the commission in requiring the same rate to be charged for other classes of service; (4) that the rate earned by a domestic electric refrigerator under the domestic residence lighting rate, as charged by the Illinois Northern Utilities Company, is not excessive nor greater than the value of the service.

## Recent Court Decisions

**Theory That Loss from Fire Was Due to Electric Company's Negligence Found Speculative.**—In Dare vs. Atlantic City Electric Company damages were sought because of the alleged negligence of the company in controlling a fire of old lumber started on its premises and said to have spread to a barn owned by the plaintiff. The trial jury had found for the plaintiff, but the Supreme Court of New Jersey set the finding aside on the ground that it showed a high degree of speculation and was against the weight of evidence. (140 At. 249.)*

**Power of State Commission to Tax Water-Power Production Under Guise of Rental Denied.**—In the decision of the Chancery Court at Nashville, Tenn., denying the right of the Tennessee State Railroad and Public Utilities Commission to tax the Tennessee Eastern Electric Company one mill per kilowatt-hour on energy produced, as a condition of the issue to the company of a certificate of convenience and necessity, and also declaring the commission's fifty-year recapture clause illegal, as noticed under "News of the Industry" in the Electrical World for March 31 (page 673), the court said: "It was contended by counsel for the defendant commission that the one-mill tax sought to be imposed was in the nature of a rental for the use of the state's property. It is not claimed that the state owns any land which will be needed in the proposed development. The Legislature has not delegated to the commission any power or authority to rent out its properties for a long period of years at the price of one mill per kilowatt-hour or upon any other terms, even though it be said the state has the proprietary rights in the waters of such streams, a point not necessary to be decided. The powers given the commission are regulatory, relating to the public utilities and the conduct of their business, and it is without power to grant, bargain, sell, lease or otherwise dispose of or confer any sort of title to any property for the use of which the state might have a right to claim rentals." The recapture clause was declared confiscatory under the constitution of the state, which says that "no man's particular services shall be demanded, or property taken or applied to public use, without just compensation being made therefor."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

**F. M. Ferrell** of the Kansas Gas & Electric Company, Wichita, has been made agricultural engineer for the company in the Newton district.

**J. H. McCombs**, formerly distribution engineer of the Georgia Power Company in Atlanta, has been appointed division superintendent of operation in Rome.

**J. R. English** has been appointed commercial manager for the Pennsylvania group of properties of the Associated Gas & Electric System, with headquarters at Johnstown.

**W. J. Cahill** has been appointed superintendent of power supply substations of the New York Power & Light Corporation, in charge of the operation and maintenance of the substations of the company.

**John Hurley** has been appointed publicity manager of the Winnipeg Electric Company, Winnipeg, Man., to succeed H. C. Howard, who has left the service of the company. Mr. Hurley was formerly a local newspaper man.

**Ward Chittenden** has been appointed manager for the Missouri Electric Power Company at Marshfield. Mr. Chittenden has been connected with the company since it acquired the Marshfield plant, and previous to that was engineer for the plant.

**Henry Oliver**, president of the Oliver Iron & Steel Corporation, Pittsburgh, Pa., has resigned to become chairman of the board of directors. **Bertram D. Quarrie**, formerly connected with the American Steel & Wire Company and with the Otis Steel Company, has been elected to succeed Mr. Oliver.

**Henry F. Schmidt**, consulting engineer of the Westinghouse Electric & Manufacturing Company, South Philadelphia, was made the recipient of the medal of the American Society of Naval Engineers for the best article submitted during the year 1927. In addition to the medal Mr. Schmidt was given an honorary life membership in the society and a cash prize for his paper entitled "Some Screw Propeller Experiments, with Particular Reference to Pumps and Blowers."

**R. W. Williamson**, manager of the western division of the Alabama Power Company, has been appointed general manager of the Gulf Power Company, with headquarters in Pensacola. Mr. Williamson entered the service of the Alabama Power Company in 1913 as draftsman, a position he held until he was transferred to the field, where he was engaged in construction and operating work. He left the employ of the Alabama Power Company in 1915 and was engaged in engineering work with the T. A. Gillespie Company of Parlin, N. J., and munition work for the British and United States governments. He re-entered the service of the Alabama Power Company in 1923 in the budget division, later going to the commercial department. After serving in this capacity he was made manager of the western division.

## *A. B. Day Becomes President in Los Angeles*

Addison B. Day, executive vice-president and general manager of the Los Angeles Gas & Electric Corporation for the past four years, has been named president of that utility to succeed William Baurhyte, whose resignation was announced in the March 31 issue of the Electrical World. Mr. Day is recognized as one of the leading executives in the public utility field on the Pacific Coast. His entire business career has been spent in the service of the utility which he will head. He entered the employ of the Los Angeles Light Company, predecessor of the Los Angeles Gas & Electric Corporation, in charge of the gas-stove department, in 1895, and has risen successively to the positions of bookkeeper, chief clerk in the gas department, chief clerk in the electrical department, manager of the appliance department, auditor, assistant secretary, manager of operation, general superintendent, vice-president and executive vice-president and general manager. He will retain his duties as general manager in connection with the presidency.

*A. B. Day*

**Charles L. Cadle**, general manager of the Rochester Gas & Electric Corporation, Rochester, N. Y., will sail for a twelve weeks' trip to Europe April 14 to inspect various power developments. Mr. Cadle was the guest of honor at a surprise party given at the Rochester Chamber of Commerce March 28. Among those attending were Robert M. Searles, president of the corporation; J. Clarence Collins, secretary and treasurer; Joseph P. Haftenkamp, assistant general manager, and Ernest C. Scobell, general auditor.

**James W. Cuthbert** of the Keene, N. H., division of the Public Service Company of New Hampshire has been transferred to the Manchester office as head of the department of public relations and safety.

**Eugene Mauer** has resigned as operating engineer for the Galesburg (Ill.) division of the Illinois Power & Light Company to become electrical engineer with W. A. Baehr Company, Chicago.

**M. C. Thompson**, formerly connected with the distribution engineering department of the Utica Gas & Electric Company, Utica, N. Y., has resigned to join the distribution engineering department of the Syracuse (N. Y.) Lighting Company.

**Glenn R. Trumbull** has joined the Columbia Gas & Electric Corporation as director of new business and merchandise sales for the Columbus (Ohio) group of properties. A native of Ohio and a graduate of Ohio State University, Mr. Trumbull received his early utility experience with the Union Gas & Electric Company of Cincinnati and later merchandising experience with several large utility companies.

**John S. Maloy** has been appointed distribution engineer of the West Penn Power Company to succeed M. W. De Merit, now assistant to the president. His connection with the company covers a period of ten years and started at the laboratory in Connellsville. Subsequently being transferred to Pittsburgh, he engaged in estimating and layout work. When distribution engineering became a separate department, in 1922, Mr. Maloy became one of the four engineers comprising the department.

**E. C. Conroy**, formerly assistant superintendent of distribution for the southwestern district of the Puget Sound Power & Light Company, has been transferred to the western district with headquarters at Bremerton, where he will be superintendent of distribution.

**Merritt C. Huse**, formerly assistant to C. J. Russell, vice-president in charge of the commercial department of the Philadelphia Electric Company, has been appointed sales manager of the company. A native of Manchester, N. H., and a graduate of the University of New Hampshire, Mr. Huse was associated with D. C. and William B. Jackson, consulting engineers of Boston and Chicago, from 1909 to 1917. It was in 1917 that he affiliated himself with the Philadelphia Electric Company. In his new position as head of the sales department he will be in charge of power sales, lighting sales, appliance sales and industry promotion work. Mr. Huse is a member of the Illuminating Engineering Society and is chairman of the wiring committee and a member of the industrial lighting, residential lighting and merchandising committees of the National Electric Light Association.

George E. Fuller, office manager and comptroller of the Worcester (Mass.) Electric Light Company, has been elected a vice-president of the organization. Mr. Fuller is widely known in New England central-station circles.

H. O. Gross, formerly connected with the engineering department of the United Gas Improvement Company, has been appointed manager of the Delaware division of the Philadelphia Suburban-Counties Gas & Electric Company with headquarters at Chester.

A. N. Kemp, vice-president of the California Bank of Los Angeles, has been elected a director of the Southern California Edison Company. Mr. Kemp was formerly vice-president in charge of finance of the Southern California Edison Company but he resigned five years ago to become an executive officer of the California Bank.

A. A. Brown has been appointed sales manager of the Oklahoma Gas & Electric Company with direct supervision over the investment and appliance departments. The identity of both departments will remain intact. Mr. Brown first joined the Oklahoma company in 1910 in the commercial department at Muskogee. From 1911 to 1917 he served as sales manager of the Northern States Power Company at St. Paul, but following military service he returned to the Oklahoma Gas & Electric Company as manager of the investment department in 1919.

Wells Stanley, formerly general manager of the Gulf Power Company, Pensacola, Fla., has been appointed manager of sales of the Alabama Power Company. Mr. Stanley became identified with the Alabama Power Company in 1914 as local manager at Huntsville, following the purchase by that company of the Huntsville Light, Railway & Power Company, of which he had been manager. He remained until 1917, when he was made manager of local operations with headquarters in Birmingham, later returning to Huntsville as manager of the Northern division. This position he held until his appointment in 1925 as general manager of the Gulf Power Company.

H. F. Boehner has resigned his position as assistant general manager of the Iowa-Nebraska Light & Power Company, Lincoln, Neb., and has organized the Midwest Refrigeration Company of Des Moines, Iowa, for the purpose of distributing General Electric refrigerators in 75 counties in the central part of Iowa. Mr. Boehner was originally interested in the Malvern Electric Company of Malvern, Iowa, which property was sold to the Continental Gas & Electric Corporation, and after operating at Malvern for the purchasers for a few years Mr. Boehner was named district manager of the Red Oak district, which embraced Malvern. Later he was transferred to the general office of the company as assistant general manager, which position he has held until the present time.

## *H. Carl Albrecht Receives New Appointment*

H. Carl Albrecht, who has been connected with the Philadelphia Electric Company since 1909, has been named assistant operating manager of the company. A native of Philadelphia and a graduate of the University of Pennsylvania, Mr. Albrecht entered the employ of the company as assistant to H. P. Liversidge, at that time superintendent of station electrical construction. In 1917 he became engineer of the station electrical design and construction division and in 1925 he was made manager of the purchasing, stores and transportation department. Mr. Albrecht has been active in the work of the National Electric Light Association, having served as chairman of the electrical apparatus committee in 1923, and also in the affairs of the A.I.E.E.

*H. C. Albrecht*

Philip S. Biegler, professor of electrical engineering at the University of Southern California for the past five years, has been appointed acting dean of the college of engineering just created at that institution. Professor Biegler removed to California five years ago after thirteen years of teaching at the Universities of Iowa, Illinois, Purdue and Washington State College and after a lengthy connection with the Commonwealth Edison Company in Chicago and the Washington Water Power Company of Spokane in an engineering capacity. From 1918 to 1921 he was associate engineering editor of Electrical World. The new dean has written extensively on educational problems, constant current regulators, deep well pumping and other engineering subjects. He is a member of the American Institute of Electrical Engineers, the Society for the Promotion of Engineering Education and of other professional and academic associations.

# Obituary

G. S. Williams, secretary of the Maryland Utilities Association, with headquarters in Baltimore, Md., died March 6.

Thomas A. Wilkinson, transmission engineer for the New England Public Service Company, died at his home in Augusta, Me., of cerebral hemorrhage April 2. Mr. Wilkinson was one of the pioneers in the industry, having first been connected with Westinghouse, Church, Kerr & Company for a number of years as head of the statistical department. After the dissolution of this organization he was affiliated for a time with the Ontario Hydro Commission. Subsequently he joined the Westinghouse Electric & Manufacturing Company to supervise the work of calculating transmission line constants for its book known as "Electrical Characteristics of Transmission Circuits." He has been transmission engineer for the New England Public Service Company for the past two years.

David H. Darrin, president of the Automatic Switch Company of New York, died March 29 at his home in New Rochelle, N. Y., of pneumonia. Mr. Darrin was many years ago identified with electric light and power plants in northern New York. Subsequently he entered the electric elevator manufacturing field and after his enterprise was absorbed by the Otis Elevator Company in the early nineteen hundreds he purchased an interest in the Automatic Switch Company, which had been incorporated in 1888. Mr. Darrin was one of the oldest members of the American Society of Mechanical Engineers and was a charter member of the old Electric Power Club.

Dr. Delos F. Wilcox, well-known authority on franchises and public utility valuation matters, died of pneumonia April 4 at New York Hospital after a brief illness. He was 55 years of age. A native of Monroe, Mich., Dr. Wilcox removed to New York in 1907 to become chief of the bureau of franchises of the Public Service Commission for the First District, which was then being organized. He resigned in 1913 to enter private practice as a public utility expert, but one year later he again took public office as Deputy Water Commissioner of the city of New York. He resigned from this position in 1917 to resume his private practice. As a public utility expert he was consulted by a large number of cities on franchise rate and valuation matters. He was the author of a large number of works dealing chiefly with the problems of city government and regulation of public utilities. Before removing to New York Dr. Wilcox engaged in work relating to improved city government, first in Cleveland and later at Grand Rapids and Detroit. He was a graduate of the University of Michigan.

# Financial and Statistical News

## *Utility Market Firm*
## *No Drastic Changes in Prices*

THE general market continued its upward spurt of the past few weeks so that interest continued to be centered in the more speculative issues. Few changes of any importance took place in the case of the common stocks of the electric light and power companies, though several did show gains. Particularly noteworthy for strength was the Brooklyn Edison Company, which advanced twelve points, reaching the highest mark in the history of the company, 245. Edison Electric Illuminating of Boston went up seven points and Public Service of New Jersey five. Many of the light and power preferred issues showed gains.

Radio Corporation touched the 195 mark, advancing from 169 during the week under review, and General Electric gained eight points, from 149 to 157.

## Company Reports

| Name of Company | Gross Earnings Twelve Months Ended Feb. 29 1928 | 1927 |
|---|---|---|
| Associated Gas & Electric System | *$40,174,238 | *$29,705,641 |
| Bangor Hydro-Electric | 1,881,770 | 1,763,491 |
| Baton Rouge Electric | 1,041,345 | 980,306 |
| Blackstone Valley Gas & Electric & subs | 5,946,189 | 5,600,687 |
| Cape Breton Electric | 658,268 | 628,398 |
| Central Illinois Light | 4,453,060 | 4,244,172 |
| Cities Service | 32,951,844 | 27,521,058 |
| Columbus Electric & Power | 4,305,390 | 3,821,598 |
| Commonwealth Power | 54,020,022 | 49,651,699 |
| Consumers Power | 27,245,543 | 24,501,172 |
| Eastern Texas Electric & subs | 7,325,083 | 5,892,873 |
| Edison Electric Illg. of Brockton | 1,958,721 | 1,786,638 |
| Elec. Lt. & Pwr. Co. of Abington & Rockland | 626,454 | 584,683 |
| El Paso Electric & subs | 3,026,888 | 2,872,333 |
| Galveston-Houston Electric & subs | 5,105,462 | 4,740,485 |
| Illinois Power | 2,650,883 | 2,594,248 |
| Kansas City Power & Light | 12,856,793 | 11,023,319 |
| Northern Ohio Power | 12,729,680 | 12,034,975 |
| North Texas Elec. & subs | 2,780,232 | 2,536,280 |
| Ohio Edison | 1,956,416 | 1,835,339 |
| Penn Ohio Edison | 13,015,572 | 12,948,064 |
| Portland Electric Power | 12,201,970 | 11,891,001 |
| Public Service Co. of New Hampshire & subs | 3,653,371 | 3,479,462 |
| Puget Sound Pwr. & Lt. & subs | 14,961,978 | 13,735,428 |
| Savannah Electric & Power | 2,228,751 | 2,241,373 |
| Sierra Pacific Elec. & subs | 1,258,451 | 1,267,873 |
| So. Indiana Gas & Electric | 3,055,241 | 2,924,767 |
| Tampa Electric & subs | 4,693,978 | 4,905,426 |
| Tennessee Electric Power | 12,664,657 | 11,942,760 |
| Virginia Electric & Power & subs | 15,624,176 | 14,603,405 |

*Twelve months ended Jan. 31.

## Canada's Output Increases 16.4 per Cent

The output of central electric stations in Canada during January totaled 1,317,736,000 kw.-hr., as compared with 1,131,212,000 in January, 1927. The increase is equivalent to 16.4 per cent. The report of the Dominion Bureau of Statistics shows that of the total, 1,297,783,000 are credited to water and 19,953,000 to fuel-using plants. Output generated from water power in the five economic areas shows a slight decline as compared with December, except in the Maritimes and British Columbia. In the former area, 10,880,000 kw.-hr. were produced, as compared with 10,686,000 in the preceding month and 9,335,000 in January, 1927. British Columbia records an increase from 91,875,000 in December to 93,340,000 in January. Production in that province has shown a steady advance in the past few years, the January total being the highest on record.

Both Ontario and Quebec record a decrease in output during January, as compared with the preceding month. The former had a production of 485,309,000 kw.-hr., as compared with 498,254,000 in December, while the latter's output totaled 611,728,000, as against 637,615,000 kw.-hr. in December. It is also noted that output in Ontario in January was less than in the same month in 1927. Output in the Prairie Provinces totaled 93,340,000 kw.-hr., a decrease of about 4,000,000 kw.-hr. from the preceding month, but compared with the total for January, 1927, there was an increase of about 19,000,000 kw.-hr.

## General Electric Records Another Profitable Year

ANOTHER profitable year is added to the creditable financial history of the General Electric Company. Although orders received during 1927 declined 5 per cent, to $309,784,623, net sales billed during the year were down almost 5 per cent and unfilled orders at the end of the year were 5 per cent lower. Net profits, however, increased almost 5 per cent. Price declines explain the decreases noted.

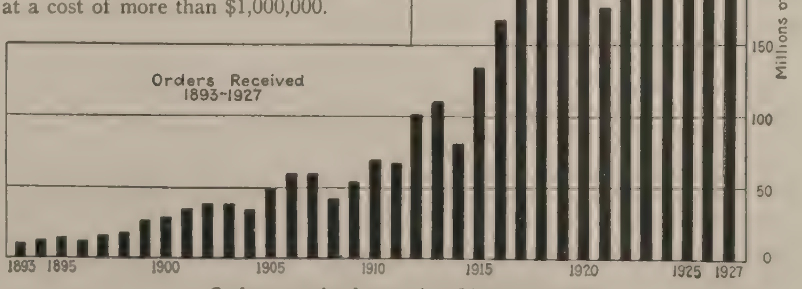
General Electric shows an unusually attractive earnings record over the past 25 years. Average profit available for dividends on common stock per share over a 25-year period was $14.84. For more than 28 years cash dividends have been paid continuously on the common stock, and from April, 1900, to and including 1926 the rate was $8 per share per year with an extra of $1 in 1917. In May, 1926, the old stock was split four for one and cash dividends of $3 per share per annum were paid on the new stock from July, 1926, to April, 1927, inclusive. Last July an extra cash dividend of $1 per share was paid, and at the same time the regular cash dividend was increased to $4. In addition liberal stock dividends have been paid from time to time.

The capacity of the company's operations was materially increased during 1927. A large addition to the switchgear factory was completed at Philadelphia at a cost of about $3,000,000. Furthermore, a high-power testing laboratory was completed in Schenectady, at a cost of more than $1,000,000.

The year was a profitable one also from the standpoint of the company's investments. An increase of nearly $19,000,000 is recorded in holdings, due partly to additional investments in associated manufacturing companies and in part to advances to enable the Electric Securities Corporation and the United Electric Securities Company to call bonds amounting to $13,440,000 and for other purposes.

Income accounts for the past two years follow:

| | 1927 | 1926 |
|---|---|---|
| Net sales billed | $312,603,772 | $326,974,103 |
| Costs, tax., deprec. | 276,454,003 | 289,878,335 |
| Net op. income | $36,149,768 | $37,095,768 |
| Other income | 15,395,918 | 12,561,526 |
| Total income | $51,545,687 | $49,657,295 |
| Interest | 284,486 | 436,512 |
| Gen. reserve | 2,461,712 | 2,548,284 |
| Net profit | $48,799,489 | $46,672,499 |
| Special dividends | 2,574,447 | 2,357,614 |
| Common dividends | 34,251,774 | 19,828,897 |
| Stock dividend | ........... | 7,210,810 |
| Surplus for year | $11,973,267 | $17,275,177 |



*Orders received covering 34-year period*

## Canadian Manufacturing Companies Issue Reports

Gross profits of the Canadian General Electric Company, Ltd., for 1927, after reserves and taxes, but before providing for depreciation, increased by 55 per cent, to $2,903,053, or $1,032,435 more than was earned in 1926. The net profits after writing off $800,000 for depreciation, as compared with $700,000 in 1926, amounted to $932,435 more than in 1926, or $2,103,053 available for the preference and common stocks. The sum of $599,042 was distributed in dividends during the year on the preference stock, leaving a surplus of $1,504,011, or nearly 16 per cent on the common stock. The same amount of money was paid in dividends in 1926 on the preferred stocks.

The financial report of the Canadian Westinghouse Company, Ltd., for the year ended Dec. 31, 1927, shows a further substantial increase in profits, with net earnings for the year equal to 23.04 per cent on the company's outstanding capital stock, as compared with 18.3 per cent in 1926 and 14.4 per cent in 1925. Operating profit for the year amounted to $2,551,188, as compared with $1,796,741 in 1926. Deduction of depreciation at $240,000, Dominion taxes at $187,000 and pension fund at $50,000, left net earnings at $2,074,188, against $1,366,741 in the preceding year. Dividends paid during the year amounted to $838,116, and patent, etc., reduction of $499,999 left a surplus for the year of $736,073.

GERMANY'S THREE-BILLION MARK INDUSTRY

| Item | 176 Generating Establishments<br>Amount, Millions of Marks | 176 Generating Establishments<br>Per Cent | 194 Manufacturing Establishments<br>Amount, Millions of Marks | 194 Manufacturing Establishments<br>Per Cent |
|---|---|---|---|---|
| Invested capital as per balance sheet | 1,195.9 | 60.6 | 591.8 | 54.7 |
| Borrowed capital | 765.5 | 38.8 | 478.5 | 44.2 |
| Employees' benefit funds | 12.3 | 0.6 | 11.6 | 1.1 |
| Total | 1,973.7 | 100.0 | 1,081.9 | 100.0 |
|  |  | Per Cent of Invested Capital |  | Per Cent of Invested Capital |
| Year's net profits | 95.8 | 8.02 | 33.3 | 5.64 |
| Year's net losses | 1.3 | 0.1 | 8.9 | 1.5 |
|  |  | Per Cent of Capital Participating in Dividends |  | Per Cent of Capital Participating in Dividends |
| Total dividends | 74.9 | 6.9 | 27.9 | 5.4 |

## German Electrical Industry

The latest census of the electrical industry in Germany was taken in 1925, according to a recent report received from one of the ELECTRICAL WORLD'S foreign correspondents. The returns, covering 176 generating and 194 manufacturing establishments, are summarized in the table above.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 3 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 79½ | 72 | 81 |
| Ala. Pwr., $7 com. pf.—no par | k114½ | 114½ | 115½ |
| Allis Chalmers Mfg., 6% com. | 123 | 115½ | 125 |
| Aluminum Co. of Amer., com. | 126¾ | 120 | 136 |
| Aluminum Co. of Amer., 6% pf. | k108¾ | 105½ | 109¼ |
| Amer. & Foreign Pwr., 7% pf.—no par | 108¼ | 105¼ | 109 |
| Amer. & Foreign Pwr., com.—no par | 23⅞ | 22⅛ | 27¼ |
| Amer. Bosch Magneto, com.—no par | 28¾ | 15⅛ | 28¾ |
| Amer. Brown Boveri Elec.† | 14 | 10¼ | 18 |
| Amer. Brown Boveri Elec., pf. $7 | 48½ | 46½ | 63 |
| Amer. Gas & Elec., 6% pf.—no par | k108½ | 105 | 108¼ |
| Amer. Gas & Elec., com. †—no par | 135 | 117 | 145 |
| Amer. Lt. & Trac., 6% pf. | 113 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 194½ | 170 | 195 |
| Amer. Pwr. & Lt., 6% pf. | 107¼ | 104 | 109⅞ |
| Amer. Pwr. & Lt., com. †—no par | 77⅜ | 62¼ | 83 |
| Amer. Pub. Serv., 7% pf. | a 98 | 97½ | 101 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | k 95 | 90 | 95 |
| Amer. Pub. Utilities, 7% pr. pf. | 99 | 94 | 101 |
| Amer. Pub. Utilities, com. | k 60 | 60 | 65 |
| Amer. States Sec., A | a 7¾ | 4 | 7¾ |
| Amer. States Sec., B | a 7½ | 4⅜ | 7¾ |
| Amer. Superpwr., 6% ptc pf.—25 | m30 | 28½ | 30½ |
| Amer. Superpwr., 6% 1st pf. | l 103½ | .... | .... |
| Amer. Sup pwr., Class A†—no par | 44¾ | 37 | 46¾ |
| Amer. Sup pwr., Class B†—no par | 45⅜ | 37¼ | 48 |
| Amer. Wtr. Wks. & Elec., 6% pf. | 104½ | 101½ | 105 |
| Amer. W.W. & E., com. new—no par | 56¼ | 52½ | 61 |
| Anaconda Copper cap. $3 | 64⅛ | 53¾ | 64⅝ |
| Appalachian Electric Pwr., 7% pf. | 108½ | 108½ | 110 |
| Arkansas Pwr. & Lt. 7% pf | 107½ | 108 | 109¼ |
| Assoc. Gas & Elec., $3.50—50 | 54 | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 95 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par | 48¼ | 47 | 51⅜ |
| BABCOCK & WILCOX, 7% com. | 118 | 117½ | 124¾ |
| Binghamton L., H. & P., $6 pf. | 107 | 102 | 108 |
| Birmingham Elec., pf.—$7—no par | 105 | 109½ | 111 |
| Blackstone Valley G. & E., 6% pf. | m106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k160 | 135 | 165 |
| Blaw-Knox, com.† | i102 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f229¾ | .... | .... |
| Brazilian Trac., Lt. & Pwr., com., new | f 58½ | .... | .... |
| Broad River Pwr., 7% pf. | 107 | 105 | 108 |
| Brooklyn Edison, 8% com. | 241 | 206¼ | 249½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | i 26¼ | .... | .. |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | i 37½ | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | 99 | 98 | 101 |
| California Ry. & Pwr., 7% pf. | 135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l110¼ | 109 | 110½ |
| Central & S. W. Util., $7 pf.—no par | a104½ | 99¾ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a108 | 103½ | 108 |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 105 | 107 |
| Central Ill. Pub. Serv., $6 pf. | a99¾ | 97¾ | 100 |
| Central Ind. Pwr., 7% pf. | a 99½ | 95 | 99¾ |
| Central Maine Power, 6% pf. | 96 | 96 | 98 |
| Central Maine Power, 7% | 106½ | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 106 | 104½ | 105½ |
| Central States Elec., 7% pf. | 112 | 104¼ | 112 |
| Century Elec., 6% com. | b135 | 135 | 145 |
| Cincinnati Gas & Elec., 5% com. | g 99 | 97½ | 99¼ |
| Cities Service, $6 pf.—no par | i100⅛ | 87 | 94½ |
| Cities Service, pf. B—no par | l 9⅜ | 8 | 8⅝ |
| Cities Service, pf. BB—no par | l94 | 80½ | 86 |
| Cities Service, com.—20 | l 57½ | 40¼ | 58¾ |
| Cities Service, Bks. Shrs.—10 | l 28⅜ | 22¾ | 27 |
| Cities Service Pwr. & Lt., 7% pf. | k107 | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf. | 101 | 95½ | 101⅛ |
| Cleveland Elec. Illg., 6% pf. | 112½ | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 390 | 350 | 410 |
| Columbia Gas & Elec., 6% pf. | 109½ | 107⅛ | 110⅛ |
| Columbia G. & E. com. $5—no par | 93 | 89½ | 97⅞ |
| Columbus Elec. & Pwr., $2 com.—no par | 77⅜ | 64 | 79 |
| Columbus Elec. & Pwr., 7% | 113½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 107½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 107½ | .... | .... |
| Columbus Ry., P & Lt. com.—no par | 115 | ... | .... |
| Commonwealth Edison, 8% com. | a179 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 104⅜ | 102⅛ | 104⅞ |
| Commonw'th Pwr., $2, com.—no par | 73⅛ | 62¼ | 76¾ |
| Conn. Lt. & Pwr., 8% pf. | 122 | 120 | 125 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 118 | 121 |
| Cons. Gas of N. Y., pf. | k104 | 101⅛ | 105 |
| Cons. Gas of N. Y., com. $5—no par. | 146⅜ | 119⅜ | 149¾ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111½ | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | e111¼ | 110⅜ | 114¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e105½ | 100½ | 104⅜ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 72⅜ | 67¼ | 73 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | ... | .... |
| Consumers Pwr., 6% pf. | 104¾ | 105½ | 106½ |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108 | 106½ | 108½ |
| Conti. G. & E. com. $4.40—no par | k230 | 240 | 265 |
| Crocker Wheeler, com.† | 38 | 24 | 30 |
| Crocker Wheeler, 7% pf. | 90 | 77 | 90 |
| DALLAS PWR. & LT., 7% pf. | 111 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108½ | 108¼ | 109½ |
| Derby Gas & Elec., 7% pf | 100 | 96 | 100½ |
| Detroit Edison, 8% com. | k182¼ | 166½ | 194¾ |
| Dubilier Condenser, com.—no par | 2¾ | 2⅜ | 3¾ |
| Duke Pwr., cap. | k143 | 130 | 145 |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 111 | 112½ |
| Eastern New York Util. com. | m 65 | ... | ... |
| Eastern States Pwr. $7, com. | k 12 | 12 | 14½ |
| Eastern States Pwr., pf | k 98 | 98 | 99 |
| East. Tex. Elec., 7% pf. | 107 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d277 | 252 | 280 |
| El Paso Elec. 7% pf. | 113 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l110 | 108⅜ | 111⅜ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 90⅛ | 76 | 95⅜ |
| Electric Household Util.† | a 22½ | 13½ | 24 |
| Elec. Investors, 6% pf.—no par | 103 | 101 | 103½ |
| Elec. Investors, com.†—no par | 48¾ | 40⅛ | 49⅞ |
| Elec. Pwr. & Lt., ctfs. pf. | 109⅞ | 106⅛ | 110⅛ |
| Elec. Pwr. & Lt., ctfs., 40% pd. | m125¼ | 120⅜ | 125½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 36¾ | 28¾ | 39⅞ |
| Elec. Refrig. cap.† | m15⅜ | 11⅛ | 17½ |
| Elec. Ry. Securities, com.—no par | 6½ | ... | ... |
| Elec. St. Battery com. $5.25—no par | 80 | 69 | 80 |
| Elmira Wtr., Lt. & R.R., 7% pf. | 106½ | 104 | 107 |
| Empire Pwr., ptc.† | 32 | 27⅛ | 35⅜ |
| Engr. Pub. Serv. $7, pf.—no par | 110¼ | 107 | 110¼ |
| Engr. Pub. Serv., com.—no par | 39½ | 33 | 42½ |
| Eureka Vacuum Cleaner, com. $4—no par | 73 | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | 109½ | 104 | 110 |
| F.-M., com.—$3—no par | 40¾ | 32½ | 40⅞ |
| Federal Lt. & Trac., com $1.40 | 52¾ | 42 | 55 |
| Federal Lt. & Trac., $6 pf.—no par | 103 | 98 | 105 |
| Florida Pwr. & Lt., 7% pf. | k107½ | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf. | i114 | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf. | 78 | 75 | 78 |
| Galveston-Houston Elec., com. | 38 | 31⅜ | 38 |
| General Cable, Cl. A | 79½ | 56 | 80⅞ |
| Gen. Elec. $3 com.—no par | 157⅛ | 124 | 161½ |
| Gen. Elec., special—6% | 11⅜ | 11¼ | 11⅜ |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 41 | 35½ | 43¼ |
| Gen. G. & E. (Del.) pf. A $8—no par | 125 | 125 | 128 |
| Gen. G. & E. (Del.) pf. A $7—no par. | 113 | 110 | 114 |
| Gen. G. & E. (Del.) pf. B $7 | 111 | 105½ | 111 |
| Gen. Pub. Serv., $7 cum. pf., no par. | 117 | 110 | 120 |
| Gen. Pub. Serv., com., no par | 20⅜ | 16⅜ | 21½ |
| General Public Utilities, $7 pf. | k 58 | 55 | 65 |
| Ga. Lt., Pwr. & Rys., com. | k 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | h105½ | .... | .... |
| IDAHO PWR., 7% pf. | 104½ | 109 | 110½ |
| Ill. No. Utilities, 6% pf. | k 96 | 96 | 98 |
| Ill. Pwr. & Lt., 7% pf. | 104¼ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 105½ | 102 | 107¼ |
| Indianapolis Pwr. & Lt., $7 pf. | 104 | 100 | 105 |
| Ingersoll Rand com. | 91 | 90 | 94 |
| Int. Combus. Engr., com. $2—no par | 52 | 45¼ | 55⅛ |
| Int. Combustion Engr., 7% pf. | j104⅜ | 103 | 105½ |
| Int. Util., Class A—$3.50—no par | 44⅛ | 45 | 44⅜ |
| Int. Utilities, Class B—no par | 8⅞ | 6⅜ | 10½ |
| Interstate Pwr., pf.—$7—no par | 102 | 99 | 103½ |
| Interstate Pub. Serv., 7% pf. | 105 | 103 | 106 |
| Iowa Ry. & Lt., 7% pf. | 101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 107½ | 105 | 107 |
| Johns-Manville com.†—no par. | 110¾ | 111½ | 125 |
| Johns-Manville, 7% pf. | m113½ | 111¼ | 113½ |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 31. lBid price Wednesday, April 4. mLatest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 3 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | 113 | 111½ | 113½ |
| Kansas Gas & Elec., 7% pf. | l110 | 107 | 109 |
| Kentucky Hydro-Elec., 7% pf. | m104½ | 102 | 104½ |
| Kentucky Sec., 6% pf. | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 103 | 100 | 103 |
| LACLEDE GAS LT., 10% com. | k210 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 26½ | 19⅜ | 27⅞ |
| Long Island Ltg., 7% pf | 111½ | 110½ | 112½ |
| Long Island Ltg., 6% pf | k107½ | 107 | 108½ |
| Long Island Ltg., com.† no par | k187 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | h110½ | 105½ | 109½ |
| Louisville Gas & Elec., cl. A. $1.75 | 33⅞ | 28 | 33⅞ |
| MAN ELEC. SUPPLY, cap. $5—no par | 55⅛ | 50 | 61 |
| Manila Elec., com.†—no par | m 47 | 45¼ | 50 |
| Maytag Mfg., com. 50 no par | 33⅜ | 30 | 34⅜ |
| Memphis P. & L., pf.—$7—no par | 109 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 108½ | 103 | 108½ |
| Metropolitan Ed., pf. $7 no par | 109½ | 109 | 111 |
| Metropolitan Ed., com. $5 no par | k160 | 125 | 155 |
| Middle West Utilities, 7% pf | a122 | 116½ | 124½ |
| Middle West Util., 7% pr. lien | a125⅝ | 125 | 129¼ |
| Middle West Util., com. $7—no par | a134 | 123½ | 135 |
| Midland Utilities, pr. ln. 6% pf | a 95⅜ | 94½ | 97 |
| Midland Utilities, 6% pf. A | a 91 | 89⅞ | 92¼ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k104 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 102 | 98 | 101⅝ |
| Minn. Pwr. & Lt., 7% pf. | l108½ | 107 | 109 |
| Miss. River Pwr., 6% pf | 108 | 94 | 109 |
| Miss. River Pwr., 3% com. | m108 | .... | .. |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | 109 | 107½ | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | k104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 34⅜ | 29¾ | 36¾ |
| Montana Pwr., 5% com | 164 | 102¾ | 167¾ |
| Montreal Pwr., 7½% com. | f 94 | .... | .... |
| Mountain States Pwr., 7% pf. | k104 | 97 | 105 |
| Mountain States Pwr., com.† | 17½ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109 | 98 | 110⅛ |
| National Elec. Pwr., A† | a 31½ | 27½ | 32¼ |
| National Lt., Ht. & Pwr., com | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 109 | 108½ | 111 |
| National Pwr. & Lt., com.†—no par. | 26⅜ | 21¼ | 27⅛ |
| National Pub. Serv., 7% pf. | 101 | 99 | 103 |
| National Pub. Serv., 7% ptc., pf | 114 | .... | .... |
| National Pub. Serv., A com. $1 60—no par | 25⅞ | 22 | 27½ |
| National Pub. Serv., B com.—no par | 28⅜ | 24¼ | 30 |
| Nebraska Pwr., 7% pf. | l112 | 110 | 111½ |
| Nevada-Calif. Elec., com. | 35 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | 62 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | k108 | 98½ | 109½ |
| New Eng. Pub. Serv., pf. $7 | 106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf | 104½ | 101 | 105½ |
| New York Power & Light 7% pf | 115½ | ... | ... |
| New York Power & Light, 8% pf. | m114 | .... | .... |
| Niagara Falls Pwr., 7% pf.—25. | 28 | 27¾ | 28¾ |
| No. Amer., 6% pf.—50 | k 53¼ | 53¼ | 55 |
| No. Amer., com.—10 | 64⅜ | 58⅞ | 67 |
| No. Amer. Edison, $6 pf.—no par | k104 | 102½ | 105⅜ |
| No. Caro. Pub. Serv., pf.—$7—no par | m109 | 93 | 105 |
| Northeastern Pwr., com. | 25½ | 19⅜ | 26⅜ |
| No. N. Y. Utilities, 7% pf | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 25¼ | 18 | 27½ |
| No. Ont. Pwr. & Lt., 6% pf. | 98 | 90 | 99 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 108¼ | 108¼ | 110 |
| No. States Pwr. (Del.), 8% com. | 134 | 123 | 136⅜ |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 16 | .... | .... |
| OHIO BRASS, com. B $4—no par. | k100¼ | 89 | 100½ |
| Ohio Brass, 6% pf. | k107 | 106 | 111 |
| Ohio Pwr., 6% pf | 107 | 104 | 107½ |
| Ohio Pub. Serv., $6 pf. | 103½ | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 112½ | 107 | 112 |
| Ohio River Edison, 7% pf. | 108½ | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf | 114¾ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 29¾ | 26⅜ | 29⅜ |
| Pacific Gas & Elec., 8% new com. | 46¼ | 43½ | 49⅜ |
| Pacific Pwr. & Lt., 7% pf. | l110 | 106 | 109½ |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 80⅞ | 79⅞ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 95⅞ | 93½ | 96 |
| Penn-Ohio Edison, 7% pf | 108½ | 106¼ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 110 | 99 | 110 |
| Penn Pwr. & Lt. $7 no par. | l110¼ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2 50 com., new | e 70½ | 68 | 72½ |
| Phila. Co., 5% pf. 50 | k 46 | 45½ | 48⅜ |
| Phila. Co., 6% pf. 50 | 56⅜ | 52 | 57 |
| Phila. Co., com.—50 | k145 | 145 | 163 |
| Phila. Elec., 8% com.—25 | 61⅜ | 55½ | 60 |
| Portland Elec. Pwr., 7% pf. | 102½ | 100 | 104¼ |
| Portland Elec. Pwr., 6% pf. | 94 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf | 80 | 55 | 88 |
| Portland Elec. Pwr., com. | 51 | .... | .... |
| Potomac Elec. Power, 6% pf. | j112½ | .. | ... |
| Pwr. Sec., pf. no par | k 65 | 50 | 68 |
| Pwr. Sec., com.—no par | 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | 105 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 108½ | 103⅜ | 108½ |
| Pub. Serv. of N. J., 7% pf. | 121 | 118 | 121 |
| Pub. Serv. of N. J., $2 com.—no par | 49 | 41½ | 49⅞ |
| Pub. Serv. of No. Ill., 6% pf. | a115 | 110 | 115 |
| Pub. Serv. of No. Ill., 7% pf. | a120 | 119 | 121 |
| P. S. of No. Ill., com. $8—no par | a172 | 159¼ | 180 |
| Pub. Serv. of No. Ill., $8 com. | a174 | 159⅜ | 180 |
| Pub. Serv. of Okla., 7% pr. ln. | 106½ | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | k110 | 108 | 110⅛ |
| Puget Sound Pwr. & Lt., 7% pf. | 109½ | 109 | 113 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 98 | 96½ | 99 |
| Puget Sound Pwr. & Lt., com. | 58½ | 29⅜ | 63½ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 56½ | 54½ | 57⅜ |
| Radio Corp. of Amer., com.—no par. | 195¼ | 85½ | 196½ |
| Rhode Island Public Service, pf. $2—no par | m 31¼ | 30⅜ | 31¼ |
| Rochester Gas & Elec. 6% pf. D | k105 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105½ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 116 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | k 6¼ | 4¼ | 7⅞ |
| Sierra Pacific Elec., 2% com. | 35½ | 29 | 38¾ |
| Sioux City Gas & Elec., 7% pf. | 107¼ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 109½ | ... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 88¼ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 47⅞ | 40⅜ | 48 |
| So. Calif. Edison, 8% pf. | l 47 | 38½ | 41 |
| So. Calif. Edison, 7% pf. | 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 27⅜ | 25¾ | 27⅞ |
| So. Calif. Edison, 8% com. | 45¾ | 43½ | 48⅞ |
| Southern Cities Utilities, 7% pf | k 85 | 75 | 85 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 92 | 88 | 92½ |
| Southwestern Pwr. & Lt., 7% pf | k112 | 103 | 113 |
| Standard Gas & Elec., 8% pf | 68¼ | 65 | 68¼ |
| Standard Gas & Elec., 7% pr. pf | 113½ | 110½ | 114½ |
| Standard G. & E., com. $3 50 | 63¾ | 57⅞ | 66⅞ |
| Standard Power & Light, com. | 40 | 29¾ | 45 |
| Standard Pwr. & Lt., 7% pf. | 107 | 103⅞ | 107 |
| Staten Island Edison, pf.—$6—no par | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | m164 | 162 | 175 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 68½ | 62 | 68½ |
| Tenn. Elec. Pwr., 6% pf. | 103½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 108⅜ | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 10 | .... | .... |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf | l114 | 113½ | 115 |
| Tide Water Pwr., 8% pf. | 112 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 124 | 112⅜ | 134 |
| Toledo Edison, 7% pf. | 110½ | 103 | 115 |
| Toledo Edison, 6% pf. | k104½ | 95 | 105 |
| Toledo Edison, 6% com. | k145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 93 | 102 |
| UNITED GAS & ELEC., 7% pf. | 95 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c123¾ | 111¼ | 120¾ |
| United Lt. & Pwr., pf.—$4—no par | k 55 | 49 | 56½ |
| United Lt. & Pwr., pf.—$6 50—no par | a100¼ | 95 | 101 |
| United L. & P., com. A .48—no par | a 22 | 14 | 22 |
| United L. & P., com. B .48—no par. | a 29½ | 19 | 25 |
| Utah Pwr. & Lt., 7% pf | l111 | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105½ | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101 | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 31½ | 28½ | 34½ |
| Utilities Pwr. & Lt., com. B $1—no par | 23½ | 18½ | 26⅛ |
| VERMONT HYDRO-ELEC., 7% pf. | 100 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | k110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 101 | 97 | 103 |
| WAGNER ELEC., 7% pf. | b101 | 96⅛ | 102 |
| Wagner Elec., com.—no par | b 52 | 37½ | 55⅛ |
| Washington Ry. & Elec., 5% com. | 470 | 450 | 560 |
| Washington Ry. & Elec., 7% pf. | 103 | ... | ... |
| Washington Wtr. Pwr., 8% com. | 227 | 175 | 235 |
| West Penn Elec., 7% pf. | 114 | 109¼ | 114⅜ |
| West Penn Elec., Cl. A $7 | k110 | 106¼ | 110⅞ |
| West Penn Pwr., 7% pf. | 116⅜ | 117 | 117 |
| West Penn Pwr., 6% pf. | 110½ | 109½ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf. | 103 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 102 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 108 | 88⅜ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | 33½ | 30½ | 34 |
| Weston Elec. Instrument, com.—no par | 17⅞ | 12⅜ | 17⅞ |
| Wheeling Elec., 6% pf. | 105 | 95 | 104 |
| Worthington Pump, 7% pf. A | k 49 | 46½ | 55 |
| Worthington Pump, 6% B | k 44½ | 41 | 49½ |
| Worthington Pump, com. | 29 | 28 | 34½ |
| YALE & TOWNE com. $5—25. | 70⅜ | 68½ | 75 |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 31. lBid price Wednesday, April 4. mLatest quotations available. †Dividend rate variable.

ELECTRIC POWER & LIGHT PAYS INITIAL DIVIDEND.—Directors of the Electric Power & Light Corporation have declared an initial quarterly dividend of 25 cents per share on the common stock, no-par value, payable May 1 to holders of record April 14.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of 5,162 additional shares of common stock, class A, of the General Gas & Electric Corporation, without par value, on official notice of issuance and payment in full, making the total amount applied for 350,909 shares. There have been placed on the Boston Stock Exchange list first mortgage 5 per cent twenty-year gold bonds of the Oklahoma Power & Water Company to the amount of $4,500,000.

HARTFORD ELECTRIC TO REDUCE PAR OF STOCK.—The directors of the Hartford Electric Light Company, Hartford, Conn., met March 27 and voted to recommend to stockholders a par value reduction in stock from $100 to $25. This is advised by the directors to obtain a wider distribution of ownership. At present the capital structure has 180,000 shares, which under the plan would become 720,000 shares. New certificates for shares will be issued as soon as the recommendation is approved by a majority of the stockholders.

TRI-CITY PASSES PREFERRED DIVIDEND.—The Tri-City Railway & Light Company, Davenport, Iowa, has passed the preferred dividend due April 1 this year. The last payment was 1½ per cent, paid Jan. 2.

ELECTRIC VACUUM DECLARES EXTRA DIVIDEND.—The Electric Vacuum Cleaner Company, Inc., declared an extra dividend of $1 in addition to the regular quarterly dividend of $1 a share on the common stock.

BUFFALO, NIAGARA & EASTERN STARTS CONSOLIDATION OF SUBSIDIARIES.—As the first step in consolidating the subsidiaries, stockholders of the Buffalo, Niagara & Eastern Power Corporation, March 19 voted to authorize an issue of 500,000 shares of first preferred stock without par value. The stock will be entitled to cumulative dividends at the rate of $5 a share annually. Plans call for the issuance soon of not more than 350,000 shares of the new stock to acquire by exchange or to provide funds for redemption of preferred stocks of the Niagara Falls Power Company, Niagara, Lockport & Ontario Power Company and the Tonawanda Power Company, three of the subsidiaries to be consolidated.

PENN CENTRAL SHAREHOLDERS GIVEN RIGHTS.—Holders of $5 series preferred stock of record April 2 will be given the right to subscribe on or before May 6 at $45.50 per share for a new series of preferred shares of no-par value, designated as $2.80 series, to the extent of 15 per cent of their holdings. The unsold portion of the 25,000 shares of $2.80 series preferred stock will be offered to the public at $47 per share.

## April Issues Total $94,775,000

Six electric light and power companies issued new securities during the first week in April to the amount of $94,775,000. The American Gas & Electric Company was responsible for $50,000,000 of the total in the form of 5 per cent gold debentures priced at 101 and accrued interest, to yield about 4.95 per cent. Proceeds will be used in connection with the redemption on May 1, 1928, of all of the $46,904,000 6 per cent gold debenture bonds of the company now outstanding with the public. Another sizable offering of 5 per cent gold debentures was made by the New England Power Association, a piece of financing involving a total of $25,000,000.

First and refunding mortgage gold bonds of the Gulf Power Company were offered at 99 and interest, to yield about 5.06 per cent. This issue amounted to $2,500,000. Two new offerings were made by the Central States Edison Company—one in the form of first lien 5½ per cent gold bonds, series A, amounting to $1,350,000, and the other in the form of three-year 5½ per cent convertible gold notes, priced at 98½ and interest, amounting to $675,000.

The North Continent Utilities Corporation issued 12,500 shares of 7 per cent cumulative preferred stock at $100 per share and accrued dividends, proceeds from the sale of which will be used for extensions and betterments.

The Minnesota Power & Light Company made an offering of first and refunding mortgage gold bonds, 4½ per cent series, amounting to $14,000,000, the price being 97¼ and interest, yielding 4.64 per cent. These bonds were dated May 1, 1928, and mature May 1, 1978. Upon completion of this financing there will be $24,700,000 first and refunding mortgage gold bonds and $7,747,000 underlying divisional bonds outstanding.

# Utility Offerings in 1928 Total $330,000,000

DURING the first three months of 1928 the electric light and power companies of the country issued new securities to the amount of $330,406,852, as compared with $486,634,000 for the corresponding period of 1927. The month of March contributed $128,301,352 to this total, a figure which indicates an increase of $32,000,000 over March, 1927, and of $25,000,000 over February, the preceding month.

The largest individual offering in March was made by the Engineers Public Service Company in the form of convertible preferred stock, a piece of financing involving a total of $32,000,000. Proceeds will be used to retire the 311,662 shares of $7 dividend preferred stock. Engineers Public Service was not the only utility that took advantage of favorable conditions to replace old issues bearing high interest rates with new issues yielding lower returns. The Iowa Power & Light 4½ per cent issue replaced 6 per cent and 5½ per cent bonds; Utah Power & Light's five-and-a-half-million-dollar issue replaced a similar amount of 6s outstanding; proceeds from the twenty-three-million-dollar issue of the Metropolitan Edison Company retired various 5 and 6 per cent issues and the Memphis Power & Light offering of 4½ per cent bonds refunded a 6 per cent issue.

With the exception of one small issue the new financing was all of a long-term nature. The average yield dropped to 5.09 per cent in March.

## *Security Issues of Electric Service Companies in March*

| Name of Company | Amount of Issue (Par Value) | Period Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Rochester Gas & Electric Corp. | $6,000,000 | 49 | General mortgage gold bonds, series D | To reimburse for cost of extensions and additions | 4½ | 99½ | 4.52 |
| Interstate Public Service Co. | 12,554,000 | 30 | First mortgage and refunding gold bonds, series F | To reimburse for refunding bonds and for other corporate purposes | 4½ | 94½ | 4.85 |
| Oklahoma Power & Water Co. | 4,500,000 | 20 | First mortgage gold bonds, series A. | To provide a part of the purchase price of properties acquired | 5 | 96½ | 5.30 |
| National Power & Light Co. | 10;314,852 | .. | Cumulative preferred stock | General corporate purposes | 6 | 102 | 5:88 |
| Iowa Power & Light Co. | 6,000,000 | 30 | First mortgage gold bonds, series A | To retire bonds, for additions and extensions and for other corporate purposes | 4½ | 95¼ | 4.80 |
| San Antonio Public Service Co. | 7,500,000 | 30 | First mortgage and refunding gold bonds, series B | To finance acquisition of new properties and to reimburse company for other capital expenditures | 5 | 97½ | 5.16 |
| Utah Power & Light Co. | 5,500,000 | 16 | First lien and general mortgage gold bonds | To retire bonds | 4½ | 96¾ | 4.79 |
| Metropolitan Edison Co. | 23,000,000 | 40 | First mortgage gold bonds, series D. | To retire bonds bearing higher rates of interest and for additions and betterments | 4½ | 99½ | 4.52 |
| Memphis Power & Light Co. | 2,275,000 | 50 | First and refunding mortgage gold bonds, series C | To retire bonds | 4½ | 96¼ | 4.70 |
| Orange & Rockland Electric Co. | 1,250,000 | 30 | First mortgage gold bonds | To retire all present outstanding bonds and notes, to reimburse for expenditures on construction and for other corporate purposes | 5 | 99½ | 5.03 |
| United Public Utilities Co. | 3,750,000 | 19 | First lien gold bonds, series B | To acquire securities of subsidiaries | 5½ | 97¾ | 5.70 |
|  | 3,307,500 | .. | Preferred stock | ........ | 6 | 94½ | 6.35 |
| American Commonwealths Power Corp. | 4,750,000 | .. | First preferred stock | To acquire stocks of other companies and for other corporate purposes | 6½ | 95 | 6.85 |
| Engineers Public Service Co. | 32,000,000 | .. | Convertible preferred stock | To retire preferred stock | 5 | 100 | 5 |
| Iowa Public Service Co. | 1,500,000 | 40 | Gold debentures | For acquisition of stock of another utility and for other corporate purposes | 5 | 95 | 5.30 |
| North Continent Utilities Corp. | 3,500,000 | 20 | First collateral lien and refunding gold bonds, series A | To retire outstanding bonds or to reimburse for expenditures on additions and improvements already made and for other corporate purposes | 5½ | 97 | 5.75 |
| Great Western Utilities Corp. | 600,000 | 5 | First lien and collateral trust gold bonds, series A | Acquisition of properties, to retire indebtedness and for other corporate purposes | 6 | 100 | 6 |
| Total | $128,301,352 |  | Rights | $32,595,000 |  |  |  |
| Total amount actually realized | 126,088,078 |  | Total financing for March | $158,683,078 |  |  |  |

# Business News and Market Conditions

## Underwriters Report on Armored Cable

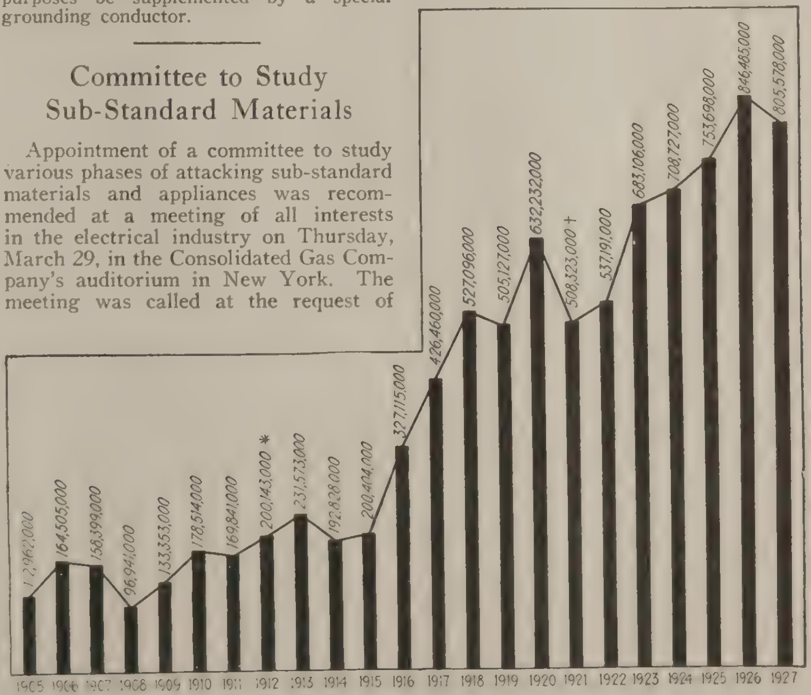
A. R. Small, vice-president the Underwriters' Laboratories, New York City, has issued a report covering the work of the Laboratories on armored cable to determine the various properties of armored cable using the new standard of 0.025 in. for thickness of strip instead of 0.034 in. as previously. The report is as follows:

> The manufacturers of armored cable have approved in principle the recommendations of the report of Underwriters' Laboratories made as a result of research undertaken at their instance and request, pursued for upward of a year. The object of this research was to determine the various electrical and physical properties of armored cables in relation to the use of the product under the conditions of the National Electrical Code.
>
> In addition to laboratory work, the research included studies, at the factories of all producers, of machines, equipment and methods in the manufacture, test and packing for shipment, and extensive studies in the field of contractors' practices in the installation and use of the product. This latter phase of the research, together with the provisions of the National Electrical Code, provided the basis for determining what are the necessary and desirable electrical and physical properties of armored cable.
>
> Various determinations reached are judged of especial interest at this time, viz., the thickness of strip and the conductivity or, inversely, the resistance, in runs of the cable and at outlet fitting connections. The detailed results of tests described in the report covering the physical properties of resistance to tension and crushing loads give conclusive evidence of acceptable values in these properties of the product to the industry as a whole. These results seem to dispose of the questions raised in the minds of inspection authorities and of contractors covering the new standard for thickness of strip of 0.025 in. instead of 0.034 in. in effect prior to 1925.
>
> In laboratory tests many samples representative of all makes and designs of armored cable were subjected to electrical burnout and overload current tests to determine the characteristic performance when abnormal conditions exceeding those contemplated in the National Electrical Code rules were imposed. The report shows that cable made of 0.025 strip does not convey fire to the outside when burnouts of conductors take place with the conductors loaded up to 100 per cent in excess of National Electrical Code standard fusing for the circuits involved.
>
> Determinations of resistance and conductivity developed the interesting point that over-heating, when carrying grounding currents, would not occur with loads greatly in excess of those appropriate for the fusing of the circuits, and, further, that the actual conductivity of the metal strip of armor varied according to the attitude of the armor as installed; at bends or when the cable was in other than the lying-straight position the resistance dropped to values much less than obtained when specimens were lying straight. This phenomenon is due to the contacts made by the edges of the strip in the convolutions which form the armor with the surface of the adjoining strip. These contacts are better electrically on account of the pressure produced by the curved attitude of the armoring.
>
> It was shown that it will be feasible to specify and obtain such a maximum value for resistance of armor when in the lying-straight position as to produce no dangerous rise in temperature in the metal when it is called upon to carry grounding currents much in excess of those for which the circuit wires are properly fused. All manufacturers in the industry are now co-operating with the staff of the laboratories relative to the installation of equipment and test methods to control this factor on the entire output.
>
> The report thoroughly disposed of questions which have been raised concerning the resistance of connections at outlet fittings. All usual makes and types of terminal fittings with different standard makes and types of outlet boxes were tested with various combinations and sizes of standard armored cable. In general, the data of the report show that the resistance across an outlet including two fittings is no greater than the resistance of a run of 6 in. of the cable itself. These results were the considerations leading the committee on wiring methods (article 5 of the National Electrical Code) to take no action on the proposed recommendation that the conductivity and reliability of connections of armored cable for protective grounding purposes be supplemented by a special grounding conductor.

## Committee to Study Sub-Standard Materials

Appointment of a committee to study various phases of attacking sub-standard materials and appliances was recommended at a meeting of all interests in the electrical industry on Thursday, March 29, in the Consolidated Gas Company's auditorium in New York. The meeting was called at the request of various interests by the Electrical Board of Trade of New York, Inc., whose chairman, Charles L. Eidlitz, opened the meeting and turned over the chair to T. H. Joseph, who called on various members to offer their suggestions. Reinspection of installations was suggested as one way to stop the use of non-approved material, but J. C. Forsyth of the New York Board of Fire Underwriters said the cost was prohibitive. H. R. Sargent, speaking for the manufacturers, said that while some manufacturers were for quality and approved material only it was impossible to control the production and standards of all the manufacturers. Harry Kirkland of the Society for Electrical Development referred to the city ordinances of Portland, Ore., and Louisville, Ky., where none but approved material could be offered for sale. In discussing the passage of a similar ordinance in New York City objection was made by representatives from adjoining territories in Long Island, New Jersey and Westchester County, who said that a local ordinance would have the effect of dumping the non-approved products in

### Trend of Electrical Sales



Combined Electrical Sales of Allis-Chalmers Manufacturing Company, Crocker-Wheeler Electric Manufacturing Company, General Electric Company, Graybar Electric Company, Western Electric Company and Westinghouse Electric & Manufacturing Company

(a) Munitions sales during the war years and non-electrical sales not included.

(b) Sales of any one of the companies do not include purchases from any of the other companies listed.

*Fort Wayne, Sprague and National added to General Electric sales.

†Southwest General Electric added and International General Electric omitted from General Electric sales.

their respective localities. It was suggested that relief be sought through State legislation. Whether to remedy the situation through State legislation, label registration, complete fire insurance inspection or some other way will be determined by a committee which will represent all branches of the industry.

## N.E.M.A. Develops Code of Business Conduct

Through its board of governors the National Electrical Manufacturers' Association has indorsed a code of business conduct. This code, as developed by the committee on code of ethical and sound merchandising principles, was presented to the policies division meeting in Chicago by N. A. Wolcott, chairman of the committee, and will appear shortly in printed form. The more specific portions of the code are as follows:

The electrical manufacturers indorse the principle of a one-price policy.

A request for competitive prices on the part of a buyer involves definite obligations toward all bidders. The electrical manufacturers indorse as in the interest of sound, ethical and economic relations between buyer and seller the following principles to apply to competitive bidding under any specific inquiry:

That the bids be considered as confidential information between buyer and bidder until all bids are in and the buyer has placed the business.

That bidders exchange, where practicable, full information regarding their bids after the business is placed.

Where specifications call for various items involving different types and classes of apparatus, the relative merit of the different bids is best determined and freedom of choice on the part of the buyer promoted if each bidder quotes segregated prices at which any individual item would be accepted.

# Market Conditions

STEADY buying of general supplies is reported in the New England district. Orders for heavy industrial equipment and central-station supplies are predicted for the coming months, though at present the market is quiet. Building supplies are in good demand. In the Eastern district satisfactory sales continue. A New York power company placed an order for $300,000 worth of substation apparatus. There is an increasing number of new prospects now in the market for motor equipment. A manufacturer of appliances reports excellent business.

In the Southeast the industrial field is active. A textile plant in Tennessee purchased considerable equipment, including a 3,000-kw. turbo-generator; two 1,500-kw. turbines also were ordered for the use of tobacco plants in the Carolinas, and a tannery in Georgia purchased 31 motors. The demand for building materials is steady in St. Louis, and good sales of electric ranges are reported. March business in the Middle West improved over that of January and February. On the Pacific Coast buying by industrial plants is active. A paper plant at Grays Harbor, Wash., purchased $30,000 worth of equipment, a paper plant at Port Townsend ordered $10,000 worth of transformers and a Nevada mining company bought $17,500 worth of equipment. A decided improvement in motor sales is reported by Seattle concerns.

### *Lead Sales Active—Little Copper Buying Recorded*

The only metal in the non-ferrous group that enjoyed an active market is lead. Buying was particularly brisk at the higher prices established on Monday. Following a phenomenally big week from the standpoint of volume of sales the copper market quieted down and sales have been very light. Zinc continues dull, though prices are a little better. Tin is inactive with little net change in prices.

NEW YORK METAL MARKET PRICES

| | Mar. 28, 1928 Cents per Pound | April 4, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 13 90 | 14 0 |
| Lead, Am. S. & R. price | 6 | 6.10 |
| Antimony............ | 9¾ | 9½ |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots............ | 6.046 | 6.075 |
| Tin, Straits.......... | 53 | 53¼ |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price April 4, 1928, 16 cents.

### *New England Sales Continue at Steady Rate*

Sales of general supplies is in steady volume in the New England district. Orders for heavy industrial equipment and central-station supplies are predicted for the coming months, though at present the market is quiet. Small-motor sales are normal. Orders recently have been received for motors to replace group drive in several factories, among which are noted two shoe factories in southern New Hampshire and a prominent rubber factory in eastern Massachusetts.

New construction supplies are in good demand. With a large amount of new building to be done in the district, the volume of supplies to meet this need gives promise of showing a marked increase over that of last year. Wire, wiring devices, cable and conduit are moving steadily, outside work is advancing, floodlighting systems are receiving attention, and street-lighting projects are progressing. A plan has been proposed to establish a "whiteway" in Haverhill, Mass. Electric heating furnace sales are encouraging. A prominent manufacturer reports for the first quarter sales of seventeen pot furnaces, four box type units and three special types, aggregating about 750 kw. The Holyoke Water Power Company has received permission from the War Department to build a hydro-electric plant and plans have been prepared for a development of 40,000 hp. from four units. The United States Finishing Company, Providence, R. I., plans an addition to its textile mill, to cost $100,000.

### *Industrial Field Active in Southeast*

Such activity as is noted in the Southeast is in the industrial field. Central-station buying is considerably off. Contracts were let in connection with a textile plant in Tennessee and orders were placed for a 3,000-kw. turbo-generator and auxiliary equipment, $125,000 worth of wiring supplies, and oil circuit breakers amounting to $12,000. A switchboard order for $30,000 was recently placed in connection with the same textile plant. A small turbine and motor equipment were purchased by a Carolina textile plant at a cost of approximately $20,000. Two 1,500-kw. turbines also were ordered for use of tobacco plants in the Carolinas. A tannery in Georgia ordered 31 motors aggregating 465 hp. for use in a rebuilt plant. Building contracts which will be let in a few days include one for a silk mill in Tennessee, the electrical materials on which will approximate $15,000, and another on a bleachery in South Carolina, wiring materials transformers and motor equipment on which will be about $30,000.

The Georgia Power Company has purchased the privately owned distribution system at Lyerly and will extend its 38,000-volt transmission line a distance of 7 miles and will install a 150-kva. transformer substation to serve that town. The Georgia Power Company also has purchased the municipally owned distribution system in Bowman and will install a 150-kva. transformer substation and revamp the system for three-phase operation.

Construction news is as follows: The Southeast Power Company has acquired the municipal power plant at Nashville, Ga., and plans installation of Diesel engine-generator and other equipment. The Mississippi Power & Light Company will install a distribution system at Myrtle, Miss. The Chatham Manufacturing Company, Elkin, N. C., is building an addition to its textile mill to cost $85,000. The Duke Power Company plans a substation at Marion, N. C., to cost $50,000. The Cleveland Cloth Mills Company, Shelby, N. C., will build an addition to cost $200,000.

The Chilhowee Mills Company, Athens, Tenn., will build an addition to its textile mill, to cost $70,000. The Dixie Stock Yards, Memphis, Tenn., plan a packing plant to cost $100,000. The Virginia Electric & Power Company plans a substation at Norfolk, Va., to cost $250,000. The Central Atlantic Service Corporation, 20 Broad Street, New York, plans an ice plant at Pulaski, Va., to cost $100,000. The Carolina Power & Light Company has authorized surveys for a transmission line from Sanford to Broadway, N. C. The Southern Public Utilities Company will build a transmission line to Walnut Cove, N. C. The Tennessee Electric Power Company plans a transmission line from Nashville, Tenn., to Muscle Shoals, to cost $700,000. The Northern Virginia Power Company plans a transmission line to Kabletown, W. Va. Montgomery, Ala., and Pineville, W. Va., will install street-lighting systems.

## *Satisfactory Sales Continue in Eastern District*

Both central-station and industrial business continue active in the Eastern district. While orders are on a reduced basis, the gross volume of transactions compares favorably with sales for the same period last year. A New York power company has placed an order for substation apparatus amounting to about $300,000, while a New Jersey utility has been active in ordering substation and switching equipment. Northern New York power interests are becoming more noticeable in the market, and with comparatively small sales from this quarter up to the present time it is expected that satisfactory business will ensue. A Connecticut central-station company has been making purchases of transformers, switching apparatus and other substation equipment to a total of $90,000, and the demand is growing stronger from utilities in that section. Increasing industrial activity in certain lines is leading to corresponding advance in electrical equipment orders. There is a healthy tone to the growing inquiries for motors and kindred apparatus for paper mills, chemical plants, iron and steel works, and textile mills. A leading manufacturer of industrial motors comments upon the increasing number of new prospects now in the market for equipment, with each week developing a sizable quota of such account. Sales of automatic timing switches for plant service also show improvement. A manufacturer of sewing machines in New Jersey has placed an order for control and kindred apparatus with a prominent maker to an amount of $20,000. A paper mill has asked bids on a complete line of equipment for a new plant at Tacoma, Wash., and will soon place contracts. A chemical company at Syracuse, N. Y., is making commitments for a plant at Hopewell, Va. Another such concern at New York will purchase a considerable amount of equipment, including electric cranes, for a synthetic gypsum plant at Tampa, Fla. Newark, N. J., has asked bids for a signal system to cost about $25,000.

A prominent manufacturer of electric appliances reports excellent business in that line, with sales records for the first quarter of 1928 exceeding the figures for the corresponding period or for any other quarter of last year. Jobbers have been active purchasers, with particularly heavy demand from this quarter at Philadelphia and Harrisburg, Pa. Electric elevator business is decidedly good in the metropolitan district at the present time, with inquiries indicating continuance. The call for electric welding apparatus has been lagging for several weeks, but early revival is in sight. Electric railway business continues to show improvement. New York subways are expected to be in the market for motor apparatus for the new Flushing, L. I., extension at an early date. Business with steam railroads is on a reduced basis. Wire and cable sales have been at a low point, but current inquiries point to more sizable commitments within a short time.

Construction activities in the Eastern district include the following: The Bronx Gas & Electric Company plans a substation on Laconia Avenue to cost $100,000. The New York Central Railroad Company is asking bids until April 13 for railway motors and multiple-unit control equipment. The Signal Corps Procurement District, Governors Island, will receive bids until April 12 for 24 lightning switches (Circular 140). The Public Service Electric & Gas Company plans a switching station at Metuchen, N. J., and a substation at Princeton, N. J. The Great Lakes Portland Cement Company, Buffalo, N. Y., plans a mill near Cleveland, to cost $1,000,000. The Bethlehem Shipbuilding Corporation, Baltimore, Md., will construct an addition to cost $1,800,000. The Southern Light & Power Company has purchased the Millington Electric Light & Power Company, Millington, Md., and will build transmission lines in Queen Anne County. Patapsco Power, Light & Mineral Company, Marriottsville, Md., plans a feldspar mining mill to cost about $85,000. The United States Engineer, Pittsburgh, Pa., will receive bids until April 11 for two hydraulic turbines (Circular 358). The Board of District Commissioners, Washington, D. C., is asking bids until April 12 for six transformers for the new McKinley technical high school. The General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until April 19 for electric fans, etc. (Panama Schedule 1869).

## *March Business Improved in Middle West*

March business in the Middle West improved over that of January and February. Sales during the first quarter of the year were not quite up to the expectations expressed at the beginning of the year. Apparently there is no room for apprehension as to conditions. Building activity is getting under way. Utility companies continue active in construction work. An order placed for the construction of a substation amounted to $50,000, and another order called for 46 distribution transformers from 37½ kva. to 450 kva. Jobbers' sales are normal. Considerable municipal business is being obtained and sales are expected to improve.

Construction projects are as follows: The Udell Printing Company, Chicago, plans a new plant to cost $300,000. The Consolidated Sign Company, Battle Creek, Mich., plans a new plant to cost $100,000. The Kalamazoo Vegetable Parchment Company, Kalamazoo, Mich., plans an addition to cost $900,000. The Consumers Power Company, Jackson, Mich., plans a 35,000-hp. hydro-electric plant in the Mecosta-Newaygo district, to cost $1,500,000. The Michigan Rubber Company, Owosso, Mich., plans an addition to cost $100,000. Montpelier, N. D., plans a light and power system to be furnished by the Otter Tail Power Company. Christ Hospital, Cincinnati, Ohio, plans a power plant and laundry, to cost $350,000. Sioux Falls, S. D., is arranging bonds for $100,000, for improvements in its municipal power plant. The Modine Manufacturing Company, Racine, Wis., plans an addition to its automobile radiator plant, to cost $100,000. Cedar Rapids and Jewell, Iowa, and Neenah, Wis., plan ornamental lighting systems.

## *Buying by Industrial Plants Active on Pacific Coast*

Industrial plant buying marked the activity on the Pacific Coast. Such orders as two 1,000-kva. control switchboards, totaling $30,000, for a paper plant at Grays Harbor, Wash., power transformers totaling $10,000, for a Port Townsend paper plant, $4,000 worth of synchronous motors for ice machine service, a 187-kva. waterwheel generator, valued at $3,500, for the porcelain plant of a spark plug manufacturer, a 125-hp. slow-speed synchronous motor, valued at $4,500, for a cement mill, and a 200-hp. synchronous motor, valued at $2,500, for a Nevada mining company. Another Nevada mining company ordered two storage battery General Electric locomotives, which, with nine transformers, 150 kva. and 200 kva., motor-generator set, lightning arresters and accessories, comprises an order totaling $17,500. Mining business is indeed brisk. Orders include $2,000 worth of wiring material for a gold dredger, a similar assortment for Alaska mines, and a large shipment to Mexico comprising 30 motors from 3 hp. to 75 hp. and three 75-kva. transformers, totaling $12,000. Power company orders have included one carload of 10-kv. pin-type insulators, valued at $5,000, for the Fresno district, $3,000 worth of weatherproof wire, $1,000 worth of hardware for the Turlock irrigation area, and 200 ranges, valued at $20,000, principally for the Tulare and northern California areas.

A decided improvement in motor sales is reported by Seattle concerns and includes 50 machines, from 125 hp. down, to a pulp and paper mill in the Grays Harbor district, 25, from 30 hp. down, to a pulp mill in Bellingham, and approximately 100 small motors from 15 hp. down, mainly for irrigation and orchards and the remainder divided between woodworking and industrial sources. The city of Seattle is expected to call for bids for furnishing and installing network protectors and cable material to cost about $200,000 including installation. An ordinance is before the Bremerton city council providing for the installation of a street lighting system to cost about $22,000.

Construction projects are as follows: The Pacific Fruit Express Company, San Francisco, will build a refrigerator car repair shop at Tucson, Ariz., to cost $225,000. Los Angeles plans a substation at Venice, to cost $80,000. The Western Oil & Refining Company, Martinez, Calif., plans a new plant to cost $350,000. The Mechow-Pateros Growers Association, Pateros, Wash., plans a cold storage plant to cost $90,000. The Wenatchee Produce Company, Wenatchee, Wash., plans a cold storage plant to cost $100,000. The Great Northern Railway Company, St. Paul, Minn., plans a repair shop for electric locomotives at Wenatchee, Wash., to cost $100,000. The Puget Sound Power & Light Company, Seattle, Wash., plans transmission lines in Louis County, to cost $80,000. Montesano, Wash., will install ornamental lighting system. The British Columbia Electric Power & Light Company, Victoria, B. C., plans a distribution station to cost $250,000.

### *Building Material Demand Steady in St. Louis*

Important orders in the St. Louis district include four motors, amounting to $6,000 for the oil district, substation equipment for southern Illinois amounting to $35,000, and four generators, to cost $10,000, for connection with Diesel engines. Jobbers and retail dealers report business in building and line construction materials holding up to last year's level, also a good demand for electric ranges.

Construction projects are as follows: The Varnell Lumber Company, Hampton, Ark., plans a local power plant and system. The Kansas State Industrial Reformatory, Hutchinson, Kan., plans an addition to power plant to cost $50,000. The Waxide Paper Company, Kansas City, Mo., plans a mill at St. Louis, to cost $250,000. The Kansas City Fibre Box Company, Kansas City, Mo., plans an addition to cost $750,000. The Great Atlantic & Pacific Tea Company, New York, plans a baking plant at St. Louis, to cost $650,000. The B. F. Goodrich Company, Akron, Ohio, plans a factory branch and distributing plant at St. Louis, to cost $100,000. The Great Plains Mill & Elevator Company, Enid, Okla., plans a new flour mill, to cost $200,000. The Syndicate Power Company, Abilene, Tex., plans a hydro-electric plant on the Colorado River. The San Antonio Tanning Company, San Antonio, Tex., plans a plant to cost $100,000. The Ewauna Box Company, Klamath Falls, Ore., plans a branch mill at San Benito, Tex., to cost $200,000. Amite, La., Muskogee, Okla., and Bossier City, La., plan ornamental lighting systems.

# Activities of the Trade

## Standard Underground Makes Organization Changes

A. B. Saurman, formerly vice-president and general sales manager of the Standard Underground Cable Company, Division of General Cable Corporation, Pittsburgh, has been made vice-president and consulting general sales manager and will continue his headquarters at the general offices in Pittsburgh, upon his return from the South, where he has been for some time on account of ill-health. Harold P. Childs has been made general sales manager. Mr. Childs was formerly vice-president in charge of sales and advertising for the Servel Corporation and previous to that served with the General Electric Company in the executive office under Anson Burchard, vice-chairman of the board, and J. R. Lovejoy, vice-president.

## Hydroil Sales Corporation Changes Name

The Hydroil Sales Corporation of Lebanon, Ind., having purchased a factory and broadened its operation to include manufacturing as well as engineering and selling, has changed its name to the Hydroil Corporation. The company in making this change felt that the new name conveys a more complete understanding of its operation.

## Celoron Company Builds New Laboratory

A new laboratory has just been completed by the Celoron Company, division of the Diamond State Fibre Company, Bridgeport, Pa. The company manufactures virtually all its own raw material, making its own paper, resins, etc. The new laboratory has been equipped with facilities for making electrical, physical and chemical tests on its products both during the process of manufacture and as a finished article, and also for doing research work. The laboratory building is a two-story brick structure 42 ft. by 53 ft.

## Edison Appliance Appoints Simplex Division Manager

Following the acquisition of the wall outlet appliance business of the Simplex Electric Heating Company, Cambridge, Mass., by the Edison Electric Appliance Company, Inc., Chicago, the Edison company announces that H. K. Dewees will be manager of the Simplex division at 5600 W. Taylor Street, Chicago. Mr. Dewees was formerly assistant appliance division manager of the Edison company. He is succeeded by J. Eugene Armes of the "Hotpoint" appliance sales division of the Edison company. The sale of the wall outlet appliance business of the Simplex company was announced in the Feb. 11, 1928, issue of the ELECTRICAL WORLD.

The Simplex business will retain its own identity and virtually the same sales personnel. All the present appliances in the Simplex line will be continued with the probable addition of some new items in the near future. The nation-wide system of service stations which the Edison Appliance company maintains will be available to all Simplex dealers.

THE ERICSON MANUFACTURING COMPANY, Cleveland, manufacturer of "C & E" safety handles, etc., is now marketing an insulated guard which consists of a metal framework to which the necessary thickness of rubber is added. The guard is primarily for use with the "C & E" safety handle made by the company, but also may be used where any loose guard is required.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces that William M. Bradshaw, manager of the meter engineering department, and 39 of his engineers have been transferred from the main plant of the company at East Pittsburgh to the Newark works at Plane and Orange Streets.

THE MARTINDALE ELECTRIC COMPANY, 1260 West Fourth Street, Cleveland, announces its new double-duty commutator stones.

THE WORTHINGTON PUMP & MACHINERY CORPORATION, 115 Broadway, New York City, announces the removal of its executive offices and export and New York district sales department to 2 Park Avenue, New York City, on or about April 1. The company also has moved its head office sales and advertising departments to the Harrison plant of the corporation, located at 421 Worthington Avenue, Harrison, N. J.

THE IDEAL COMMUTATOR DRESSER COMPANY, Sycamore, Ill., has opened a new branch office at 182 Purchase Street, Boston. New sales representatives recently appointed are as follows: C. B. Keck, Cleveland; F. D. Lawrence Electric Company, Cincinnati; O. T. Hall, Maryland, District of Columbia and the eastern part of Virginia; G. A. Brewer, Connecticut, and De-Moss Fox & Company, Michigan and Toledo, Ohio.

THE DAMPNEY COMPANY OF AMERICA, Hyde Park, Boston, announces that the sale of its "Apexior" protective coatings for power plant equipment will be handled in North Carolina, South Carolina, Florida, Tennessee, Georgia, Alabama, Mississippi and Louisiana by Nevill & Cleary, Inc., Candler Building, Atlanta. The new agents have branch offices in New Orleans and Tampa.

# New Equipment Available

## Steel Poles

The Truscon copper bearing "Weltrus" steel poles have been placed on the market by the Truscon Steel Company, Youngstown, Ohio. The pole is composed of two channel leg or chord members formed in one continuous length from special sections of copper-bearing steel. These members are connected at suitable intervals by a continuous lattice web member made from plain or round sections, thus forming a simple Warren truss. The web member is autogenously welded by automatic machinery which accurately regulates the time, current and pressure uniformity of each weld. The manufacturers claim that the "Weltrus" pole is a very economical type which will resist a very large transverse load per pound of pole weight, or per dollar of first cost.

*Portion of channel member and web section of "Weltrus" steel pole*

## Time Switch

A new Sauter time switch with a fourteen-day key-wound clock is being offered by R. W. Cramer & Company, 136 Liberty Street, New York. The clock has a six-jewel lever escapement. Only six full turns of the winding key are needed to wind the spring and the clock is so designed that overwinding is not possible. It is for use on circuits of not more than 15 amp. A cast-aluminum case is used and the case lock can be operated only with the clock-winding key. Every switch undergoes an insulation test of 2,500 volts, although not intended for circuits normally over 250 volts. One type of this switch, the S-15-II-W, can be furnished with a Sunday cut-out.

WELDER TRACTOR COMBINATION.—An improved combination of electric arc welder and Fordson tractor is now offered by the General Electric Company. The principal improvements consist of the substitution of a new type welding equipment and the addition of head and tail lights and a protective cover. This outfit is being marketed direct by the General Electric Company. The older outfits utilized General Electric welding equipment but were not sold by that company.

INDUSTRIAL LIGHTING UNIT.—The "Factrolite" unit, an RLM dome with adjustable features, has been placed on the market by the Bryant Park Electric Lamp Company, 330 West 42d Street, New York. The unit consists of an ivory-enameled aluminum reflector, translucent glass diffuser and adjustable aluminum holder which will permit correct focusing for any lamp from 100 watts to 500 watts. By using a wire holder and a metal or glass diffuser disk the reflector may be suspended in an upside down position for indirect or semi-indirect lighting.

## Arc Welder

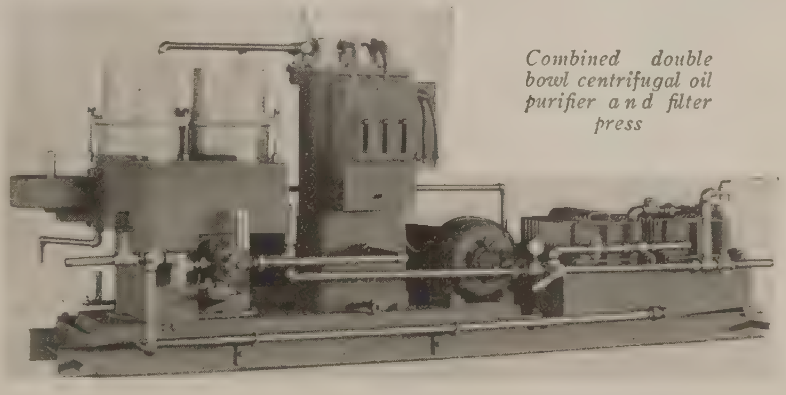
A new 200-amp. single-operator welding set, designed to meet every requirement in both the shop and field, has been developed by the Westinghouse Electric & Manufacturing Company. The set is started by connecting directly across the line. A single rheostat varies the arc current over the entire welding range. Accurate adjustment over the welding range, from 60 amp. to 300 amp., is afforded by steps of 5 amp. The motor-generator and control equipment are assembled in a totally inclosed frame. The exciter, which is overhung from the motor end, is securely fastened to the unit frame. The set can be operated while suspended at any angle that could possibly be required in any application. The motor is wound for 220 or 440 volts and is assembled with the necessary connections made for operation from a three-phase, 60-cycle circuit. If it is desired to operate the unit from a 440-volt, three-phase, 60-cycle circuit it is only necessary to replace the operating coil on the magnetic starter and to reconnect the motor leads.

## Transformer for Post-Top Mounting

A new form of street-lighting transformer especially constructed for mounting on the top of a trolley pole has been designed by the General Electric Company. The new design simplifies the installation problem by eliminating the necessity of drilling the pole for the secondary leads. A support just below the top of the transformer carries insulators to which are dead-ended the street-lighting cable. The primary leads are connected to these, while the secondary leads go through the pole and out into the units through the brackets, thus leaving no exposed wires.

## Oil Purifier

A large-capacity oil purifying machine, the F-100, has been placed on the market by the Hydroil Corporation of Lebanon, Ind. In basic principle the large capacity machine is similar to the smaller Hydroil machine but uses twin bowls, goes through a heater which oil, before it passes into the centrifugal bowls, passes through a heater which raises the temperature to the point at which the impurities are most easily separated out. Twin bowls are employed to keep the diameter of each bowl small, thus giving high centrifugal separation efficiency and the large capacity needed by present-day large power stations. After the oil leaves the bowl, it passes through a pressure settling tank, where all air is separated from the oil. It then passes through a twin filter press. This filter is so designed that one-half of the twin press only is in operation at any one time. All the dirt, water and sludge is removed by centrifugal separation, while the filter press removes the fine particles of carbon that cannot be separated by centrifugal force.



*Combined double bowl centrifugal oil purifier and filter press*

After the oil has passed through the filter press, it can be passed through a continuous test chamber. The test chamber can be so connected with a relay and by-pass valve that only oil of the desired dielectric strength can pass through to the switch tank, transformer or storage tank. The machine is made in stationary and portable models and in combinations to suit any condition.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued March 13, 1928)

1,662,446. Metal Foil Electrode; R. H. Wappler, Yonkers, N. Y. App. filed Jan. 14, 1924. Suitable for use in supplying electric currents to the skin of a patient.

1,662,508. Alternating-Current Motor; S. G. Nottage, Murraysville, Pa. App. filed March 13, 1924. Phase-converting apparatus.

1,662,548. Testing Device; H. R. Van Deventer, New York, N. Y. App. filed Feb. 14, 1924. Which may be used to make tests to discover the nature and location of trouble in electrical circuits as induction coils, lighting circuits, motor or generator armatures, fuses, relays, and various types of wiring.

1,662,549. Method of Speed Regulation for Polyphase Induction Motors; K. von Kando, Budapest, Hungary. App. filed Feb. 28, 1922. By means of changing the pole connections and employing all the coils of the winding in each arrangement.

1,622,555. Universal Bottle Heater; E. Wojciechowski, Aberdeen, Wash. App. filed Dec. 18, 1926.

1,622,556. Thermostatic Control Device; J. C. Woodson, East Pittsburgh, Pa. App. filed June 23, 1926.

1,622,559. Regulator System; J. H. Ashbaugh, Pittsburgh, Pa. App. filed Dec. 4, 1924. Means for extending the range of operation of vibratory regulator systems.

1,622,677. Rotary Relay; C. F. Jenkins, Washington, D. C. App. filed July 21, 1924. For controlling the speed of distant motors, and has for its particular object means for controlling motor speeds by radio.

1,622,697. Time Switch; J. Clifton, J. Robinson and J. Spencer, London, England. App. filed May 5, 1922.

1,622,746. Electric Superheater; E. Howe, San Gabriel, Calif. App. filed Feb. 17, 1927. An electric element for boiling water in boilers for producing steam for steam heating.

1,662,771. Resistance Unit; G. H. Whittingham, Baltimore, Md. App. filed May 8, 1926. Composed of wire coils wound on bodies of refractory material, such as porcelain.

1,662,805. Electrical Stove; H. Frank, Hartford, Conn. App. filed July 23, 1926. Portable type.

(Issued March 20, 1928)

16,908 (reissue). Drink Heater; J. W. Rittman, J. Rood, and W. Driver, Racine, Wis. App. filed July 28, 1923.

16,912 (reissue). Electric Switch; J. D. Hilliard. Schenectady, N. Y. App. filed Feb. 8, 1921. Oil circuit breaker.

1,662,817. Plug for Electric Connections; A. C. Bollmann, St. Louis, Mo., and W. Davies, Granite City, Ill. App. filed Sept. 28, 1922. As electric irons, toasters, etc.

1,662,822. Terminal; M. J. Dunne, West Orange, N. J. App. filed May 2, 1922. For use in welded electrical connections as a rail bond.

1,662,835. Electrical Measuring Instrument; A. R. Rutter, East Pittsburgh, Pa. App. filed March 12, 1926. Watt-meter.

1,662,858. Automatic Control Device for Electric Arc Welding Apparatus; W. R. Hume, Melbourne, Victoria, Australia. App. filed Sept. 21, 1925.

1,662,866. Secondary Battery of Accumulator; E. A. Salazar, Madrid, Spain. App. filed Dec. 14, 1925.

1,662,881. Armature Winding Machine; P. E. Chapman, St. Louis, Mo. App. filed March 22, 1924.

1,662,889. Electric Converter; A. S. Hubbard, New York, N. Y. App. filed Dec. 6, 1922.

1,662,920. Operating Mechanism for Timepieces; N. D. Holbrook, Thomaston, Conn. App. filed Sept. 2, 1926.

1,662,935. Electric Steam Radiator; J. B. Odell, Riverside, Calif. App. filed June 6, 1927.

1,662,970. Safety Device for Electric Lines; C. Grosse, Berlin-Hermsdorf, Germany. App. filed June 12, 1925. Automatic device for domestic service.

1,662,979. Circuit Closer; P. R. Nelson, The United States Army, Fort Totten, N. Y. App. filed May 7, 1927. Granted under the provisions of the Act of March 3, 1883. Used in the operation of submarine mines.

1,662,987. Light Signal; C. S. Snavely, Pittsburgh, Pa. App. filed July 20, 1923.

1,662,988. Train Signal System; E. C. Stafford, Philadelphia, Pa. App. filed March 7, 1921.

1,663,005. Solderless Connecter; L. E. Hendee, Milwaukee, Wis. App. filed June 16, 1924.

1,663,007. Electric Conductor Support; E. H. Jacobs, Chicago, Ill. App. filed Jan. 31, 1919.

1,663,011. Line Conductor Insulator; W. D. Kyle, Milwaukee, Wis. App. filed Sept. 19, 1924. Adapted for attaching conductor wires to buildings.

1,663,013. Battery Terminal; T. P. Logan, Columbus, Ohio. App. filed May 19, 1924.

1,663,030. Cigar Lighter and Advertising Cabinet; C. J. Underwood and J. A. Underwood, Huntington Beach, Calif. App. filed March 16, 1925.

1,663,062. Can Cap Soldering Apparatus; A. E. Roe, Oakland, Calif. App. filed March 28, 1927.

1,663,081. Snap Switch; H. Hertzberg, Brooklyn, N. Y. App. filed April 17, 1926.

1,663,086. Means for Indicating Frequency Changes; M. B. Long, Glen Ridge, N. J. App. filed March 4, 1924.

1,663,113. Electric Soldering Device; S. Clayton, Chicago, Ill. App. filed May 18, 1925. Designed especially for use by jewelers and watch makers.

1,663,137. Electric Spot Welding Machine; R. Mack, Berlin-Tempelhof, Germany. App. filed Feb. 20, 1925.

1,663,138. Switch Operating Mechanism; C. F. Parker, San Francisco, Calif. App. filed Jan. 28, 1924. Interlocked for controlling two circuits as range and water heater circuits.

1,663,153. Pole Supporting Device; A. W. Bensley, Pawtucket, R. I. App. filed Sept. 22, 1927.

1,663,179. Renewable Fuse; F. J. Roth, New York, N. Y. App. filed Sept. 10, 1926.

1,663,187. Multiple Timer; T. J. Barrett, Los Angeles, Calif. App. filed May 20, 1925.

1,663,193. Storage Battery; F. P. Danna, Plaquemine, La. App. filed June 4, 1927.

1,663,200. Resistance Welding Machine; A. Jonsson, Helsingborg, Sweden. App. filed Nov. 10, 1926.

1,663,252. Fuse Holder for Electrical Circuits; M. B. Herbrick, Omaha, Neb. App. filed April 3, 1926.

1,663,255. Electric Pipe Heater; L. P. Hynes, Albany, N. Y. App. filed Nov. 25, 1924.

1,663,258. Electrode Clamp; J. W. Meadowcroft, Philadelphia, Pa. App. filed Jan. 31, 1925.

1,663,264. Lamp Retainer for Lamp Sockets; D. N. Thompson, Syracuse, N. Y. App. filed Sept. 13, 1922.

1,663,318. Electric Machine; T. Schou and R. L. Behrens, Mansfield, Ohio. App. filed June 4, 1923.

1,663,325. Automatic Switch Mechanism; C. H. Wolff, St. Louis, Mo. App. filed Jan. 18, 1926. For opening the circuit of the split-phase winding of a single-phase motor when a suitable speed has been attained.

1,663,333. Fuse; J. H. Carmean, Kansas City, Mo. App. filed Nov. 2, 1925. Adapted to function by absorption of heat from external sources.

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Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A sole agency is desired in Amsterdam, Netherlands (No. 30,463), for electric advertising novelties.

An agency is desired in Alexandria, Egypt (No. 30,365), for household electrical equipment, domestic appliances and wiring supplies.

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Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

# New Trade Literature

TIME SWITCHES.—R. W. Cramer & Company, 136 Liberty Street, New York City, has issued bulletin F, in which it describes and illustrates the Sauter type S-15-II electric time switches. Wiring diagrams show the application of the switch to a two wire or three wire system.

SOLDERLESS CONNECTORS.—The Delta-Star Electric Company, 2400 Block Fulton Street, Chicago, Ill., has issued a bulletin covering its rigid stud compression type solderless connectors.

FUSED SWITCH.—The W. N. Matthews Corporation, 3722 Forest Park Boulevard, St. Louis, has issued a price sheet covering the No. 1317 open type Matthews "Fuswitch" with a rating of 100 amp. and 7,500 volts.

STEAM GENERATION.—The Combustion Engineering Corporation, 200 Madison Avenue, New York City, is distributing a booklet entitled "Recent Developments in Steam Generation," presented before the Engineers' Society of Western Pennsylvania of Pittsburgh, Pa., by George T. Ladd, president of the Ladd Water Tube Boiler Company. This booklet summarizes the important developments that have occurred in the field of steam generation during the past decade and discusses present trends.

ELECTRIC RANGE.—"A Complete Summer Sales Plan for the Willwear Walloutlet Electric Range" is the title of a folder prepared by the Beardsley Manufacturing Company, Waterbury, Conn. It contains booklets and pamphlets for distribution and posters for display signs, etc.

ELECTRIC APPARATUS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-916, describing its electric apparatus such as motor-generators, transformers, synchronous motors, induction regulators and rectifying equipment for use with the Cottrell precipitation process.

ELECTRIC FURNACES.—Bulletin No. 5 issued by the Ajax Electrothermic Corporation, Ajax Park, Trenton, N. J., describes the new Ajax-Northrup motor generator type furnaces and equipment. The principle of operation is illustrated and described.

POLES.—The MacGillis & Gibbs Company, Milwaukee, is distributing an illustrated booklet describing a trip through one of its cedar pole yards at Minnesota Transfer, Minn. A photograph compares the grading prior to 1925 and since that time to show the improving standards of quality now being maintained.

TRAFFIC SIGNALS.—The Crouse-Hinds Company, Syracuse, N. Y., has issued catalog No. 224 covering its electric traffic signals and control equipment. It contains illustrations showing typical installations and also its various types of lamps, cabinets and mountings. Information signs for pedestal and horizontal bracket type signals are also included.

PORTABLE COMPRESSORS.—The Ingersoll-Rand Company, 11 Broadway, New York City, has issued the sixth edition of its booklet entitled "100 and 1 Ways to Save Money with Portable Compressors." It contains comparative cost data on its portable air compressors and air-operated tools. Figures are presented on a man-hour basis so that they can be applied to local conditions. Tables are included to show the number of tools that any given portable compressor will operate. The book is profusely illustrated with applications of portable air compressors and air-operated tools to various jobs.

ELECTRIC FURNACES.—Bulletin No. 4 issued by the Ajax Electrothermic Corporation, Ajax Park, Trenton, N. J., describes and illustrates the Ajax-Northrup furnaces for small production and experimental laboratory work operated from 3-kva., 15-kva. and 35-kva. frequency converters. The use of the furnace and its principles are described and illustrated. The historical development of the company is included and a chart shows the growth in sales from 1917 to the present time.

MOTORS.—Sterling Electric Motors, Inc., Telegraph Road at Atlantic Boulevard, Los Angeles, is distributing a pamphlet describing the Sterling "Cross-Line" electric motors.

FOOD MIXER.—The Reynolds Electric Company, 2650 West Congress Street, Chicago, is distributing bulletin No. 603 covering the 12 quart mixer suitable for commercial as well as domestic purposes.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## The Trend Toward 115 Volts

WE HAVE heard much, in these recent years, of simplification in manufacture by reducing the excessive number of sizes and styles of certain commodities. In the electrical industry a reduction in the number of different distributing voltages greatly decreases the number of different kinds of lamps required. Complete unification, with one universally adopted value (and the maintaining, in practice, of the actual service voltage at the announced nominal), would result in more uniform operation of appliances, especially heating devices, that now have to perform in some fashion under a variety of conditions.

Complete unification has not yet arrived, but a strong trend toward standardization is evident from a comparison of data on distribution voltages for 1928 with corresponding figures for 1923. These are to be found in the booklet on central-station voltages recently issued by the lamp committee of the National Electric Light Association. Service at 115 volts increased from 38.5 per cent of the total to 58.8 per cent in terms of population served and from 35.6 per cent to 68.2 per cent in terms of number of communities served. Service at 110 volts decreased from 33.6 per cent to 14.8 per cent of the population served, whereas that at 120 volts increased from 11.3 per cent to 20.8 per cent. The drift is therefore distinctly toward standardization at 115 volts, but with a stronger leaning than formerly, or at least a more uniform leaning, toward the next higher voltage step.

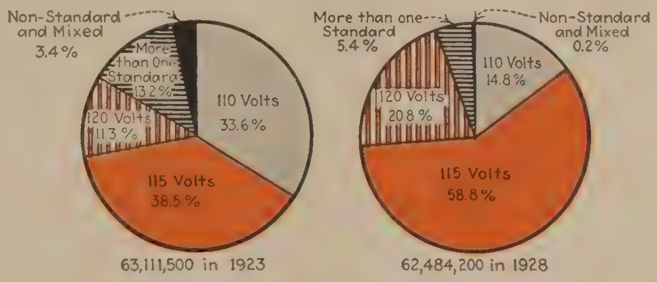
Of equal significance is the reduction in the population served at more than one standard voltage from 13.2 to 5.4 per cent, and the virtual elimination of service at other than the three standard voltages or service at several voltages in the same community.

Even these figures scarcely tell the whole story. Thus, the entire state of New Jersey is served at 115 volts, with the exception of four small communities having either municipal or local private plants, all of which operate at 110 volts.

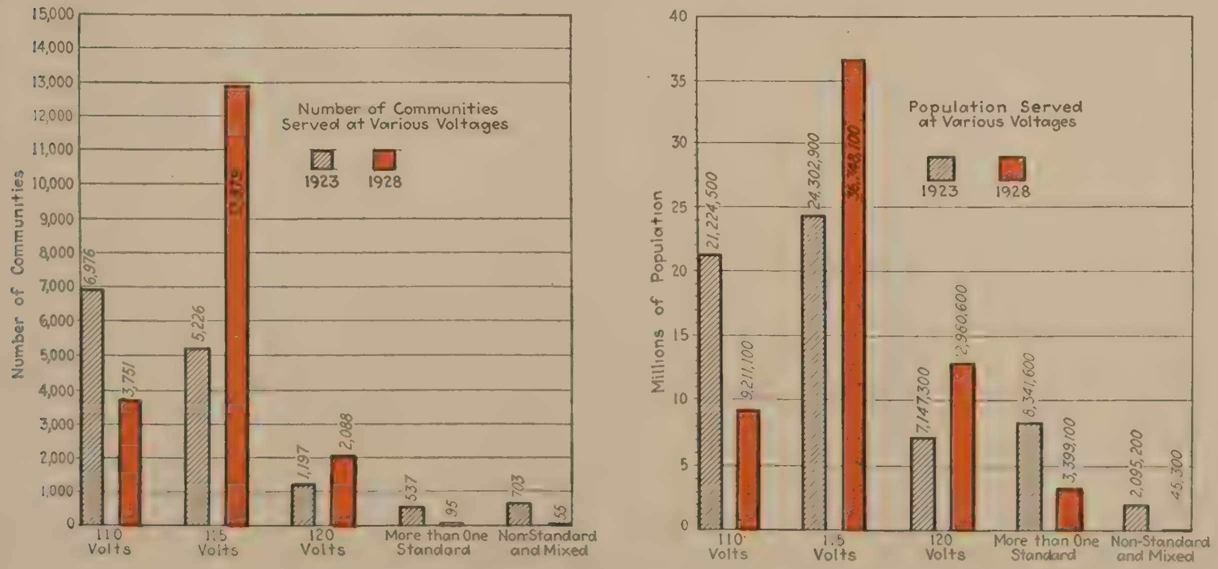
Unification of voltage has apparently been favorably influenced by the consolidation of small operations into larger systems, for with rare exceptions the service voltage in all parts of a given system is the same; in the period of their separate operation that was not necessarily the case.

The number of communities now listed exceeds that in the survey of 1923 by more than 4,000. The actual number of new ones is somewhat greater than that because of the dropping of some on which no information was obtainable. The change is obviously confined to very small communities; the population accounted for is substantially the same as before.

The statement of total population served, 63,111,500, is probably conservative, for three reasons: (a) There has been a very considerable increase in population, particularly in our larger cities, since the 1920 census, on which it is based; (b) it is almost impossible to avoid omitting the population, often considerable, just outside the corporate limits of cities except by estimating; (c) no provision can be made in such a survey for the purely agricultural population represented by the 300,000 to 350,000 farm customers.



Population of Communities on which Analysis is Based and Per Cent of Population Served at Various Voltages



*Service at 115 volts now predominates*

# More Than Seasonal Gain in Middle Atlantic States Industrial Activity

MANUFACTURING plants in the Middle Atlantic States witnessed a slightly more than normal seasonal increase in activities during February, and the productive activities of these plants were also about 12.5 per cent over those of February, 1927. It appears that industrial conditions in this section during February were slightly better than those characterizing industry in the nation as a whole.

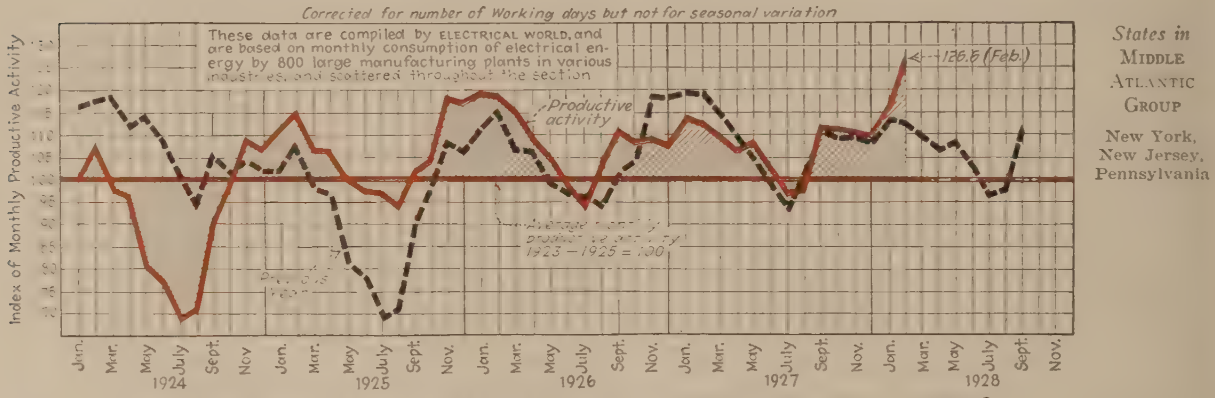
During February five of the section's primary industries—chemicals and allied products, ferrous and non-ferrous metal working plants, rolling mills and steel plants, paper and pulp, and textiles—witnessed productive activities materially over those reported for February, 1927. On the other hand, both the leather and its products industry and the paper and pulp industry were operating slightly below February, 1927. It now seems probable that the volume of industrial production during the first quarter of the current year was between 7 and 10 per cent over that reported for the same period last year.

*Indexes of Productive Activity in the Middle Atlantic States*

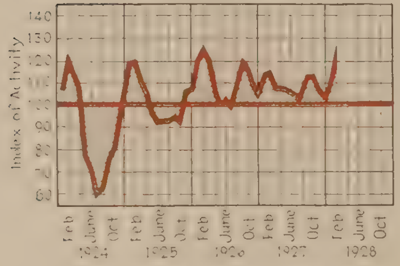
All Figures Adjusted for Number of Working Days

| | Feb., 1928 | Jan., 1928 | Dec., 1927 | Average Full Year, 1927 |
|---|---|---|---|---|
| All industries | 126.6 | 116.2 | 109.9 | 107.5 |
| Chemical and allied products | 134.0 | 129.0 | 107.3 | 108.4 |
| Food and kindred products | 103.0 | 93.0 | 97.0 | ..... |
| Leather and its products | 122.0 | 119.0 | 115.0 | 101.9 |
| Lumber and its products | 114.0 | 102.6 | 104.5 | ..... |
| Metals group | 122.6 | 112.4 | 101.4 | 107.7 |
| Rolling mills and steel plants | 120.8 | 110.5 | 101.5 | ..... |
| Metal fabricating plants (ferrous and non-ferrous) | 124.4 | 114.4 | 101.4 | 105.6 |
| Paper and pulp | 118.7 | 113.4 | 123.5 | 122.6 |
| Stone, clay and glass | 116.9 | 103.9 | 97.6 | |
| Textiles | 130.2 | 119.8 | 120.0 | 108.4 |

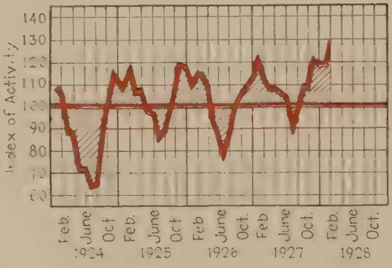
ELECTRICAL WORLD *Barometer of Industrial Activity in the Middle Atlantic States*



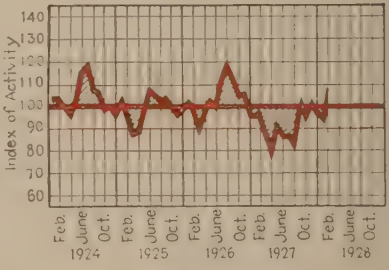
GENERAL INDUSTRIAL ACTIVITY IN THE MIDDLE ATLANTIC STATES



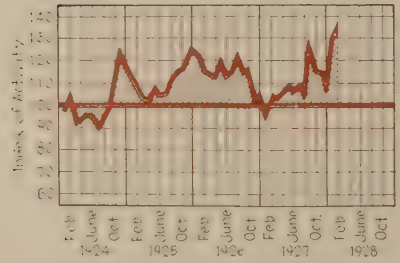
Metal Industries



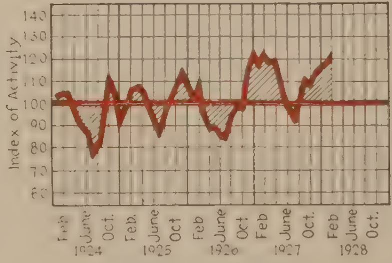
Textile Industry



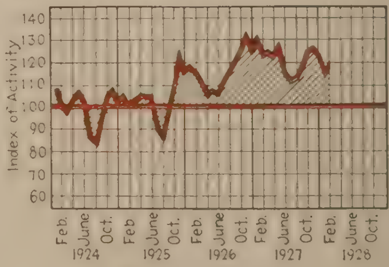
Food Industry



Chemical and Allied Products



Leather Industry



Paper and Pulp

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES
OF THE MIDDLE ATLANTIC STATES

# Electrical World

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W. H. ONKEN, JR.
*Editor*

VOLUME 91 *New York, Saturday, April 14, 1928* NUMBER 15

## *Well-Earned Success of the Southwestern Division*

IN MANY respects the Southwestern Geographic Division of the National Electric Light Association may well serve as a model for other sections. Its committees are active, concern themselves with the everyday intimate problems of the region, and their work so commends itself to the executives of the public utility companies that they give the division their whole-hearted support. There is now apparent a wonderful spirit and cohesion in the public utility field in the five states constituting the Southwestern Geographic Division, brought out into bold relief no doubt by the problems and circumstances of the devastating flood which last year swept over Arkansas, Mississippi and Louisiana. There is also apparent a great faith in the ultimate development of territory not particularly blessed with natural resources but possessing latent fertility and desirable climate.

It is an inspiration to electric light and power men from other sections to witness the rapid extension of circuits into virgin territory all through this region. Nothing could more clearly prove the confidence which public utility operators have in the ultimate development of local resources than the utility companies' own great investment. It is this spirit—the spirit in which empires are built—that accounts for the remarkable progress recorded last year in the Southwest. The same determination to will and to do was plainly manifest in the convention of the division at Edgewater Park, Miss., last week. Association work which enables companies engaged in it to show a growth three to four times greater than the normal for the whole country certainly merits executive support. Not that association work of itself will perform miracles, but because it inspires effort and equips those eager to work with the necessary facts and imbues them with the enthusiasm to accomplish results. The results achieved by the Southwestern Division speak eloquently of hard work delighted in.

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## *Creating a Permanent Money Market*

ONE of the nation's largest operating power and light companies states in its annual report that the cumulative effect of selling stock to customers continuously over the past ten years was manifest in facilitating the sale and distribution of its securities during 1927. Junior financing carried on in this way, the report shows, totaled more than $30,000,000.

At a time when the proportion of financing carried on through direct sale to customers is declining—it dropped from 23 per cent in 1925 to 19 per cent in 1926 and to 11 per cent last year—it may be worthy of consideration that, for one company at least, customer sales have had a value beyond merely the raising of a specific amount of money in any one year and the improvement of public relations. The policy persisted in has developed what may be regarded as a permanent money market for junior financing. The company in question has combined customer sales with the issue of rights. The existing number of its shareholders is exceedingly large, and all of these are readily available potential buyers of future issues. Furthermore, the policy has reduced selling costs radically. An official of the company stated to the ELECTRICAL WORLD recently that "the cost of selling securities through our customer ownership campaign is, on the average over a ten-year period, about 60 per cent cheaper than the cost would have been for other modes of financing. The figures for cost are used in the underwriting sense and do not take into account the yield on the types of securities in question, which would enter into a computation of real cost of money to the company."

In the present easy money market it would be an error to overlook the advantages of customer sales in junior financing.

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## *New Order in Production*

AGITATION to amend anti-trust laws is acute because production is ahead of consumption and because restrictive legislation has made industrial prosperity rest upon ability to reduce costs and not upon selling prices. It is argued that industrial law should be based upon the economic requirements of the country and that these requirements indicate a monopoly in many industries, with public control of unreasonable profits. It is said that the time has arrived to make industrial law harmonize with economic life.

Industry is moving toward a new order in this country, and electricity has had a decided influence on the new form industry is taking. The enormous plant in one location has been found uneconomical and is giving way to the use of multiple production plants located in local marketing areas or where labor, raw materials and taxes give advantages. There has been found an economic limit to size in an industrial plant, and as a consequence of this fact industry is decentralizing its production. The cement, gypsum, steel and textile industries are building plants in many territories, and the size of these plants is dictated by minimum production cost figures. These multiple plants are then tied into a national executive and sales organization which affords each plant the best executive and sales talent. These industries have found this method best to meet present economic conditions.

Electric utilities should back this decentralized industrial plant movement and should study carefully proposed industrial legislation. Decentralization is made possible largely because electric power is available alike in large and small communities, and the utilities can help national conditions and themselves by taking power to any locality where raw material and workers demand it. All elements in a community benefit from industrial decentralization, and much better social and economic conditions are created.

Carried to its logical conclusion, however, decentralized industry means the creation of monopolies to insure the fullest economic benefit to both capital and labor, and serious thought should be given to legislation so that this type of industrial progress may be directed along lines which make for public wellbeing.

* * * *

## *Service and Its Definition*

UTILITIES, more than almost any other industry, labor under the banner of service. The word has been vastly misused, but, as applied to electric light and power companies, it involves the supplying of electrical energy when, where and in such manner as the customer may desire it. It means the supply of uninterrupted, steady potential energy at prices commensurate with a fair return to the security owners of the utility. It involves an obligation to technical and economic progress. Grand gestures, endless words, devout protestations of altrusim, full-page self-eulogies in the newspapers or blatant electric signs are not proof of service. The word does not involve, necessarily, the repetitive annoyance of high-pressure appliance and stock salesmen at the customer's front door, nor does it include undue corporate activity in politics. Service is fundamentally the only thing that a utility has to sell—good service—more service—better service.

* * * *

## *A Convention Echo*

IN THE non-technical world it is freely accepted that engineering is a romantically absorbing phase of modern life. The glorious accomplishment of the seemingly impossible and the spectacular element in successive triumphs leave the lay mind in bewildered appreciation. There is, however, in this same non-technical world a definite impression that engineers, as individuals, are tremendous bores. Possibly it is because as a class they tend to do much and say comparatively little. When a technical meeting is over and the last listless word has been said the listener may well wonder if this reputed dullness of the engineer is not a very real characteristic, for inflectionless voices, muffled murmurings and the reading of quivering pages, interrupted only by furtive glances at the audience, are the rule rather than the exception. That the subject matter is theoretical, or involved, or specialized, or a part of one's every-day life, does not bar it from an interesting, or at least interested, presentation. It is said that one of the great actors of yesterday could, and did upon several occasions, recite the alphabet or multiplication table with true emotional values.

The speakers at the last annual meeting of the American Society of Mechanical Engineers were parties to an interesting experiment. A professional public-speaking coach was engaged by the meetings and program committee, and with the co-operation of a number of those who were to present papers a courageous and unusual effort was made to ameliorate the potential sufferings of the audience. This is something which should gain merit through repetition. There is one obligation that every one who speaks or writes should unfalteringly meet, and that is—to be interesting. It is not incompatible with accuracy, brevity or ability.

## *Stars in the Meadow*

THERE is, in all probability, a special, inconspicuous corner of Heaven reserved for artists—for those who work for the sheer ecstasy of creative effort. There is also, be assured, a reward for the workman who handles fine machinery with the spirit of an acolyte.

To enter a generating station in which the proportions of roof and walls have been balanced and molded with a fine sense of artistry and in which machines have been placed and designed for esthetic satisfaction is as refreshing as a cool, grass-fragrant breeze in a foundry. To see paint and metal gleaming brilliantly, to find pastel shades instead of hard reds, greens, blacks and browns, to see transformers and circuit breakers without an accompanying trace of telltale drops of oil on a spotless floor, to discover illuminating values and fixtures of perfection, to find unconstricted space around all apparatus, and to meet operating men with a simple, unboasting faith that theirs is the finest station in all the world and that they are privileged to have the task of keeping it in superlatively gleaming glory is—well, unusual.

* * * *

## *High-Voltage Cable Problems*

HIGH-VOLTAGE underground cables, when subjected to wide variations of load, pass through a temperature cycle which has long been recognized as one of the sources of trouble in this type of cable. With elevations of temperature the insulation expands, stretches the lead sheath, which is not elastic, and does not return to its original dimensions when the cable cools. The result is the formation of voids in which gaseous ionization takes place, resulting in alterations in power-factor characteristics and progressive deterioration of the insulation. Particular emphasis was drawn to this serious problem not long since in the paper at the Chicago regional meeting of the A.I.E.E. by L. Emanueli, describing the 132-kv. cables now in operation in New York and Chicago. The careful provision which has been made in these cables for meeting the trouble referred to is undoubtedly one of the most important elements contributing to the successful experience so far enjoyed by these record-making installations.

Oil-duct cables of the 132-kv. type, however, involve elaborate auxiliary equipment in the way of reservoirs, pressure tanks, junction boxes and the like, and it is not as yet evident that these auxiliaries are always justified for cables of moderate voltages. The danger arising from excess-temperature cycles in these cables must therefore be met in other ways. The paper of T. N. Riley in the ELECTRICAL WORLD of Jan. 21 is an interesting discussion of this phase of the general problem. It is a plea for conservative design and for a more careful scrutiny than is usual of the electric performance of cables after installation. In fact, he advocates the study of the changes in the power-factor-voltage relation following the extreme temperature cycles which may occur. The presence of dangerous voids manifest itself very quickly in a change in the shape of the power-factor-voltage curve. In particular, Mr. Riley shows that it is possible so to construct a cable that any voids that are created by a temperature cycle will occur in regions not subjected to electric stress, as, for example, in the filling of a three-phase cable in which the separate conductors have metallized wrappings. The curves indicate that a cable of this type may show an excellent power-factor performance which is well preserved after a temperature cycle corresponding to the extreme rating of the cable.

Another feature of interest in Mr. Riley's paper is his discussion of the properties of cable paper and of the impregnating oil separately. Particularly in connection with the oil, elevation of temperature is seen here also to play a very important rôle. It is evident that cable oils are anything but stable materials, and if a moderate temperature cycle can bring about great increases in power factor, it is altogether probable that continued application of electric stress causes various changes which may seriously affect not only the power factor but also the life of the cable. There is too little information available on the properties of oils, and the problems associated with them offer a fine opportunity for experimental investigation.

* * * *

## *Abolish the "Gypper"*

LET any business show signs of prosperity and it attracts a horde of parasites whose existence depends upon their ability to capitalize upon and at the same time undermine the good name and reputation which that business has built up through honest service and costly development. In the electrical industry there is a particularly virulent and obnoxious type of this parasite—the "gyp." It might not be so bad if there were but one of the species, but the "gyp" comes with variations. There are "gyp" dealers, "gyp" jobbers, "gyp" appliances, "gyp" radios, "gyp" parts, "gyp" wiring supplies, "gyp" manufacturers and gyppers who gyp for the sake of gypping. The business methods—there are no ethics—of the gyp and of gypping are familiar to every responsible man in the electrical industry. The dictionary defines a "gyp (*slang, U. S.*)" as a "swindler," which rightly puts him in the same category with the goldbrick artist or the operator of three-card monte. It's the old army game.

The sale of inferior electrical equipment has already been permitted to go too far. There have been too many sub-standard devices foisted upon the public. Not only does the sale of such products lessen the sale of reliable electrical devices made by reputable manufacturers, but, if allowed to continue, it will seriously jeopardize the fair name of the electrical industry. Fortunately, in some localities it has been possible to curb the selling of sub-standard devices by passing local city ordinances which make it a misdemeanor for any merchant to sell any electrical appliance or other equipment which does not meet the requirements of the city electrical department. Where such an ordinance is in effect customers are protected against the hazard of shoddily made and dangerous merchandise. The operations of the unscrupulous dealer are thus measurably circumscribed. But this is not enough. Responsible electrical manufacturers owe it to themselves and to the electrical industry to educate the public to the value of buying reliable electrical apparatus. That the public should have to learn through experience that sub-standard merchandise is dear at any price is too costly a process to the customer and is costing the electrical industry too much in lost business and lost prestige. There should be concerted action by electrical manufacturers, reliable dealers and the central-station industry which would effectively abolish the gypper. He has no legitimate place in developing the electrical industry.

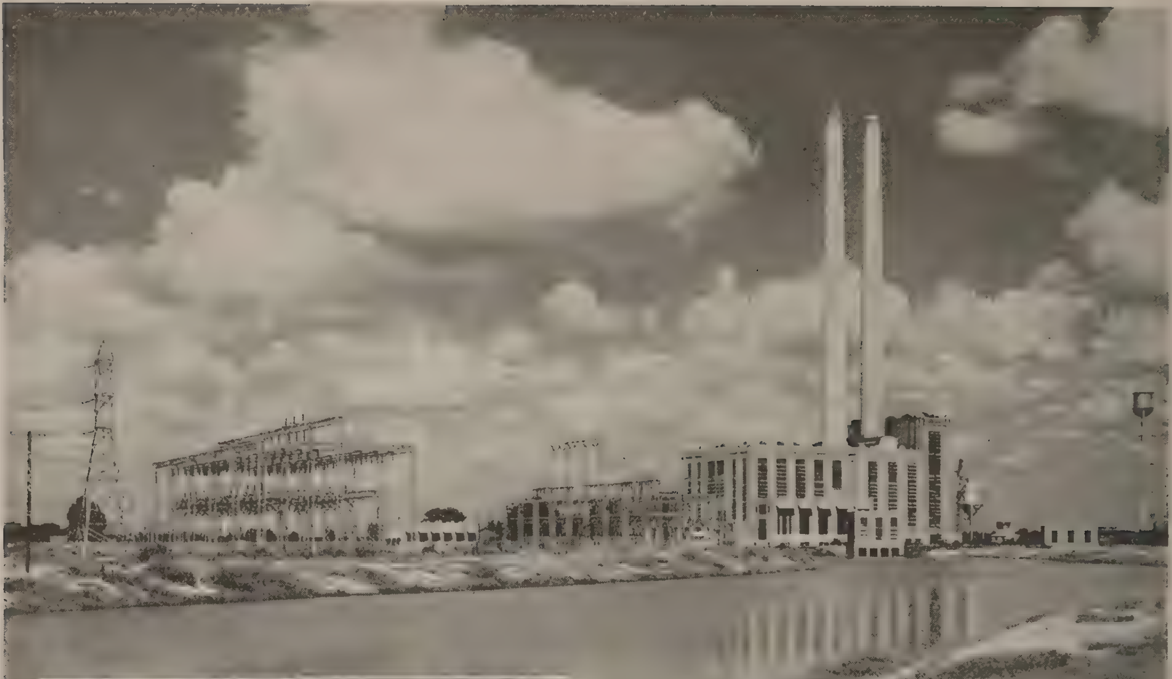
## *Making Team Play Count in Power Sales*

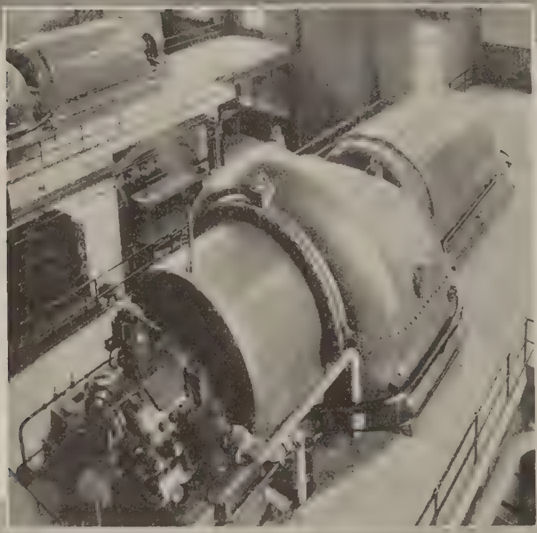
TRANSFERS of light and power company administration from individual to centralized management call for no little open-mindedness on the part of both local and headquarters executives during the readjustment period which is inevitable with such changes. Among the important problems which often have to be solved at such times is the establishment of effective team play between local power sales engineers and those of the headquarters office, assuming the customary set-up of specialists at the central point of group administration and local properties of sufficient strength to maintain one or more trained industrial men each. Failure to define the responsibilities of sales engineers at each end of the line and to provide for authoritative direction of all industrial service activities only prolongs the readjustment period, retards market development and at times, indeed, leads to actual loss of highly competitive power business.

Self-forgetful team play is the key to such situations, coupled with clear definitions of responsibility and authority. Local sales engineers are in a position to a man to render invaluable service in power business solicitation in co-operation with headquarters forces. Their residence in the territory, local acquaintances and friendships in industry, knowledge of the local system and its operating practices are the result in many cases of years of faithful work and good citizenship. These men have much to bring to the counsels of the larger organization, but if they are debarred from whole-hearted team play, whether by inability to adapt themselves to the new order, fear of diminished usefulness through sharing responsibilities and credit with "H. Q." staff members, or through the slowness of their immediate superiors to appreciate the value of specialized headquarters service in terms of recurrent annual revenue representing perhaps ten or fifteen times its initial cost, something must indeed be wrong!

On the other hand, the headquarters sales engineering staff must maintain a receptive attitude toward local ideas if the best results are to be obtained. Anything remotely resembling a "high-hat" approach to the territorial sales engineer or his customers is a colossal blunder. Team play demands many things, but among the vital requirements nothing surpasses a sympathetic and continuous desire to serve the local property's needs to the utmost ability of the entire staff. There is no room for either individual or departmental jealousies to enter into these relations.

No matter how much authority may be lodged with headquarters vice-presidents or what may be their titles, no matter how freely headquarters sales engineers may enter into negotiations with local customers or call upon them (naturally informing resident salesmen of their activities and seeking their co-operation whenever possible), it is fundamental to success that all concerned pool their abilities and their efforts for the good of the service. Absurd and indefensible practices and prohibitions often arise during the transition period between individual and centralized management, but with clear vision and a determination to work out a co-operative program for business development unhampered by nonreceptiveness to new ideas and improved methods, with a disposition and a clean field to practice teamwork: what may not be achieved!





## *Lignite Burned in New Trinidad Station*

TRINIDAD station from across the intake canal. The 132-kv. switching structure is on the left and the 60-kv. structure is in the center of the above view. The control house is in between. The operators' village as seen from station roof, with artificial cooling lake in background, is shown in the lower illustration. Water-treating plant, transformer-cooling waterspray pond, ash-disposal track and discharge canal in foreground.

# Trinidad Burns Lignite

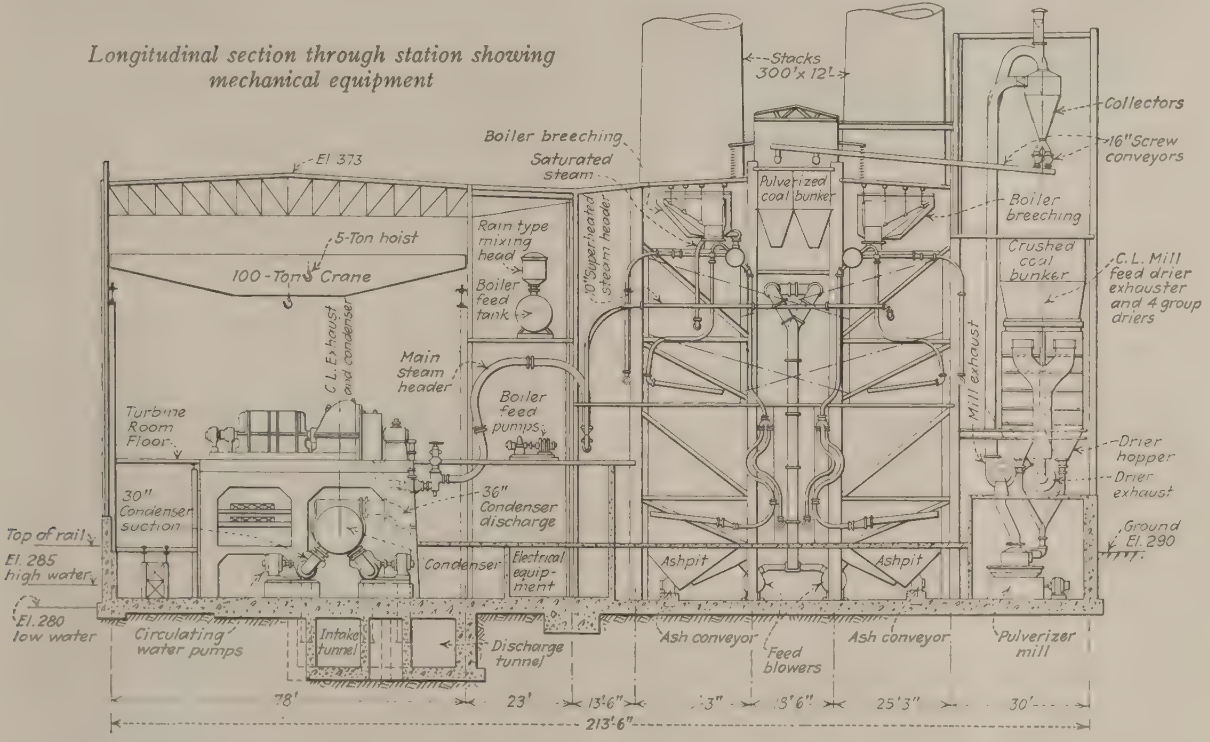
### Base-load plant of Texas Power & Light Company in operation. Details of construction and equipment. Pulverized lignite proves economical

By E. T. Keck

*Superintendent of Power Texas Power & Light Company*

ALTHOUGH the Trinidad station of the Texas Power & Light Company has been in operation only a short time, the developments leading to its erection may be traced back over a period of ten years. The territory served by the Texas Power & Light Company and interconnected companies is characterized by widely separated towns and cities and low density of rural population. The 2,400 miles of transmission line making up the company's transmission system extends 290 miles from north to south, 260 miles from east to west and is a part of an interconnected system extending over 500 miles from east to west and about 400 miles from north to south, all within the state. Consequently, the selection of a station site involved careful study to determine the probable future load center so that the station might be developed to its economical capacity without involving too great a transmission problem. At the same time it was necessary to select a location with due consideration to availability of water and fuel. After investigation of the fuel resources, it was decided to locate the new station in Henderson County near the Trinity River and within 10 miles of an area containing an adequate quantity of lignite.

As the flow of the Trinity River varies from 20 sec.-ft. to 75,000 sec.-ft. (the period of minimum flow generally occurring at the time of the system peak load) it was necessary to create an artificial cooling lake to which water would be supplied by pumping from the river.



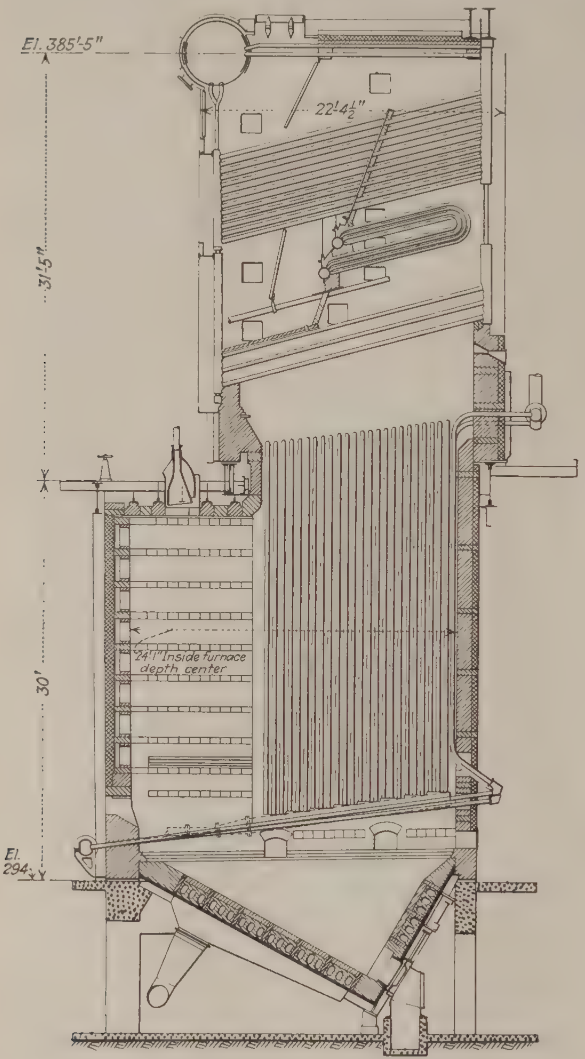
*Longitudinal section through station showing mechanical equipment*

The site chosen for the plant is on the east side of the Trinity River about 1½ miles south of the village of Trinidad and 65 miles southeast of Dallas.

It is, roughly, a rectangular plot with an area of 1,600 acres, on which are located the circulating water lake, employees' village, outdoor switchyard, control house, lignite storage yard, lignite storage tracks, storehouse, laboratory, water-treating plant and main station building. The circulating water lake covers 650 acres of this area. The buildings, switchyard, lignite storage yard and tracks are located northwest of the lake, adjacent to a natural slough which is used as a discharge canal to the east end of the lake.

Trinidad is a base-load station, but the extent of the system necessitates the division of load with several other stations for voltage regulation and prohibits carrying the entire load on the most economical plants at times of light system load.

Reliability and continuity of fuel supply are assured by the proximity of the mines, and while a large proportion of the fuel burned will be supplied from shaft mines, deposits of lignite, sufficient for six months' supply, are stripped in advance so that fuel may be delivered to the station by only a shovel and train crew. In addition, a month's fuel supply is kept in storage at the plant for emergency purposes to insure against failure of delivery from the mines.



*Sectional elevation of boiler and furnace*

All station auxiliaries, with the exception of one turbine-driven boiler feed pump and the steam jet air pumps, are driven by full-voltage-starting induction motors, which may be supplied with power from either of the main generators, the 60-kv. bus or the house turbo-generator, which is designed to pick up load at 3 per cent drop in frequency. Three-stage bleeding of the turbines for feed water heating, the use of a gland seal leak-off condenser and low-pressure drip returns provide for economical feed water heating and low make-up. The absence of preheaters or economizers and the use of natural draft contribute to simplicity of operation.

### BUILDING CONSTRUCTION

The station buildings are of red brick with gray terra cotta trim on structural steel resting on a monolithic concrete slab which is supported by nineteen concrete caissons, 16 and 23 ft. in diameter, extending 40 ft. below the ground level to rock. The main building, containing the turbine room, boiler room and fuel preparation bay, is 213 ft. long east and west and 100 ft. north and south, with a two-story office and machine shop 100x30 ft. adjoining on the south side of the turbine room. The crusher house is 23x30x86 ft. high above the ground level, located 28 ft. east of the main building and connected with it near the top by an inclined conveyor bridge. The laboratory and water-treating plant and the intake house are in separate buildings south of the main building and the storehouse is a corrugated iron structure located northwest of the station building. The control house and switchyard are west of the main building. The capacity of the present installation is 40,000 kw. in two 20,000-kw. units, but the cooling water system, railroad tracks and control house are designed for an ultimate capacity of 160,000 kw. and the lignite crusher house is equipped for twice the present capacity. The present main building will accommodate only the two turbo-generators and four boilers now installed and the lignite pulverizing and drying equipment is sufficient for only the present capacity. The north side of the building is temporary and is covered with corrugated asbestos sheeting painted brick red to harmonize with the permanent walls.

### FUEL- AND ASH-HANDLING SYSTEM

The following is a typical analysis of the Texas lignite as received at Trinidad: Moisture, 33.73 per cent; volatile matter, 21.10 per cent; fixed carbon, 35.93 per cent; ash, 9.12 per cent; sulphur, 0.48 per cent; B.t.u. per pound, 7,000.

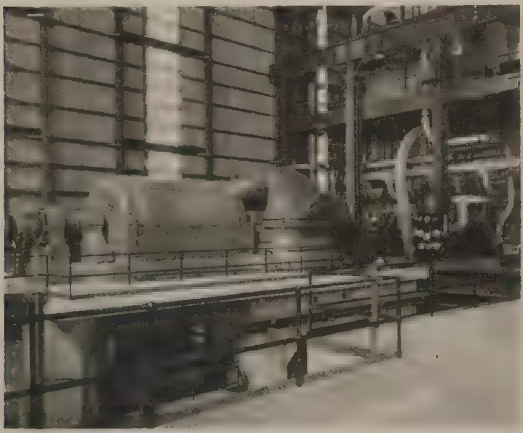
Before the combustion equipment for this station was selected tests were made with this fuel on stokers and in a plant equipped for burning pulverized bituminous coal. The pulverized fuel system was selected in preference to stokers after comparing the relative economy and fixed charges.

Lignite is delivered by the mining company to the storage tracks in 50-ton bottom dump cars. Switching in the plant yard is done by a 25-ton storage-battery locomotive and an electric car puller is provided at the crusher house for emergency use. The lignite is weighed on track scales, dumped into a track hopper at the crusher house and is carried from the track hopper into the crushers by 30-in. apron feeders having 24-in. diameter magnetic pulleys on the head shafts for the removal of tramp iron. The crushers are single roll machines arranged two in series with vibrating screens between the primary and secondary elements. The crushed lignite is then elevated to the top of the crusher house, whence it is carried by belt conveyors over weightometers through the connecting bridge into the main building, or diverted into the storage yard through a chute in the east wall of the crusher house. As the storage is permanent the normal route is into the fuel preparation bay, where it is discharged over another set of magnetic pulleys onto cross conveyors, whence it is dumped into the crushed lignite bunkers. A dust-collecting system removes dust from the points where the crushed lignite falls on the belt conveyors in the crusher house and on the cross conveyors over the crushed lignite bunkers in the preparation bay.

The driers, located directly under these bunkers, are of the steam grid type, supplied with steam at 10-lb. gage pressure bled from the seventh stage of the turbines, or, if necessary, taken directly from the saturated steam header through reducing valves. The pulverizing mills are at basement floor level, each directly under its drier. The mill exhauster fans and drier fans are on a floor between the mills and driers. The pulverized lignite is drawn from the mills by exhauster fans and discharged into cyclone separators above the screw conveyors on the top floor of the pulverizing bay.

The mill exhauster system operates in a closed circuit and under a slight vacuum, maintained by a cross-connection to the suction of the drier air-circulating fan, which tends to eliminate dust discharge from this equipment. The drier circulating fans discharge through cyclone separators and combination steam and water jet air washers. The drier cyclones are adjusted to produce a slight vacuum at their base and discharge any collected dust into the screw conveyors. The vacuum in the cyclones creates a slight vacuum in the screw conveyors and pulverized fuel bunkers which eliminates dust from these sources, and also keeps moist air out of the pulverized fuel bunkers, where the moisture would condense and cause caking of the lignite. Screw conveyors transport pulverized lignite from the discharge of the cyclones to storage bunkers in the aisle above and between boilers.

The entire fuel conveyor system from the crushers to the pulverized fuel bunkers is in duplicate. The crushers, bucket elevators and belt conveyors are electrically interlocked, as are also the three sets of screw conveyors which carry the pulverized fuel, so that they can be started only in the proper sequence.

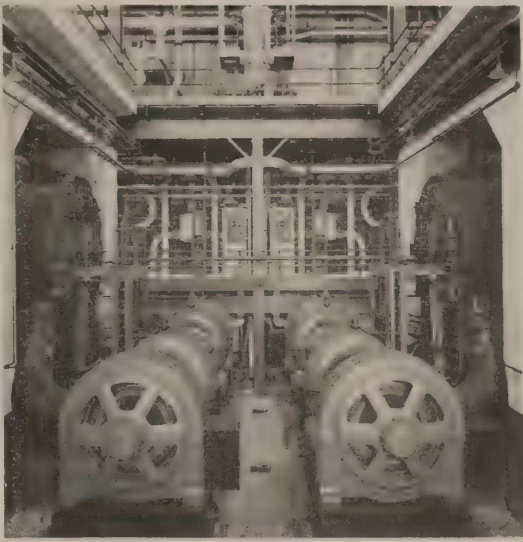


*Turbine room from southwest corner*

Two 20,000-kw. units at right and center and 1,200-kw. house generator at left next to temporary wall. Note neat arrangement of boiler feed pump piping in opposite corner and boiler feed tank on deck above.

The pulverized lignite is drawn from the bunkers by helical feeders and blown vertically downward into the furnaces through fantail burners by primary air drawn from around the ashpits by the primary air fans. Steam jets are provided in each burner for use in case of primary air failure. Each boiler is served by twelve burners and feeders arranged in groups of six, independently driven and controlled. The feeder screws are driven by constant-speed motors through variable-speed transmissions.

The ashpit floors slope toward the rear of the furnaces, from where the ashes are drawn into water-sealed drag scraper conveyors which carry them to a cross-conveyor at the south side of the building. The cross-conveyor is elevated at the east end and discharges into a skip hoist which elevates to a bunker, whence the ashes are dropped into dump cars and transported to low ground south of the station.



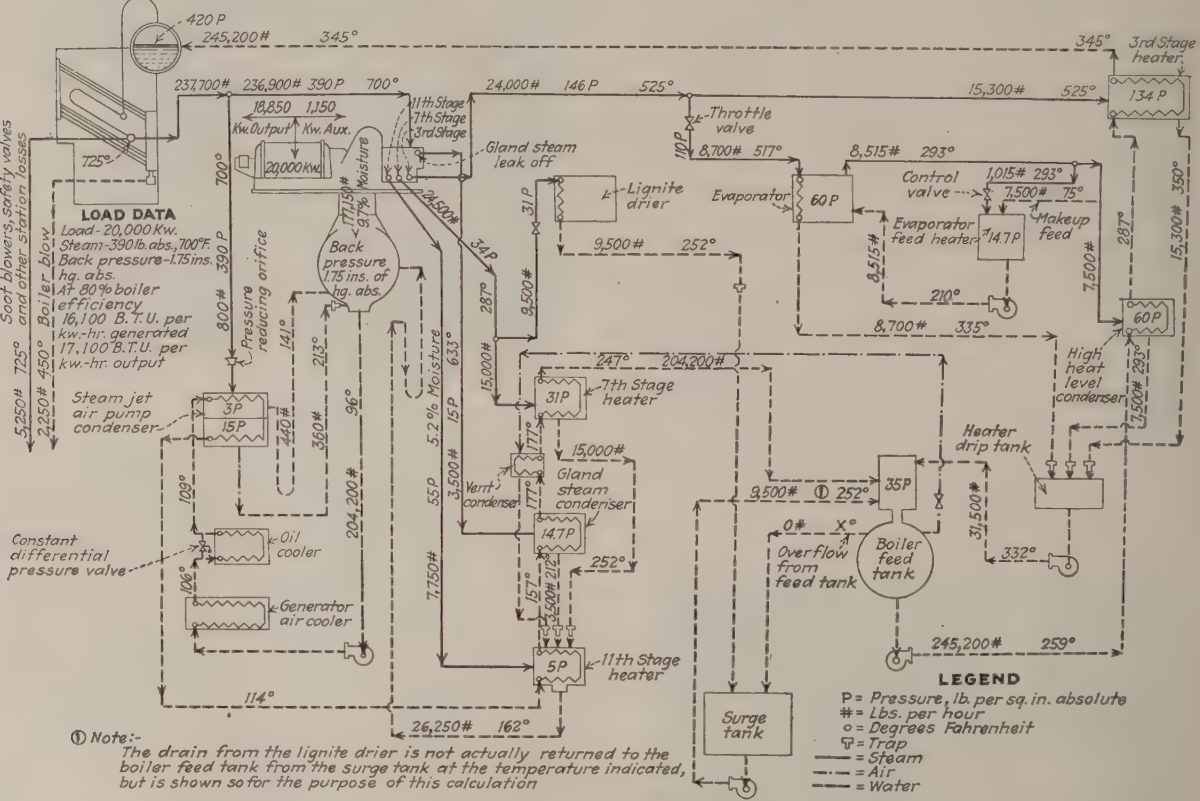
*Condenser pit showing evaporator and heater gallery in background*

When lignite was first placed in storage spontaneous combustion developed along the slopes of the pile, particularly on the windward side and where the lignite was not properly packed. To eliminate this earth dikes were built around three sides of the storage area and the lignite spread in 2-ft. layers, leveled and packed with tractor and roller. This has eliminated all serious heating and spontaneous combustion in the 18,000 tons in the storage yard.

### STEAM-GENERATING EQUIPMENT

The boiler house occupies the center section of the main building between the fuel preparation bay and the turbine room. The present installation consists of four boilers, arranged two on each side of the firing aisle, which will extend the full length of the ultimate installation. The boilers are 18,756 sq.ft. Babcock & Wilcox cross-drum, sectional header type, with interdeck superheaters designed for steam pressure of 425-lb. gage and temperature at the superheater outlet of 750 deg. F. Normal operating conditions are 400-lb. gage pressure and 735 deg. F. total temperature. The boilers are standard in every respect except the lower section of tubes, from which alternate rows are omitted to eliminate staggering and to provide more room between tubes, thereby reducing tendency for ashes to bridge. Boiler tubes are 4-in. No. 6 gage with the exception of the two lower rows, which are 3¼-in. No. 8 gage. The superheaters, located between the upper and lower tube decks, contain 4,000 sq.ft. of surface, arranged in four loops with three steam passes. Sixty-six tubes, or a possible area of 700 sq.ft., are blanked off in the inner loop.

A 10-in. steam lead runs from the non-return valve on each boiler to a 16-in. manifold located on the west, or turbine room side, of each pair of boilers and on the center lines of the main turbines. These manifolds are connected by a 12-in. vertical expansion loop, and as extensions are made additional manifolds will be similarly located and connected by expansion loops to form a continuous header. Steam leads to the main units are 14-in. vertical expansion loops leading from the center of the manifolds over the auxiliary bay and passing through the turbine room operating floor just ahead of the main throttle valve. The 6-in. steam lead to the house turbine and 3-in. lead to the boiler feed pump turbine are connected to the expansion loop between manifolds near the manifold for No. 2 turbine. Valves at the manifolds on steam leads from the boilers, steam leads to main turbines and those at each end of the loop connecting the manifolds are motor-operated, controlled by nearby push-button stations, but they may be closed from an emergency control panel in the plant superintendent's office. The valves on the leads to the house turbine and boiler feed pump turbine and non-return valves on the boilers are all hand-operated. The saturated steam header is a 4-in. line located directly above the boiler drums, connected by a straight line at the south end and by an expansion bend at the north end, forming a continuous loop. Horizontal expansion bends are located on each side of the loop between boilers.



**LOAD DATA**
Load-20,000 Kw.
Steam-390 lb. abs., 700°F.
Back pressure-1.75 ins. hg. abs.
At 80% boiler efficiency
16,100 B.T.U. per kw.-hr. generated
17,100 B.T.U. per kw.-hr. output

① Note:-
The drain from the lignite drier is not actually returned to the boiler feed tank from the surge tank at the temperature indicated, but is shown so for the purpose of this calculation

**LEGEND**
P = Pressure, lb. per sq. in. absolute
# = Lbs. per hour
° = Degrees Fahrenheit
Ɏ = Trap
—— = Steam
—·— = Air
– – – = Water

*Full-load heat-balance diagram*

Three motor-driven and one turbine-driven boiler feed pumps are provided, any two of which will feed the boilers under maximum station load conditions. The turbine-driven pump, which is for emergency use only, is controlled by a 3-in. pressure governor. The motor-driven pumps are driven by constant speed induction motors. Boiler feed is controlled by two Copes regulators per boiler and a constant excess pressure is maintained by an S.-C. differential pressure regulating valve installed ahead of each Copes valve.

The feed-water heating system is designed to operate on the regenerative cycle, using steam bled from the third, seventh and eleventh stages of the main turbines. The condensate passes successively through the generator air cooler, turbine oil cooler, steam jet air pump condenser, eleventh stage heater, gland steam condenser, boiler feed tank vent condenser and seventh stage heater into the boiler feed tank through a rain type mixing head. Proper level in the boiler feed tank is maintained by overflow to surge tanks in an underground room adjacent to the stations and by float control of pumps which supply water from surge tanks to feed tank. Duplicate headers lead from the boiler feed tank to the pumps. Feed from the pumps to the boilers is normally through the high-heat level condensers and third-stage heaters to the 8-in. boiler feed loop header. However, an auxiliary line is provided through which the pumps may discharge directly into the loop header.

Boiler feed make-up is supplied by single-effect evaporators which use steam bled from the third stage of the main units. The evaporator feed is lake water which has been settled, filtered in pressure sand filters and treated in Zeolite softeners. Well water from the domestic supply may be treated and used in the same way, or, if necessary, fed directly into the boiler feed tank without treatment.

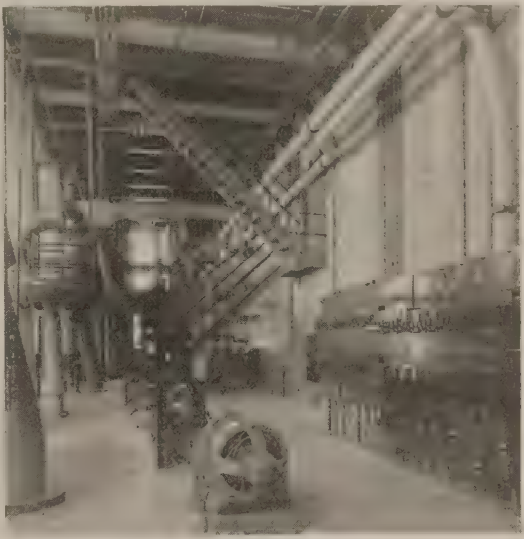
The boilers are fired from the rear or drum end through flat arches. The back and a portion of the furnace side walls adjacent to the arch are of brick cooled by the secondary air which passes through openings in the outer wall into horizontal ducts, from which it is distributed through sinuous ports in the rear furnace wall which are so designed as to protect the steel work in the outer wall from radiant heat. The other walls are water cooled with 24 fin tubes in each side wall and 26 plain tubes in the front wall opposite the burners. The slag screen over the ashpit also consists of 26 plain water tubes. The wall and screen tubes are all connected by external headers to the boiler circulation, their 2,520 sq.ft. of heating surface giving each boiler a total heating surface of 21,276 sq.ft. Each pair of boilers is served by a reinforced-concrete stack 300 ft. high above the boiler room roof, 12 ft. inside diameter at the top and supported by the building steel. Each furnace is approximately 25 ft. square inside below the arch and 35 ft. high from the slag screen to the lower boiler tubes. The ashpit, with 30 deg. and 60 deg. sloping sides, has a maximum depth below the slag screen of 12 ft. The furnace volume above the ashpit is 18,540 cu.ft., which gives a combustion chamber volume of 0.988 cu.ft. per square foot of boiler surface and 0.871 cu.ft. per square foot of heating surface, including the surface in the water-cooled walls and slag screen.

### MANUAL CONTROL

The combustion control is manual. Each individual boiler control panel is equipped with boiler pressure gage, multipointer gage showing furnace draft, top first pass draft, uptake draft and primary air pressure; boiler meter equipped with indicating, recording and integrating steam flow elements and air flow, flue gas temperature and steam temperature recording elements; speed indicators and speed-controlling switches for the feeder drives and indicating lamps and stop buttons for feeder motors and primary air fan. On the master boiler room control board are mounted a clock, boiler blow-off temperature recorder, boiler feed temperature and pressure recorder, boiler feed tank low water alarm, surge tank high water alarm, multipointer stack draft gage, boiler feed pump indicating lamps and stop buttons. The individual gage boards are located next to the cross aisle between the boilers leading to the turbine room and fuel preparation bay. The master gage board is located at the intersection of this aisle and the firing aisle and facing in the direction of future extension.

*Auxiliary switch room*

A master pilot gage and a station load indicator are mounted at the south end of the firing aisle. The uptake damper, primary air damper and secondary air damper for each boiler are controlled by hand wheels located near the individual boiler control boards. Thus all firing controls are located on or adjacent to the boiler control panel so that the fireman can watch all instruments while making firing adjustments.



*Turbine room auxiliary bay*

Steam lead to No. 1 turbine, auxiliary exciters and auxiliary load centers in foreground and boiler feed pump piping and steam lead to unit No. 2 in rear.

### TURBINES AND TURBINE AUXILIARIES

The turbine room occupies the west section of the building and is separated from the boiler room by the auxiliary bay. The turbo-generators are placed with their axes east and west or perpendicular to the length of the ultimate turbine room so that the steam end is as near as possible to the boiler room and the generator close to the transformer structure. The main units are set on individual decks 20 ft. above the ground and 30 ft. above the condenser pit floor. The house turbo-generator is located north of the present main units. A railroad track runs across the west side of the turbine room to the machine shop at ground level and a 100-ton crane provides for handling of equipment during erection or overhaul.

The main turbines are 20,000-kw., fourteen-stage, 1,800-r.p.m., single-cylinder, General Electric units designed for steam pressure and temperature of 375 lb. gage and 700 deg. F. at the throttle and arranged for bleeding from the third, seventh and eleventh stages. A constant supply of clean oil for the turbines is provided by a continuous by-pass filtration system and the oil is cooled in surface coolers using condensate or house service water for the cooling medium. On each of the turbine gage boards are mounted transmitting and receiving telegraphs connecting with the control house, main steam and first stage pressure gages and vacuum

## Principal Equipment in the Trinidad Steam-Electric Station

### TURBO-GENERATORS AND AUXILIARIES

*Turbo-Generators*—Two General Electric. Turbine, 20,000 kw., 1,800 r.p.m., fourteen stage, bleeding at third, seventh and eleventh stages. Generators, 25,000 kva., 12,000 volts, three phase, 60 cycles. Main exciters, direct connected, 120 kw., 250 volts, shunt wound. Steam flow meter, two General Electric, one per turbine.

*Condensers and Auxiliaries*—Two Wheeler Condenser & Engineering Company. Surface, 20,000 sq.ft. each, horizontal, single pass, one floating tube sheet, Admiralty metal tubes; tubes rolled into both tube sheets.

*Circulating Pumps*—Four Wheeler Condenser & Engineering Company (2 per condenser); centrifugal, 20,000 g.p.m. (44.5 c.f.s.) against a total head of 21 ft.; each driven by a 150-hp., 2,200-volt, three-phase, two-speed General Electric induction motor.

*Condensate Pumps*—Four Wheeler Condenser & Engineering Company (2 per condenser); centrifugal, 440 g.p.m. (220,000 lb. per hour) against a 210-ft. head; each driven by a 40-hp., 2,200-volt, three-phase General Electric induction motor.

*Generator Air Coolers*—Two General Electric, each 15,000 sq.ft., fin type.

*House Turbine*—One General Electric. Turbine, 1,200 kw., single stage, 3,600 r.p.m., non-condensing. Generator, 1,500 kva., 2,300 volts, three phase, 60 cycles. Exciter, direct connected, 17 kw., 250 volts, compound wound.

*Auxiliary Exciter*—One General Electric; 150 kw., 250 volts, shunt wound; direct connected to General Electric 225-hp., 2,200-volt, 1,200-r.p.m., squirrel-cage induction motor.

### BOILERS AND AUXILIARIES

*Boilers*—Four Babcock & Wilcox, sectional cross-drum water tube. Heating surface, 18,756 sq.ft. Working pressure, 425 lb. gage.

*Superheaters*—Four Babcock & Wilcox; interdeck, 4,000 sq.ft., three pass. Total steam temperature. 750 deg. F.

*Furnaces*—Four Combustion Engineering Corporation; Lopulco water cooled. Heating surface of water walls, 2,520 sq.ft. Arches, American Arch Company. Furnace volume, 18,540 cu.ft. above ashpit screen.

*Primary Air Fans*—Four B. F. Sturtevant Company; each driven by a 75-hp., 1,800-r.p.m., 2,200-volt General Electric induction motor.

*Soot Blowers*—Diamond Power Specialty Company; 22 per boiler.

*Soot Ejectors*—Four Girtanner Engineering Corporation; steam jet conveying.

*Boiler Meters*—Four Bailey Meter Company; D-26, 0-200,000 lb. per hour. Recording steam flow, air flow, steam temperature and flue gas temperature; also indicating steam flow.

*Boiler Feed Pumps*—Three A. S. Cameron Steam Pump Works; No. 5 H.S.T., six stage, 700 g.p.m. (350,000 lb. per hour) each, against 1,155-ft. head; each driven by 350-hp., 2,200-volt General Electric induction motor. One A. S. Cameron Steam Pump Works H.M.T., five stage, 700 g.p.m., against 1,155-ft. head; driven by 340-hp. Terry turbine, type GS.

*Heaters*—Wheeler Condenser & Engineering Company; horizontal closed type, floating head; two eleventh stage, 750 sq.ft.; two seventh stage, 837 sq.ft.; two third stage, 1,290 sq.ft.; two Gland steam, 287 sq.ft.

*Evaporators*—Two units, Wheeler Condenser & Engineering Company; Contraflo, single effect, two per unit; capacity per unit 10,000 lb. per hour; equipped with Atwood & Morrill drainers, Cochrane 9,000-lb.-per-hour deaerating heater and 820 sq.ft. high-heat level condenser.

*Evaporator Feed Pumps*—Three Goulds Manufacturing Company; centrifugal, 30 g.p.m. against 145-ft. head; each driven by a 5-hp., 220-volt General Electric induction motor.

### FUEL PREPARATION, BURNING AND HANDLING EQUIPMENT

*Track Scale*—One Fairbanks Company; capacity 250,000 lb.

*Weightometers*—Two Merrick Scale Manufacturing Company; capacity, 100 tons per hour each.

*Apron Feeders*—Two Stephens-Adamson Manufacturing Company; capacity, 100 tons per hour each; each driven by a 7½-hp., 220-volt General Electric induction motor.

*Crushers*—Two units, Stephens-Adamson Manufacturing Company; two crushers per unit. Single roll, Pennsylvania Armorframe, 24x50 in. with vibrating screens between primary and secondary crushers; each crusher driven by a 50-hp., 220-volt General Electric induction motor.

*Elevator Conveyors*—Two Stephens-Adamson Manufacturing Company; V bucket type, 100 tons per hour each; each driven by a 25-hp., 220-volt General Electric induction motor.

*Belt Conveyors*—Four Stephens-Adamson Manufacturing Company; each driven by a 5-hp., 220-volt G.E. induction motor.

*Pulverized Fuel Conveyors*—Six Combustion Engineering Corporation; screw; 20 and 25-hp., 220-volt G.E. induction motors.

*Lignite Storage Equipment*—Stephens-Adamson Manufacturing Company; Crescent drag scraper; 75-hp., 2,200-volt General Electric induction motor.

*Driers*—Four Combustion Engineering Corporation; steam grid, four stacks each, 45 grids per stack.

*Pulverizing Mills*—Four Combustion Engineering Corporation; six-roll Raymond, 15 tons per hour each; each driven by a 200-hp., 2,200-volt General Electric double-squirrel-cage-induction motor.

### ASH-HANDLING EQUIPMENT

*Ash Conveyors*—Combustion Engineering Corporation; Combusco water seal drag.

*Ash Skip Hoist*—Stephens-Adamson Manufacturing Company.

*Ash Bunker*—Stephens-Adamson Manufacturing Company.

*Ash Cars*—Three Western Wheeled Scraper Company; 30-yard, with extended sides to give 45-yard capacity.

### MISCELLANEOUS

*Pumps*—Make-up for lake water, Worthington Corporation. Fire pumps, Allis-Chalmers company. House service, Allis-Chalmers company. Surge tank and sump, Goulds company. Domestic water supply, American Well Works.

*Air Compressor*—One Ingersoll-Rand Company; two stage, belt driven, 384 cu.ft. air at 110 lb. gage; driven by 100-hp., 2,200-volt Westinghouse induction motor.

*Turbine Room Crane*—Whiting Corporation; 100 ton.

### ELECTRICAL EQUIPMENT

*Main Transformers*—Seven Westinghouse, 8,333 kva. each, 136,800/64,800Y, 12,000 delta-volt, single-phase, water-cooled, outdoor type.

*Auxiliary Transformer*—Three General Electric, 2,000 kva., 12,000/2,300 volts, three phase, self-cooled.

*Standby Auxiliary Transformer*—One General Electric, 2,000 kva., 60,000Y/2,300 volts, delta, three phase, self-cooled.

*Auxiliary Transformer*—General Electric, 2,300-115/230 volts, single phase, oil cooled, six 150 kva., sixteen 100 kva., four 37½ kva., three 25 kva.

*132-kv. Synchronizing Equipment*—General Electric; condenser type, with vacuum tube amplification.

*Oil Circuit Breakers and Disconnect Switches*—Pacific Electric Manufacturing Company.

*Grounding Switches and Choke Coils*—Burke Electric Company.

*Direct-Current Control Power*—Storage battery, Electric Storage Battery Company; E-17, 60 cell, 120 volts, 320 amp.-hr.

*Motor-Generator Sets*—Two General Electric; 35 kw. each.

*Battery Charger*—One G.E.; motor-generator, 5 kw., 140 volts.

*Switchboards and Control Panels*—General Electric.

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gage, mercury column vacuum gage, synchronism indicator, lubricating oil and condenser temperature recorders, turbine speed indicator, indicating wattmeter, generator air temperature indicator with alarms and lubricating oil temperature alarm.

Each turbine exhausts into a 20,000-sq.ft. single-pass surface condenser having Admiralty metal tubes and Muntz metal tube sheets. Two 30-in. circulating pumps are provided for each condenser, each rated at 20,000 g.p.m. (44.5 c.f.s.) and driven by 150-hp., 2,200-volt, 300-240-r.p.m. squirrel-cage induction motors.

The most interesting and unusual features of the condensing equipment is the floating tube sheets in the condensers. The tubes are expanded into both of the tube sheets, one of which is mounted on rollers and connected to the shell by a rubber expansion ring. This construction eliminates packing of condenser tubes and assists in keeping condenser leakage at a minimum.

The house turbine is a 1,200-kw., 3,600-r.p.m., single-stage, non-condensing unit designed to take steam at the same condition as the main units. This turbine is especially adapted for operation as a station auxiliary protection unit, and when operated as such the turbine carries no load and the generator floats on the auxiliary bus as a synchronous condenser. When this unit is floating on the line the turbine windage is reduced to a minimum by connecting the exhaust to one of the main condensers. A 3 per cent drop in frequency causes this unit immediately to pick up load up to 1,200 kw.

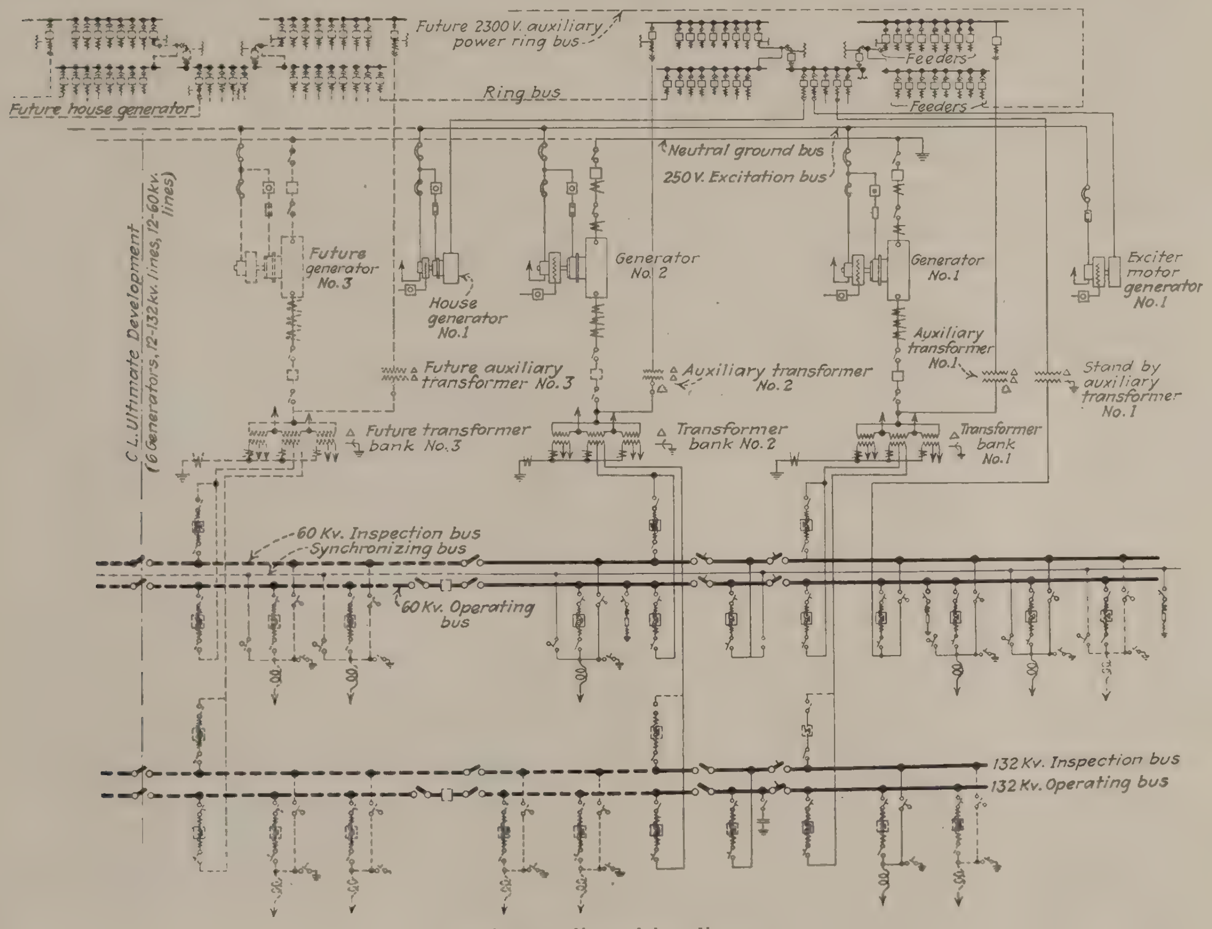
### ELECTRICAL FEATURES OF PLANT

Both of the present generators are 25,000-kva., 12,000-volt, star-connected units with neutrals grounded through non-automatic, remote-controlled oil circuit breakers. Each generator is connected directly to a bank of three 8,333-kva. outdoor, water-cooled transformers which are wound for 60,000 and 132,000 volts on the high side.

All of the control and metering equipment is located in the control house, which is 130 ft. west of the main building between the 60-kv. and the 132-kv. switch structures. Besides metering panels and control benchboards for the generators, 60-kv. feeders and 132-kv. feeders the control house is equipped with turbine room telegraph, steam gage and exciter control panel. All switching is done at 60 kv. and 132 kv. All oil circuit breakers and the main disconnects are motor-operated and controlled from the benchboards in the control house. A condenser type synchroscope with vacuum tube amplifier is provided for synchronizing at 132 kv. and an ordinary synchroscope using potential transformers is used for the 60-kv. circuits. Control current is furnished by a storage battery in the control house basement. This battery also furnishes current for emergency lighting.

### Switch Structures

The present switch and feeder structures are built to accommodate six 60-kv. feeders and two 132-kv. feeders, but only four 60-kv. feeders and one 132-kv. feeder are now in operation. The design provides for an ultimate development of twelve 60-kv. feeders and twelve 132-kv. feeders. The 60-kv. switching structure is arranged with duplicate buses, an inspection bus and an operating bus. Each generator transformer bank is connected directly to each of these buses through remote-controlled automatic oil circuit breakers. Both the operating and inspection buses are tied between each generator section by short-sectionalizing buses with gang-operated disconnects. The operating and inspection sectionalizing buses are in turn connected by a remote-controlled automatic circuit breaker. Each feeder is connected to the operating bus through a remote-controlled automatic circuit breaker and to the inspection bus by a motor-operated disconnect switch. The 132-kv. structure and bus is similarly arranged except that the generator connection to the inspection bus and feeder circuit breaker have been omitted for the present, as only one feeder has been placed in operation.



*Station one-line wiring diagram*

Station auxiliary power is normally taken from each generator lead by a 2,000-kva., three-phase, 12,000/2,300-volt transformer. When neither machine is operating, or these transformers are not in service, auxiliary power is taken from the 60-kv. bus by a 2,000-kva., three-phase, 60,000/2,300-volt transformer. In case of failure of both of these sources the auxiliary load is carried by the house turbo-generator, which, if it is floating on the auxiliary bus, will take load automatically, as previously explained.

The 2,300-volt auxiliary panels are of the truck type and are located in a concrete compartment in the basement of the auxiliary bay. The present 2,300-volt bus is divided into five sections, three general service buses and two unit auxiliary buses. Each unit auxiliary bus is connected directly to one of the 12,000/2,300 auxiliary transformers and from it are fed the circulating and condensate pumps for one turbine, one primary air fan, two pulverizer mills and mill exhausters and the 220-volt load centers for the fuel feeders, drier auxiliaries and sump pumps, the 220-volt buses in the drier and feeder load centers being in duplicate, and each connected to a different 2,300-volt bus, so that the drier fan and feeder motors may be supplied from either of these sources. When both units are operating, one group, or half of the feeders for each boiler, is connected to one unit bus and the other group to the other unit bus to prevent complete loss of fires under any boiler in case one unit trips off or is shut down without tying the auxiliary bus for that unit to the general bus. The three motor-driven boiler feed pumps, general 2,200-volt auxiliaries and 220-volt load centers are divided between the three sections of the general bus. The house generator and the 60,000/2,300-volt auxiliary transformer feed to the center section of the general bus, which also serves as a tie between each end group, consisting of one general and one unit auxiliary bus. Similarly arranged buses are to be installed with each pair of generators and a ring bus formed by connecting the ends of the general buses. The lighting panels are divided between the three general buses and when the alternating current supply fails some are automatically transferred to the 125-volt direct-current bus to serve as emergency lights.

All motors are 2,200-volt or 220-volt, constant-speed, squirrel-cage type, with the exception of the circulating pump motors, which are two-speed motors. In general, all motors smaller than 50 hp. are 220-volt and those 50 hp. and larger 2,200-volt. There are, of course, exceptions, such as the 40-hp., 2,200-volt condensate pump motors and the 50-hp., 220-volt motor-generator and crusher motors. Motors driving the boiler feed, evaporator feed, circulating water, condensate, transformer circulating water, fire, drip and sump pumps and the primary air and drier exhauster fans are equipped to restart automatically after an interruption. Other motors must be manually restarted.

An intake house for cooling water, a machine shop and an operators' village on the plant site are added features of the station. The station office, locker rooms and a water-treating laboratory are other features which go to complete the project.

## Job Cost of 1,600-Kw. Hydro Plant $158 per Kilowatt

DATA for a 1,600-kw. generating station built at Marlboro, N. H., for the Keene Gas & Electric Company by L. H. Shattuck, Inc., Manchester, N. H., have been released. The plant consists of two 800-kw., 2,300-volt General Electric generators connected to S. Morgan Smith horizontal waterwheels delivering 1,429 hp. each when using 56 c.f.s. at 260.6-ft. head, Woodward governors, a reinforced concrete generating station building, outdoor substation, steel surge tank 12 ft. in diameter and 8 ft. high, redwood penstock 4 ft. in diameter and 5,800 ft. long (staves $1\frac{9}{16}$ in. and $2\frac{1}{16}$ in. thick), including three steel bends in a gorge, and a partially reinforced concrete arch dam 60 ft. high, with arched portion 175 ft. long on top, 22-ft. gravity section at one end and a 45-ft. spillway section, the thickness at the base being 12 ft. thick and the top 4 ft. The total cost of this job, excluding office overhead, office supervision, engineering costs and construction profits, was $252,618.59, itemized as shown in the accompanying table.

DATA ON HYDRO PLANT COSTS, MARLBORO, N. H., 1923

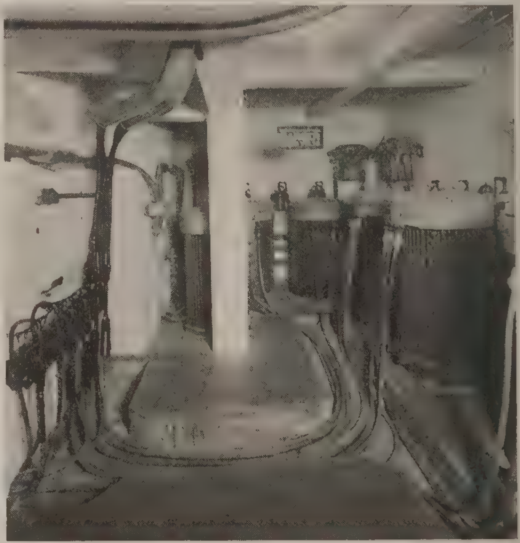
| | |
|---|---|
| **Unit Costs** | |
| Excavating earth and loose rock at dam site, including clearing and stripping, per cubic yard | $4.03 |
| Foundation trenches in solid rock, per cubic yard | 10.67 |
| Cost of forms, including material, placing, stripping, moving, etc., and expansion joints per face foot | 0.34 |
| Mixing and placing concrete, per cubic yard | 2.75 |
| Reinforcing steel in place, per pound | 0.06 |
| Earth excavation per foot of penstock line | ... |
| Rock excavation per foot of penstock line ($4.32 per cubic yard) | 0.82 |
| Timber trestles, per foot (local timber) | 2.66 |
| Concrete bases for cradles, per foot of line | 1.76 |
| Reinforced concrete cradles in place, each | 4.07 |
| Redwood cradles in place, each | 5.50 |
| Penstock in place, head range 30 to 260 ft., average per foot | 6.85 |
| Haulage and distribution of materials for penstock, per foot | 0.55 |
| **Total Costs Main Items** | |
| Dam | $71,623.18 |
| Penstock | 81,130.54 |
| Surge tank | 4,290.00 |
| Power house and tailrace | 34,488.81 |
| Hydraulic equipment | 23,192.80 |
| Electrical equipment | 16,846.14 |
| Outdoor substation and switching station | 10,075.62 |
| Railroad riprap | 6,318.31 |
| Rights-of-way | 4,653.19 |
| Total | $252,618.59 |

## Floor Trenches Aid in Racking Cables

By T. W. Swartz

*Assistant Engineer Northwestern Electric Company, Portland, Ore.*

OF THE several methods of racking cables in transformer vaults all have been discarded by the Northwestern Electric Company, Portland, Ore., in favor of that shown in the accompanying illustration. As will be seen, floor trenches are provided which may be covered either with smooth or $\frac{1}{4}$-in. checkered plate broken up into easily removable sections. Formerly cables were racked on the walls of the vault.



*Neat, safe and economical layout provided by laying cables in floor trenches*

The trench method of racking has been found to have the following advantages:

1. If heavy secondary cables are required the saving in cable to reach a junction box or busing point is very material, much more than offsetting the additional work necessary in the floor.
2. Less labor in placing and racking cables.
3. Greater safety because the cables can be completely placed out of the way for shifting transformers.
4. Complete separation of high and low voltage cables is obtained so that failure on one class cannot affect the other.
5. Secondary cables are much more accessible for changes in case of increase in size after the original installation.
6. All things considered, this method has proved more economical than the older method.

# Loads from Looped or Tapped High-Tension Feeders

## Effect of such conditions on one of several paralleled lines, with particular reference to underground cable systems

By H. L. Wallau
*Electrical Engineer, Cleveland*

HIGH-TENSION loads may be taken on a system in one of three ways: (a) Radial lines from supply stations to the loads; (b) existing lines between stations may be looped through the loads; (c) existing lines between stations may be tapped and tap lines extended to the load.

When method (a) is used the lines supplying the station from which the radial feeds are run have their loading increased in direct proportion to the added load. When method (b) is used, if there is more than one line feeding the supply station, the loading of the direct lines may be greatly distorted after adding the looped load. The same is true of method (c).

Since the latter method affects the division of load between the supply lines, it is desirable to know to what extent such unequal division may create unfavorable operating conditions. This is especially true of underground cable systems in which the thermal characteristics of cable and subway, rather than conductor section or voltage drop, limit the load which may be carried on a given line.

To this end the following closely approximate method is suggested. The figure shows a typical looped load diagram, as well as one for a tapped load:

$n$ = number of paralleled lines between stations.
$Ra$, $Rb$, etc., $Xa$, $Xb$, etc., $Za$, $Zb$, etc. = respective constants in ohms.
$Zm$ = combined parallel impedance.
$Pr$ = power delivered to receiving station, in kilowatts.
$\cos\phi$ = power factor of receiving station load.
$E$ = delivered voltage phase-to-neutral.

Then the total current per phase at the receiving station before adding the looped load is—$Ir = Pr/3000\,E\cos\phi$.

The total impedance drop is $Ir\,Zm$.

The current in each line is $Ia = Ir\,Zm/Za$, $Ib = Ir\,Zm/Zb$, etc.

Considering the effect of adding the looped load, let the looped line be lettered —$n$. Its constants are

$$Rn = Ro + Rn - Ro$$
$$Xn = Xo + Xn - Xo$$
$$Zn = Zo + Zn - Zo$$

where $Ro$, $Xo$, $Zo$ are the constants from sending station to customer's premises.

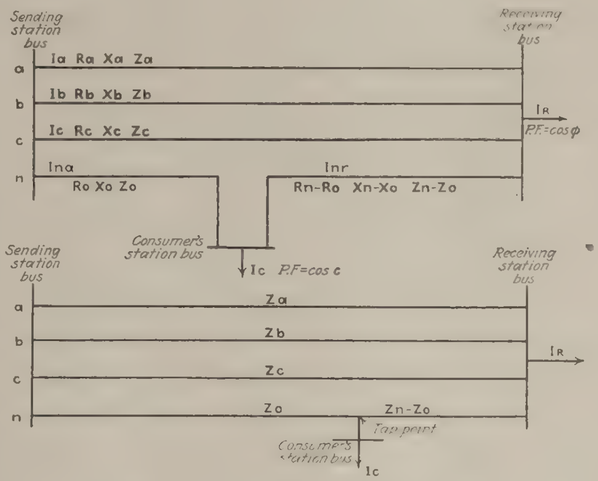
Let the customer load be $Pc$ at power factor $\cos c$, current $Ic$.

The regulation between sending station and consumer's premises is due to two components of current, the consumer's load current and the portion of the receiving station current flowing over the looped line. Under certain conditions this latter current may be negative; that is, part of the consumer's load may be furnished directly from the sending station and part may flow from sending station to receiving station and back to consumer's premises.

The regulation between sending station and receiving station is due to the two preceding components plus the receiving station component over the portion of the line between consumer's station and receiving station. The regulation from sending to receiving station over this line can also be considered as due to a fictitious load at consumer's power factor flowing to the receiving station combined with the above-mentioned component of receiving station load.

The regulation due to the consumer's load may be computed by the usual formula:

$$\text{Reg. }(c) = Ic\,Ro\cos c + Ic\,Xo\sin c + \frac{(Ic\,Xo\sin c - Ic\,Ro\cos c)^2}{200} = Vc \text{ volts}$$



*Typical looped and tapped load circuits*

Substituting $Rn$ and $Xn$ in the preceding formula and solving for the fictitious current $I_f$ produces the same regulation $Vc$. For the fictitious condition set up the receiving station load becomes $Ir + I_f$ (vectorial addition), hence the total current $I_t$ for these conditions may be determined. The current over each line would then be

$$Ia = It\,Zm/Za$$
$$In = It\,Zm/Zn, \text{ etc.}$$

But,

$$Ir - Ia - Ib - \dots\dots\dots - I(n-1) = Inr$$

the receiving station component of $Ir$ at power factor $\cos\phi$ flowing over line $n$.

And

$$Ina = Inr + Ic \text{ (vectorial addition)}$$

in which $Ina$ is the actual current flowing out from the sending station to the consumer station, $Ic$ the consumer's load current and $Inr$ the balance flowing from the consumer's station to the receiving station.

If the introduction of the looped load necessitates an increase in circuit length of the line $n$ the constants for the increased length of looped line must be used in making the calculations.

### SOLUTION OF TAPPED LOAD EFFECT

In the solution of tapped lines, the method is the same, the values of $Ro$, $Xo$, $Zo$ being computed to the tap point. There is, of course, additional regulation to the consumer's load over the tap line extension.

To illustrate, assume a receiving station having a load of 600 amp. per phase at a power factor of 71 per cent to be fed by four No. 4/0 12,000-volt cables having impedances as follows: $Za = 1.74$, $Zb = 1.91$, $Zc = 2.08$, $Zn = 1.74$, $Zm = 0.464$. Under these conditions the division of current will be: $Ia = 160$, $Ib = 146$, $Ic = 134$, $In = 160$, $Ir = 600$.

Assuming that it is desired to loop a load of 100 amp. per phase at 80 per cent power factor through line $n$ at such a point that $Ro = 0.55$, $Xo = 0.42$, $Zo = 0.70$, the regulation due to this load to the consumer's premises is 88.5 volts. Solving for the fictitious equivalent current $I_f = 48$ amp.

Then

$$\begin{array}{lll} Ir = 600 & Ir \cos\phi = 426 & Ir \sin\phi = 426 \\ I_f = \phantom{0}48 & I_f \cos c = \phantom{0}38 & I_f \sin c = \phantom{0}29 \\ \hline I_t = 650 & \phantom{Ir \cos\phi = }464 & \phantom{Ir \sin\phi = }455 \end{array}$$

For $I_t = 650$ the line currents are: $Ia = 173.5$, $Ib = 158$, $Ic = 145$, $In = 173.5$, $It = 650$.

$$Ir\text{-}Ia\text{-}Ib\text{-}Ic = Inr = 600 - 476.5 = 123.5$$

Before adding the looped load lines a, b and c carried 440 amp. of the receiver station load. After adding the looped load the same lines carry 476.5 amp. The difference of 123.5 amp. is superimposed at the sending station on the 100 amp. of customer load and the current flowing over line $n$ is, therefore,

$$\begin{array}{lll} Ic = 100 & Ic \cos c = 80 & Ic \sin c = 60 \\ Inr = 123.5 & Inr \cos\phi = 88 & Inr \sin\phi = 88 \\ \hline Ina = 230 & \phantom{Inr \cos\phi = }176 & \phantom{Inr \sin\phi = }148 \end{array}$$

The currents after adding the looped load then are: $Ia = 173.5$, $Ib = 158$, $Ic = 145$, $Ina = 230$.

The next step is to repeat the calculation with each of the various lines down to see whether or not under emergency conditions the maximum safe current loading on any cable will be exceeded. The division of load prior to the addition of the looped load need not be computed, but it was done here to clarify the discussion.

## Size Important in Brush Replacements

By M. E. Reagan
*Switchboard Engineer*
*Westinghouse Electric & Manufacturing Company*

THE operation of each device used in automatic switching equipment depends on the proper functioning of some previously actuated relay. Manufacturers accordingly give careful attention to the design details and service characteristics of these relays, realizing that failure of any one means a "black eye" for the entire switching equipment.

Some automatic switching schemes use a small polarized motor-driven relay to check the polarity of a synchronous converter before placing the unit on the line. If the converter polarity is right the small two-brush motor rotates in one direction, if the polarity is wrong the motor operates in the opposite direction.

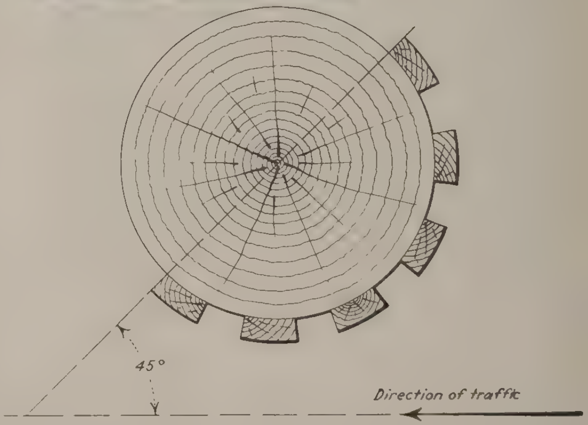
In time the brushes wear out and are often carelessly replaced by those of smaller size. Trouble begins here, although the motor may operate successfully for several months. If there is a small amount of play between the carbon brush and the brush-box or holder, the brush will assume a leaning position, depending upon the direction of rotation. Since such a motor operates for approximately equal periods in each direction, the brush will wear to a shallow letter "V" on the commutator end. This means that the brush will ride momentarily on the middle point every time the motor is called upon to reverse its direction of rotation. As the point wears to a distinct ridge, it will sooner or later come to rest on the mica insulation between the commutator bars and an open motor circuit will result.

To prevent such failures it is necessary, first, slightly to undercut the mica below the surface of the commutator bars, and, second, to use a brush with but a small clearance in the brush-holder. This amount of clearance should be just enough to allow the brush to move axially within the holder without excess friction.

## White Strips Make Poles Conspicuous to Traffic

By R. E. Cunningham
*Farnham & Cunningham, Los Angeles, Cal.*

PAINTING poles white for about 6 ft. above the ground so that they will be conspicuous, particularly at night, has been practiced by power companies for several years in an effort to aid in the reduction of automobile accidents. As it is impracticable to attempt to use white paint on full-length creosote pressure-treated wood poles it has been necessary to devise another method to accomplish the desired results. It has become quite common practice on railroad crossing gates, boulevard stop signs, etc., to use alternate black and white stripings to attract attention. This same barber pole effect has been obtained on black creosoted poles by nailing white battens around them, as shown in the accompanying illustration. This method has been approved by the California State Highway Commission for use on poles located on highways. The size of the battens is $\frac{3}{4}$ in. x $2\frac{1}{2}$ in. x 5 ft. They need be placed around only half the circumference of the pole, facing the direction of traffic.



*White wood strips on creosoted poles offer inexpensive and simple means of warning autoists of danger*

# Puncture Tests Affected by Strength of Oil

By J. T. Littleton, Jr., and W. W. Shaver
*Corning Glass Works*

The A.I.E.E. specifications for testing insulators[1] call for a puncture test while the latter are immersed in insulating oil. Practically all tests on the dielectric strength of insulating materials in general are made under such conditions. The only reason for immersion is to prevent a flashover before the voltage is high enough to produce a puncture. The oil, of course, has a dielectric constant different from air and the electrostatic field of force surrounding the insulator is accordingly changed by immersion in the oil. In the case where insulation is to be used in air a test under oil therefore introduces an artificial condition which should not be accepted if it can be shown that results under oil are not equivalent to those in air.

Experiments recently described by the authors[2] show that the puncture of an insulator in regular insulating oil is preceded by a breakdown of the oil, which is instrumental in causing the puncture. The question of the extent of the effect due to such oil failure is of prime importance. If dielectric failure under oil takes place at a much lower voltage than in air, then the conditions of the oil puncture test should be modified so as to approximate air conditions.

The experiments described below were made to furnish information on this subject; that is to say, to determine the effect of the dielectric strength of the oil on the puncture voltage of an insulator under oil. In these experiments a given lot of insulators were subjected to three high potential tests in the following order: (1) In air at a pressure of about 60 lb. per square inch; (2) in special steam-treated oil up to the potential used in (1), and (3) in regular insulating oil. After each of the first two tests the insulators were all subjected to an over-potential flashover test at 112 kv. for five minutes with no resulting failures, showing that they had not been damaged by partial punctures in either of the high potential tests. In the third test in the regular insulating oil the insulators were all punctured.

Fourteen Pyrex insulators with a rated dry flashover of 82 kv. (25-deg. C., 760-mm. pressure, 60 per cent relative humidity) were selected for these tests from rejections on account of having less than the standard head thickness so as to have low puncture values. These insulators were subjected, one after another, to the three high potential tests as stated above and all fourteen were tested simultaneously in the two table flashover tests at 112 kv. for five minutes with no resulting failures. All the tests were made with a 150-kva., 300-kv. transformer, with the center grounded and the voltage controlled by an induction regulator.

TABLE I—COMPARATIVE FLASHOVER POTENTIALS IN THREE MEDIUMS

| Ins. No. | Maximum Potential in Air Chamber, Kv. | Remarks | Maximum Potential in Steam-Treated Oil, Kv. | Remarks | Maximum Potential in Regular Oil, Kv. | Remarks |
|---|---|---|---|---|---|---|
| 1 | 140.5 | (a) | 150 | No puncture | 108 | Punctured |
| 2 | 144.5 | (a) | 150 | No puncture | 106 | Punctured |
| 3 | 146 | (a) | 150 | No puncture | 100.5 | Punctured |
| 4 | 143 | (a) | 150 | No puncture | 102 | Punctured |
| 5 | 136.5 | (b) | 150 | No puncture | 108 | Punctured |
| 6 | 141.3 | (a) | 150 | No puncture | 108 | Punctured |
| 7 | 142 | (a) | 150 | No puncture | 111 | Punctured |
| 8 | 142 | (a) | 150 | No puncture | 108 | Punctured |
| 9 | 156 | (a) | 150 | No puncture | 109.5 | Punctured |
| 10 | 160 | (b) | 150 | No puncture | 118 | Punctured |
| 11 | 147 | (b) | 150 | No puncture | 107 | Punctured |
| 12 | 148 | (a) | 150 | No puncture | 107 | Punctured |
| 13 | 150 | (a) | 150 | No puncture | 104 | Punctured |
| 14 | 142 | (a) | 150 | No puncture | 108 | Punctured |
| Average | 146 | | 150 | | 107.5 | |

(a)—Flashover occurred between leads outside the chamber.
(b)—Flashover occurred inside chamber over the insulator.

TABLE II—PUNCTURE TESTS IN OIL OF TWO DIELECTRIC STRENGTHS

| Ins. No. | Maximum Potential in Steam-Treated Oil, Kv. | Remarks | Maximum Potential in Regular Oil, Kv. | Remarks |
|---|---|---|---|---|
| 1 | 193 | No puncture | 105 | Punctured |
| 2 | 184.5 | Punctured through lower skirt | 132 | Punctured |
| 3 | 179 | No puncture | 117 | Punctured |
| 4 | 205.5 | No puncture | 106.5 | Punctured |
| 5 | 202 | No puncture | 104 | Punctured |
| 6 | 200 | No puncture | 109.5 | Punctured |
| 7 | 200 | No puncture | 103 | Punctured |
| 8 | 200 | No puncture | 105 | Punctured |
| 9 | 200 | No puncture | 109.5 | Punctured |
| Average | 196 | | 110 | |

The steam-treated oil was regular insulating oil with water suspended in it, introduced by bubbling steam through the oil for a few seconds, until the dielectric strength of the oil was reduced to about 17 kv. for a 0.2-in. gap between ½-in. electrodes. For the compressed air tests the electrode leading into the pinhole was insulated by a Pyrex heavy-walled tube so that the flashover took place from the bottom of the pinhole around the insulator to the wire in the tie wire groove. The insulator was mounted in a pressure chamber consisting of two Pyrex deck insulators clamped together with the two high-tension leads entering at the ends. The tests with respect to the initial applied voltage and rate of increase of voltage were made according to the A.I.E.E. specifications for a puncture test under oil. The air pressure in the chamber was about 60 lb. per square inch and the voltage was noted when flashover occurred either over the insulator or between the leads outside.

The five-minute table flashover tests were made with the electrodes in the pinhole, again insulated by Pyrex heavy-walled tubes, and the insulators mounted on small metal cans about 4 in. high, in order to raise the flashover potential to the maximum possible. For the oil tests the insulator was screwed on a pin, with a small amount of mercury in the pinhole to insure good contact between the pin and the insulator, and a short length of ½-in. brass rod was tied in the line groove with No. 8 A.W.G. copper wire. These tests were made according to the A.I.E.E. specifications with the exception that in the steam-treated oil the insulators were tested only to 150 kv. and not until puncture occurred.

Measurements on the dielectric strengths of the two oils used in the above tests made according to the specifications given by the A.S.T.M.[3] using ½-in. brass disk electrodes separated by 0.2 in. indicated a strength of 17 and 47 kv. for steam-treated and regular oil, respectively.

Inasmuch as these experiments did not show at what voltage the insulators would have punctured in air or under the steam-treated oil nine other insulators were selected for additional tests in the two oils. These insulators were first subjected to a high-voltage test in the oil of low dielectric strength and then they were punctured in the regular insulating oil of high dielectric strength.

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[1] *A.I.E.E. Standards, Insulator Test Specifications, July, 1925.*

[2] *"Electrical World," Sept. 10, 1927, page 503.*

[3] *A.S.T.M. Standards, 1924, page 1070.*

The results in Table I show an average puncture voltage for the tests in the high-strength oil about 73 per cent of the average voltage that the insulators had previously withstood without damage in high-pressure air and in the low-strength oil. The results in Table II show an average puncture voltage in high-strength oil of 56 per cent of the voltage that the insulators had previously withstood in the low-strength oil. No corona was in evidence in the low dielectric strength oil tests, but it appeared when the voltage reached 80 kv. in the regular oil.

## Airplane Line Patrol

THE interconnected system comprising the properties of the Arkansas Power & Light Company, the Louisiana Power & Light Company and the Mississippi Power & Light Company contains about 1,000 miles of 110-kv. transmission, not to speak of 66-kv. and 33-kv. lines. The system covers large areas in the three states, and on this account the problem of transmission line inspection and maintenance is much more difficult than on a more compact system in a smaller area. Therefore a means for locating trouble faster than patrolling a line on foot—the lines do not follow the highways and therefore automobile patrolling is not wholly practicable—is much to be desired. An airplane seemed to be a reasonable solution.

*Plane owned and used by Arkansas Power Company. Observer accompanies pilot*

During the Mississippi flood last year H. C. Couch, president of the three companies, was most active in relief and levee protection work. Early in May of 1927 he secured the services of Allen Scott, a young pilot of Pine Bluff, Ark., who had his own airplane, to deliver sacks to locations where levees were threatened. Many of the transmission lines were in water up to 10 or 15 ft. deep, and after the flood had passed the crest and the danger to levees was past Scott made more or less systematic patrols of the lines to spot weakened construction and places where driftwood had accumulated against poles or towers. The line crews would then go out in rowboats or motorboats to make repairs or clean away the drift. After 1½ weeks of work in his own plane Scott was instructed to go to the factory of the Advance Aircraft Company at Troy, Ohio, and accept delivery of a Waco two-seater that Mr. Couch had ordered. This ship was used during the remainder of the flood period, and following that it became an integral part of the organization of the three companies.

The plane is not used for routine line inspection patrol. This is done on foot, as is the usual practice. But when a line goes out and it is necessary to find the trouble in the shortest possible time the plane is sent out. Since the flood emergency the airplane has located four line breaks, doing the job in each case in only a small fraction of the time that would have been necessary if the trouble had been hunted on foot or by automobile. It is the practice on this work for an observer to go along. In addition to line work the plane has been very useful in making emergency deliveries of small parts and equipments. General system dispatching is done by carrier telephone. One carrier installation in Mississippi got into trouble. Spare parts were available at a station in Arkansas. The plane made the delivery in a couple of hours and the communication system was immediately restored to normal operation upon the replacement of the defective parts.

In the period from May 4, 1927, to March 2, 1928, the plane traveled about 26,000 miles and was in the air about 300 hours. The motor was taken out and a new one installed after 225 hours. The first motor has been reconditioned and is now ready to replace the second when necessary. This work of reconditioning and changing motors is done by the pilot, who also added the cabin.

## Performance with Pulverized Coal

REPORTING an experience with pulverized coal firing at the Big Sioux station of the Sioux City Gas & Electric Company to the second Iowa Power Conference, J. E. Enerson, chief engineer of that company, presented the data shown in the accompanying table.

The installation is of the storage type firing Stirling boilers with economizers and bottom water screens. Steam pressure is 350 lb. with 240 deg. of superheat. Since starting operations in 1925, coal from ten states, Iowa, Kentucky, Illinois, Indiana, Arkansas, Oklahoma, Colorado, Missouri, Wyoming and Kansas, has been used. The variation was made more complete by the use of coal from several fields in each state. The Colorado coal was not lignite, but of the semi-bituminous variety; coal from the northern, central and southern districts of Illinois has been used; all Kentucky coal came from the western fields. These coals varied in moisture content from 2 to 20 per cent, in ash from 9 to 24 per cent and in B.t.u.'s per pound from 8,700 to 13,800. To make the range greater petroleum coke breeze having a B.t.u. value of more than 15,000 per pound and cinders with a B.t.u. value of from 2,600 to 3,000 per pound have been successfully burned. As a matter of fact, serious consideration is being given to the use of cinders in connection with a certain coal of fragile structure, the purpose of the cinders being to act as a cushion in the milling of this coal.

OPERATING EXPERIENCE WITH PULVERIZED FUELS

| **Coal** | 1926 | 1927 |
|---|---|---|
| Heating value | 10,990 | 10,610 |
| Moisture in coal, per cent | 9.45 | 10.15 |
| Ash in coal, per cent | 14.00 | 14.35 |
| Ash-fusing temperature | 2,200 | 2,200 |
| **Boiler** | | |
| Average rating, per cent | 179 | 197 |
| Boiler and economizer efficiency | 81.8 | 82.9 |
| **Coal Preparation** | | |
| Tons of coal pulverized per mill hour | 7.41 | 6.84 |
| Energy, kilowatt-hours per ton | 20.90 | 20.70 |
| Steam for heating coal house per ton, lb. | 73 | 73 |
| Total operating cost (labor, energy, material and heating steam), cents per ton | 26.75 | 26.08 |
| Total maintenance (labor, material), cents per ton | 8.56 | 12.00 |

# Breakdown of Spark Gaps

## Electrical characteristics at atmospheric pressure. Townsend theory contradicted. Temperature rise of 4,000 deg. C. produces great conductivity by thermal ionization

By Dr. J. Slepian
*Westinghouse Electric & Manufacturing Company*

*The great speed of breakdown of spark gaps at atmospheric pressures observed experimentally contradicts sharply the classical Townsend theory of sparkover. To solve this dilemma, it is suggested that thermal ionization of the gas takes place in the single passage of an electron from cathode to anode, and before the Townsend process can develop. Calculation, taking space change into account, confirms this view. Sparkover takes place at those gradients which produce thermal ionization, and good agreement is obtained between breakdown gradients calculated on this basis and those observed experimentally. The "suppressed discharges" figures of Torok, which are difficult to explain otherwise, are a natural consequence of the theory developed here. The time for breakdown with moderate overvoltages comes out satisfactorily of the order of $10^{-7}$ seconds.*

IN A very interesting and important paper W. Rogowski[1] has pointed out the inadequacy of the Townsend theory of electrical breakdown of gases for explaining the extreme shortness of the time in which breakdown of spark gaps in air at atmospheric pressures occurs. Whereas at voltages little greater than the static sparkover many experimenters[2] agree that the spark lag is of the order of $10^{-7}$ seconds, application of Townsend's theory leads to times of the order of $10^{-5}$ seconds. The basis of Townsend's theory, namely, the phenomenon of ionization by collision, is so well established in so many ways and Townsend's theory of breakdown itself is in such good agreement with experiments at lower pressures[3] that it seems necessary to continue to hold to it in accounting for the beginning of sparkover at atmospheric pressures, but to look for some new effect which short circuits the relatively slow Townsend process for explaining the extremely short time lag at atmospheric pressures.

According to Townsend, the mechanism of breakdown is as follows: Electrons move toward the anode, producing many ions by collisions on the way. The positive ions so generated move toward the cathode and also ionize by collision, although the capacity of the positive ion for ionizing by collision is much less than that of the electron. If, in moving toward the cathode, the positive ions are able to generate by collision electrons in number greater than those to which they owe their birth the discharge will be unstable, the current continually increasing so long as the impressed electric field remains the same. If $\alpha$ is the average number of ions generated by the collisions of an electron during its advance through one centimeter toward the anode, and if $\beta$ is the corresponding quantity for a positive ion, Townsend[4] gives for the steady state current flowing between plane electrodes in a uniform electric field below the breakdown value the following expression,

$$i = i_o \frac{(\alpha - \beta)\varepsilon^{(\alpha-\beta)d}}{\alpha - \beta\varepsilon^{(\alpha-\beta)d}} \qquad (1)$$

Here $i_o$ is the current which would flow if there were no ionization by collision and $d$ is the distance between the electrodes in centimeters. $\alpha$ and $\beta$ are rapidly increasing functions of the electric field, and as the electric gradient is increased the denominator in equation (1) becomes smaller. At a certain critical gradient the denominator becomes zero

$$\alpha - \beta\varepsilon^{(\alpha-\beta)d} = 0 \qquad (2)$$

and the current by equation (1) becomes infinite. According to Townsend, this critical gradient is the breakdown gradient, and for it and larger gradients there is no steady state current as in equation (1), but the current continues to increase without limit.

Essential to this briefly sketched theory is the ionizing action of the positive ions on their way to the cathode. The building up of the current during breakdown may be regarded as taking place in stages. First, electrons move toward the anode, generating many ions by collision. Then the positive ions move toward the cathode, generating a larger number of electrons. These electrons moving toward the anode generate a larger number of positive ions. And so the process continues. However, Rogowski shows that at atmospheric pressure, with a spark gap of one centimeter or more length, under breakdown conditions, a positive ion requires for moving from the anode to the cathode a time of the order of $10^{-5}$ seconds. Thus the theory leads to a very sharp contradiction with experiment.

The time required for an electron to move from cathode to anode is, according to Rogowski, of the order of $10^{-7}$ seconds and is more nearly in accord with experiments on time lag. There is a strong suggestion, then, that at atmospheric pressures the return of the positive ions to the cathode is unnecessary, breakdown occurring on the first passage of electrons to the anode.

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[1] *Rogowski, Archiv. für Elektrotechnik, XVI, 1926, page 496.*

[2] *For résumé of experimental work see article of Rogowski, l.c.*

[3] *Occasional observations of the time lag of spark gaps at reduced pressures which have come to the author's attention indicate that Townsend's theory gives correctly the order of magnitude of the time of breakdown.*

[4] *"Electricity in Gases," Oxford, 1915, page 313.*

Strengthening this suggestion, there are the very interesting pictures of "suppressed discharges" obtained by Torok,[5] one of which is reproduced on page 764. These pictures apparently show an impulse breakdown in the course of formation. We find here a number of luminous streamers of quite small section, originating in the more intense parts of the field next to the electrodes and growing out into the spark gap space. Presumably the breakdown occurs when a streamer bridges across the whole gap. The Townsend mechanism described above would seem to be inconsistent with such growing streamers. If the breakdown depended on many back and forth reactions of electrons and positive ions it would seem that the luminosity should develop more uniformly over the whole breakdown path, being faint in the early stages and then becoming more intense as the breakdown proceeded.

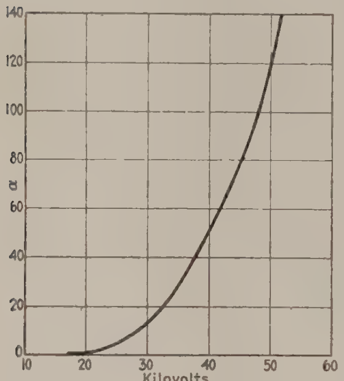

*Fig. 1—Values of α at atmospheric pressure*

### THERMAL IONIZATION THEORY

In this paper is brought out the fact that by calculation the energy density input into the gas in the path of an electron moving under the influence of an impulse breakdown field and ionizing by collision rises to enormous figures, and that consequently the gas in the neighborhood of the path is raised to a very high temperature. This temperature is so high that thermal ionization sets in, and it is by this thermal ionization that it is proposed to explain the speed of breakdown of spark gaps at ordinary pressures.

That gases at very high temperatures should be highly ionized is to be expected from kinetic and thermodynamic theory. Saha[6] has given this subject quantitative treatment and derived the following equation,

$$\log \frac{x^2}{1 - x^2} P = - \frac{U}{4.57\,T} + 2.5 \log T - 6.5 \quad (3)$$

where $x$ is the fraction of molecules ionized, $P$ is the pressure in atmospheres, $U$ is the energy required for ionization in calories per gram molecule and $T$ is the absolute temperature.

K. T. Compton[7] has applied Saha's equation to explain the conductivity of the space between the electrodes in an arc in air. He concludes that at the existing temperature, about 4,500 deg. K., there will be enough thermal ionization to account for the observed conductivity of about 50 amp./cm.$^2$ at a gradient of 27 volts/cm.[8]

In deriving his results from Saha's equation, Compton, of course, took $P = 1$. However, in the case of the spark discharge it is the density rather than the pressure which remains atmospheric, and at a temperature of 4,500 deg. K the pressure will increase to 15 atmospheres; $X$, the fraction of molecules ionized, will, therefore, by equation (3) be reduced in the ratio of $\sqrt{15}$. However, the number of molecules per centimeter$^3$ is increased fifteen times, so that the density of ions will be $\sqrt{15}$ times greater than at atmospheric pressure. The mobility of the ions will reduce at the higher pressure by approximately $\sqrt{15}$, so that the conductivity will not differ very much from that determined by Compton. We may conclude that a temperature rise of 4,000 deg. C. will be enough to produce great conductivity by thermal ionization.

### THE IONIZING CONSTANTS α AND β

The ionizing constants α and β, which are the average number of ionizing collisions made per centimeter travel in the direction of the field by the electrons and positive ions respectively, are important in the subsequent calculations. From kinetic theory considerations, it appears that the following functional relations hold.[9]

$$\frac{\alpha}{p} = f\left(\frac{X}{p}\right) \quad (4)$$

$$\frac{\beta}{p} = F\left(\frac{X}{p}\right)$$

Here $p$ is the gas pressure and $X$ the electric gradient. From these relations it is possible to calculate from the values of α and β found by Townsend and others for lower pressures what will be corresponding values at atmospheric pressures. Taking the data given by Townsend[10] and by Wheatley[11] we obtain the curve of Fig. 2.

Starting with a single electron, it is quite evident that ionization by collision will cause the number of electrons to multiply in an exponential manner. According to Townsend[12] the number of electrons generated by an initiating electron, and in its immediate neighborhood, when it has traveled a distance $x$ in the direction of the impressed field will be:

$$N = \varepsilon^{\alpha x} \quad (5)$$

### DIFFUSION OF ELECTRONS IN IONIZING PATH

To calculate the temperature rise in the gas due to the moving electrons whose number is given by (5) we must determine what is the cross-section of the path they traverse. If this path were a geometrical line, the temperature rise would be infinite. Actually the path will have a finite section due to the sidewise diffusion of the ions.

In his "Electricity in Gases," page 85, Townsend has shown that for particles spreading by diffusion, the mean square of the distances of the particles from any fixed point increases proportionally with the time. More particularly,

$$\overline{R}^2 = 6\,Dt \quad (6)$$

where $\overline{R}^2$ is the mean square of the particle distances, $D$ is the coefficient of diffusion of the particles and $t$ is the time.

We may regard the electrons of equation (5) as all moving together with a uniform velocity in the direction of the electric field, but that superposed upon this uniform velocity is a radial diffusion. Hence, we expect the electrons of (5) at any moment to have a spherical configuration. To simplify our calculations and for lack of any better hypothesis we shall assume that the electrons fill out a sphere of radius $R$ with uniform density.

It is readily verified then that $R^2 = \frac{5}{3}\overline{R}^2$ so that

$$R^2 = 10\,Dt. \quad (7)$$

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[5] *J. J. Torok, Transactions A.I.E.E., 1928.*

[6] *Saha, Phil. Mag. 40, page 472, 1920.*

[7] *K. T. Compton, Phys. Rev. 21, page 287, 1923.*

[8] *K. T. Compton, loc. cit., page 286.*

[9] *Townsend, "Electricity in Gases," Oxford, 1915, pages 279 and 291.*

[10] *J. S. Townsend, Phil. Mag. (6), 27, 1914.*

[11] *Wheatley, Phil. Mag. (6), 26, 1913, page 1034.*

[12] *"Electricity in Gases," page 264.*

As to the coefficient of diffusion, Townsend's "Electricity in Gases," page 88, gives the formula $D = \frac{1}{3}\, lc$ where $l$ is the mean free path of the diffusing particles and $c$ is their effective velocity of agitation. Taking with Rogowski (l.c. page 501) $l = 5.70 \times 10^{-5}$ and $c = 1.09 \times 10^{7}$ we get $D = 2{,}070$.

The time $t$ in (7) is given by $\frac{x}{v}$ where $v$ is the velocity of the electrons in the direction of the field. Taking for this velocity $U = \sqrt{2\,\frac{e}{m}\,\frac{l}{\pi}\,E}$ and substituting numerical values and changing to practical units, $X$ being the electric gradient in volts per centimeter,

$$V = 2.53 \cdot 10^{5}\ X^{1/2} \qquad (8)$$

$$R^2 = 8.18 \cdot 10^{5}\ X^{-1/2} \qquad (9)$$

The mean density of electrons over the path section will be $N/\pi R^2$, but of course it will be greater at the center of the section. There it is readily seen it will be larger, namely,

$$n = \frac{3}{2\pi}\ N/R^2 \text{ electrons per square centimeter} \qquad (10)$$

When these electrons are pulled by the electric field through a distance of 1 cm. they will produce heat in amount $neX$, where $e$ is the electronic charge. To calculate the temperature rise, we must know the heat capacity of a cubic centimeter of air at high temperature, but at atmospheric density. Since experimental data are lacking for high temperatures we may use the kinetic theory. The molecules of a diatomic gas have three degrees of freedom in translation and two degrees of freedom in rotation. Also at high temperatures we must probably consider the oscillations of the atoms making up a molecule toward and away from each other, in which oscillations there will be kinetic and potential energy. From the principle of equipartition of energy it follows that the total energy of a molecule will be 7/3 times its kinetic energy. Taking for the translational energy per molecule, $2.058 \cdot 10^{-23} T$ joules and for the number of molecules per centimeter$^3$ $2.52 \cdot 10^{19}$, the heat content of a centimeter$^3$ of air at $T°\,K$ will be $1.20 \cdot 10^{-3} T$ joules. Hence,

$$neX = 1.20 \cdot 10^{-3} T \qquad (11)$$

$T$ being now the temperature rise.

Taking $e = 1.59 \cdot 10^{-19}$ coulombs and substituting (10), (9) and (5), in (11) we get

$$T = 7.82 \cdot 10^{-15}\ X^{3/2}\, x^{-1}\, \varepsilon^{\alpha x} \qquad (12)$$

This gives the temperature rise along the path of the ionizing electron. When $T$ equals 4,000 deg. the path becomes highly conducting because of thermal ionization. Equation (12) shows that for a given gradient the temperature rise increases very rapidly with $x$, and because of the dependence of $\alpha$ upon $X$ it increases very rapidly with $X$. In Fig. 2 are plotted the temperature rises for a few electric gradients.

If we assume tentatively that the critical gradient for breakdown of a plane electrode spark gap is that at which thermal ionization or a temperature rise of 4,000 deg. is reached, we get from Fig. 2 the gap lengths corresponding to various gradients shown in Table I. These may be compared with the experimental values considered best by Schumann, *Elektrische Durchbruchfeldstärke von Gasen,* Berlin, 1923, page 25. Although the proper order of magnitude is obtained, the spark lengths predicted by the tentative theory come out too long. It seems that we must look for some effect which sets in earlier than the thermal ionization, or which makes the thermal ionization set in earlier. This effect may be found in the influence of the space charges produced in the path of ionization.

TABLE I

| Critical Gradient Kv. per Cm. | Spark Length by Fig. 2, Cm. | Spark Length Schumann, Cm. |
|---|---|---|
| 30 | 2.02 | 1.9 |
| 35 | 0.89 | 0.47 |
| 40 | 0.48 | 0.19 |
| 45 | 0.39 | 0.09 |

### THE SPACE CHARGE EFFECT

As the initiating electron and its numerous progeny move along the path of ionization, they become separated from the positive ions which are also produced, and thus the growing sphere containing the electrons, which was considered in the preceding section, will not contain enough positive ions to neutralize the electrons, but there will be an excess of negative charge in the sphere. This negative charge and the positive charge left along the path will produce a field, which it is easy to see will increase the electric gradient acting on the more advanced electrons, and decrease the gradient on the lagging electrons. This space charge effect is readily calculable, at least approximately.

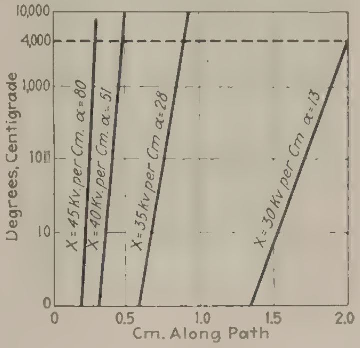

*Fig. 2—Temperature rise in the path of ionizing electron with space charge not considered*

Because of the low mobility of the positive ions relative to that of the electrons, we may neglect the motion of the former and assume that they stand still in space where they were formed. We now calculate the position of the center of gravity, $x$, of these positive ions at the moment the center of the sphere of electrons has reached the point $x$.

The number of positive ions, $dN_+$ generated when the sphere of electrons moves a distance $dx$ is given by:

$$dN_x = N\alpha dx \qquad (13)$$

The mean $x$ co-ordinate of the positive ions will, therefore, be:

$$\bar{x} = \frac{1}{N}\int_0^N x\,dN_+ = \frac{1}{N}\int_0^x \alpha x N\,dx \qquad (14)$$

Substituting $N = \varepsilon^{\alpha x}$ from (5) and carrying out the integration,

$$\Delta x = x - \bar{x} = \frac{1}{\alpha}\left(1 - \varepsilon^{-\alpha x}\right) \qquad (15)$$

The field produced by the electrons at the point $x + R$, will be $\frac{Ne}{R^2}$ e.s.u., and that produced by the positive ions will be $\frac{Ne}{(R + \Delta x)^2}$. Hence, the increase in gradient at the head of the ionizing column due to space charge will be:

$$\Delta X = \frac{Ne}{R^2} - \frac{Ne}{(R + \Delta x)^2} = \varepsilon^{\alpha x} e \left[\frac{1}{R^2} - \frac{1}{(R + \Delta x)^2}\right] \quad (16)$$

$R$ being given by equation (9) and $\Delta x$ by (15). Fig. 3 gives the gradient at the head of the ionizing column for a number of initial gradients.

The space charge effect only changes by a small amount the average gradient acting on the electrons. It increases the force on some, with an almost corresponding decrease in the force on others. But because the rate of increase of $\alpha$ with $X$ is such a rapidly increasing function of $X$ as shown in Fig. 1, it follows that the increase in $\alpha$ for those electrons in the stronger field far exceeds the decrease in $\alpha$ for those electrons in the weaker field, so that the effect of the space charge is to cause an increase in the average value of $\alpha$ for the electrons. Hence, when the space charge effect begins to appear, the effective value of $\alpha$ increases, which causes the space charge effect to increase still more rapidly, so that taking this into account, the curves giving the gradient at the head of the ionizing column will turn up even more rapidly than do those shown in Fig. 3.

*Suppressed discharge on spheres as observed by Torok*

The rapid increase in the value for $\alpha$ at the head of the ionizing column will cause thermal ionization to set in almost at once at the point where the gradient due to space charge turns up rapidly. If again we tentatively assume that breakdown occurs when thermal ionization begins, and locate the beginning of thermal ionization as the points where the curves of Fig. 3 turn up rapidly, we get the data of Table II. The agreement with the values of Schumann is now much better than in Table I.

The electric field due to the space charge is directed radially outward in the sphere of advancing electrons. Hence, it will act like the diffusion in causing the sphere to grow in size. We must compare this effect with the normal rate of growth of the sphere by diffusion to see if the calculations must be altered on this account. From equation (7) we get for the rate of increase in the radius of the sphere due to diffusion,

$$\frac{dR}{dt} = \frac{5D}{R} \quad (17)$$

On the other hand, we may use equation (8) for determining the rate of increase of the radius of the sphere due to the radial field arising from space charge. At the points selected in Table II we get the results shown in Table III.

TABLE II

| Critical Gradient Kv. per Cm. | Spark Length by Fig. 3, Cm. | Spark Length Schumann, Cm. |
|---|---|---|
| 30 | 1.1 | 1.9 |
| 35 | 0.45 | 0.47 |
| 40 | 0.20 | 0.19 |
| 45 | 0.13 | 0.09 |

TABLE III

| Critical Gradient, Kv./Cm. | Radius of Electron Sphere, Cm. | Radial Velocity Due to Diffusion, Cm./Sec. | Radial Field Due to Space Charge, Kv./Cm. | Radial Velocity Due to Radial Field, Cm./Sec. |
|---|---|---|---|---|
| 30 | $7.2 \times 10^{-3}$ | $1.44 \times 10^{6}$ | 4.0 | $16.0 \times 10^{6}$ |
| 35 | $4.4 \times 10^{-3}$ | $2.35 \times 10^{6}$ | 2.2 | $11.8 \times 10^{6}$ |
| 40 | $2.9 \times 10^{-3}$ | $3.56 \times 10^{6}$ | 0.45 | $5.3 \times 10^{6}$ |
| 45 | $2.2 \times 10^{-3}$ | $4.7 \times 10^{6}$ | 0.88 | $7.5 \times 10^{6}$ |

We see, then, that at the points selected in Table II the rate of increase in the radius of the sphere of electrons due to space charge field is greater than the rate of increase due to diffusion; for the 30-kv./cm. gradient it is more than eleven times greater, while for the 45-kv./cm. gradient it is only 1.6 times greater. It must be noted, however, that the effect of the space charge field has only just come into being at the points chosen, whereas the diffusion has been active over the whole path. Hence, the space charge effect cannot have caused the radius of the sphere to have increased much except possibly for the 30-kv./cm. gradient. This calls for a correction which would improve the agreement in Table II.

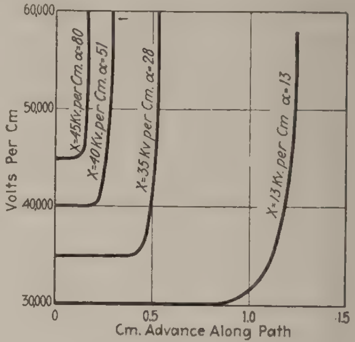

*Fig. 3—Voltage gradient at the head of the ionizing column*

## The Mechanism of Breakdown

We may now consider in more detail the mechanism of breakdown. After the initiating electron has traveled a greater or lesser distance, depending on the gradient as in Table II, the breakdown path becomes thermally ionized. From this point on the initiating electron and its accompanying progeny leave behind them a trail not merely of comparatively immovable positive ions but a trail having a considerable number of free electrons produced during and after the passage of the initiating electron as a consequence of the high temperature of the gas. This thermally ionized trail may be regarded as highly conducting and its influence upon the electric field may be determined from the elementary principle of electrostatics.

At the point where thermal ionization begins we may regard the thermally ionized region as a conducting sphere, and hence the electric gradient at its front and rear will be three times the mean gradient.

As the thermally ionized trail lengthens we may regard it as a rod-shaped conductor in the electrostatic field. The gradient at its ends is then enormously larger than the average gradient; the rate at which it lengthens toward the anode is increased enormously also. At the cathode end of the thermally ionized trail the positive ions move toward the cathode in an intensified field, so that their velocity is much greater than that corresponding to the uniform field, Because of their large number, they also thermally ionize the region they pass over, so that the thermally ionized trail is extended toward the cathode. The charging currents flowing to the sides of the ionized trail will serve to keep the trail thermally ionized while it is extending. When the thermally ionized trail reaches from cathode to anode the sparkover may be said to be completed.

### TIME FOR BREAKDOWN

The theory just developed gives much shorter times for the breakdown process than does the classical Townsend theory. At a gradient just sufficient for breakdown an electron starting at the cathode will cause thermal ionization to appear near the anode. The gradient on the cathode side of the thermally ionized region will be multiplied by three or more, and then as the thermally ionized path extends toward the cathode the gradient will increase to a much greater degree. Positive ions need to move from the neighborhood of the anode clear up to the cathode, as in Rogowski's analysis of the Townsend mechanism, but they now move in a very much stronger field, and also they need to traverse the spark gap space only once for the breakdown to be complete. When gradients larger than that just sufficient to cause breakdown are applied the thermal ionization sets in much closer to the cathode, the positive ions at the cathode end of the thermally ionized trail need to move a shorter distance to reach the cathode and are driven by a stronger field, so that the time is greatly reduced by a slight overvoltage.

In order to calculate the time of breakdown it is necessary to know the radius of curvature of the ends of the rod-shaped thermally ionized trail, so that the electric gradient there may be determined. When thermal ionization first sets in the circular section of the trail by Table III has a diameter of the order of 0.001 to 0.01 cm. After thermal ionization, however, it seems a hopeless task to predetermine the trail section. The pictures of Torok indicate, however, that the trail remains fine, with section probably less than 1 mm. diameter.

If we assume, then, that the radius of curvature of the trail ends is constant and equal to 0.05 cm. we may hope to get results which are correct as to order of magnitude. The calculations for a few cases follow: Consider a 2-cm. gap, for which, according to Schumann, 30 kv./cm. is only a little greater than the breakdown gradient. By equation (8) an electron will move in this field with a velocity of $4.37 \times 10^7$ cm./seconds and will require $4.56 \times 10^{-8}$ seconds to go from cathode to anode. There it produces thermal ionization, and the gradient for the positive ions moving toward the cathode from this region will be 3 × 30 or 90 kv./cm. Using the same formula as was used in obtaining equation (8) we find for the velocity of the positive ion, molecular weight 28.

$$U_{\infty} = 5.6 \times 10^2 \overline{X^{\frac{1}{2}}} \qquad (18)$$

The initial velocity of the positive ions will, therefore, be $3.36 \times 10^5$ cm./seconds.

To calculate further, we need to know the radius of curvature of the cathode end of the thermally ionized trail, and we assume it to be 0.05 cm. Let us then take as an approximation to the field intensity at the end of the trail that intensity which would exist at the surface of a 1-mm. diameter conducting sphere, placed at the end of the trail, and joined by a wire to the anode. We then get, letting $y$ be the distance to the anode, $X$, the mean gradient, and $\overline{X}$ the gradient at the sphere surface,

Hence
$$\overline{X} = (20y + 1)X \qquad (19)$$

$$v_+ = \frac{dy}{dt} = 5.6 \times 10^2 \overline{X}^{\frac{1}{2}} = 5.6 \times 10^2 (20y + 1)^{\frac{1}{2}} X^{\frac{1}{2}} \qquad (20)$$

Using this equation, the time to reach the cathode is approximately:

$$t = \frac{4.46 \times 10^{-4}}{X^{\frac{1}{2}}} \int_{y_o}^{2} \frac{dy}{(20y + 1)^{\frac{1}{2}}} = \frac{4.46 \times 10^{-4}}{X^{\frac{1}{2}}} \left[ 0.64 - 0.1(20y_o + 1)^{\frac{1}{2}} \right] \qquad (21)$$

Taking $X = 30{,}000$, and $y_o = 0.1$; i.e., the value for which $\overline{X} = 3X$ by (19) we get

$$t = 4.2 \times 10^{-6} \text{ seconds}$$

The total time of breakdown is, therefore, $4.2 \times 10^{-6} + 4.56 \times 10^{-8} = 4.2 \times 10^{-6}$ seconds.

Let us now consider the 2-cm. gap with a gradient of 35 kv./cm. By Table II, thermal ionization begins at 0.45 cm. from the cathode, or 1.55 cm. from the anode. Hence setting $y_o = 1.55$ and $X = 35{,}000$ in (21) we get

$$t = 7.4 \times 10^{-7} \text{ seconds.}$$

For a 40-kv./cm. gradient we have by Table II $y_o = 1.8$, and by (21) we get

$$t = 2.6 \times 10^{-7} \text{ seconds.}$$

For a 45-kv./cm. gradient we get $y_o = 1.87$ and

$$t = 1.7 \times 10^{-7} \text{ seconds.}$$

The times for breakdown thus calculated agree well in order of magnitude with those obtained by experiment, and the rapid increase in breakdown speed with moderate increase in overvoltage also comes out very satisfactorily.

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## Bundling Cable Reel Lagging

By N. E. BUCK
*Superintendent of Underground Work*
*Commonwealth Edison Company, Chicago, Ill.*

THE handling of lagging removed from cable reels is always a problem. If the pieces are piled loosely around the reel they are a hazard to pedestrians and workmen and are easily removed for bonfires by the omnipresent small boy. The Commonwealth Edison Company formerly bundled the lagging with No. 8 iron pull wire, but the wire could not be pulled up tight enough to prevent the inner pieces from sliding out when the bundles were handled and a loose piece of wood of this size involves safety hazards. One of the men in the underground department worked out a scheme for using galvanized steel strip which was pulled tightly around

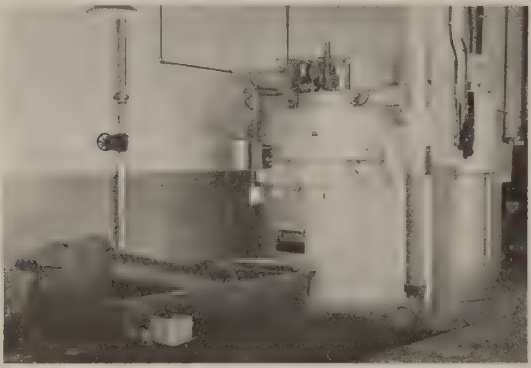
*Reel lagging readily bundled with galvanized strip* the bundle by means of a special tool and then nailed down. This method has proved to be far superior to any heretofore used. It is safe and easy and it greatly facilitates piling the lagging in the yard during storage and preparatory to its ultimate disposal.

## Rotary-Hearth Furnace for Small Pieces

By W. J. Diederichs
*Industrial Heating Engineer*
*Westinghouse Electric & Manufacturing Company*

An automatic discharging device incorporated in an electric furnace of rotary-hearth type permits the hardening of cap screws and similar parts with satisfactory operating economies. None of the parts is larger than $\frac{1}{2}$ in. in diameter by $3\frac{1}{2}$ in. long. They are treated in quantities of 800 lb. per hour. The material is heated to 1,500 deg. F., properly soaked and then discharged for quenching purposes.

The furnace provides an annular heating chamber 24 in. wide by 23 in. high, the floor of which consists of a rotating hearth of 5 ft. mean diameter, upon which twelve alloy trays are mounted on trunnions, about which they rotate when the rear end is lifted. The slope of the tray, when so lifted, is sufficient to discharge any work. The hearth is motor driven and is normally stationary. The control of this drive is such, however, that at regular intervals the hearth is advanced one tray and again stops. When in any of its stationary positions the hearth spots one tray directly in front of the charging door and another tray directly over a discharge chute. The time which the hearth remains stationary is adjustable and by this means the time the work remains in the furnace, subjected to heat, can be varied through wide limits. This permits the adjustment of the heating cycle to the size of work to be treated.



*Small-parts treating furnace employs automatic discharging device*

The automatic discharge mechanism is mounted on top of the furnace. It is motor driven and electrically interlocked with the hearth drive. Immediately after the hearth has stopped with a tray over the discharge chute the discharge motor engages with a hooked arm which extends through the furnace roof and connects under the tray. The hook, on being lifted, raises the tray and discharges the work into the discharge chute, whereupon the hook and tray are automatically lowered to their original stationary positions.

At regular intervals a tray of properly heated work is automatically "dumped" into the discharge chute and quenched. In traversing the chute and falling through the quenching medium the individual pieces are separated so that quenching results are obtained which closely approximate those obtained by the ideal individual quenching.

The furnace has an electrical input of 90 kw. for operation on 230-volt, three-phase power supply. This input is divided into two zones, each occupying one-half of the annular chamber. Each zone is independently controlled by a separate pryometer and thermocouple actuating suitable contactor panels. This two-zone arrangement of input permits adjusting the temperature being maintained in the ingoing and outgoing halves of the chamber and makes it possible to vary the rate of heating of the work.

The furnace, when operating at a production of 800 lb. of work per hour at a temperature of 1,500 deg. F., successfully treats 9 lb. of work per kilowatt-hour of energy consumed.

## "Activity" of Lamp Sockets in Residential Field

By M. Luckiesh
*Director Lighting Research Laboratory, National Lamp Works of General Electric Company*

From two extensive surveys of homes in all parts of this country and from other observations we find that the average home, exclusive of halls, closets, basement and exterior, consists of 6.5 rooms, of which 2.5 rooms are bedrooms. In this average home there are 22 lamp sockets, distributed as follows:

| | Sockets | | Sockets |
|---|---|---|---|
| Living room | 6.0 | Bathroom | 1.3 |
| Dining room | 3.7 | Basement | 2.1 |
| Kitchen | 1.4 | Halls | 1.7 |
| Bedrooms (2.5) | 5.8 | | |
| | | Total | 22.0 |

For purposes of computation and discussion we have coined the terms "average socket" and "active socket." The average operation per day per socket for lighting amounts to approximately one hour. Therefore, we have defined an "average socket" as one which operates an average of one hour per day, or 1,000 hours (one lamp-life) in three years. However, there are certain sockets in the house, such as that in the modern kitchen unit, which we term "active sockets." An "active socket" is defined as one which operates 1,000 hours per year, or approximately three hours per day.

One "active socket" containing a 50-watt lamp represents to the central station at the present time an increase of 16.5 per cent in gross lighting revenue per customer and an increase of $3.82 in annual gross revenue per customer. According to some figures which we have this represents an increase of 150 per cent in annual net revenue.

The average home today requires about seven lamp renewals per year, which accounts for the sale of 123,000,000 lamps per year. For each million new homes added to central-station service each year at least 22,000,000 lamps are installed. If we include the sockets in halls, closets, basement and exterior this figure becomes at least 27,000,000. Thus we may account for 150,000,000 large lamps entering the homes of this country each year.

# Off-Peak Rate Desirable

New England utility attracts valuable ice-making load through adjusted rate base. Customers minimize demand during restricted periods

By J. A. Cook

*Superintendent Electrical Department,*
*Lynn (Mass.) Gas & Electric Company*

ICE-MAKING plants have requested a number of public utility companies to develop suitable power rates for this kind of business. In some cases it has been difficult to convince the utilities of the value of the load and the importance of making rates competitive with other kinds of drives, including Diesel engines. Still, considerable progress is being made with purchased-power installations where the estimated cost of electric power is close to that of mechanical drive. In these instances the small investment required for the electrical equipment and the simplification of operating problems and maintenance has turned the scales in favor of electricity.

To the central station this business has the advantages of being off-peak and having a high power factor and weekly load factor. The Lynn company recently studied the situation and has developed a profitable rate based on the attractive features of the load.

In examining others' rates it was found that the New York Edison, United Electric Light & Power and affiliated companies have a schedule based on weekly bills figured from the weekly maximum kilowatt demand, which in well-managed ice plants is nearly the same as the weekly average demand. From November to February, inclusive, shutdown of major apparatus is required between 4 and 8 p.m. The demand charge is adjusted yearly according to annual revenue. Using this rate as a base, it was modified for Lynn to insure that all load occurring on the peak is paid for in full, including energy and investment costs, and that the best rate is earned by large consumption at high weekly load factors. Annual adjustments involving large refunds or excess payments which might disturb the customer's cash position are avoided by the terms adopted. Energy is taken at unity power factor whenever possible; normally it runs between 95 per cent lagging and 95 per cent leading.

### Essentials of Lynn Rate

Available to customers with 200-hp. minimum connected load, ice making only, with synchronous motor drive, capable of operating at leading power factor for main compressor units to keep between 95 per cent leading and 95 per cent lagging.

Customer supplies and maintains transformers and supplies ventilated transformer vault or approved outdoor platform and also space for metering equipment and service oil circuit breaker.

Energy may be used for lighting ice manufacture not exceeding 5 per cent of the total kilowatt-hour consumption of the ice plant.

Power demand restricted 4 to 8 p.m., November-February inclusive, to 10 per cent of highest demand during preceding twelve months.

All energy used off-peak billed weekly at:

| Energy Billed per Calendar Year (Net) Kw.-Hr. | Bill per Week per Kilowatt Demand |
|---|---|
| First 7,500 | $2.14 |
| Next 7,500 | 1.99 |
| Next 7,500 | 1.84 |
| Over 22,500 | 1.70 |

All energy used during the restricted period is billed for each of ten consecutive weeks beginning with the time of use at $4.50 per kilowatt per week of such demand. The total charges for energy used during the restricted period amount to $45 per kilowatt of maximum demand during that period.

Kilowatts of demand are measured over fifteen-minute time

*Computation of Customer's Bills for a Year's Period Under Assumed One Year's Operation of 140-Ton Plant in New England*

Natural Ice Used to Some Extent During Winter Months

| | Off-Peak Period | | | | | | Restricted Period | | | Total Bill | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Weekly | | |
| Weeks | Kilowatt Demand | Load Factor | Hours Per Day Operation | Kilowatt-Hours | Rate Per Week Per Kilowatt-Demand | Weekly Bill Gross | Kilowatt Demand | Kilowatt-Hour L. F. 0.60 | Weekly Bill Gross | Gross | Net (Less 10 Per Cent Cash Five Days) | Sum of Weekly Bills for Calendar Year |
| Jan. 4 | 0 | .... | 0 | 0 | .... | 0 | 0 | 0 | $90 | $90.00 | $81.00 | $81.00 |
| Feb. 4 | 100 | 0.93 | 20 | 52,080 | $2.14 | $856.00 | 20 | 336 | ... | 856.00 | 770.40 | 851.40 |
| March 5 | 150 | 0.93 | 24 | 117,180 | 2.14 | 1,605.00 | .. | .... | ... | 1,605.00 | 1,444.50 | 2,295.90 |
| April 4 | 200 | 0.93 | 24 | 124,992 | 2.14 | 1,712.00 | .. | .... | ... | 1,712.00 | 1,540.80 | 3,836.70 |
| May 4 | 300 | 0.93 | 24 | 187,488 | 2.14 | 2,568.00 | .. | .... | ... | 2,568.00 | 2,311.20 | 6,147.90 |
| June 2 | 300 | 0.93 | 24 | 93,744 | 2.14 | 1,284.00 | .. | .... | ... | 1,284.00 | 1,155.60 | 7,303.50 |
| June 2 | 300 | 0.93 | 24 | 93,744 | 1.99 | 1,194.00 | .. | .... | ... | 1,194.00 | 1,074.60 | 8,378.10 |
| July 5 | 300 | 0.93 | 24 | 234,360 | 1.99 | 2,985.00 | .. | .... | ... | 2,985.00 | 2,696.50 | 11,074.60 |
| Aug. 4 | 300 | 0.93 | 24 | 187,488 | 1.99 | 2,388.00 | .. | .... | ... | 2,388.00 | 2,149.20 | 13,223.80 |
| Sept. 3 | 300 | 0.93 | 24 | 140,616 | 1.99 | 1,791.00 | .. | .... | ... | 1,791.00 | 1,611.90 | 14,835.70 |
| Sept. 1 | 300 | 0.93 | 24 | 46,872 | 1.84 | 552.00 | .. | .... | ... | 552.00 | 496.80 | 15,332.50 |
| Oct. 5 | 200 | 0.93 | 24 | 156,240 | 1.84 | 1,840.00 | .. | .... | ... | 1,840.00 | 1,656.00 | 16,988.50 |
| Nov. 4 | 150 | 0.93 | 20 | 78,120 | 1.84 | 1,104.00 | 20 | 1,344 | 360 | 1,464.00 | 1,317.60 | 18,306.10 |
| Dec. 5 | 100 | 0.93 | 20 | 65,100 | 1.84 | 920.00 | 20 | 1,680 | 450 | 1,370.00 | 1,233.00 | 19,539.10 |
| Totals 52 | | | | 1,578,024 | | $20,799.00 | | 3,360 | $900 | $21,699 00 | $19,539.10 | $19,539.10 |

Average rate per kilowatt-hour over year = $19,539.10 ÷ 1,581,384 kilowatt-hour = $0.01235 per kilowatt-hour.

intervals. The maximum demand in each week is used for that week's billing.

Discount of 10 per cent of total bill if paid within five days of date of bill.

Minimum charge, $7,500 per year, excluding coal clause and charges for energy used in restricted period.

Coal Clause—For each 25 cents increase or decrease in the price of coal per gross ton at company's bunkers from the base price of $5.35 per gross ton, the net price of energy is similarly increased or decreased 0.02 cents per kilowatt-hour.

### RATE APPLIED TO 140-TON PLANT

The equipment required by a 140-ton plant now being installed to operate under the above rate consists of the following synchronous motors: One 175-hp., 20 per cent leading power-factor synchronous, driving No. 1 main compressor, and one similar 100-hp. motor driving No. 2 main compressor; one 30-hp. induction motor for air compressor (one air compressor is driven by a gasoline engine), and the following other induction motors: Two 7.5-hp. for agitators, three 4-hp. for bridge type crane, one 1-hp. for core siphoning unit, two 7.5-hp. motors for water pumps, one 1-hp. for brine pump, one 3-hp. for auxiliary air compressor, one 2-hp. for ice tiering machine, two 10-hp. motors for motor-generator exciter sets and one 2-hp. motor for ice conveyor. This gives a total of 275 hp. in leading power-factor synchronous motors and 101 hp. in inductions. Although the main compressors are shut down during the restricted period, certain other motors have to run. Thus, the agitator motors must operate or the ice in the tanks will freeze white. The brine continues to circulate and some ice is made while the main compressors are shut off. It appears that for the above plant efficient operation can be had during the restricted period with a demand of 15 kw. At full capacity the demand may reach 350 kw. There are 480 hours in the period of restriction, and each kilowatt of the maximum demand during this period is billed at $40.50 net. Thus the customer pays in full for all use of capacity during the restricted period, including investment charges on generating station, transmission and distribution equipment, as well as for energy used. It is to the customer's advantage to keep his maximum demand at a minimum during this period.

Ice plants can readily operate for a week at load factors between 90 and 95 per cent figured on the unrestricted period; i.e., 24 hours per day during eight months and twenty hours per day during four months. The total annual unrestricted period is 8,280 hours. Each week the ice manufacturer determines the running rate for the entire week and adjusts his operation to that rate. He is free to adjust to a new rate of manufacture at the start of the next week. During the winter months in New England some use will be made of natural ice, and the total volume of business is less than in summer. The ice manufacturer may shut down his plant for several weeks during the winter and in general will have a smaller power demand in winter. The accompanying table shows how the rate applies during a typical year for a typical 140-ton plant operating under expected schedule.

This table and the rate schedule show that the rate paid per kilowatt-hour increases as the load factor decreases. In other words, the ice manufacturer has the opportunity of earning a lower rate by operating at higher load factor. The rate "puts it up to him," as he pays according to his demand, but is free to use his maximum demand during the entire unrestricted period.

Synchronous motors with 20 per cent leading power-factor design are installed on the main compressors. This permits maintaining unity power factor on the entire plant. A graphic power-factor meter is installed to verify customer's adherence to the unity power-factor requirement.

The accompanying tabulation shows that during a calendar year the customer pays his weekly bills without heavy adjustments. This is accomplished for the unrestricted period by adopting a step rate for kilowatt demand. He pays the highest step of the rate commencing with Jan. 1 of each calendar year until his weekly payment to the company totals $7,500, when he is billed on the next lower step of the rate until his payments have totaled $15,000. The next lower step then becomes effective. The tabulation shows the figures for a 140-ton plant. A 200-ton plant gets the benefit of the last step in the rate and accordingly earns an appreciably lower rate per kilowatt-hour.

Our own executives regard this business as most attractive for the utility company, as it gives a steady load during all hours except the annual peak periods. The high load factor and high power factor are particularly helpful in reducing switchboard costs during the early morning hours when residence load and factory load have dropped to a small fraction of their maximum value. The ice manufacturing load comes on the valleys of the central station daily load curve and tends to lower the unit cost of all energy delivered to the generating station busbars. The ice-making load is a maximum during the summer when the central station output is relatively small.

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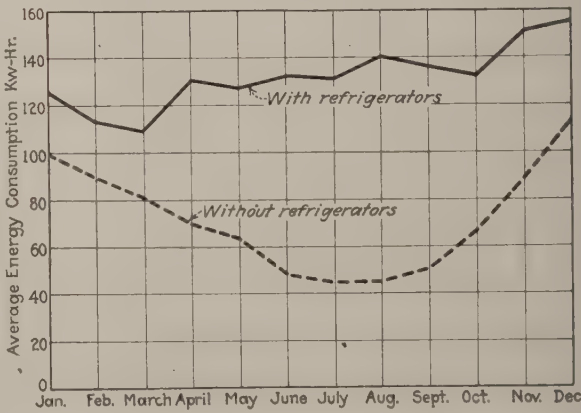
# Refrigerators Reduce Fluctuations of Domestic Consumption

By E. H. JENNESS
*Power Sales Engineer Ohio Public Service Company, Elyria, Ohio*

AN ANALYSIS by the Ohio Public Service Company of the energy consumption of eighteen domestic consumers in Elyria, Ohio, indicates the value of electric refrigeration as an equalizing influence upon load fluctuations throughout the year. The survey covers approximately 4 per cent of the total domestic refrigeration list.

These users of electrical service were somewhat above the general average of residence consumers even before



*Average summer energy consumption raised by refrigerator load*

Electric refrigerators were installed in the spring of 1926 in the homes of eighteen utility customers whose average monthly consumption throughout two consecutive years is indicated.

they installed electric refrigeration. Furthermore, the total increase shown by the curves cannot be attributed entirely to the installation of refrigeration units, as all of the domestic customers demonstrated a normal increase in energy use from 10 to 20 per cent. The results do, however, indicate clearly the possibility of summer load factor improvement for the generating station through increased use of refrigerators.

## Analyzing a Street-Lighting Contract

RECENTLY an Eastern power company and the principal city it serves carried on negotiations for a street-lighting contract over a period of many months without coming to an agreement until an arbitration board determined the terms. In the course of the proceedings a consulting engineer for the city presented a draft of a new contract which contained many features objectionable to the company in comparison with the terms of its own proposal. In the belief that some of the principal features of the city's proposal which were found to be undesirable by the company should be known to other utilities carrying on similar negotiations, an outline of typical points discussed analytically by the company before the arbitration tribunal follows:

### Relation Between Rates and Term

Lower prices are the natural result of security of a long term. If the term is short, e.g., a few months or one or two years, the company has no assurance that at its expiration the city will not materially reduce the number of lamps required, rearrange their location, or require the substitution of an entirely different type of lamp. Should the action of the city be arbitrary or capricious, it would entail the scrapping of costly apparatus and equipment long before worn out, thus putting a heavy burden on the company. Again, controversial negotiations are damaging in the public mind and cause economic loss by disrupting the attention of employees from normal duties.

### Points Not Made Clear in City's Proposal

Both parties have agreed to no further extension of the magnetite system, but the city's draft makes no recognition of this.

It should be made clear that the contract remains in force after expiration unless and until notice of termination is given by one party to the other.

Sixty days' notice is too short a time to negotiate a new contract.

Lamps are described in wattages only; both watts and candlepower should be stated.

The location and method of lamp installation should be included with stated price, rating and number of units.

### Specification of Payment

Contract clause should make it clear that the city should pay for service on the next regular pay-day following rendition of monthly bills by the company. Agreement should contain clause that the liability of the city thereunder is made subject to the making of sufficient appropriations from time to time to carry out the contract provisions.

### Quality of Service

The city's draft carries unreasonable penalties for outages and the use of such terms as "maximum of good service" and "maximum of unobstructed light" is too rigid for practical application and might lead to disputes. No equipment can be maintained at its "maximum," and the company should only obligate itself to give satisfactory service.

### Miscellaneous Objections

The company should be able to make independent contracts for street lighting in adjoining or adjacent municipalities without becoming involved in a dispute with the city.

The company should not be obliged to assume the initial expense of defending all suits and proving the city's negligence.

Testing equipment should conform to a specified standard and the interval between tests should not be inconveniently short.

The company should not be under the obligation to pay for all extensions.

The proposed agreement permits the city arbitrarily to reduce the number of lamps and to continue indefinitely on such a course. The city has the objectionable right to nullify the contract at any time, which would render the agreement of small value as such from the company standpoint. Again, the city has the power to order an extension of the hours of burning without statement of the company's right to make an additional charge for such service. The terms "extra dark mornings and evenings" are too elastic.

Inspection requirements are excessive and the clause requiring the company to favor residents of the city in taking on employees discriminates against residents of suburban towns which it serves.

Individuals and boards not conversant with or trained in technical matters are given undesirable power to specify the kind of equipment which shall be operated by the company in street lighting.

## Modern Electric Deliveries

A FLEET of six electric vehicles of smart appearance, rapid speed and long-mileage characteristics has recently been placed in service by Bonwit, Teller & Company, a New York department store. The appearance is entirely that of a modern gasoline vehicle. Speed, 18 miles an hour. Service, 70 miles at one charge. Body capacity, 100 cu.ft. The bodies were built by the Elysee Corporation, the chassis by the Walker Vehicle Company.

## Electric Baking of Food Products Proves Economical

A LITTLE more than two years ago the Tasty Baking Company, Philadelphia, was operating all of its power and lighting load with a current consumption of 55,000 kw.-hr. per month. At that time, according to R. M. Gantert of the Philadelphia Electric Company, the only increase in business which could be expected was that which would result from normal growth of the power load. Today, however, this bakery is consuming about 395,000 kw.-hr. per month, representing an increase of 600 per cent in current consumption and about 325 per cent increase in revenue from this customer. The utilization of energy will be increased by about 100,000 kw.-hr. within a short time. This remarkable increase is the result of the application of electricity in the baking of various types of food products in this plant. The first oven to be installed was a 70-ft. one with a connected load of about 325 kw., operating at temperatures between 300 and 400 deg. F. According to Mr. Gantert, this oven was a complete success from the start, baking a cake of better quality with less spoilage and proving to be more economical than estimated. "When properly analyzed, the current cost chargeable to the oven is such that, with all factors considered, the resultant cost is lower than any other known method of baking."

It is estimated by Mr. Gantert that the fuel costs of

## Organize to Build Load of Existing Rural Lines

"WHENEVER we get ready to handle a major operation or to do anything new which calls for expenditure of a great deal of money and adds materially to the property and income of a company, the first thing we do is create an organization to handle the new work. The bigger the job the bigger the organization and the higher grade man we select to head it up. It seems to me that inasmuch as the rural development is a new development, a big development and an important development, we must certainly be willing to organize fully and carefully to bring it about efficiently and rapidly. This calls for the proper organization of a rural-service department in any utility company operating in rural territory.

"Our first job is to build up the load of the farm customers we now have and to secure as customers those farmers now living along or near existing lines, but who for some reason or other have not connected to them."

G. C. Neff,
*Vice-President Wisconsin Power & Light Company.*

baking represent only about 1 per cent of the selling price of a loaf of bread and that even a reasonable increase in a 1 per cent item will be more than offset by intangible advantages. Because of the fact that these ovens operate at unity power factor the system power factor is improved and attractive characteristics are offered to the utility company. According to Mr. Gantert, the 40 large bakeries in the territory served by the Philadelphia Electric Company, which may be considered to be prospects for electric heat for baking purposes, represent a possible load of about 20,000 kw. with an assumed energy consumption of 85,000,000 kw.-hr. a year. This is estimated to represent about $1,000,000 a year possible business from an entirely new source.

## Elimination of Old Ranges Purpose of Campaign

HAVING as its object the elimination of all ranges built prior to 1921, the Southern California Edison Company has under way a campaign which it is hoped will displace 4,000 of the older type ranges on its system with ranges of the latest type. It is realized that one of the greatest obstacles to the sale of the electric range is the presence throughout the country of six- to eight-year-old ranges, with their relatively slow cooking speed and consequent increased operating cost. Central stations have been up against practically the same situation that the automobile manufacturers would have to meet if the bulk of buyers of cars were to use the same automobile for seven or eight years.

The Southern California Edison Company has decided to profit by the experience of automobile dealers and make a generous allowance to owners of these old ranges on the purchase of new ranges. An appropriation has been set aside which it is expected will be sufficient to eliminate practically all of the 4,000 older types of ranges on the Edison system. During the first month of the campaign its effectiveness was proved by the fact that 139 exchange sales were made.

In furthering the campaign the word-of-mouth method is used, no advertising of any kind being brought into play. If results of the campaign are as anticipated, it is expected that this move will have a stimulating effect upon all range sales activities in the territory served.

## Floodlighting Establishes Theater Location

FLOODLIGHTING as a means of advertising is not particularly new, but the floodlighting of an uncompleted building possesses some novelty. A Seattle building corporation decided, after careful study of the city's present development, that a location that is now outside the "white-light" district and eight blocks from the heart of the present retail shopping district would in ten years be in the center of a new section. It was confronted, however, with selling the location to Seattle now and determined to bring the "white-light" district to a theater and apartment building by the use of floodlighting during construction.

*Selling the public a new theater location through use of floodlighting during building construction*

Ten 1,000-watt Pittsburgh floodlights were installed on street railway poles across from the building on one side and six on the other. It was found that the curiosity of night pedestrians, window shoppers and theatergoers led them past the building to see what it was all about. Pedestrian traffic was practically tripled, while vehicular traffic was increased by about one-third. By the time the theater was opened, on March 1, practically every one in Seattle had the location firmly fixed in mind and a relatively inexpensive newspaper campaign was all that was necessary to insure "houses" from the start So successful was the floodlighting advertising campaign during building construction that the installation is to be made permanent.

# Letters from Our Readers

## *Southern Pine and Creosoting*

*To the Editor of the* ELECTRICAL WORLD:

I have read with considerable interest the article on "Southern Pine and Creosoting" in the Feb. 18 and March 3 issues of the ELECTRICAL WORLD and feel that you have contributed valuable data for the readers of your magazine.

The second paragraph of your article in the March 3 issue in regard to the seasoning of timber products before treating impresses me particularly, as in my judgment sufficient consideration is frequently not given this very important feature.

My observations at several of the treating plants revealed the fact that Southern yellow pine piling, poles and timbers are treated when having a very high moisture content, and in fact when only a few days from the stump. In order to secure the desirable penetration of creosote these timber products are subjected to live steam under pressure for several hours, followed by a partial vacuum to remove moisture. Statistics show that the moisture removed in this manner is but slightly more than the amount added by the live steam, and consequently timbers are removed from the treating cylinder with practically the same moisture content as when entering, with the serious disadvantage that wood fibers have been more or less strained by the live steam and that the moisture is forced toward the center of the timber by the pressure treating process.

It is a well-known fact that timbers are weakened in proportion to the increase in moisture content and it is very evident that many of the commercial treating plants, in their endeavor to fill rush orders for treated poles, etc., are supplying their customers with material far below the working stresses allowed for the different species. On the other hand, where an effort has been made to air-season Southern pine I have seen very decided evidence of fungi after four or five months, indicating that in some localities, at least, it is impossible thoroughly to air-season this species of timber without danger of decay to the sapwood.

In my opinion the solution of the problem is in "boiling under vacuum," whereby the moisture is taken from the timber instead of being forced toward the center. The danger of injury to the timber during the boiling process is avoided provided a uniform and constant temperature is maintained throughout the cylinder at a degree suitable for the species under treatment.

I am thoroughly convinced the Southern pine pole will become the standard for the Southern and Eastern territories, but in order to secure the maximum service from them and at the same time obviate the necessity for carrying charges, either by the producer or consumer, I feel that improvements must be made in the present methods of seasoning and treating this material.

THOMAS A. WILSON,
Superintendent Timber Department.
Consolidated Gas, Electric Light & Power Company of Baltimore.

## *Price or Cost?*

*To the Editor of the* ELECTRICAL WORLD:

In a paper of recent date by public-ownership proponents, claims have been asserted that the domestic consumer is the victim of discriminatory rates, while the large power user enjoys low rates made under pressure of competition with private plant operation. The domestic consumer, being unable to produce his own electricity, is forced to accept the rates and is thereby made to pay for losses or small margins of return incurred in serving the larger customers, is the claim of these writers.

On first thought the obvious answer would seem to be available from cost analyses showing the rates of return earned from different classes of customers. The results invariably show that the domestic consumers are less profitable to the utility companies than are the large users.

However, there are other considerations more pertinent and which merit consideration regardless of what results a cost analysis shows. Let us assume that such an analysis will show that the domestic consumers yield a company a larger return than do a number of large industrial plants on its lines. Assume, further, that to remedy this "discrimination" large power rates are raised. The effect of this would be to release some of these larger customers and to discourage the acquisition of additional industrial customers. Even if we discount the expense incident to the capacity of the system released by the loss of these large users there will be a lower load factor, not only in the sense of expenses at the generating station but that concerned with maximum utilization of the property. The effect of this will be to leave a larger burden of fixed charges and expenses to be borne by the residential customers. This will place them in a distinctly less favorable position in the matter of cost of supply, and consequently rates, than were the large users retained at the lower rates under which they now operate.

So it can be seen that discrimination is a difficult charge to sustain if the concern of the domestic consumers is for the lowest rate compatible with a reasonable return and unimpaired service. With this as the only premise on which the champions of domestic rates can proceed, it is obvious that the only ultimate concern of the domestic customers should be: Under what policy can the lowest rates be secured, and not with figures purporting to show unjust discrimination without considering the effect of these competitive rates upon the costs, and consequently upon rates to the domestic consumer.

In substance, then, the claims of unjust discrimination fail to consider the reciprocal effect of price upon cost, but are seemingly content to neglect this mutual interrelationship.

While this discussion is somewhat hypothetical in character, I believe it portrays the futility of attempting to charge discrimination in this question of small versus large consumers. It should be remembered the costs for service are made possible by the contributions of all classes to the system and that the lower unit costs are the fruits of all rather than the property of a single class. In fact, the small consumer should in a measure be thankful to his large manufacturing brethren for the latter's having assumed an important rôle in lowering the charges for service to all classes.

Pelham Manor, N. Y. JOHN F. DUFFY.

# Digest of Electrical Literature

## Hydro-Electric Development and Steam Equipment

*Steam Storage in Power Stations.*—The application of a steam accumulator of the Ruths type is described in this article. A specific application in the generating station of the Malmo municipal power plant in Sweden is cited. In this application two accumulators, each of 8,000-cu.ft. volume and with a joint capacity of 80,000 lb. of steam on a pressure drop of 114 to 28 lb. per square inch, are used with a specially designed condensing steam turbo-generator of 3,750 kw. capacity. It is stated that the accumulator installation is sufficiently large for supplying steam to the turbine for about one hour while developing some 3,000 kw. This is estimated to be sufficient to start the turbine, and as soon as the proper pressure has been obtained from the boilers the turbine is run by steam from that source until the hydraulic power, which is the primary supply of the station, can be applied. As soon as the load is taken over by the hydraulic power and the accumulator is charged to full pressure through the valve, the boilers are shut down.—*Electricity* (*England*), March 15, 1928.

## Transmission, Substations and Distribution

*Cable Laying Improvements.*—E. S. Byng.—In this first of several articles the author has discussed the types of cable systems as a preliminary to the contemplated discussion of actual installation practices. An analysis has been made of the several plans and methods for overhead and underground work used in European countries and the advantages and disadvantages of these methods are compared. Economic considerations involved in determining whether cable should be laid direct or in a duct have been considered by the author. The conduit system has a number of advantages over other methods, including: Minimized trenching operations, minimized paving charges, flexibility of carrying capacity, simplified replacement of impaired sections, simplified repair operations and high reclamation value.—*World Power* (*England*), March, 1928.

*Voltage Regulation.*—The merits of various types of regulators have been summarized as follows: Induction regulators avoid interruption of circuits on switch contacts and give smooth regulation, internal regulators on tapped transformers concentrate the whole apparatus into a small space and minimize external connections, the separation of the switchgear simplifies transfromers and reduces their over-all dimensions with particular advantage in the largest units, natural cooling of transformers is unrestricted and removal from tank is facilitated, there are no moving parts in the transformer tank and the makers claim that the design of the regulating switch is not hampered by the necessity of adapting it to transformer, routine inspection is possible without opening up main transformer, and, in those cases in which it is practicable to provide suitable isolating gear, inspection is possible without cutting off the supply. A description is offered of the so-called Brookhirst drum type regulator, which comprises for each phase a drum type tapping selector switch not subject to arcing and one which needs no adjustment throughout a reasonable life. This provides two independent circuits necessary to permit changing over without interruption to the main circuit and, if required, reverses the regular winding. The regulator is composed of two drum type, quick-break diverter or auxiliary switches, with renewable butt contacts especially designed for circuit breaking. Continuity of the main circuit is assured either by self-contained buffer resistances or separate intermittently rated choking coils. Mechanical operation, in correct sequence, of the auxiliary switches by cams and of the drum by smooth-action intermittent gear insures the interruption of each circuit on its auxiliary switch before the drum moves, and the drum construction prevents the possibility of wrong connections.—*World Power* (*England*), March, 1928.

*Methods of Determining Correctness of Watt-Hour Meter Connections.*—The necessity for a simple, accurate and complete method for checking the connections of polyphase watt-hour meters in service has been recognized by the engineering and statistical subcommittee of the meter committee of the N.E.L.A. in the preparation of this report. A new scheme for checking the correctness of connections with watt-hour meters used with instrument transformers is described. It is stated that no method as yet advanced will cover all possible incorrect connections in cases where the power-factor angle of the load cannot be ascertained within 60 deg. of its actual value. It is stated, however, that the new method described in this report constitutes a real contribution to the information available on this subject. In addition, a check may be made under normal operating conditions by any meter tester familiar with alternating-current meters and circuits. The report covers the methods of making connection on two-element, three-phase watt-hour meters connected to three-wire, three-phase primaries through instrument transformers. A theoretical analysis of the general problem of checking the correctness of connection, a description of the new method and a discussion of the schemes for checking the connections which have been proposed in the past, together with an indication of the limitations of each scheme, is offered.—*Serial Report, National Electric Light Association,* March, 1928.

## Units, Measurements and Instruments

*The Dufour Cathode-Ray Oscillograph.*—I. E. Cole.—The design and application of the Dufour cathode-ray oscillograph has been outlined by the author. It is stated that many different techniques have been developed for using this instrument, each particularly suited to some special investigation. The author has outlined several characteristic procedures.—*Sibley Journal of Engineering,* March, 1928.

*Statical Hysteresis in Cycles of Equal Load Range.*—G. H. Keulegan.—The author has endeavored to ascertain the influence of the extreme loads on the energy hysteresis loss in the cycles of equal load range during the flexure of an iron bar. The flexure of the bar is considered for the case where one end is clamped and the other end loaded. Armco iron was used and since the hereditary hysteresis of this material is negligible in comparison with the statical hysteresis the results of the experiment apply mainly to the latter. Cycles of small extreme loads only are considered and the conclusion derived from the result of the experiments is to the effect that the energy loss due to statical hysteresis in cycles of equal load range is independent of the extreme loads. The apparatus used in this investigation and the experimental procedure, as well as an analysis of the specimen and a thorough discussion of the data secured, are offered. The value of the hysteresis modulus of Armco iron was predetermined and found to be in agreement with the results of previous experiments.—*No. 365 Technologic Papers of the Bureau of Standards.*

## Illumination

*Methods of Calculating General Illumination Intensities for Interiors.*—Imbrie Smith.—The author has endeavored to cover in a comprehensive way the various developments and methods used in estimating illumination intensities and values in interior work. The polar curve of light distribution, the law of inverse squares and the cosine law are recognized as the fundamental basis for such calculations. Because of a number of technical difficulties involved in the application of these fundamentally desirable values, a number of emperical formulas have been evolved, and in this first of several articles the author has considered the value and use of such devices. This discussion constitutes not only historical record of progress in illuminating engineering but also involves the practical features of design and estimating work. —*Illuminating Engineer (England)*, March, 1928.

### *Traction*

*Heavy Electric Traction in Italy.*—THEODORE RICH.—Electrification has proceeded to a state of wide utilization in Italy. The author has endeavored to review the factors which influenced the change-over from steam to electric equipment throughout this country and has analyzed the factors involved in the power supply, application and utilization of equipment in this first of several articles. An unusual feature of the design is the inclusion of two trolley wires, made necessary by the utilization of three-phase power on the locomotive. Each locomotive has two sets of contact bows for pick-up purposes.—*Electrical Review (England)*, March 23, 1928.

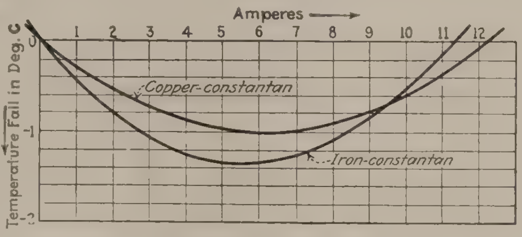
*Railway Electrification.*—E. H. CROFT.—A comprehensive review of the general methods in vogue for the protection of electric railway equipment with suggestions for various improvements for the minimization of danger and the avoidance of delays. The author suggests that the arrangement of protection devices should be such that the main power circuits and the auxiliary power circuits should be kept separate as far as possible; that apart from ordinary overload relays and auxiliary circuit fuses additional protection should be afforded to both circuits in the form of some type of protective apparatus close to the supply of energy on a car; the circuits should be so arranged that either the protective apparatus should not be called upon to interrupt a circuit showing a greater current than the capacity of the device allows for, so that the interrupting of such current should be transferred to the protective apparatus capable of handling it, and that it should be realized on low-voltage systems that it is difficult to transfer the faults to the feeder or substation breakers and that therefore the protection of low-voltage systems is more difficult than that of high-voltage ones.—*Electrical Review (England)*, March 16, 1928.

### *Telegraphy, Telephony, Radio and Signals*

*Radio-Controlled Motor Boat.*—M. CHAUVEAU.—A high-speed motor boat, driven by two 180-hp. gasoline motors, which is so equipped that all maneuvers can be controlled by proper radio impulses from the shore, is described. The arrangement of the control relays for the starting and accelerating or reversing of the motor, the setting of the rudder and the lighting of a searchlight at the bow of the ship is also outlined. An 80-volt, 40-amp.-hour storage battery serves to supply the necessary control current on the boat. This battery is charged from a 500-watt generator, driven by one of the gasoline motors. The radio control is accomplished by a sustained 300-meter fundamental wave, modulated by 30,000-cycle high-frequency impulses. Great care was taken to make the controls absolutely unaffected by static, commercial code or radio programs. —*Bulletin de la Société Française des Electriciens*, December, 1927.

### *Electrophysics, Electrochemistry and Batteries*

*The Peltier Effect.*—T. F. WALL.—Closely allied with the generation of electromotive force by heating or cooling a junction of two dissimilar metals is the reverse effect of the absorption of heat in excess of that generated when an impressed current of electricity passes across a junction of two dissimilar metals. This phenomena, discovered by Peltier, is discussed by the author for both iron-constantan and copper-constantan junctions. The direction in which an induced current is forced through the junction affects the phenomenon at the junction and it is stated that if the impressed current is passed from the constantan to the iron the junction will be cooled, while if the current is sent in the reverse direction the junction will be warmed beyond the resistive heating of the joints. The author has given full consideration to the physical and mathematical aspects of the phenomena and has derived characteristic curves indicating the qualities under varying conditions for the two types of two metal junctions considered. — *Electrician (England)*, March 16, 1928.



*Temperature fall of two-metal functions with impressed currents*

*The Theory of the Electrical Breakdown of Gases at Atmospheric Pressure.*—LEONARD E. LOEB.—The general theory of the electrical spark, as advanced by Townsend some years ago, is accepted by the author as describing the phenomena with essential accuracy. Other investigators have assailed certain assumption made by Townsend on the basis of measurements made at low pressures in the inert gases with different electrode materials. Their criticisms, while cogent, are more directed at developing their own theories, so that they miss some of what appears according to the author to be the essential significance of the phenomena. It is the avowed purpose of this article to point out these facts in the hope that more work will be done on these features in laboratories equipped for such work. After a brief summary and discussion of Townsend's theory of the electrical breakdown of gases in the light of certain recent criticisms it is shown that these are compatible with his theory except for one serious discrepancy. This discrepancy lies in the fact that at the assumed fields at which breakdown occurs in air, at atmospheric pressure, and in inert gases at low pressures, the positive ions are incapable, at these fields, of acquiring the ionizing energy. Various solutions proposed are discussed and found inadequate. It seems necessary, in order to keep this otherwise successful theory, to doubt the validity of the assumption generally made for plane parallel electrodes that the potential drop between the plates is uniform before the spark passes. It is shown that such fields are possible under the conditions of the spark potential experiments, due to space charges resulting from the difference of ionic and electronic velocities. —*Journal of the Franklin Institute*, March, 1928.

### *Miscellaneous*

*Earth Pressure on Flexible Walls.*—R. N. STROYER.—The author states that it is a matter of general knowledge that sheeting piles, both timber and reinforced concrete, are usually much lighter than would be required to take the earth pressure behind them, if the latter is calculated in the ordinary way, but that it is not generally recognized that earth pressure and the resulting bending moment on the sheeting vary with the thickness of the latter and that, within certain limits, the thinner the sheeting the smaller is the bending moment thereon. This problem has been subjected to critical analysis and as a result certain principles have been developed by the author as a result of theoretical and experimental investigations. —*Engineering (England)*, March 9, 1928.

*Thermal Expansion of Alloys of the "Stainless Iron" Type.* — PETER HIDNERT and W. T. SWEENEY. — The increasing use of low-carbon iron-chromium alloys of the stainless iron type in turbines, chemical processes and articles which must resist corrosion led to the investigation recorded by the authors. As the result of tests upon nine samples of stainless iron of varying compositions values were plotted. It is stated by the authors that data relating to the critical regions indicate that an increase in the chromium content of stainless iron generally causes a slight increase in the temperature at which the transformation occurs on heating. The contraction during the transformation on heating decreases with increase in the chromium content. A tabular summary gives average coefficient of expansion derived from data on all samples of stainless iron. The coefficient of expansion increases gradually with temperature.—*No. 570 Scientific Papers of the Bureau of Standards.*

# Book Reviews

## *An Introductory Textbook of Electrical Engineering*

By John Robert Benton, professor of physics and electrical engineering University of Florida. Boston: Ginn & Company, 1928. 347 pages. Price, $3.60.

Professor Benton has produced a clear-cut exposition of the fundamentals of electrical engineering which should be useful to students possessing some knowledge of college physics and helpful to engineers specializing in other than electrical fields. It offers a refreshing review of principles and major apparatus features to the electrical specialist who seeks from time to time to renew his mental youth by contact with phenomena and laws underlying modern practice, although it does not pretend to serve the daily needs of the expert or to take the place of a handbook. Most of the mathematics used is simple in form, but throughout the book the quantitative viewpoint is apparent, the value of measurement being pressed home to the reader until it becomes second nature in his approach to the problems of the electrical field. The sections on vector analysis, generator principles and alternating-current theory are particularly well done, and there is a good index. The author has wisely kept the complex and specialized laws of electron engineering and so-called static electricity well out of the work, confining his book to the important field of power apparatus, fundamental design and applications. A bibliography of rather limited scope is included, and this might well be enlarged in future editions.

## *Electro-Farming*

By R. Borlase Mathews. London: Ernest Benn, Ltd. 300 pages, 100 illustrations. Price, 25 shillings.

In speaking of rural electrification in Europe the author of this book remarks that the progress "in the various regions seemed to depend largely upon the energy and initiative of the engineer in charge of the local electricity supply undertaking." If he were making a survey of rural electrification in the United States he would probably make the same remark as applying to this country.

Much of the material included in this book has been accumulated by the author from direct observation and experience with electricity on his own farm in Great Britain. On this farm he has 67 different applications of electricity. It would seem, then, that the book must possess some element of authority. The matter of the book is not confined alone to farm applications of electricity, although these are set forth in sufficient detail, but includes also an understanding discussion of the characteristics of rural lines, their effects upon general system conditions and method of rural transmission and distribution. Rural industries in which electricity may be profitably employed and which make use of indigenous raw materials are given some space in the book. There are chapters devoted to special applications of electricity directly and by means of electric light to plant culture and forcing. Electro-silage receives consideration, as do also uses of electric power for plowing, harvesting, handling crops, threshing and soil fertilization. Electrical applications in the farm home, including cooking and refrigeration, have not been neglected. It would seem as though this book would be of value to project directors and rural service specialists to give them that viewpoint on their daily problems which is always obtained from a knowledge of how those problems are attacked in another country.

## *Electrical Engineering Practice*

Vol. II. By J. W. Meares and R. E. Neale, fourth edition, revised. New York: John Wiley & Sons. 668 pages, illustrated. Price, $6.50.

This book was written to fill the gap between the text book and the specialist's book. The authors have compiled a practical work devoted to energy transformation, methods of converting electricity, batteries, distribution and wiring practice and applications of electricity to welding, heating, lighting and cutting. The book is elementary in technical features and uses very little mathematics. It is written for the practical engineer and contains many good illustrations, charts, tables and drawings of a practical nature. The authors are Englishmen, but American engineers will find the treatment of distribution and wiring especially interesting. It covers English practices as laid down in the I. E. E. wiring rules and gives details of accessories and methods of installation. In the chapters devoted to electrical applications general principles are discussed, and data and practical applications to illustrate their use are given. This book should serve very well as an elementary practical text book and for reference.

## *Elektrowärmeverwertung*

By Ing. Robert Kratochwil. Munich and Berlin: R. Oldenbourg. 695 pages, 431 illustrations.

Power companies and manufacturers abroad as well as in the United States are recognizing the importance of electric heating as a load builder of most desirable characteristics. The present treatise, now in its second edition, is written from that point of view by an Austrian engineer who has evidently studied the subject from its economic as well as its technical aspects, and has not been limited by national frontiers, language or the Atlantic Ocean in his search for material; it is by far the most comprehensive publication dealing with the numerous forms of electric heat applications in industry, in the home and in agriculture that has come to the reviewer's attention. In addition to descriptive matter, there is a considerable fund of test data, a discussion of rates in various countries as they affect the sale of energy for heating, and comparative figures on competitive heat sources. The last-named group includes studies on the heating of rooms. A long bibliography shows that much material has been published on the subject under consideration, but it does not seem heretofore to have been adequately coordinated.

## Book Notes

Central-Station Voltages. By Lamp Committee. New York: National Electric Light Association. 95 pages.

This book is distributed by the National Electric Light Association through its lamp committee with the recommendation to all dealers in lamps that only the lamps of voltage specified be supplied for use on the circuits of the central station. The data are kept up to date by voluntary reporting by utilities of changes in voltage.

Laboratory Notes for Electrical Engineering Students. By A. R. Nissar. Calcutta, India: The Calcutta Technical School. 57 pages. Price, 75 cents.

Involves suggestions for 92 groups of studies regarding electrical circuits, apparatus, etc., prepared in such a way as to stimulate the student's initiative and reasoning power. For example, it instructs the student to draw connections for certain tests, conduct tests taking different readings, calculate and plot results, explains theories, etc. This book presupposes a knowledge of electrical theory, as it presents none itself.

## Books Received

*The Story of Public Utilities.* By Edward Hungerford. New York: G. P. Putnam's Sons. 384 pages, 81 illustrations.

*A Century of Industrial Progress.* Edited by Frederic William Wile. New York: Doubleday, Doran & Company, Inc. 581 pages. Price, $5.

*Materials and Design in Turbo-Generator Plant.* By O. Lasche and Walter Kieser. English edition by A. L. Mallenby and U. R. Cooper. 204 pages, 363 illustrations. Price, 24 shillings.

*Grundlagen der Wechselstromtheorie.* By Dr. Ing. P. B. Arthur Linker. Berlin: Georg Stilke. 245 pages, illustrated. Price, 18 marks.

*Die Messwandler.* By Dr. I. Goldstein. Berlin: Julius Springer. 166 pages, illustrated. Price, 13½ marks.

*Electric Winders.* By H. H. Broughton. New York: D. Van Nostrand Company. 402 pages, illustrated. Price, $15.

*The A.C. Commutator Motor.* By C. W. Olliver. New York: D. Van Nostrand Company. 281 pages, illustrated. Price, $7.50.

*Matter, Electricity, Energy.* By Walter Gerlach and Francis J. Fuchs. New York: D. Van Nostrand Company. 427 pages, illustrated. Price, $6.

*Transmission Line Engineering.* By W. W. Lewis. New York: McGraw-Hill Book Company. 361 pages, illustrated. Price, $4.

# News of the Industry

## Portland Defeats Merger

*Oregon Metropolis Votes Two to One Against Permitting Sale of Northwestern Electric Company to Portland Electric Power*

VOTING at a special election called April 9 by the City Council for the purpose of permitting them to approve or reject the plan of the Portland Electric Power Company to purchase the physical properties of the Northwestern Electric Company, the people of Portland raised a decisively negative voice. The final count showed 30,028 votes against to 14,513 in favor of the measure, or a ratio of more than two to one against the proposal, with about a 50 per cent vote cast. Only 24 out of the 486 precincts returned a favorable majority, in each case a narrow one, while in many precincts the ratio against ran five to one or greater.

The proposal to merge the companies and thereby to effect a large annual saving in fixed charges and operating expenses now incurred in operating the duplicated systems had come from the companies themselves, which offered to return these savings to the ratepayers in the form of reduced rates. New and decreased rate schedules had been filed with the Public Service Commission of Oregon and by order of that body had been made effective if and when the sale should be consummated. Under the proposed new tariffs 87,000 domestic customers would have saved $200,000, 9,300 commercial lighting customers $125,000, and 2,000 industrial power customers $100,000.

The franchise of the Northwestern Electric Company prohibited the sale of the company to a competitor without consent of the City Council. The expense of the special election was defrayed by the companies.

## Super-Power of Illinois to Build Powerton Plant

Rapid completion of the first unit of the great new Powerton steam-electric generating station of the Insull companies, to be erected on the Illinois River near Pekin, 12 miles southwest of Peoria, is apparently assured by the authorization granted last week by the Illinois Commerce Commission to the Super-Power Company of Illinois to proceed with the work.

The purpose of building the Powerton station is to combine in one large modern plant individual units in excess of 50,000 kw., thereby obtaining mass production to the four utility companies it will serve—the Commonwealth Edison Company of Chicago, Public Service Company of Northern Illinois, Illinois Power & Light Corporation and Central Illinois Public Service Company. The power house proper is already entirely completed for the installation of two 55,000-kw. units, and the first turbine, boilers and auxiliaries are being installed and are expected to be in operation by Oct. 1. It is expected that the second unit will be ready for operation a year later.

The company is also building three high-voltage electric substations and approximately 55 miles of 132,000-volt steel-tower transmission line extending from Powerton to a point 2½ miles east of Kewanee, Ill., where it will interconnect with a similar line of the Illinois Power & Light Corporation. Then it goes east to Seneca, interconnecting with a line of the Public Service Company of Northern Illinois. The latter line interconnects at Joliet with the network of the Public Service Company of Northern Illinois, which is interconnected with the Commonwealth Edison Company's lines. A second steel-tower transmission line of 132,000 volts, approximately 5 miles long, is being built to interconnect the station with the lines of the Illinois Electric Power Company.

## Transportation to N.E.L.A. Convention Arranged

Although the annual convention of the National Electric Light Association, to be held at Atlantic City in the week of June 4, is still nearly two months away, the association through its traffic manager, Ross I. Parker of the Chicago office of the General Electric Company, has already made the following arrangements for special trains:

The Pennsylvania Railroad will run a special train from Chicago to Atlantic City, with special pullmans from Detroit, Cleveland, St. Louis and Kansas City, leaving Chicago on Sunday, June 3, at 1:15 p.m., Central standard time, and arriving at Atlantic City on Monday, June 4, at 10.30 a.m., Eastern time. Western delegates, their families and guests, are urged to use this train.

There will be a special train from Atlantic City to New York on Friday, June 8, leaving the Atlantic City Pennsylvania Railroad Station at 3.30 p.m., Eastern time, arriving at the Pennsylvania Station, New York, 6.40 p.m., Eastern time. This will be an all-parlor-car train, scheduled to make the run from Atlantic City to New York in three hours and ten minutes.

An all-pullman special train will leave the Atlantic City Pennsylvania Railroad Station on Friday, June 8, at 3.35 p.m. Eastern time, and arrive in Chicago at 10.10 a.m., Central time. Stops will be made at Mansfield, Ohio, and Fort Wayne, Ind. No arrangements have been made for special trains from New York or vicinity to Atlantic City in view of the frequent train service.

## Vetoes Sargent Bills

*Governor Smith of New York Finds Them Unnecessary and Inimical to the Preservation of State Forest Lands in the Adirondack Region*

CONTRARY to the expectation of many who have followed water-power matters in New York State, Governor Smith has voted the two Sargent water-power bills, affecting possible hydro-electric sources in the Adirondack region, which passed the Legislature with little opposition in the last days of the session. They had for their ostensible purpose the prevention of the use of Tupper and Saranac Lakes for a river-regulating district development. They also provided that the state should investigate with the idea of ultimately imposing a charge upon the people benefited by a river-regulating development from the standpoint of the amount of water power that might be produced.

These bills had the indorsement of men and organizations interested in scenery preservation who joined hands with the Governor in 1923 to defeat the constitutional amendment then submitted to the voters to permit hydro-electric development on a small part of the state reserve and a transmission line through the forest. Governor Smith, however, found reasons other than esthetic ones for disapproving the bill. He said in his veto message:

> Both of these bills seem to me to be unnecessary. No river-regulating districts or dams can be set up in the resorts proposed to be protected in the one bill unless there is actual river regulating to be done, and there is no evidence that these particular resorts could conceivably be part of any reasonable river-regulating scheme. The returns to the state in connection with power developments cannot be fixed by law. All that the law can provide is the administrative machinery under which a reasonable return to the state can be determined. The state already has such an agency in the Water Power and Control Commission.
>
> It is, therefore, clear that the bills are not needed, and the obvious inference is that they will operate in the interest of the groups whose main object is to develop power in the Adirondacks at the expense of the great forest preserve which we have built up, contrary to the provisions of the constitution and against the interests of the great majority of the people of the state. There must be some good reason why the property holders in the finest sections of the Adirondacks not owned by the state are alarmed by demands for power developments. They live in these sections and must know what is threatened. I do not propose by any act of mine to agree that they need protection of this kind nor by any implication to abandon other sections of the Adirondacks to power developments.

Some political observers at Albany

see the origin of the bills in a feud between power companies and paper manufacturers over rights to hydro sites in the mountain region, but if this "angle" exists, the veto message does not allude to it.

## Flathead River License Applied For

*Rocky Mountain Power Company Wants to Develop Initial 80,000 Hp. There — Permit on Chattahoochee Sought—Licenses Asked for Gauley and Sultan Rivers*

APPLICATION to the Federal Power Commission has been made by the Rocky Mountain Power Company of Butte, Mont., for a license covering one of the five sites on the Flathead River included in its preliminary permit. As the first step in the development the company proposes to erect a dam, 180 ft. high, which will regulate Flathead Lake and permit it to act as a reservoir. It is planned to install 148,000 hp. at the first dam, where 80,000 hp. of primary power will be developed. The difficulty represented by the Newell tunnel has been removed through the passage of the Interior Department appropriation bill. A conflicting application is on file, but prospects favor granting the license.

The Columbus (Ga.) Electric & Power Company has applied for a preliminary permit covering two dams and power houses on the Chattahoochee River in Georgia and Alabama. One of the sites is near Maple Creek and one near Houston Island. It is proposed to install 40,000 hp.

Having completed the work called for in its preliminary permit, the Gauley Power Company of Charleston, W. Va., has applied to the Federal Power Commission for a license covering the project it has been examining on the Gauley River, in Fayette and Nicholas Counties, West Va. The company plans to construct a concrete dam 125 ft. high at a point 21 miles from the mouth of the river, where, it is estimated, 54,500 hp. of primary power will be made available. It is proposed to install three 20,000-hp. generators. This is one of the few applications received from West Virginia since the enactment of the water-power law—a fact attributed to the unsatisfactory character of the state law.

The Washington Electric Company of Seattle has applied for a preliminary permit covering a project on the Sultan River near Sultan, Wash. It is proposed to build a dam 310 ft. high which will create a reservoir of 230,000 acre-feet capacity. Estimates of electrical output have not been received.

J. B. McConley and F. A. Hebbard of San Francisco have applied for a license covering a small dam on Canon Creek in Trinity County, Calif. The primary power available is 520 hp.

The Pacific Gas & Electric Company of San Francisco has applied for a license connected with completed projects on the Yuba and American Rivers.

## Restraining Order Vacated in Cambridge Rate Case

Judge Morton of the United States District Court in Massachusetts issued a decision on Wednesday vacating a restraining order which prevented the Department of Public Utilities from enforcing its recent decision reducing the domestic and commercial lighting rate of the Cambridge Electric Light Company from 8 cents to 5 cents per kilowatt-hour. The opinion holds that, pending a hearing of the case before a master, reasonable doubt exists as to the company's contention that the commission's decision will cause it grave and irreparable injury. No reasonable probability exists, in the court's view, that the utility will prevail upon final hearing.

The District Court is not satisfied that the commission's valuation, arrived at in this case under the reproduction-cost rule of the United States Supreme Court, is based upon some fundamental error of either fact or law; that a return of less than 8 per cent would *ipso facto* be confiscatory, or that the return which the company will actually obtain under the new rate will be of that character.

## Storms Hamper Utilities in Nebraska and Ohio

A Middle West snowstorm with high winds that lasted the greater part of Friday, April 6, caused pole and wire damages totaling $100,000, the principal sufferers being the Nebraska Power Company, with an estimated damage of $50,000, and the Iowa-Nebraska Light & Power Company. As telephone and telegraph communication was interrupted for many hours, the work of rehabilitation was considerably delayed. This was especially true of the latter company, because of the wider distribution of its lines. The wet snow clung tenaciously to the wires, and the wind that followed within a few hours after it began to fall pulled down long pole-line leads and inextricably tangled miles of wire.

General Manager Davidson of the Nebraska Power Company, Omaha, said that while temporary repairs had enabled the company to resume service, many rural lines would have to be reconstructed. The same opinion was expressed by General Manager Brooks of the Iowa-Nebraska company. The storm area covered eastern Nebraska and western Iowa, and telegraph and telephone companies estimate their total damages at close to a quarter of a million dollars.

Damage to the extent of more than $750,000 to various utilities is reported as the result of a sleet storm which swept over northwestern Ohio on March 29. Electrical and communication service was particularly hard hit in the city of Findlay, more than a week's effort proving necessary for its complete restoration there. The Toledo, Bowling Green & Southern Traction Company, which supplies Findlay with light and power, suffered also from the crippling of its interurban railway service, but has emerged from its troubles. The loss to this company is placed at $100,000.

## Ashurst Presents Views

*Arizona Senator Makes Clear the Position of His State in a Minority Report from Him on the Swing-Johnson Boulder Dam Bill*

WHETHER or not the states are sovereign over their own waters, excepting in matters pertaining to navigation, is the great question involved in the Boulder Canyon bill now before the Senate, according to Senator Ashurst of Arizona, who has submitted his minority report on the bill. He characterizes this legislation as a reckless and relentless assault upon his state. Senator Ashurst's minority views cover 38 printed pages. He sums up Arizona's position as follows:

> Arizona cannot, under any circumstances, yield her right to an equitable share of the waters of the Colorado River available for use in the lower-basin states. This water is absolutely essential to Arizona's development. It represents the only possibility of the reclamation of a large tract of her arid but exceedingly fertile and otherwise highly favored land. It means, at some time in the not remote future, population, homes, taxable wealth, prosperity and the subsisting of peoples. Aside from the question of the rights of states and of geographical boundaries, the deprivation of this land of an opportunity for development would mean a tremendous economic waste, both in the production of crops and in the duty of water.
>
> Arizona has 1,500,000 acres of land, easily susceptible of irrigation from the main stream of the Colorado River. It is land highly favored both by soil and climatic conditions and lies adjacent to the Colorado and Gila Rivers in the southwestern portion of Arizona. It requires only water to make it tremendously productive of crops of a highly valuable character and which can be produced only to a limited extent in the United States. This land drains back into the Colorado and Gila Rivers, and its irrigation will therefore result in a return flow and in an important saving of water over the irrigation of land having no drainage, where the water actually used on the land as well as the surplus flowing in the canal is forever lost. Through engineering feats of the greatest proportions all of the water of the Colorado River might be placed by gravity upon Arizona land, but no questionable engineering feat is involved in the utilization of Arizona's fair division of the water available for use in the states of the lower division. This is Arizona's claim, which she presents for the consideration of all who are fairly disposed toward the principle of equity and justice. It may be true that with only one-half of the water in the lower basin at her disposal some of California's desert land could not be watered. If so, no hardship would be suffered by that state which would not likewise be visited upon Arizona. If some acreage must forever be arid, there is no sound reason why Arizona should be singled out to bear the burden and the loss.
>
> This bill is ruthless and cynical. It swarms with cryptic phrases. It is not the voice of compromise or an extension of the hand of amity and friendship.

# Electric Progress Rapid in North Carolina

*Next Year 90,000 Hp. Will Be Added to This Spring's Hydro Installation of 205,000 Hp. at Three Sites—Riverbend Steam Plant*

THE plant of the Carolina Power & Light Company on the Pigeon River in North Carolina, near the Tennessee state line, will be completed next year with a capacity of 90,000 hp., to be raised ultimately to 135,000 hp. The North Carolina Department of Conservation and Development points out that this plant is of particular interest as differing from all existing hydro-electric projects in the state in its type of development. All the major water-power developments in the state have heretofore been constructed on the larger streams in the Piedmont region and are dependent on producing a fall entirely by the construction of dams from 50 ft. to 200 ft. in height. The Pigeon River development makes use of a relatively small mountain river, but by diverting it through a tunnel in the mountains over four miles long causes the water to fall down the mountain sides through steel pipes to a power house far removed from the dam, thereby developing a total fall of 861 ft.

The Pigeon River development, when it is ready, will follow three others in North Carolina which have just gone into operation or will soon do so. These are the Santeetlah plant of the Tallassee Power Company, supplying the Aluminum Company of America, where a 66,000-hp. installation is now in operation; the Carolina Power & Light Company's Norwood plant on the Yadkin River, with 83,000 hp., and the Duke Power Company's Oxford Shoals plant on the Catawba, near Hickory, with 56,000 hp.

With the Duke Power Company's completion of its hydro-electric plant at Oxford Shoals and the letting of contracts in connection with the first 112,000-kw. unit for its coming steam plant at Riverbend, on the Catawba, designed to produce ultimately 450,000 kw. and which will cost more than $20,000,000, it is forecast that the Piedmont section of the Carolinas will experience an inflow of new business. In the last five months, in fact, Duke company officials say, 43 new industries have been established in that section.

# Electrical Papers on Program of Missouri Association

Seven or eight papers related to the electrical industry are scheduled for presentation at the twenty-second annual convention of the Missouri Association of Public Utilities, which will be held at Jefferson City on April 26-28. These include:

*Thursday, April 26.*—"Industrial Development of a Territory by the Public Utility Company Working in Conjunction with the Chamber of Commerce," F. S. Dewey, vice-president Kansas City Power & Light Company.

*Friday, April 27.*—"Economic Changes in the Light and Power Industry in Missouri and Their Value to the Public," L. A. Pettit, Jr., vice-president Missouri Power & Light Company, Kansas City; "The Public Utility Company's Responsibility in Relation to Street Lighting," L. A. S. Wood, Westinghouse Electric & Manufacturing Company, South Bend, Ind.; "Load Building—The Commercial Man's Obligation and Opportunity," W. L. Berry, Union Electric Light & Power Company, St. Louis.

*Saturday, April 28.*—"Electricity in Missouri Agriculture," Prof. M. M. Jones, University of Missouri; "What a Farm Woman Thinks of Electricity on the Farm" (illustrated), Mrs. Aubrey Fellows, Salisbury, Mo.; "Desirability of District Steam-Heating Business in Connection with Central-Station Service" (illustrated), T. S. Ayers and W. C. Kaber, St. Louis.

# Need More Subscriptions for Louvain Gift

A total of $61,729 has been subscribed up to date toward the fund for the clock and carillon which the Engineering Foundation is presenting to the University of Louvain. This sum represents 2,662 subscriptions. As the gift will cost $80,000, there is still needed nearly $20,000, and the committee in charge is appealing to the engineers who have not yet subscribed to act promptly in the matter. A generous response is confidently anticipated.

The new memorial library at Louvain will, as already published, be dedicated on July 4 in the presence of an American delegation. It is hoped to arrange to have the United States national anthem played on the evening of that day by the new chorus of bells and to have it broadcast across the Atlantic so that it may be heard in this country about noon.

# New Brunswick Approves Tidal Power Project

An exceptionally keen battle has just been concluded in the New Brunswick Legislature by the passing of what is known as the Cooper Dam bill, involving the right to develop power from the tidal waters of the Bay of Fundy. This is a companion bill to the one already passed by the Maine Legislature. Those favoring the bill stressed the vast amount of power which the project is designed to develop in Passamaquoddy Bay both for Canada and the United States. Adverse opinion pointed to the loss in the fisheries, the change of a valuable harbor into a landlocked lake and the handing over of New Brunswick resources to United States interests. The development plans must be approved by the Canadian Department of Public Works and the International Joint Waterways Commission. The estimated cost of the development was placed at between $50,000,000 and $75,000,000 by the proponents of the bill and its initial development at from 400,000 hp. to 500,000 hp., ultimately to reach 700,000 hp. or 800,000 hp.

# Rochester Gas & Electric's Caneadea Dam

THIS two-million-dollar link in the Rochester Gas & Electric Corporation's proposed Genesee River power development will be capable of producing 8,000,000 kw.-hr. of electrical energy yearly when the power house is completed. The dam, viewed in the picture from the spillway side, stands in Caneadea Creek at Caneadea, N. Y. It is 128 ft. high in the center. The artificial lake will cover 740 acres. The spillway capacity is 12,000 cu.ft. per second. Three villages disappeared under the reservoir.

## Legislation, Platforms and Stump Speeches

*Virginia Passes Water-Power Bill—Agitation Subsides in Oregon—"Power Trust" Denounced in Nebraska and Wisconsin—Ohio "Pence Law" Attacked—Maine Water-Power Issue*

A BILL placing regulation of water-power development in Virginia under the State Corporation Commission has been signed by Governor Harry F. Byrd. This measure, which is regarded as of considerable importance to hydro-electric projects, was introduced in the Legislature at the instigation of the State Conservation and Development Commission.

A review of 75 pre-election statements contained in that number of petitions filed to date by candidates seeking legislative offices in Oregon indicates that the state's 1929 Assembly will be remarkably free from bills affecting the development of hydro-electric power and the utility business in general. There have appeared so far no "slogans," pledges or recommendations in connection with proposed laws affecting the utility industries, although matters of this character have occupied first place in pre-election statements for twelve years past.

The so-called "power trust" constituted a big issue in the primary campaign for the Republican nomination for United States Senator in Nebraska, with Attorney-General Spillman detailing at length to the voters in dozens of towns the story of how he secured a permanent injunction at Hartington that "halted the progress of the conspiracy among the big companies to destroy municipal competition." Senator R. B. Howell, who won his fight for renomination, insisted that his record as a foe of monopoly and corporations entitled him to another term and publicly charged that the "power trust" was supporting Spillman in spite of his speeches.

A bitter attack on the "power trust," the Federal Trade Commission, Samuel Insull and others was made at Racine, Wis., by Senator Robert M. LaFollette in a plea for sending a Wisconsin delegation of progressive delegates to the Republican National Convention at Kansas City. "The power monopoly is a hierarchy of construction companies, advisory companies, financial companies, holding companies, super-holding companies and super-super-holding companies, each with a separate organization to be maintained and a separate profit earned," said the Senator. "They own newspapers, they finance election campaigns, they hire expensive attorneys and legislative counsel to lobby in their interests at the national and state capitols, where they ingeniously oppose every activity that might tend to reduce their indefensible profits."

Writing as a champion of Ohio farmers, Charles H. Hubbell, a Cleveland attorney, has addressed letters to candidates for Governor asking each what he would do to adjust electric rates in rural Ohio should he be nominated and elected. "What specific steps will you take to see to it that rural Ohio gets adequate electric service at fair and reasonable rates?" asks Mr. Hubbell. "Will you put a farmer on the commission? Will you favor repeal of the Pence law?" The Pence law makes it possible for public utilities to increase rates under bond pending decision of the Public Utilities Commission.

At the state Democratic convention held at Waterville, Me., recently two mutually antagonistic planks were debated—one calling for the exportation of power outside the state and the other declaring against the repeal of the Fernald law, which forbids such exportation. Agreement was reached on a plank permitting exportation of power under state control. Both parties are divided on the question, which will loom large in the coming campaign. Governor Brewster defends the Fernald law, declaring that Maine is not lagging in the production of electrical energy and has no surplus of primary power. These contentions are disputed by the power companies.

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## "Electrical World's" London Letter

### Results of National Electric Week Bring Suggestion of "Electrical Fortnight"—Disadvantages of Municipal Control of Generation—Electrical Engineers as Scapegoats

By Bernard C. Holding
Editor of *The Electrician*

LONDON, March 30.

SINCE I last wrote it has been possible to form a more accurate estimate of the real effect of the first National Electric Week ever organized in this country. Although the campaign, of which details have been given in earlier letters, seems to have had very little effect on sales, most of the participants agree that the effort was worth the time and money expended upon it, even if only for its propaganda value. Moreover, there seems to be a fairly widespread desire for an effort of longer duration than a week, and the idea of an "Electrical Fortnight" for 1928 is finding considerable backing. There seems to exist a curious difference of opinion as to whether the newspaper advertising of a campaign of this kind should comprise fairly large spaces, appearing at comparatively long intervals in selected papers, or small spaces published with great regularity in a large number of papers on lines similar to the famous "Eat more fruit" campaign.

The municipally owned electricity supply authorities in this country have certain advantages over the company undertakings, but, as recent happenings have shown, they labor under very heavy disabilities. These municipal undertakings are normally run by a competent electrical engineer who is paid by the municipality and who is assisted by an "electricity committee" composed of selected members of the local governing authority. There are, however, a number of towns in which the engineer is placed at a disadvantage through the existence of an electricity committee composed of people possessing the most rudimentary ideas regarding not only electricity supply but also the running of any sizable business, and who, perhaps through ignorance, but more often for local political motives, hamper the work of their engineers.

While this state of affairs is by no means new and can usually be borne, there have been several cases of late where the folly of such a system of governance has been proclaimed for all to see. In one town possessing an electricity committee of no fewer than 23 members, who met for a few minutes only once a month, charges were made of inefficient working, unnecessary expenditure on plant and so on. Fortunately for him, the engineer concerned was able to bring about an inquiry by a well-known consulting engineer, whose report not only acquitted him of all the charges, but also made recommendations which are in course of being carried out to replace the unwieldy committee of laymen by a small panel of five business men of repute.

Less fortunate, however, has been the case of the engineer of another municipal undertaking with an annual generation approaching 250,000,000 kw.-hr. Charges of inefficient administration, unauthorized expenditure, etc., have been leveled against this engineer by the very people who were appointed by their fellow citizens to check such items, and his resignation was called for. The indignation aroused by this action has reverberated throughout the country, but, despite criticism, the municipality concerned has refused to have an impartial inquiry and is leaving further investigation of the allegations to a sub-committee chosen from the electricity committee, which, if there is any substance in the charges, was jointly responsible with the engineer it has chosen as its scapegoat. Here the matter rests for the moment, but there is a growing feeling that incidents of this kind may be repeated from time to time unless some radical change is made.

The first of the co-ordinated regional schemes of generation and transmission, which, as I have stated in an earlier letter, is concerned with south-east England, including the important area of Greater London, has now undergone revision at the hands of the Central Electricity Board and has been very considerably modified in the process. Into the detailed changes it is impossible to enter here, but some idea of their sweeping nature may be gathered from the fact that eighteen more generating stations are to be added to the thirteen "selected" stations included in the original scheme. There were many objections to the original scheme put forward by the Electricity Commissioners last October, but the vastly different scheme which is now to go forward seems to meet with general approval.

An effort which should exert a quickening effect on domestic electrification is about to be launched by the Electrical Association for Women, an organization which exists to interest women in the possibilities of electricity in the home. The plan of campaign is that, after deciding upon a national specification showing the desirable number and position of electrical outlets in each room of the modern house, members of the association shall pay visits to all new housing estates throughout the country and arrange deputations to architects, builders, housing authorities, and eventually to the Minister of Health, with a view to pointing out the discrepancy between the electrical needs of the home-maker and the provision that is being made to meet those needs. It is obvious that this mass demand from the potential occupants of new houses will be more effective than a trade-organized attempt to achieve the same purpose.

## Philadelphia and Baltimore Utilities Resume Fight

Having failed to settle their controversy over the right to serve Havre de Grace, Md., and adjacent territory in Harford County after several months of negotiation, the Consolidated Gas, Electric Light & Power Company of Baltimore and the Philadelphia Electric Company, owner of the Northern Maryland Power Company, will resume their fight in the Circuit Court for Cecil County, Md. This case, springing from a rivalry which probably envisages more than merely supplying a small territory with light and power, has been reported from time to time in the ELECTRICAL WORLD.

A suit by the Philadelphia company to set aside the order of the Public Service Commission granting the Baltimore company the right to serve Havre de Grace was postponed in Cecil County last January. The Baltimore company asked for the postponement so as to ascertain whether a settlement could be arranged by which it would buy the property of the Northern Maryland Power Company.

Inability of the two companies to agree on a price for the property has resulted in the termination of negotiations, and the Philadelphia company has instructed its counsel to have the case set for a hearing at an early date. The Maryland Public Service Commission, a codefendant with the Baltimore company, is opposed to an early trial. Meanwhile work on a transmission line from the Conowingo hydro-electric plant to the Northern Maryland system at Havre de Grace is to be begun by the Philadelphia interests.

## Purchases and Mergers

*Montana Power Company Is Acquired by American Power & Light—New York and Many Other States See Numerous Shifts in Control*

AN UNUSUALLY important transfer of utility property was effected when, as officially announced on April 6, the Montana Power Company and the American Power & Light Company agreed to merge, subject to the approval of stockholders. The combined capital investment of these two companies amounts to $115,000,000. The necessary corporate action will be taken by shareholders about April 24. Financial details of the merger will be found under "Financial and Statistical News."

The American Power & Light Company, which is managed by the Electric Bond & Share Company, has recently taken control of the Washington Water Power Company (ELECTRICAL WORLD, Jan. 21, page 166, and March 24, page 627), whose system is interconnected with that of the Montana Power Company. The American Power & Light controls also large operating properties in Kansas, Nebraska, Minnesota, Texas, Florida, Oregon and other states. As elsewhere reported, by a vote on Monday of this week in Portland, Ore., the electors of that city refused to allow purchase of the Northwestern Electric Company by the Portland Electric Power Company, thus leaving the former still the property of the American Power & Light.

The Montana Power Company, of which John D. Ryan has been the president and directing power, has, it is believed, for years resisted efforts to acquire it. Closely associated with the Anaconda Copper Mining Company, it has enjoyed much prosperity, controlling hydro-electric subsidiaries at Great Falls, Mont., and elsewhere.

The Associated Gas & Electric Company has purchased the Delaware & Otsego Light & Power Company of Franklin, N. Y., serving that place and nearby communities. Headquarters have been moved to Ithaca.

A certificate has been filed by the Plattsburg Gas & Electric Company in the office of the Secretary of State at Albany, N. Y., announcing merger with the Eastern New York Electric & Gas Company, Inc., of Granville and assuming that name.

A court decision has been handed down in the Hammond Light & Power Company case referred to in these columns on March 24 (page 627) favoring F. A. Southgate and his associates in the St. Lawrence County Utilities, purchasers of 54 per cent of the Hammond company's stock, and declaring illegal the election of directors by Michael Doyle and associates of the Oswegatchie Light & Power Company, who had bought 46 per cent.

Application has been made to the New York Public Service Commission to permit exchange of the capital stock of the Cortland County Traction Company for stock of the Mohawk-Hudson Power Corporation. The traction company for 35 years has operated the Cortland light and power plant, supplying also Homer, Preble, McGraw and surrounding territory. It is capitalized at $320,000.

Purchase, already noted, by the Interstate Public Service Company of four small electric properties in and near Columbus, Ind., for $97,500 has been approved by the Indiana Public Service Commission. The companies are the H. F. Clevenger Electric Company, Columbus; the Trafalgar Light & Power Company, the Winterrowd Electric Company, Flat Rock, and property owned by H. F. Clevenger south of Columbus.

Voters of Caldwell, Kan., have approved the sale of the city's electric light and water plants to the Western Light & Power Corporation, with headquarters at Salina. The consideration was $205,000 cash. The vote also authorized the City Commission to grant a 20-year franchise. The proposal to sell the plants to a former and lower bidder lost several weeks ago, and the vote to sell to the Salina organization was carried by only 74 votes.

Negotiations are under way for the sale by the city of Claflin, Kan., to the United Power & Light Corporation, Abilene, of the municipal distribution system and 8 miles of transmission line.

After having voted down by 513 to 366, at a special election in February, a proposal to sell the municipal electric lighting plant to the Iowa-Nebraska Light & Power Company, College View, a Lincoln educational suburb, has now voted, 411 to 318, to sell for $35,000 in consideration of an agreement by the company to supply gas to the town at the Lincoln rate.

Palmer (Neb.) voters have voted by 154 to 35 to sell the municipal electric system to the Central Power Company, Grand Island, which will build a transmission line there and continue through to Central City, thus effecting a loop. Julian, Neb., also voted with only two dissentients to sell its plant to the Central Power Company.

An offer of $330,000 by the Southern Colorado Power Company for the municipal light and power plant of Lamar, Colo., has been raised to $400,000.

The Northern States Power Company has made a formal offer of $350,000 cash for the competing municipal electric lighting plant at Sioux Falls, S. D. The offer includes all physical property of the system but does not include the buildings and land.

The sale of the Bartlesville (Okla.) Gas & Electric Company to the Southwestern Gas & Electric Company has been approved by the Oklahoma Corporation Commission. The Bartlesville company was formerly a Doherty property.

Purchase of the Burnsville (N. C.) Light, Heat & Power Company, serving Burnsville, Bakersville, Toecane and Micaville, by the East Coast Utilities Company of Chicago is announced. Lines are to be built to Mars Hill and Marshall and to other points in western North Carolina.

The Carolina Gas & Electric Company, whose bid of $1,271,000 for the municipal electric plant of Kinston, N. C., is to be submitted to popular vote in July, after tentative approval by the City Council, now offers to add $86,000 to its bid to make it equal to another one rejected by the Council as vaguely worded. Should the bid be indorsed at the polls, the Mayor of the city advocates paying off the city's debt of $803,000 as it falls due and creating a special fund out of the balance to be spent on such improvements as the voters indorse.

Voters of Athens, Ala., have voted down decisively the proposal to sell the city's plant to the Alabama Power Company for $113,000. This is the third time in about fifteen years that the city has refused to sell the plant.

Waxhaw, N. C., and Walhalla, S. C., in addition to Walnut Cove, N. C. (already noted), have voted unanimously to sell their distribution systems to the Southern Public Utilities Company of Charlotte, N. C.

The Texas Utilities Company has placed

a new power plant in operation at Sonora, Tex., after purchasing the local plant and that at Eldorado.

Application to the California Railroad Commission for authority to acquire the Fair Oaks Electric Company for $37,500, to assume its indebtedness of $9,500 and to consolidate the system with its own has been made by the Great Western Power Company. The Fair Oaks company serves the unincorporated town of Fair Oaks and surrounding territory 12 miles northeast of Sacramento and has been purchasing all its energy from the Great Western Power.

The Mid-West Utilities, Limited, a subsidiary of the International Utilities Corporation, has purchased the plants owned and operated under franchises in southern Saskatchewan, Canada, by the Northern Light & Power Company. The plants taken are those at Broadview, Indian Head, Wolseley, Moosomin and Grenfell.

Shareholders of the Quebec Railway, Light, Heat & Power Company have approved its sale to the Quebec Power Company.

# Three Topics Predominate at Omaha

## Cheap Power as a Magnet for Industry, the Tri-County Project and Rural Service Provide Fruitful Sessions for Meeting of Nebraska N.E.L.A.

Interest at the twenty-seventh annual convention of the Nebraska Section of the National Electric Light Association, held at Omaha on April 4 and 5, centered in the result of a study made by Ford Bates of the Nebraska Power Company of the factor of cheap power in the location of manufacturing industries, in the report of a special engineering committee as to the feasibility of the Tri-County project in central Nebraska, for which government and state aid have been asked by the promoters, and in the progress of rural electrification.

Mr. Bates' study was of Nebraska industries. He found that in the location of industries consideration was first given to the market for the production, then to these other things in the order named: Availability of raw material, transportation, labor supply, building costs, financial accommodations, and, last, cheap power. He instanced the failure of the Keokuk plant to draw industries to it and the final necessity of selling energy to St. Louis, with its thousands of factories and workshops, as typical of the situation.

Roy Page, assistant general manager of the Nebraska Power Company, reported for the special engineering committee that under no one of the five plans for the Tri-County project presented by the government would the power section take care of itself, let alone aid in reducing the cost of irrigating the land as proposed. The committee found that the electrical energy which could be produced there could not compete with existing sources of supply.

The proposal was condemned as economically unsound, and studies were presented which showed that the present sources of production, being nearer the principal power markets of the state, can put out energy at a lower price. Because of the ever-increasing size and efficiency of steam plants and the fact that hydro-plant efficiency has about reached its maximum, making the cost of hydro production almost entirely a function of investment, the development of this and similarly located high-cost large water powers must wait until the nearby market has grown so that the necessary investment will be justified, thus offsetting the high cost of distribution to points of use.

This investigation was undertaken on the theory that if the project offered a more economical source of electrical energy, the power companies should make the development. Dean Ferguson of the University of Nebraska, discussing the report, said that the committee had underestimated and undervalued the possibilties of development of a market in the immediate territory. He thought that taking a smaller unit of development would have yielded more satisfactory results.

### Many Hydro Plants Idle

Dr. G. E. Condra, head of the state conservation department, gave statistics showing that of the 286 water-power developments in the state in past years, only 70 are now operated. One contributing factor was the decline of local power demands, and another was better methods of development.

C. W. Amidon, president of the Central Power Company, which operates both types of plants, gave as the result of his experience that the hydro plant costs more to construct and, because of the interest cost, more to operate, and in Nebraska sand in river bottoms forces a higher maintenance cost. The company's hydro plants were idle many hours last year because of low water and slush ice. The successful method is to develop the load of the steam plant to the point where the hydro is available only for emergency; it cannot be considered as a primary but as a secondary source, to be used only when conditions are favorable. Similar experiences were related by George W. Steinmyer, district manager Iowa-Nebraska Light & Power Company.

L. E. Nelson, Omaha merchant, discussing trade relations, said that the light and power companies were making the competitive situation very difficult for retailers of limited capital. He criticised the use of premiums by the companies in selling merchandising and the terms extended. He had no criiticism of prices. C. N. Chubb, president Iowa-Nebraska Light & Power Company, said that on the power companies was laid the burden of pioneering in both invention and creation of a demand. This department should always be operated at a profit, and he urged co-operation of retailers with power companies.

Great progress in reaching the farmer with dependable service was reported by W. R. McGeachin, assistant general manager Iowa-Nebraska company; S. P. McFadden, general manager Western Public Service Company, and Prof. E. E. Brackett, University of Nebraska. The general opinion was that a service charge with a lower energy rate would promote greater use of energy and prove better in the long run for both producer and consumer. Professor Brackett gave the results of a survey that showed 2,200 rural consumers, only a few of them connected with municipal plants. Rates run from 5¾ cents to 14.42 cents a kilowatt-hour, and the average consumption is 520.8 kw.-hr. per year.

Other features of the program included papers on legal aspects of the year, merchandising methods, service problems, safety conferences, inductive co-ordination, transformer loads, fuel and radio.

C. W. Amidon of Grand Island was named president; S. P. McFadden, Scottsbluff, vice-president; Thorne A. Browne, Lincoln, re-elected secretary, treasurer and managing director. The registration totaled 155.

# Briefer News

**Radio Board Elects Officers.**—Ira E. Robinson of Grafton, W. Va., newest member of the Federal Radio Commission, was unanimously elected chairman at a meeting of the commission late last week, and Judge E. O. Sykes was elected vice-chairman.

**Columbus (Ohio) May Enlarge Municipal Plant.**—Plans for expansion of the municipal lighting plant have been outlined by Service Director Duffy of Columbus, Ohio. They include installation of a 7,500-kw. generating unit, additional distribution systems, new stokers and boiler equipment and a new automatic substation for the South Side, involving a total expenditure of $515,000.

**Ponca City, Okla., Rebuilding Its Plant.**—A new municipal plant is under way at Ponca City, Okla., Superintendent J. W. Crow reports, in which will be installed two 1,125-kva. generators driven by Diesel-oil engines, to which will be added the two engines now in service in the old plant. The total cost is put at $300,000.

**Cedar River Dam to Wait.**—Although the Iowa Railway & Light Corporation has submitted an application for permission to erect and operate a two-million-dollar dam and hydro-electric plant on Cedar River near Rochester, Iowa, Isaac B. Smith, Cedar Rapids, president of the corporation, states that the project will not be actually undertaken for three years or until the present plant proves inadequate.

The new 9,500-hp. project includes a reservoir of 2,250 acres, a concrete dam with a crest 22 ft. above normal water level, a power house 140 ft. long and five hydro-electric units of 1,400 kva. each.

Alouette Plant of British Columbia Company Begins Operation.—The Alouette power plant of the British Columbia Electric Railway Company has received the finishing touches to the equipment, and the plant began generating on March 29. It will be joined to the system of the British Columbia Electric on the lower mainland in the course of a week or so. The plant, which cost $2,500,000 to erect and took approximately three years to complete, was described and illustrated in the Electrical World for Feb. 25 (page 424.)

Petroleum Industry Electrical Association Formed. — Formation at Fort Worth, Tex., of the Petroleum Industry Electrical Association is announced, and immediate steps will be taken to embrace the entire country in the scope of its organization, according to T. J. McMahon of Houston, who was elected president. The association represents an investment of approximately $15,000,000, Mr. McMahon says, and is meant to "weld for mutual helpfulness the entire telephone, telegraph and electrical systems of the numerous oil and gas pipe-line companies and refineries of the Southwest."

Vernonia (Ore.) Light & Power Gets on Its Feet.—Intervening at the request of stockholders and customers of the Vernonia Light & Power Company after litigation failed to give relief, the Oregon Public Service Commission has effected a settlement of the affairs of this company, which has been in the hands of a receiver for the past year. G. W. Ford, formerly manager of the Toledo (Ore.) Light & Power Corporation, will take charge of operation, as receiver, and the commission's engineer has established rules and regulations under which the utility may operate and discharge outstanding obligations.

Empire State Association's Women's Section Meets.—A well-planned program was drawn up for the annual meeting of the Women's Section of the Empire State Gas and Electric Association at Briarcliff Manor, N. Y., on Thursday and Friday of this week. It included papers on "The Home Service Department," by Helen A. Smith, Rochester; "Aids in Teaching the Use of Service in the Home," Marion Brainard, New York; "The Rural Home of Yesterday, Today and Tomorrow," Dr. Ruby Green Smith, Cornell University; "Electricity in the Farm Home," Elizabeth Sweeney; "The Farm Kitchen," Laura Rischman; "Women in Public Utilities," Sara Harris, Utica; "Developing Women's Work in the Public Utilities," Marguerite Bradshaw, Nyack; "Representing the Customer," Florence Everett, New York; "The Public Speaking Committee," Frank W. Smith, New York; "Railroading from a Woman's Viewpoint," Olive Dennis, and "Our Civic Responsibilities," Mrs. Arthur Livermore. Luncheon speakers were to be Mrs. Christine Frederick, Miss Lena M. Prillips and F. W. Fisher, director public relations Rochester Gas & Electric Company.

Dr. Mead Declares that All Irrigation Power Plants Pay.—While on a visit of inspection to the Elephant Butte dam and irrigation project, Dr. Elwood Mead, chief of the United States Bureau of Reclamation, made the statement that all revenues derived from the development of hydro-electric power at that dam will go to the two irrigation districts which are served by the reservoir. Dr. Mead said that the contract of the districts with the El Paso Electric Company for the purchase of power, on which hinges the ultimate construction of the power project, had been informally approved by the Secretary of the Interior. He added: "There is unquestionably a large amount of potential power at the dam and it should be utilized. Development of the power is especially advantageous because of the market afforded by El Paso. There is not a single power plant built on any of our projects that is not profitable. Revenues from the Minidoka (Idaho) plant this year will nearly pay operating expenses of the irrigation project."

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]**

American Institute of Electrical Engineers — Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Arizona Utilities Association—Prescott, Ariz., April 26-28. M. G. Sanders, Industrial Congress Bldg., Phoenix, Ariz.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

More Rate Reductions in Kansas.—Voluntary reductions in residence lighting rates in four towns have been announced by the Kansas Power & Light Company, Topeka. The new rate provides for the first 30 kw.-hr. at 12 cents and all in excess at 6 cents; formerly the rate was 15 cents stepped down to 10 cents. Substantial rate reductions to Peabody and Junction City, Kan., have also been voluntarily made by the United Power & Light Corporation, with headquarters in Abilene. These reductions are in line with the Kansas Public Service Commission's policy of lower and more uniform rates throughout the state.

Water Resources of Virginia.—"Water Resources of Virginia," a volume of more than 500 pages containing all data compiled by the steam-gaging stations of the state—some sixty in number—since they began functioning, is just off the press. The book was compiled by the state Geological Survey, an agency of the Conservation and Development Commission, in cooperation with the federal Geological Survey. The data were obtained by J. J. Dirzulaitis and G. C. Stevens, who are in charge of stream-gaging work for the state survey. Stream-gaging work began on some Virginia streams about thirty years ago, and the volume just published covers this entire period. It also includes a summary of the report of the water-power possibilities of the Potomac River system made by Major M. C. Tyler, of the United States Army Corps of Engineers.

Westchester Lighting Company Reduces Rates.—New rates for electrical energy which will save customers of the Westchester Lighting Company and affiliated companies, serving Yonkers, Mount Vernon, New Rochelle, White Plains and other places north of New York City, more than $400,000 a year will become effective on June 1, the company announces. Reductions range from 4½ to 18 per cent. Under the new schedule the charge for the first 50 kw.-hr. used in a month will be 10½ cents a kilowatt-hour; for the next

50 kw.-hr., 10 cents; for the next 100 kw.-hr. 9½ cents, and so on in descending ratio to 6 cents for all energy in excess of 1,000 kw.-hr. The present rate, fixed two years ago, is 11 cents a kilowatt-hour.

Engineering Index Extended.—Extension of the old "Engineering Index" supplied by the American Society of Mechanical Engineers has been undertaken by that society, which announces that its new "Weekly Engineering Index Service" is now "in full swing." More than seventeen hundred publications are reviewed by this service, each article is briefly described, and the resultant notes are classified under thirteen subject headings, printed on index cards and sent to subscribers. Under the classification "Electrical" there are eight subdivisions. Major Carlos de Zafra, 29 West Thirty-ninth Street, New York, is the director of the Engineering Index Service.

Connecticut Light & Power Engineers Remain at Waterbury.—Through a misunderstanding it was announced in the Electrical World for March 31 that the engineering department of the Connecticut Light & Power Company was to be transferred on April 1 to Hartford, with the sales organization, including merchandise sales and advertising. C. L. Campbell, treasurer, informs the Electrical World that the engineering department still remains in Waterbury under the general direction of Irvin W. Day, vice-president in charge of engineering and operations. The sales organization has moved to 36 Pearl Street, Hartford, being under the direction of R. H. Knowlton, vice-president in charge of sales. The Hartford office has been for the past year and a half headquarters of the president, treasurer and financial interests of this company and the other companies controlled by the Connecticut Electric Service Company.

San Joaquin Power Drops Small Hydro Filing.—In connection with certain group filings on prospective hydro-electric sites in the mountain area several years ago the San Joaquin Light & Power Corporation, Fresno, Calif., filed on Whisky Creek, a tributary of the San Joaquin River in the Big Creek region. The site is small and capable only of a 2,000-hp. development as a stream-flow plant. When notice was received that hearing on the application had been set for March 27 the company decided to relinquish its filing as the development would not be undertaken for many years, if ever, and the cost of the plant would be high and its capacity small. At the time the application was withdrawn the company notified the Division of Water Rights that if future power demands should justify it the company would refile its application. Withdrawal of the application gave rise to erroneous newspaper stories that the company had dropped its whole San Joaquin and Kings River hydro-electric development plans.

# Commission Rulings

Purchase of Controlling Interest by Non-Residents.—The Public Service Commission of Pennsylvania held, in adjudicating a complaint brought by the Borough of Brookville against the Solar Electric Company and the Penn Public Service Corporation, that no violation of the law is involved in the purchase of the stock of an electric company by a non-resident in the interest of a holding company which owns another electric company operating in the state, although the commission had refused to approve the purchase of the stock of the first company by the one last mentioned and had approved the purchase or condemnation of its works by the complainant borough.

Indiana Commission Orders Costs of Company Audits, Appraisals and Attorneys' Fees Charged Against Net Income.—A blow at an alleged practice by Indiana utilities of charging to operating expenses large sums incurred by audits, appraisals and attorney fees has been struck by the Indiana Public Service Commission, which has ordered that in the future such expenditures be made from net income. The commissioners declared that the new rule will save utility patrons approximately $1,000,000 a year. According to Commissioner Calvin McIntosh, the resolution is the result of a hearing he conducted about a month ago in which an increase in rates was sought. He presented figures to show that attorneys' fees charged in connection with the hearing, which lasted only about one day, amounted to $3,000 for one firm, $750 for another and $350 for a third. In addition, he said that, although appraisals and audits of the property and books were made by the Public Service Commission engineers and acountants, owners of the company paid $5,000 for an appraisal to one commercial engineer and $500 to another and that $750 was paid by the company for a separate audit of the books. The commission admits that the new ruling is a departure from previous practice in Indiana and other states.

Electric Utility Must, Within Reasonable Limitations, Serve All in Its Territory Who Apply.—In granting a petition for an order requiring the Mountain States Power Company to extend its line to serve would-be customers, the Montana Public Service Commission said: "In 1926 we approved certain regulations governing rural extensions of this company. In the instant proceeding, however, the company has waived in its own evidence a strict adherence to these regulations, and in consequence of its own waiver we see no reason for giving such regulations any force or effect in this case. The subject of rural extensions for public utilities has not received careful consideration in Montana up to this time. Undoubtedly the time is not far off when the subject must be developed by appropriate investigation and some fundamental regulations established, but in the meantime it must be understood that each case is to be determined upon its own facts and the decision herein is to furnish no precedent in other cases—and, of course, it goes without saying that fair rates cannot be promulgated until after actual operation of the extension for a period of at least one year. It is the principal characteristic of commission regulation of rates that response may be made promptly to varying conditions and new circumstances. We have given this case unusual consideration owing to the very important questions presented. We fully appreciate the limitations on the exercise of power which enforces the expenditure of the money of the utility in such a way as amounts to a taking of private property. We appreciate that we may not assume the role of managers and require such property to be used in a service to which the owner has not voluntarily dedicated it. But since it seems certain that the territory is within defendants' profession of service, it is defendants' duty within reasonable limitations to serve all in such territory who apply."

# Recent Court Decisions

City Ordered to Pay for Forced Removal of Line Leased by It to Company.—A suit in the Kansas Supreme Court—Electric Service Company vs. City of Mullinville—concerned a case in which the city had constructed a transmission line for the purpose of supplying its inhabitants with electrical energy and leased it to the company for operation for a net rental sufficient to pay interest on the bonds. The lease provided that the company should maintain the transmission line in good operating condition. The line was constructed on a public highway and the board of county commissioners, desiring to widen the highway, ordered the line removed. A dispute arose over the expense of removing and rebuilding the line. The court determined that it should be borne by the city. (262 Pac. 536.)*

Legality of Sub-Metering by Landlord Upheld.—In the Cuyahoga County (Ohio) Court of Appeals one Jonas brought suit against the Swetland Company, owner of an office building, because that company bought electricity from an illuminating company at a basis of about $115 or $120 a month and charged its customers, particularly the plaintiff, a tenant, about $300 a month. The tenant contended that the defendant, not being a public utility corporation, could not sell light and power to its customers; that it was charging for the service furnished by the illuminating company, and that, therefore, its charge was illegal and it should be enjoined from collecting its bill. In holding that the owner of the building had the right to sell light, power and heat to its tenants, the court said in part: "It surely cannot be possible that a utility company furnishing light, power and heat must make a separate contract with every tenant in a big office building. A thing of that sort would lead to confusion and trouble that surely would warrant the utility company in making a contract with the owners of the building at a wholesale price, who in turn may retail it out to the various customers and tenants. Whether or not the price which they get is a proper price is not for the court to say. We do not think that the building company is prohibited from furnishing light, power and heat to its tenants. On the contrary, we think that it might be its duty to do so. . . . We think that it is a matter of contract between the tenant and the owners of the building as to the price they pay for it; that it is not *ultra vires*, and it is not against public policy that such contract should be made."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

### *J. G. Holtzclaw President of Southwestern Division*

J. G. Holtzclaw, who was made president of the Southwestern Division of the National Electric Light Association at the recent convention in Biloxi, Miss., as announced in the April 7 issue of the ELECTRICAL WORLD, has been identified with the Stone & Webster interests for twenty years. He was affiliated with the Savannah (Ga.) Electric Company at first, but later he removed to Pensacola and became chief executive of the electric light and power and traction properties in that city. Three years ago, when the transfer of A. F. Townsend to Aurora, Ill., left vacant the office of general manager of the Eastern Texas Electric Company at Beaumont, Mr. Holtzclaw was selected for the position. In 1926 the Gulf States Utilities Company was organized to take over the Beaumont properties, which are still under the executive management of Stone & Webster. Mr. Holtzclaw is a native of Georgia.

*J. G. Holtzclaw*

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**D. E. KINNEAR** has been appointed secretary of the Maryland Utilities Association to succeed the late G. S. Williams.

**THOMAS N. MCCARTER**, president of the Public Service Corporation of New Jersey, has been elected a member of the board of directors of the Philadelphia Electric Company.

**O. H. MANN** is now electrical superintendent in the Hudson district of the New York Power & Light Corporation. Mr. Mann was for several years a member of the operating force located at the Rotterdam substation.

**H. S. KILBY**, who has been in charge of the power and railway systems of the Missouri Power & Light Company at Jefferson City for the past eight years, has been appointed general manager of the Kansas Power Company, which is affiliated with the Missouri Power & Light Company, with headquarters at Salina, Kan. Mr. Kilby will have supervision of the power plants and service in 96 communities and cities in central Kansas. He has been associated with the Missouri Power & Light and affiliated companies for fifteen years.

**W. E. DICKERSON**, formerly manager of the Central Power & Light Company at Victoria, Tex., has been appointed manager of the recently organized department of industrial development.

**R. O. LOOMIS**, formerly distribution engineer of the Alabama Power Company's southeast division, Eufaula, has been transferred to Tuscaloosa in the capacity of district superintendent.

**WILLIAM G. HICKLING** has been appointed superintendent of the construction and engineering department of the Associated Gas & Electric System at Johnstown, Pa., to succeed P. H. Harris, who has assumed new duties.

**PROF. DR. C. RAMSAUER**, director of the Physical Institute of the Technical High School of Dantzig, Germany, has been appointed head of the new research laboratory which the Allgemeine Elektricitäts Gesellschaft is establishing in Berlin, Germany.

**P. A. MAXIMOV**, president of the Soviet Electrotechnical Trust, has arrived in this country, accompanied by B. I. Bukhovtsev, production manager of the trust, to make a study of the electrical industry in this country. The introduction of electrical power in industry, transportation and for lighting purposes is proceeding now on a scale never before known in Russia, according to Mr. Maximov. He expects to stay in this country about six weeks. Together with Mr. Bukhovtsev he will visit Schenectady, Boston, Chicago, Milwaukee and other industrial centers.

**GEORGE B. TRIPP**, for many years engaged in the executive management and operation of electric light and power, street railway and gas companies, has affiliated himself with Glidden, Morris & Company, investment bankers, New York. For the past three years he has directed the operation of the natural gas property of the Huntington Development & Gas Company, Huntington, W. Va., a subsidiary of the Columbia Gas & Electric Corporation. In the course of his public utility career he has been connected with the Cleveland Electric Illuminating Company in various capacities, with the Colorado Springs Electric Company as general manager, with other electric companies in Colorado, with the Harrisburg (Pa.) Light & Power Company in the capacity of vice-president and with the United Gas & Electric Engineering Corporation of New York as vice-president. Mr. Tripp was some years ago president of the Pennsylvania Electric Association and also of the Colorado Electric Light, Power and Railway Association.

### *J. E. Montague Doubly Honored*

Joseph E. Montague, vice-president and general manager Niagara Electric Service Corporation, Niagara Falls, N. Y., has been elected president of the company to succeed the late George Urban, Jr. He was also elected a director of the Niagara Falls Power Company at a meeting of the stockholders to succeed the late C. P. Hugo Schoellkopf. Mr. Montague has been in charge of the operations of the Niagara Electric Service Corporation since 1903 and the growth the company attained under his direction has been the subject of frequent comment in the electrical world. In the light of these achievements the promotion of Mr. Montague as the official head of the corporation naturally followed.

*J. E. Montague*

Mr. Montague has long been identified with various enterprises on the Niagara frontier and he occupies a prominent position in the business and social circles of that district.

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**THOMAS GRAY**, manager of the Brighton district of the Public Service Company of Colorado, has been transferred to the Alamosa district and **G. C. CHIPMAN**, manager of the Berthoud district, has been named to succeed Mr. Gray at Brighton.

**HENRY A. SUPRENANT**, formerly in charge of the Vernon plant of the New England Power System, has been appointed supervisor of operations of the company's western division with headquarters at Shelburne Falls.

**FRANCIS D. WYATT**, formerly electrical engineer of the Columbia Engineering & Management Corporation, is now chief engineer of the Cutter Company, Philadelphia. Mr. Wyatt had been associated with the Columbia system since 1916, having joined the Union Gas & Electric Company, Cincinnati, in that year in the capacity of electrical engineer. His early experience following graduation from Ohio State University was with the Doherty Operating Company, where he remained three years, and with the electric research laboratory of the National Cash Register Company, the connection he severed to affiliate himself with the Union Gas & Electric Company.

Ellis A. Ballard has been elected a director of the Electric Storage Battery Company to fill the vacancy caused by the death of J. R. McAllister.

Max W. Babb, vice-president and general attorney of the Allis-Chalmers Manufacturing Company, has been elected a director to succeed the late Charles F. Pfister.

Justin G. Smeby has been recently appointed welding engineer at the South Philadelphia works of the Westinghouse Electric & Manufacturing Company. He has been connected with the Westinghouse company since 1922.

Wylie Brown, president of the British American Metals Company, Plainfield, N. J., and vice-president of the American Copper Products Corporation, Elizabeth, N. J., has been elected president of the Habirshaw Cable & Wire Corporation, with plants at Yonkers and Nappingham, N. Y., and Bridgeport, Conn.

Ralph W. Carpenter, for the past thirteen years local manager of the Idaho Power Company at Nampa and Emmett, Idaho, has been appointed manager of its newly created Jerome division with headquarters at Jerome. Before entering the public utility field he was engaged in the contracting branch of the electrical industry in Boise.

Oliver M. Spratt, who some ten years ago was associated with the Foshay interests, has recently rejoined the Foshay Company in the capacity of assistant to the president. It was in 1916 that Mr. Spratt became local manager of the Baxter Light & Water Company, Baxter Springs, Kan., for the Foshay Company, but when the plant was sold three years later he continued to manage a private business which he had been carrying on in addition to his duties with the Baxter Springs property.

William Johnston, Jr. has been appointed vice-president of the Twin State Gas & Electric Company, Vermont Hydro-Electric Corporation, Rutland (Vt.) Railway, Light & Power Company and Middlebury (Vt.) Electric Light Company, with headquarters in Boston, Mass. Mr. Johnston joined the Twin State organization in 1919 as traveling auditor, and since 1922 has been auditor of the Twin State and associated utilities. He will have general executive responsibilities in his new post.

Leon E. Seekins has been appointed manager of the Lowell (Mass.) Electric Light Corporation, succeeding John A. Hunnewell, who recently was elected president of the company following its acquisition by the New England Power Association. Mr. Seekins was formerly employed by the Lowell company in the power sales engineering and other departments, and in 1924 was made assistant to the manager. After twelve years' service with the company he was appointed manager of the Cape Breton Electric Company, Ltd., Sidney, N. S., whence he returned to Lowell.

## *H. L. Masser Vice-President of Los Angeles Utility*

Harry L. Masser, gas engineer of the Los Angeles Gas & Electric Corporation since 1924, has been made vice-president and executive engineer of the company. Los Angeles is Mr. Masser's native city and the University of California his alma mater. His early experience was with the Southern California Gas Company and the Midwest Gas Company, connections which covered a period of three years. He served in the engineering branch of the United States Navy during the war and spent five years with the engineering department of the Railroad Commission of California. He severed his affiliation with the commission in 1924 to become gas engineer for the Los Angeles corporation. In his new position Mr. Masser will be in charge of all production, distribution, construction and operation, both gas and electric.

*H. L. Masser*

James R. Werth, formerly head of the power bureau of the Florida Power & Light Company, Miami, has been appointed head of the new-business division of that company. Mr. Werth's past connections include the Lynchburg (Va.) Traction & Light Company, the H. M. Byllesby Company, the West Penn Power Company and the General Electric Company.

Charles C. Hellmers has been appointed manager of the Lincoln district of the Iowa-Nebraska Light & Power Company. A native of St. Louis, Mo., Mr. Hellmers became interested in the utility business early in life, organizing and developing the group of electric properties in northwestern Missouri known as the Maryville Electric Light & Power Company. After the Iowa-Nebraska interests took over these properties he was advanced to an executive position in the general offices.

L. F. Sandford, until recently manager of the new-business department of the Southwest Power Company at Fayetteville, Ark., has become sales manager for the Arkansas Utilities Company at Helena.

G. M. Nash, formerly service supervisor of the Poughkeepsie district of the Central Hudson Gas & Electric Company, has been appointed district operating supervisor at Beacon, N. Y., to succeed G. D. Horne, who has assumed new duties in Poughkeepsie.

Thomas S. Craig, formerly connected with the Jones & Laughlin Steel Company and more recently with the Power Specialty Company, has joined the sales department of the Elmira Water, Light & Railroad Company, Elmira, N. Y. Mr. Craig received his technical education at the Carnegie Institute of Technology and at the Massachusetts Institute of Technology.

N. R. Beagle, assistant chief engineer of the North American Light & Power Company, with headquarters in Peoria, Ill., has been appointed superintendent of the Jefferson City offices of the Missouri Power & Light Company to succeed H. S. Kilby, who has been in charge of the power and street car systems in that city for the past eight years. Mr. Beagle has been connected with the North American company for a number of years.

R. W. Warner, formerly connected with the substation engineering department of the Kansas City Power & Light Company, Kansas City, Mo., is now identified with the overhead engineering department of that company. Mr. Warner was previously connected with the General Electric Company at Schenectady, where he engaged in switchboard work. At first he worked on transmission lines for the Kansas City company, but more recently he has done some special street lighting work.

## Obituary

John J. Murphy, president of the Electrical Construction & Machinery Company of Rock Island, Ill., died in that city April 4 in his fifty-ninth year. Mr. Murphy was a member of the A.I.E.E.

Robert Pfeil, a director of the Siemens & Halske Company, Berlin, died recently in his sixty-fourth year. A native of Wiesbaden, Dr. Pfeil was educated at the Technical High Schools of Karlsruhe and Brunswick. He had been associated with the Siemens & Halske organization since 1892.

Dr. Theodore W. Richards of the chemistry department, Harvard University, a Nobel prize winner and distinguished authority in the field of atomic weight research, died at Cambridge, Mass., April 2. He was a profound investigator in physical chemistry and a member of many learned societies.

# Financial and Statistical News

## *Four Per Cent Coupons Appear Stocks Firm and Active*

THE fact that 4 per cent utility bond issues have been predicted for some time and that they are entirely in line with the trend does not detract from the interest shown in the first one to make its appearance, the $35,000,000 issue of the Cincinnati Gas & Electric Company, which was marketed this week. The rapidity with which this issue was absorbed may be regarded as a further indication of the trend. A gradual appreciation of the merits of utility securities, the widening of the legal market for these issues, the current trend of money rates in general—all these factors are working toward lower coupons in connection with new utility issues, and the cause for surprise is not so much the reduction in yield as the fact that utility bond rates are still considerably above those of comparable issues; those, for example, of the railroads. A new level has been established this week, but the trend is still toward lower levels.

Power and light company common stocks continue their upward trend. Outstanding advances were made by American Gas & Electric, which reached 140; Brooklyn Edison, which gained ten points, to 251; Middle West Utilities, to 143, etc. Preferred stocks continue firm with prices somewhat higher for the week.

## Three New Preferred Issues Offered

During the week ended April 12 three new offerings of preferred stock were made. The American Electric Power Corporation issued 35,000 shares of $6 preferred stock at $93.50 a share and accrued dividends, to yield over 6.40 per cent. With the purpose of refunding short-term loans outstanding and for other corporate purposes the New England Public Service Company issued 45,000 shares of $6 preferred stock at $97.50 per share and accrued dividends to yield over 6.15 per cent. The Iowa Public Service Company issued 5,000 shares of $6 cumulative first preferred stock, the price being $100 per share and accrued dividend, to yield 6 per cent.

First mortgage gold bonds, series A, of the Cincinnati Gas & Electric Company were offered at 92½ and accrued interest, to yield 4.40 per cent, a piece of financing involving a total of $35,000,000. The Cincinnati Gas & Electric Company will presently effect a consolidation with the Columbia Power Company and thereafter will acquire all the physical properties of the Union Gas & Electric Company. These bonds are being issued incident to this consolidation, in consummation of which all of the previous funded debt of the Cincinnati Gas & Electric Company will be retired, its capital stock will be exchanged share for share for 5 per cent preferred stock of the consolidated company, the preferred stock of the Union Gas & Electric Company will be retired, and capital funds will be provided for other corporate purposes.

The Queens Borough Gas & Electric Company made an offering of 4½ per cent refunding mortgage gold bonds totaling $4,000,000 at 100 and accrued interest.

The Super-Power Company of Illinois made an offering of 4½ per cent gold bonds, due March 1, 1968, to the amount of $10,000,000, the price being 98½ and interest.

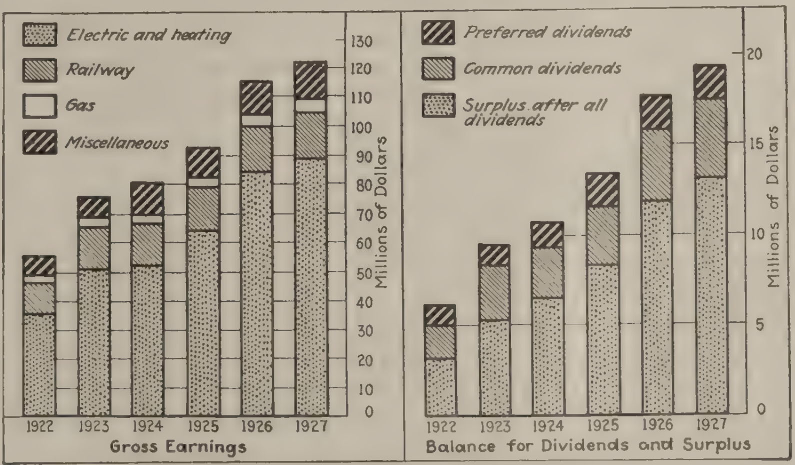
Two foreign loans were floated during the week, an issue involving 100,000 shares of the Swiss-American Electric Company in the form of $6 cumulative preferred stock and an issue of first mortgage sinking fund gold bonds of the Electric Power Corporation (Germany), involving $5,000,000.

## New England Public Service Gross up $744,177

The New England Public Service Company in its annual report for 1927 shows total net income for the year of $1,646,577. A consolidated earnings statement of the subsidiaries of the New England Public Service Company for the year shows total gross earnings of $13,569,943, an increase of $744,177 over the year 1926.

After payment of all expenses, interest and prior lien and preferred dividends there was available for dividends on the 286,889 shares of common stock outstanding Dec. 31, 1927, $1,201,425. This represents the combined surplus earnings of the New England Public Service Company and its subsidiary companies and is equivalent to $4.18 a share. The total number of stockholders of all subsidiary operating companies was 22,725.

## North American's Net Revenue Is Up 10.47 per Cent



*Earnings have doubled in past six years*

AN INCREASE in gross earnings of 5.45 per cent and a growth in net of 10.47 per cent are disclosed in the 1927 annual report of the North American Company group. The operating ratio, or the ratio between gross earnings and operating costs, maintenance and taxes, showed a decided improvement—from 55.57 per cent in 1926 to 53.46 per cent last year. Depreciation reserves exceeded 10 per cent of gross.

After all deductions, the balance for dividends and surplus was $19,254,647, of which $1,820,022 was used for dividends on parent company preferred stock. There remained $17,434,625 after all preferred dividends, which is an increase of 10.74 per cent over 1926. This is equivalent to $4.06 per share, against $3.85 in 1926 and $3.12 in 1925. After all dividends on preferred and common stocks of North American Company and charges of $3,881,478, consisting principally of writing off unamortized discount and expense and premiums on bonds retired, undivided profits increased by $9,211,375, or 21.86 per cent. At the end of 1927 undivided profits amounted to $51,358,612, in addition to $23,821,632 capital surplus.

The North American Company's electric output of 5,003,332,121 kw.-hr. in 1927 was 5.25 per cent above the 1926 total, and the gas output increased 14.42 per cent. The number of electric customers increased 5.82 per cent, to 993,332.

## American Power & Light Acquires Montana Power

Acquisition of the Montana Power Company by the American Power & Light Company, which is supervised by the Electric Bond & Share Company, is stated to be based on exchange of Montana common stock for a new $5 preferred issue, series A, of the purchasing company, one for two. A banking syndicate has made an offer to purchase at $83 a share, plus accrued dividends from April 1, new preferred stock of American Power & Light, which Montana Power common shareholders may have received in exchange and wish to sell, up to May 2. This places a value of $166 a share on the Montana Power common, or of $82,391,278 on the 496,333 shares of stock outstanding.

The new $5 preferred issue into which Montana Power common is to be converted will be entitled to cumulative quarterly dividends at the rate of $2.50 a share for the remainder of 1928, to $3 for 1929, to $3.50 for 1930, $4 for 1931 and $5 thereafter. This issue has the same standing as the $6 preferred stock except as to dividend rates and call price.

The plan is subject, of course, to the approval of the Montana Power Company shareholders, who will meet April 24.

**Illinois Utility Increases Stock.**—Stockholders of the Central Illinois Public Service Company approved an increase in the authorized $6 cumulative preferred stock to 350,000 shares (no par value) from 225,000 shares and in the authorized common stock to 350,000 shares (no par value) from 250,000 shares.

**Canadian Stockholders Offered Rights.**—A resolution of the board of directors of the Canada Northern Power Corporation, Ltd., passed March 23 authorized the issuance from the treasury of 15,000 shares of the no-par value common stock to be offered to holders of the same class of stock of record March 31, at $50 per share, on the basis of one new share for each four shares held.

## Central Maine Power Issues Good Report

The Central Maine Power Company in its annual report for 1927 shows gross earnings for the year of $5,784,988, an increase of 9 per cent over the previous year. Net earnings for the same period showed an increase of 25 per cent. Sales of electricity were 36,576,821 kw.-hr. in excess of the previous year. Of this increase 82 per cent resulted from actual growth of the company, with the remaining 18 per cent the result of companies acquired during the year. Merchandise sales for the same period were $80,000 greater than in 1926.

The report shows that visible progress has been made within its territory toward industrial expansion with twelve new industries secured and eleven idle industries rehabilitated. The company has also assisted 28 industries to expand. Approximately 650 farm customers were added last year, so that now about 14.7 per cent of the total farms within the territory are electrified. This is believed to be the high-

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 10 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par, ex.div. | 79½ | 72 | 81 |
| Ala. Pwr., $7 com. pf.—no par | k114½ | 114½ | 115½ |
| Allis Chalmers Mfg.,6% com. | 123 | 115¼ | 127⅝ |
| Aluminum Co. of Amer., com. | 139 | 120 | 139 |
| Aluminum Co. of Amer., 6% pf. | 109 | 105½ | 109¼ |
| Amer. & Foreign Pwr., 7% pf.—no par | 109 | 105¾ | 109 |
| Amer. & Foreign Pwr., com.—no par | 24½ | 22¼ | 27¼ |
| Amer. Bosch Magneto, com.—no par | 27¼ | 15¼ | 28¾ |
| Amer. Brown Boveri Elec.† | 14½ | 10¾ | 18 |
| Amer. Brown Boveri Elec., pf. $7 | 53¾ | 46½ | 63 |
| Amer. Gas & Elec., 6% pf.—no par | k108½ | 105 | 108¾ |
| Amer. Gas & Elec., com. †—no par | 139⅞ | 117½ | 145 |
| Amer. Lt. & Trac., 6% pf. | 113 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 197¼ | 170 | 197½ |
| Amer. Pwr. & Lt., 6% pf. | 107⅞ | 104 | 109⅞ |
| Amer. Pwr. & Lt., com. †—no par | 79½ | 62½ | 83 |
| Amer. Pub. Serv., 7% pf. | 99 | 97½ | 101 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | a 96½ | 87¼ | 96⅞ |
| Amer. Pub. Utilities, 7% pr. pf. | a100 | 95¾ | 101 |
| Amer. Pub. Utilities, com. | k 60 | 60 | 65 |
| Amer. States Sec., A | a 8¼ | 4 | 9 |
| Amer. States Sec., B | a 9¼ | 4½ | 9⅝ |
| Amer. Superpwr., 6% 1st pf. | l 103¼ | .... | .... |
| Amer.Sup pwr., Class A†—no par | 45¼ | 37 | 46¾ |
| Amer.Sup pwr., Class B†—no par | 46⅜ | 37½ | 48 |
| Amer. Wtr. Wks. & Elec., 6% pf | k104¼ | 101½ | 105 |
| Amer. W.W. & E., com. new—no par | 57½ | 52½ | 61 |
| Anaconda Copper cap $3 | 72 | 54¾ | 72⅞ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr., & Lt. 7% pf | 107½ | 108 | 109½ |
| Assoc. Gas & Elec., $3.50 50 | 54½ | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 96 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 48⅞ | 47 | 51½ |
| BABCOCK & WILCOX, 7% com. | 119 | 117½ | 124⅞ |
| Binghamton L., H. & P., $6 pf. | 108 | 102 | 108½ |
| Birmingham Elec., pf.—$7—no par. | 105 | 109½ | 111 |
| Blackstone Valley G. & E., 6% pf. | m106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k160 | 135 | 165 |
| Blaw-Knox, com.† | i102½ | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f232 | .... | .... |
| Brazilian Trac., Lt. & Pwr.,com.,new | f 59 | .... | .... |
| Broad River Pwr., 7% pf. | 106½ | 105 | 108 |
| Brooklyn Edison, 8% com. | 251 | 206⅞ | 253 |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26½ | .... | .. |
| Buffalo, Niagara & East Pwr. com. $1.20—no par | l 37½ | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | 99 | 98 | 101 |
| California Ry. & Pwr., 7% pf. | 135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l111 | 109 | 110½ |
| Central & S. W. Util., $7 pf.—no par | a105 | 99½ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a108 | 103½ | 108 |
| Central Ark. Ry. & Lt., 7% pf. | 104 | 105 | 107 |
| Central Ill. Pub. Serv., $6 pf. | a 99 | 97⅞ | 100½ |
| Central Ind. Pwr., 7% pf. | a 99½ | 95 | 99¾ |
| Central Maine Power, 6% pf. | 96 | 96 | 98 |
| Central Maine Power, 7% | 108 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 107 | 104½ | 105½ |
| Central States Elec., 7% pf. | 113½ | 104¾ | 114 |
| Century Elec., 6% com. | m135 | 135 | 145 |
| Cincinnati Gas & Elec., 5% com. | g100½ | 97½ | 99¼ |
| Cities Service, $6 pf.—no par | l 99⅜ | 94½ | 100 |
| Cities Service, pf. B—no par | l 9¼ | 8⅞ | 9½ |
| Cities Service, pf. BB—no par | m94 | 80½ | 86 |
| Cities Service com.—20 | l 57 | 54 | 59⅞ |
| Cities Service, Bks. Shrs.—10 | l 28⅜ | 28⅜ | 28⅞ |
| Cities Service Pwr. & Lt., 7% pf. | k107 | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf. | 100½ | 95½ | 101⅛ |
| Cleveland Elec. Illg., 6% pf. | 112½ | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 400 | 350 | 410 |
| Columbia Gas & Elec., 6% pf. | k109½ | 107½ | 110½ |
| Columbia G. & E. com. $5—no par | 96½ | 89½ | 97⅞ |
| Columbus Elec. & Pwr., $2 com.—no par | k 77½ | 66 | 79 |
| Columbus Elec. & Pwr., 7% | 112 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 108½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7 %pf. B | 108 | .... | .... |
| Columbus Ry., P.& Lt. com.—no par | 115 | .. | .. |
| Commonwealth Edison, 8% com. | a180 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 104⅜ | 102½ | 104⅜ |
| Commonw'th Pwr., $2, com.—no par | 75¼ | 62¼ | 78¾ |
| Conn. Lt. & Pwr., 8% pf. | 122 | 120 | 125 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 118 | 121 |
| Cons. Gas of N. Y., pf. | 104 | 101½ | 105 |
| Cons. Gas of N. Y., com. $5—no par. | 145¾ | 119⅞ | 149¾ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111½ | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | m111¼ | 110½ | 114¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e104 | 100½ | 105½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com $3.00—no par | e 76¼ | 67¼ | 76¼ |
| Consolidated Pwr. & Lt., 7% pf. | 105 | .... | .... |
| Consumers Pwr., 6% pf. | 104½ | 105½ | 106½ |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108 | 106½ | 108½ |
| Conti G. & E. com. $4.40—no par. | k230 | 240 | 265 |
| Crocker Wheeler, com.† | 38 | 24 | 30 |
| Crocker Wheeler, 7% pf. | 90 | 77 | 90 |
| DALLAS PWR. & LT., 7% pf. | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108½ | 108½ | 109½ |
| Derby Gas & Elec., 7% pf | 103 | 96 | 100½ |
| Detroit Edison, 8% com. | k179⅞ | 166½ | 194⅞ |
| Dubilier Condenser, com.—no par | 3½ | 2⅞ | 3¾ |
| Duke Pwr., cap. | k143 | 130 | 145 |
| Duquesne Lt., 7% pf. | k105½ | 105½ | 116½ |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 111 | 112½ |
| Eastern New York Util. com. | m 65 | ... | ... |
| Eastern States Pwr. $7, com. B | 17⅞ | 11¼ | 17⅞ |
| Eastern States Pwr., pf. | k 98 | 98 | 99 |
| East. Tex. Elec., 7% pf. | 107½ | 106 | 109 |
| Edison Elec.of Boston, $12 com. | d276 | 252 | 280 |
| El Paso Elec. 7% pf. | 113 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l111 | 108⅞ | 111⅞ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 90½ | 76 | 95⅞ |
| Electric Household Util.† | a 23½ | 13½ | 24 |
| Elec. Investors, 6% pf.—no par | 103 | 101 | 103½ |
| Elec. Investors, com.†—no par | 49½ | 40½ | 49⅞ |
| Elec. Pwr. & Lt., ctfs. pf. | 110 | 106½ | 110½ |
| Elec. Pwr. & Lt., ctfs., 40% pd | m125¼ | 120¾ | 125½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 37⅞ | 28¾ | 39⅞ |
| Elec. Ry. Securities, com.—no par | 7 | ... | ... |
| Elec. St. Battery com. $5.25—no par | 82⅞ | 69 | 83½ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 106½ | 104 | 107 |
| Empire Pwr., ptc.† | 33½ | 27½ | 35⅞ |
| Engr. Pub. Serv. $7, pf.—no par | 110¼ | 107 | 110⅞ |
| Engr. Pub. Serv., com.—no par | 39⅛ | 33 | 42⅝ |
| Eureka Vacuum Cleaner, com. $4—no par | 76⅞ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | 109 | 104 | 110 |
| F.-M., com.—$3—no par | 45½ | 32½ | 48½ |
| Federal Lt. & Trac.,com $1.40 | 54¼ | 42 | 56½ |
| Federal Lt. & Trac., $6 pf.—no par | 107¾ | 98 | 107⅞ |
| Florida Pwr. & Lt., 7% pf. | 108¼ | 105 | 108¼ |
| Ft. Worth Pwr. & Lt., 7% pf. | i114½ | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf. | 82 | 75 | 85 |
| Galveston-Houston Elec., com. | 36 | 31 | 38 |
| General Cable, Cl.A | 78 | 56 | 84½ |
| Gen. Elec. $3 com.—no par | 155 | 124 | 161½ |
| Gen. Elec., special—6% | 11⅜ | 11¼ | 11⅜ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par | 41½ | 35½ | 43¼ |
| Gen. G. & E. (Del.) pf. A.$8—no par | 131¼ | 122¼ | 131¼ |
| Gen. G. & E. (Del.) pf. A $7—no par. | 114 | 110 | 114 |
| Gen. G. & E. (Del.) pf. B $7 | 110 | 104 | 111 |
| Gen. Pub. Serv., $7 cum. pf., no par. | 117 | 110 | 120 |
| Gen. Pub. Serv., com., no par | 20⅜ | 16⅛ | 21½ |
| General Public Utilities, $7 pf. | k 58 | 55 | 65 |
| Ga. Lt., Pwr. & Rys., com. | k 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | h104½ | .... | .... |
| IDAHO PWR., 7% pf. | 110¼ | 109 | 110½ |
| Ill. No. Utilities, 6% pf. | a100½ | 98½ | 100½ |
| Ill. Pwr. & Lt., 7% pf. | 104¾ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 105½ | 102 | 107¼ |
| Indianapolis Pwr. & Lt., $7 pf. | 103 | 100 | 105 |
| Ingersoll Rand com | k 91 | 90 | 94 |
| Int. Combus. Engr., com. $2—no par | 51 | 45½ | 55⅞ |
| Int. Combustion Engr.,7% pf. | 103½ | 103 | 105½ |
| Int. Util., Class A—$3.50—no par | 44½ | 44½ | 51¼ |
| Int. Utilities, Class B—no par | 8⅞ | 6⅞ | 10½ |
| Interstate Pwr., pf.—$7—no par | 103 | 99 | 103½ |
| Interstate Pub. Serv., 7% pf. | 104½ | 103 | 106 |
| Iowa Ry. & Lt., 7% pf. | 101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 108 | 105 | 107 |
| Johns-Manville com †—no par | 126¼ | 111½ | 133½ |
| Johns-Manville, 7% pf. | 121 | 119½ | 121½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 7. *l*Bid price Wednesday, April 11. *m*Latest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 10 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY PWR. & LT. pf. $7 | 113½ | 111½ | 113½ |
| Kansas Gas & Elec., 7% pf. | l110½ | 107 | 110 |
| Kelvinator Corp. | 21½ | 11½ | 21½ |
| Kentucky Hydro-Elec., 7% pf. | m104½ | 102 | 104½ |
| Kentucky Sec., 6% pf. | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 103 | 100 | 103 |
| LACLEDE GAS LT., 10% com. | k200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 26⅜ | 19½ | 27⅞ |
| Long Island Ltg., 7% pf | k110½ | 110¼ | 110½ |
| Long Island Ltg., 6% pf. | k108 | 107 | 108½ |
| Long Island Ltg., com.†—no par | k178 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | h111¼ | 105½ | 111½ |
| Louisville Gas & Elec., cl. A. $1.75 | 34⅜ | 28 | 35 |
| MAN ELEC. SUPPLY, cap. $5—no par | 55½ | 50 | 61 |
| Manila Elec., com.†—no par | m 47 | 45¼ | 50 |
| Maytag Mfg., com. 50—no par | 38½ | 30 | 38¾ |
| Memphis P. & L., pf.—$7—no par | 111 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 108½ | 103 | 108½ |
| Metropolitan Ed., pf.—$7—no par | 109 | 109 | 111 |
| Metropolitan Ed., com. $5—no par | k160 | 125 | 155 |
| Middle West Utilities, 7% pf. | a121¾ | 116½ | 124½ |
| Middle West Util., 7% pr. lien | a126 | 125 | 129½ |
| Middle West Util., com. $6—no par | a142½ | 123½ | 142½ |
| Midland Utilities, pr. ln. 6% pf. | a 95½ | 94½ | 97 |
| Midland Utilities, 6% pf. A | a 91 | 89½ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | k104 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 102 | 98 | 101¼ |
| Minn. Pwr. & Lt., 7% pf. | l108¾ | 107 | 109 |
| Miss. River Pwr., 6% pf. | 108 | 94 | 109½ |
| Miss. River Pwr., 3% com. | 110 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k107½ | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | k104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 35½ | 29½ | 36⅞ |
| Montana Pwr., 5% com. | 165½ | 102½ | 169½ |
| Montreal Pwr., 7½% com. | f 97⅜ | .... | .... |
| Mountain States Pwr., 7% pf. | k104 | 97 | 105 |
| Mountain States Pwr., com.† | 17½ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 111 | 98 | 110½ |
| National Carbon, 8% pf. | a139¼ | 138 | 139½ |
| National Elec. Pwr., A† | a 31⅛ | 27½ | 32¾ |
| National Lt., Ht. & Pwr., com. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | k109½ | 108½ | 111 |
| National Pwr. & Lt., com.†—no par. | 26¾ | 21⅞ | 27⅛ |
| National Pub. Serv., 7% pf. | k101 | 99 | 103 |
| National Pub. Serv., 7% ptc., pf | m114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 25⅜ | 22 | 27½ |
| National Pub. Serv., B com.—no par | m 28⅜ | 24½ | 30 |
| Nebraska Pwr., 7% pf | l111¾ | 110 | 111½ |
| Nevada-Calif. Elec., com. | 35 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | 62 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 108 | 98½ | 109½ |
| New Eng. Pub. Serv., pf. $7 | 106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | 105 | 101 | 105½ |
| New York Power & Light 7% pf. | 115 | .... | .... |
| New York Power & Light, 8% pf. | m114 | .... | .... |
| Niagara Falls Pwr., 7% pf.—25 | k28 | 27⅛ | 28⅜ |
| No. Amer., 6% pf.—50 | 53⅞ | 53½ | 55 |
| No. Amer., com.—10 | 65⅛ | 58⅛ | 67 |
| No. Amer. Edison, $6 pf.—no par | 104 | 102½ | 105⅜ |
| No. Caro. Pub. Serv., pf.—$7—no par | m109 | 93 | 105 |
| Northeastern Pwr., com. | 26½ | 19⅜ | 26¾ |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 26⅛ | 18 | 27½ |
| No. Ont. Pwr. & Lt., 6% pf. | k 99 | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 109 | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 136 | 123 | 136⅛ |
| No. Texas Elec., 6% pf. | 54½ | 45 | 70 |
| No. Texas Elec., com. | 17 | .... | .... |
| OHIO BRASS, com. B $4—no par. | k106 | 93 | 107 |
| Ohio Brass, 6% pf. | k107 | 106 | 111 |
| Ohio Pwr., 6% pf. | 108 | 104 | 107½ |
| Ohio Pub. Serv., $6 pf. | 103 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 113 | 107 | 112 |
| Ohio River Edison, 7% pf. | 108½ | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 114¾ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 29⅜ | 25⅛ | 29⅛ |
| Pacific Gas & Elec., 8% new com. | 46⅛ | 43½ | 49⅜ |
| Pacific Pwr. & Lt., 7% pf. | l110½ | 106 | 110 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 80⅛ | 79⅛ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 99 | 93½ | 99 |
| Penn-Ohio Edison, 7% pf | 108 | 106¼ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 110 | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | l110¼ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 74½ | 68 | 74½ |
| Phila. Co., 5% pf.—50 | k 46 | 45½ | 48⅛ |
| Phila. Co., 6% pf.—50 | 55½ | 52 | 57 |
| Phila. Co., com.—50 | k145 | 145 | 163 |
| Phila. Elec., 8% com.—25 | c 64 | 55½ | 64 |
| Portland Elec. Pwr., 7% pf. | 102½ | 100 | 104¼ |
| Portland Elec. Pwr., 6% pf. | 94 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 80 | 55 | 88 |
| Portland Elec. Pwr., com. | 51 | 42¼ | 52 |
| Potomac Elec. Power, 6% pf. | j113 | .... | .... |
| Pwr. Sec., pf.—no par | k 65 | 50 | 68 |
| Pwr. Sec., com.—no par. | 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf. | 105 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 109¼ | 103⅛ | 109½ |
| Pub. Serv. of N. J., 7% pf. | k122 | 118 | 121⅝ |
| Pub. Serv. of N. J., $2 com.—no par | 49½ | 41½ | 49⅝ |
| Pub. Serv. of No. Ill., 6% pf. | a112½ | 110 | 115 |
| P. S. of No. Ill., com. $8—no par | a173 | 159¼ | 180 |
| Pub. Serv. of No. Ill., $8 com. | a172½ | 159⅜ | 180 |
| Pub. Serv. of Okla., 7% pr. ln. | 106½ | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109¼ | 108 | 110⅛ |
| Puget Sound Pwr. & Lt., 7% pf. | 109⅜ | 109 | 113 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 101 | 92 | 102 |
| Puget Sound Pwr. & Lt., com. | 62⅜ | 34⅝ | 63½ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 56⅜ | 54½ | 57⅞ |
| Radio Corp. of Amer., com.—no par. | 183½ | 85¼ | 196½ |
| Rhode Island Public Service, pf. $2—no par | m 31¾ | 30⅜ | 31¾ |
| Rochester Gas & Elec. 6% pf. D | k105 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105½ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 116 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | k 8 | 4¼ | 8 |
| Sierra Pacific Elec., 2% com. | k 35 | 29 | 38⅛ |
| Sioux City Gas & Elec., 7% pf. | 107¼ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 109½ | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 88½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | k 48⅛ | 41¾ | 48½ |
| So. Calif. Edison, 8% pf. | l 47 | 38½ | 41 |
| So. Calif. Edison, 7% pf. | 29 | 27⅛ | 29½ |
| So. Calif. Edison, 6% pf. | 26 | 25⅛ | 28 |
| So. Calif. Edison, 8% com. | 45⅛ | 43½ | 48⅛ |
| Southern Cities Utilities, 7% pf. | 85 | 75 | 87 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 93 | 88 | 92½ |
| Southwestern Pwr. & Lt., 7% pf. | k112 | 103 | 113 |
| Standard Gas & Elec., 8% pf. | 70 | 65 | 70½ |
| Standard Gas & Elec., 7% pr. pf. | 114½ | 110½ | 115 |
| Standard G. & E., com. $3.50 | 65½ | 57⅛ | 66⅛ |
| Standard Power & Light, com. | 42 | 29¾ | 45 |
| Standard Pwr. & Lt., 7% pf | 107 | 103⅛ | 107 |
| Staten Island Edison, pf.—$6—no par | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | k162 | 162 | 175 |
| Syracuse Lighting, 7% pf. | 109 | 103 | 111 |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 69¼ | 62 | 69¼ |
| Tenn. Elec. Pwr., 6% pf | 103½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 108⅛ | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 10 | .... | .... |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | l114½ | 113¼ | 115 |
| Tide Water Pwr., 8% pf. | 112 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 132½ | 112⅜ | 134 |
| Toledo Edison, 7% pf. | 109½ | 108 | 111 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | k145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 89 | 93 | 102 |
| UNITED GAS & ELEC., 7% pf. | 95 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c129½ | 111½ | 129½ |
| United Lt. & Pwr., pf.—$4—no par | a 57 | 49 | 56½ |
| United Lt. & Pwr., pf.—$6.50—no par | a102 | 95 | 101 |
| United L. & P., com. A .48—no par. | a 22¾ | 14 | 22¾ |
| United L. & P., com. B .48—no par. | a 29½ | 19 | 30 |
| Utah Pwr. & Lt., 7% pf. | l111½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105½ | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101 | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 31½ | 28½ | 34½ |
| Utilities Pwr. & Lt., com. B $1—no par | 24½ | 18½ | 26⅛ |
| VERMONT HYDRO-ELEC., 7% pf | 100 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | k110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102 | 97 | 103 |
| WAGNER ELEC., 7% pf. | b100 | 96½ | 102 |
| Wagner Elec., com.—no par | b 60 | 37 | 60 |
| Washington Ry. & Elec., 5% com. | j485 | .... | .... |
| Washington Ry. & Elec., 7% pf. | j102¼ | .... | .... |
| Washington Wtr. Pwr., 8% com. | 227 | 175 | 235 |
| West Penn Elec., 7% pf. | 114½ | 109½ | 114⅞ |
| West Penn Elec., Cl. A $7 | 111½ | 106½ | 112 |
| West Penn Pwr., 7% pf. | 115 | 114⅜ | 117 |
| West Penn Pwr., 6% pf. | k108½ | 109¼ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf. | 104 | 103 | 104⅛ |
| Western States Gas & Elec., 7% pf. | k102 | 100 | 106 |
| Western States Gas & Elec., com. | m38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 105½ | 88⅛ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | k33½ | 30½ | 34½ |
| Weston Elec. Instrument, com.—no par | 15½ | 12½ | 17¼ |
| Wheeling Elec., 6% pf. | 106 | 95 | 104 |
| Worthington Pump, 7% pf. A | 51⅜ | 46½ | 55 |
| Worthington Pump, 6% B | 44⅞ | 41 | 49½ |
| Worthington Pump, com. | 29¼ | 28 | 34½ |
| YALE & TOWNE com. $5—25. | 71 | 68½ | 75 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 7. *l*Bid price Wednesday, April 11. *m*Latest quotations available. †Dividend rate variable.

est percentage of farms served by any large company east of the Mississippi River.

North American Company to Decrease Number of Directors.—Stockholders of the North American Company will vote April 25 on approving the recommendation of the board that the number of directors be decreased from fifteen to twelve.

Russian Statistics.—Recent Russian economic statistics are contained in an 80-page handbook issued by the Amtorg Trading Corporation. It contains data on the electrical and other industries, agriculture, foreign and domestic trade, transportation, communication, finance, labor, natural resources and patents.

Brown, Boveri to Increase Dividend and Capital.—The directors of Brown, Boveri & Company, Mannheim, Germany, have decided upon a dividend of 9 per cent for 1927, against 8 per cent in the previous year, the net profit being 1,470,000 marks, in comparison with 1,030,000 marks in the previous year. The capital is to be increased from 15,000,000 to 25,000,000 marks. The new shares are to be offered to shareholders in the proportion of three to two. The company is said to have begun the current year with a good order book.

Survey of Kentucky Industries Attracts Attention.—An industrial survey of Kentucky has been completed by the Associated Industries of Kentucky. This survey includes a careful study for each of the 120 counties in the state, in respect to geological formation, soil, water supply, industries, transportation facilities, highways, educational opportunities and other factors which might attract industries or investment of capital. According to the Secretary of the Associated Industries of Kentucky this survey not only has served the purpose for which it was intended but has also attracted inquiries from organizations in several other states interested in similar undertakings. A limited number of copies of the survey are said to be available for general distribution from the office of the association in the Kenyon Building, Louisville, Ky.

Massachusetts Utility Votes Extra Dividend.—The Holyoke (Mass.) Water Power Company voted an extra dividend of 3 per cent on the capital stock.

# Rate of Production Up 4.4 per Cent During First Quarter

THE rate of general production during the first quarter of 1928 was on an average about 4.4 per cent over that reported for the same period during 1927, as indicated by the consumption of electrical energy by some 3,000 large manufacturing plants scattered throughout the nation. As has been the case during the last five years, the peak of operations in American manufacturing plants as a whole this year was reached in February, the March rate of production, after correction is made for the number of working days, being about 7.4 per cent under February. The March activity, however, was still about 1.2 per cent over March of last year. It would appear, therefore, that American industry as a whole is following very closely the trend of last year, but on a slightly higher plane. All of the industrial groups reported a seasonal drop in rate of operations under those of February. Nine of the industrial groups reported March operations over those of March last year, and only two—textiles and rolling mills and steel plants—reported a rate of operations under that reported for March of last year.

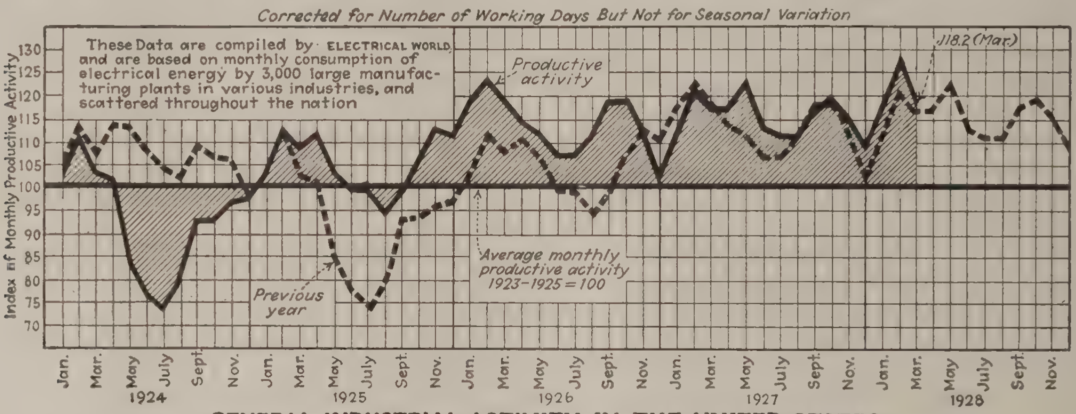
The index of activity in the manufacturing plants of the nation based on consumption of electrical energy stands at 118.2 for March, as against 127.7 for February, after adjustments are made for the number of working days in the two months. Comparative indexes of productive activity, referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days, is as follows:

| | |
|---|---|
| March, 1928 | 118.2 |
| February, 1928 | 127.7 |
| March, 1927 | 116.8 |
| Average first quarter 1928 | 121.4 |
| Average first quarter 1927 | 116.3 |

The rate of operations in the rolling mills and steel plants was quite significant, standing at 6.8 per cent under February, bringing the rate of operations to a point about 1 per cent under March last year. A decreased rate of operations was normal during March, but the drop this year was more than was to be expected, based upon the reports for past years. Last year the decline from February to March was about 1 per cent. The ferrous and nonferrous metal working plants also recorded a material drop under February, but the current March activity was still above that of March, 1927.

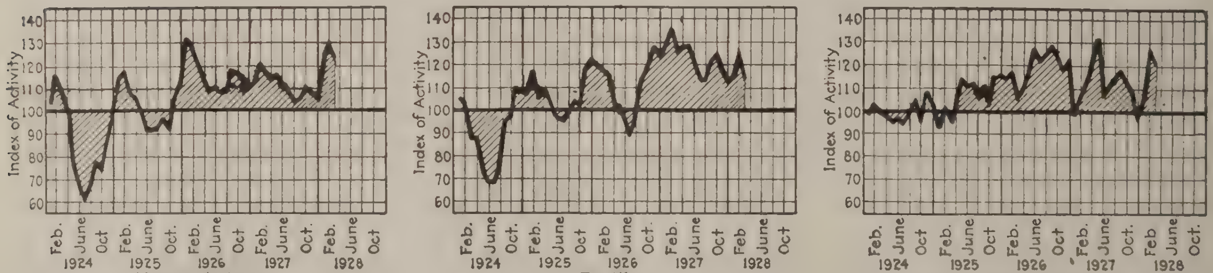
A material decrease in the rate of production in the automobile manufacturing industry, including the manufacture of equipment and replacement parts, seems to have been recorded during March. The March activity was 8.4 per cent under February, but was still about 15.2 per cent above March last year.

March rate of operations in the textile industry was some 8.2 per cent under March last year and about on the same level as for March, 1926. Operations in the textile industry of the nation have been under those of the same month of the previous year ever since last October.


Corrected for Number of Working Days But Not for Seasonal Variation

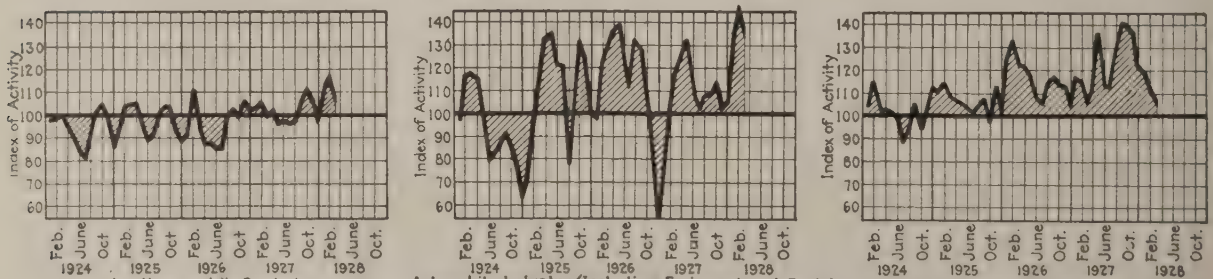
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,000 large manufacturing plants in various industries, and scattered throughout the nation

GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES


Metal Industries

Textiles

Stone, Clay, and Glass


Leather and its Products

Automobile Industry (Including Equipment and Parts)

Lumber and its Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

# Business News and Market Conditions

## Sell Additional Wiring

*N.E.L.A. Issues Serial Report to Aid Central Station Company in Conducting a Campaign for Adequate Wiring*

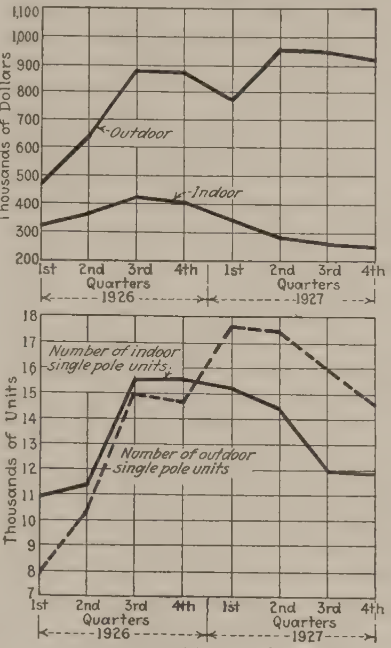
THE wiring committee of the Commercial National Section of the National Electric Light Association has issued a serial report dated March, 1928, entitled "Sell Additional Wiring." The wiring committee believes that it is essential that immediate steps be taken in every community to promote the sale of additional wiring for, as was expressed in a recent editorial, "the inadequacy of present house-wiring installations interposes a baffling barrier to the sale of electrical equipment." The committee further states that some successful sales campaigns have already been conducted and this report is presented as a summation of past experience and an urge and guide for immediate action in every community in the land.

In planning the sale of additional wiring the committee in its report offers the following eight factors with a complete discussion of each one: (1) Knowledge of the market. (2) Co-operation with local electrical interests. (3) Determination of a definite sales policy. (4) Development of an adequate publicity program. (5) Organization and training of sales force. (6) Directing of activity to reach all prospects. (7) Analysis of results as a guide for further activities. (8) Report to wiring committee. N. C. Huse, the Philadelphia Electric Company, Philadelphia, is chairman.

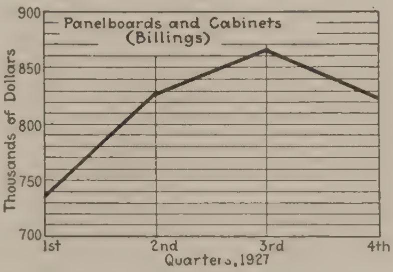
In its conclusion the report cites the past restrictive influences, gives the reasons for the present hopefulness and in referring to the need for action states that there is but one sure way to get a job done and that is to do it. "No matter what national plans may be made for co-operative industry action," states the report, "the central-station company can in no way evade direct responsibility for initiative in reaching the tremendous market which is now unattainable due to the inadequacy of the wiring connections on the customers' property at the ends of our distribution systems." The wiring committee states that it is anxious to furnish all assistance possible to central-station companies contemplating definite action and will welcome direct inquiries for more detailed information in expanding items contained in the report or for suggested plans to meet specific local conditions.

## Orders and Billings for Electrical Goods

Some of the data on orders and billings collected by the National Electrical Manufacturers' Association are shown in the form of graphs in the accompanying illustrations. Complete data for 1927 are given in every case. Statistics on the electrical manufacturing industry to help in guiding its course are still meager, although the past year has shown some improvement. A marketing plan is dependent on a proper conception of the program of the industry. Facts and conditions must be known in order to base a correct premise. The data now being gathered are a great help toward obtaining the necessary facts regarding the industry. Additional graphs covering other products will appear in succeeding issues.



*Power switching equipment*
(Not included in switchboards)



## N.E.M.A. Organizes Electric Furnace Section

Manufacturers of resistance type electric furnaces have been organized in the electric furnace section of the National Electrical Manufacturers' Association. That section begins its existence with a membership comprising about 90 per cent of the total output of the product. William Little, Hoskins Manufacturing Company, is chairman and R. F. Benzinger, Electric Furnace Company, is secretary of the section. The companies in the section and their representatives are Electric Furnace Company, Salem, Ohio, R. F. Benzinger and F. T. Cope; Hevi-Duty Electric Company, Milwaukee, E. L. Smalley; Geo. J. Hagan Company, Pittsburgh, R. E. Talley; Holcroft & Company, Detroit, C. Holcroft; Hoskins Manufacturing Company, Detroit, W. Little, and Westinghouse Electric & Manufacturing Company, Mansfield, Ohio, T. C. Kelley.

One of the first acts of the new section was to decide on the collection of statistics giving orders entered for electric furnaces in units, kilowatts and dollars and divided into two groups of 100 kw. and below and over 100 kw. The members of the section are very optimistic for the future of the electric furnace business, some believing that in the course of time the electric furnace load will exceed the motor load on central-station lines. The section is also looking to the other electrical apparatus manufacturers to help promote the more general use of electric heat in industry. It is claimed that every 100 kw. of electric furnaces requires the utilities to expend $15,000 for generating and transmission equipment, exclusive of land and buildings.

*Flexible Cord*

Data Supplied by National Electrical Manufacturers' Association

| | Single Conductor | | Parallel Cords | | Twisted Pairs | | Reinforced | | All Non-Code Footag | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Shipments Made in Feet | Stock on Hand in Feet | Shipments Made in Feet | Stock on Hand in Feet | Shipments Made in Feet | Stock on Hand in Feet | Shipments Made in Feet | Stock on Hand in Feet | Shipments Made in Feet | Stock on Hand in Feet |
| July | 14,693,613 | 20,303,223 | 3,814,254 | 8,691,520 | 6,398,916 | 17,429,277 | 2,522,237 | 8,552,130 | 9,231,088 | 5,040,755 |
| August | 8,916,703 | 18,606,023 | 5,450,190 | 7,646,047 | 8,006,896 | 18,369,883 | 3,741,437 | 8,446,555 | 9,890,039 | 5,487,371 |
| September | 9,837,760 | 15,682,986 | 8,484,817 | 8,457,327 | 10,421,209 | 14,743,285 | 4,346,205 | 6,701,476 | 13,542,270 | 5,506,136 |
| October | 11,863,849 | 13,747,671 | 9,782,695 | 6,970,911 | 10,970,193 | 13,532,773 | 4,270,565 | 7,472,502 | 15,606,308 | 5,842,044 |
| November | 9,717,120 | 14,333,954 | 9,517,137 | 9,157,525 | 10,743,520 | 10,124,915 | 5,502,504 | 5,828,605 | 20,122,449 | 6,887,351 |
| December | 6,677,832 | 13,039,925 | 7,553,824 | 7,450,619 | 8,154,705 | 12,942,459 | 4,781,615 | 5,694,377 | 10,596,003 | 7,094,352 |

# Market Conditions

IN NEW ENGLAND motor sales continue to be active and reached a volume of over $60,000 last week. Textile and leather plants were active buyers. Anticipation of the opening up of early line extensions in the northern districts is awakening interest in buying. An upward trend in market activity is reported in the Eastern district with central-station companies and industrial plants sharing about equally in the demand. An order for $330,000 worth of substation apparatus was placed by a New York company and an order for similar equipment was reported in New Jersey. A paper mill at Erie, Pa., bought $40,000 worth of motors and control apparatus.

Two 60,000-kw. turbo-generator units amounting to approximately $1,500,000 were purchased by a Carolina power company. Another order for about $110,000 worth of motors, oil circuit breakers and switching equipment was received from a central-station company in Alabama. Industrial plants in the Southeast are less active but inquiries are numerous. A slight improvement is seen in conditions in the St. Louis district. The volume of business in the Middle West has increased and utility companies are busy with construction work. A large company's purchases are averaging $95,000 per day. On the Pacific Coast power company buying was active and included diversified equipment and supplies. Pole orders were good, and motor sales were reported excellent.

## *Market Trends Upward in Eastern District*

Each week is developing improved market activity in the Eastern district with central-station companies and industrial plants sharing about equally in the demand. According to a large manufacturer the first quarter of the year shows an increase of 4 per cent in central-station orders over the corresponding period of last year, while industrial business has run close to 6 per cent below that of 1927 in the same quarter. This statement is quite typical of general findings in the trade and with increased inquiries now ensuing from industrial plants, it is expected that the slight deficiency in the quota soon will be made up. The outlook continues good and there is every indication of sizable commitments for the next few months.

Central stations are in the market for substation equipment and are also making purchases of wire and cable and line apparatus. A New York utility has placed an order for transformers, oil circuit breakers, switching equipment and auxiliary apparatus for four substations, totaling about $330,000. A New Jersey central-station company has been making contracts for similar apparatus for new substations and is expected to place further orders at an early date. A leading manufacturer of wire and cables reports marked improvement in the demand from power companies, with utilities in the New York zone leading in volume of orders. A metropolitan central-station company has placed an order for paper-covered cable totaling $300,000. Industrial interests also are purchasing sizable requirements of wire and cables, with inquiries indicating a continuance of the demand from that quarter.

A paper mill at Erie, Pa., has contracted for equipment for a paper machine installation costing about $40,000. Other business of this character is now maturing and early orders are anticipated. The demand from iron and steel mills, metal-working plants, automobile plants, leather factories and textile mills is holding up well and sizable transactions, particularly in connection with motors and accessory equipment, are being made. Municipal and other public work show improvement, both with regard to volume of bids asked and actual contracts.

The Philadelphia market is more active. Central stations are making purchases of equipment for substation installations and transmission lines, the Eastern Pennsylvania power companies being particularly busy in the latter connection. Industrial account begins to show improvement. There is a healthy tone to the present demand for motors, control devices, switchboard panels and instruments, and commitments are now being made with less hesitancy. Metal-working plants and textile mills are leading buyers.

Current construction operations in the Eastern district include the following: New York has appropriated $500,000 for the construction of a municipal airport on Barren Island, also a fund of $300,000 for a new fire alarm system. The Todd Shipyards Corporation will increase its plant in Brooklyn, to cost $2,000,000. The Bayonne Steel Ceiling Company plans a plant at Long Island City, to cost $100,000. The Stauffer Chemical Company, New York, plans a plant near Roanoke, Va., to cost $250,000. Tottenville, S. I., and Millville, N. J., plan ornamental lighting systems. Benjamin Moore & Company, Newark, N. J., plans an addition to its paint factory, to cost $175,000. The Reading Coal & Iron Company, Philadelphia, Pa., plans electrification of its coal mines at Hazleton, Wilkes-Barre and vicinity. The Metropolitan Edison Company has secured permission to take over eleven light and power companies in Chester, Adams, Dauphin, Berks, Lehigh and Lebanon Counties for a price of $2,401,000, and will extend transmission lines. The Suburban Light & Power Company, Cambridge, Md., recently formed, has secured permission to build transmission lines in St. Mary's, Charles and Prince George's Counties, to cost $100,000; service will be obtained from the Potomac Electric Power Company, which will extend its system. The Bureau of Standards, Washington, D. C., will receive bids until April 27, for equipment for power plant. The Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids (no closing date stated) for a refrigerating plant for Mare Island Navy Yard (Specification 5583.)

## *Metal Markets Quieter—Prices Slightly Lower*

Sales of lead and zinc were in fair volume in the non-ferrous metal market. No important price changes were registered during the week with the exception of tin, which dropped almost 2 cents per pound. Copper has entered another period of quiet such as characterized the early weeks of the year, with the same conditions predominating; that is, the primary producers are firm at one price, with only an occasional sale, while concessions are offered by others who make it a practice to sell an appreciable tonnage every week.

NEW YORK METAL MARKET PRICES

| | Apr. 4, 1928 Cents per Pound | Apr. 11, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14.0 | 13 9625 |
| Lead, Am. S. & R. price | 6.10 | 6.10 |
| Antimony............ | 9¾ | 9.625 |
| Nickel, ingot.......... | 35 | 35 |
| Zinc spots............ | 6.075 | 6 075 |
| Tin, Straits.......... | 53¾ | 51.875 |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price April 11, 1928, 16 cents.

## *Large Turbine Units Purchased in Southeast*

The outstanding order placed in the Southeast was for two 60,000-kw. turbo-generators. They were purchased by a Carolina power company at a cost of about $1,500,000. Another outstanding order was for motors, oil circuit breakers and switching equipment amounting to about $110,000 placed by a central-station company in Alabama. A company in Georgia ordered weatherproof copper wire amounting to $22,000 and aluminum cable totaling $5,200, and this same company's creosoted pine pole purchases in the past ten days have totaled $2,900.

Little activity was noted in industrial lines, though inquiries are increasing in number and the amount of industrial expansion projects pending or in the hands of engineers reflects the optimistic tone of business. Municipalities continue to purchase in reasonably satisfactory volume. One Georgia town ordered pole line materials amounting to $2,500 and another ordered one carload of creosoted pile poles.

Construction projects are as follows: The Columbus Electric & Power Company, West Point, Ga., plans a 40,000-hp. hydro-electric power project on the Chattahoochee River, Troup County, to cost $700,000. The Stowe Thread Company, Belmont, N. C., plans a new mill to cost $120,000. The Duke Power Company has approved plans for a steam-operated electric power plant near Mount Holly, N. C., to cost $5,000,000. The Jepson Art Weaving Company, Wadesboro, N. C., plans a textile mill, to cost $150,000.

The Victor Chemical Works, Chicago, plans a plant at West Nashville, Tenn., to cost $1,000,000. Lexington, Va., contemplates a municipal power plant. The Blue Ridge Power Company, Manassas, Va., plans a power plant to cost $80,000. The Mississippi Power Company, Gulfport, Miss., is planning extensions in transmission lines at Burnsville, Plantersville and vicinity. The Southeastern Power & Light Company plans extensions in transmission lines of the recently acquired Edisto Public Service Company, Columbia, S. C.

## *Motor Sales Continue Active in New England District*

General purpose motor sales showed encouraging activity in the New England district. The volume amounted to over $60,000 last week. Buying in lots was noted with textile and leather industries leading. Among the orders reported were several units up to 75 hp. Reorganization and change of factory sites reflect this strong demand.

A slight quickening in the demand for central-station supplies was reported. A prominent light and power company placed an order for cable and wire, to be used for service expansion, amounting to about $50,000. Watt-hour meter and voltage regulator business is active, and several interesting orders for insulators covering a wide area were noted. Anticipation of the opening up of early line extensions in the northern districts is awakening interest in buying.

Construction projects are as follows: Authorization for a new federal post-office for Boston to cost about $4,500,000 is announced. The New England Telephone & Telegraph Company plans to expend $1,250,000 for service expansion. The Holyoke Water Power Company, Holyoke, Mass., has secured permission for a 45,000-hp. hydro-electric plant on the Connecticut River to cost $850,000. The Narragansett Electric Company, Providence, R. I., plans a substation, to cost $35,000. The Connecticut Light & Power Company will add to the street-lighting system at Southington.

## *Slight Improvement Seen in St. Louis Conditions*

Conditions in the St. Louis district seem to be slightly improved. Small motors and transformers moved in good volume. A contract for switching equipment for four towns in the southwestern part of the district was closed at a cost of $15,000. Automatic substation equipment to replace hand-operated apparatus in the suburbs of St. Louis was purchased at a cost of $35,000. Poles, cables and fixtures for a "white way" for a small city in southeast Missouri amounted to $18,000. The installation cost of this apparatus is estimated at $9,000. Refrigerator manufacturers report the demand greater than the supply.

Construction projects are as follows: The White River Power Company, Little Rock, Ark., will build a hydro-electric power plant on the White River, near Cotter, Ark., to cost $1,200,000. The Meeker Advertising Company, Joplin, Mo., plans a two-story factory for novelty manufacture, to cost $100,000. The Chevrolet Motor Company, Detroit, Mich., contemplates an assembling plant at Kansas City, Mo., to cost $500,000. The Quaker Oats Company, Chicago, Ill., plans a plant at St. Joseph, Mo., to cost $2,000,000. The Independent Plumbing & Heating Supply Company, 1119 Chestnut Street, St. Louis, Mo., plans a new plant to cost $125,000. The American Car & Foundry Company plans an addition to its plant at St. Louis, to cost $200,000. The Texas Electric Service Company, Odessa, Tex., plans improvements in its power plant, to cost $75,000.

The Bell Oil & Gas Company, Sweetwater, Tex., plans an oil refining plant, to cost $175,000. The Texas Utilities Company plans extensions in transmission lines at Olton, Tex., and will install a light and power system. The Texas Utilities Company, Plainview, Tex., plans a steam-operated plant in the Panhandle district, to cost $500,000. The Springfield Gas & Electric Company, Springfield, Mo., will install an ornamental lighting system to cost $125,000. Muskogee, Okla., has contracted with the Electric Service Company, for the installation of an ornamental lighting system.

## *Power Company Buying Active on Pacific Coast*

Power company buying on the Pacific Coast has been excellent, including such orders as $95,000 worth of lead cable for the city of Los Angeles, a 200-hp. synchronous motor valued at $3,000, three heavy-duty circuit breakers valued at $5,000, and six voltage regulators valued at $10,000, for the Bay district, and $2,000 worth of rubber covered wire and $4,000 worth of assorted hardware for the Fresno district. Pole orders are good, including $1,500 worth of treated poles for Lompoc, one carload 9-in., 50-ft. treated poles and $2,000 worth of 12-in. stubs for Fresno and two carloads of 5-in., 25-ft. poles for Gilroy.

Street lighting business includes 71 standards and equipment valued at $9,000, for a San Mateo suburb, 62 standards, valued at $2,000, for Sacramento and a $3,000 equipment for a Belmont tract. An interesting inquiry covers the proposed equipment of a Yosemite resort with 3-kw. and 5-kw. 40-gallon tank water heaters and 3-kw. and 5-kw. air heaters. Industrial business includes a 175-hp. synchronous motor, valued at $3,000, for an ice company and a 300-hp. motor, switchboard and accessories, valued at $5,000, for a Hawaiian sugar plantation.

An award was made by the Port of Olympia for $16,000 worth of compressors and refrigeration equipment for a cold storage plant and several awards of equal importance are pending in the Wenatchee and Okanogan districts. The Pacific Power & Light Company at Lewiston, Idaho, plans the immediate expenditure of $90,000 in reconstructing and improving power lines in the Lewiston and Clarkston districts, and the water board of Eugene, Ore., is expected to issue specifications at once for equipment for a power plant to cost about $1,250,000.

Construction projects are as follows: The Douglas Company, Santa Monica, Calif., will build a two-story aircraft manufacturing plant, to cost $100,000. The Southern Colorado Power Company, Pueblo, Colo., plans improvements in power plants and transmission lines to cost $275,000. The Pioneer Sand & Gravel Company, Miles City, Mont., will build an electric-operated sand and gravel-washing plant, to cost $90,000. The Holly Sugar Company plans improvements in its mill at Torrington, Wyo., to cost $200,000. Santa Paula, South Gate, Santa Barbara, and Corona, Calif., plan installation of ornamental lighting systems.

## *Volume of Sales Increases in Middle West*

The volume of business increased somewhat in the Middle West and indications seem to point to a general improvement. Industrial activity is noted and employment has increased considerably. Reports of increased construction and railroad activity are encouraging and these, together with increased sales in the agricultural districts, seem to indicate a recovery from the slight depression noticed recently. The various utility companies are busy with spring construction work and a large amount of rehabilitation and maintenance work is going on, one large utility company's purchases averaging $95,000 a day. Among the interesting orders placed was one for cable valued at $92,000 and several construction orders totaling $100,000. There has been a good demand for transformers, poles, pole line hardware and general distribution equipment. Jobbers' sales have improved somewhat.

Construction projects are as follows: The Bassick Manufacturing Company, Chicago, will build a plant addition to cost $300,000. The Commonwealth Edison Company, Chicago, has filed plans for a substation on North Harding Avenue, to cost $80,000. The Martin-Parry Corporation, Indianapolis, Ind., is considering an addition to its automobile body plant, reported to cost $80,000. The Brown Shoe Company, St. Louis, Mo., plans a three-story factory at Mattoon, Ill., to cost $200,000. The Chevrolet Motor Company, Bay City, Mich., plans a one-story unit to cost $450,000. M. A. Erickson, Rugby Light & Power Company, Rugby, N. D., will make extensions in the power plant at Westhope, N. D. Akron, Ohio, plans installation of an airport lighting system at the municipal landing field. The Union Gas & Electric Company, Cincinnati, Ohio, will build a substation at Harris and Marion Avenues, to cost $35,000.

The Richman Brothers Company, Cleveland, plans an addition to its clothing factory to cost $700,000. The Miami Valley Co-operative Milk & Producers' Association, Dayton, Ohio, plans a new plant to cost about $100,000. The Miami Development Company, Dayton, Ohio, plans construction of a refrigerating plant to cost $150,000. Heller Brothers Company, Newark, N. J., plans a new plant at Newcomberstown, Ohio, to cost about $100,000. Randolph, Wis., will make extensions in municipal power plant to cost $58,000, including equipment. J. P. Larson, Lakota, N. D., is perfecting plans for a power plant at Clyde, N. D., for commercial service. Montpelier, N. D., will build a transmission line to connect with the system of the Otter Tail Power Company. The United States Power Company, Sioux Falls, S. D., is concluding negotiations for purchase of municipal property at Canistota, S. D. Elgin, Ill., and Seneca, Wis., plan ornamental street-lighting systems. Cedar Rapids, Iowa, is asking bids until April 23, and Shorewood (Milwaukee P. O.) Wis., will receive bids May 7, for ornamental lighting systems.

# Activities of the Trade

## Midland Lamp Division to Display Office Lighting

On May 1 the Midland Lamp Division of the National Lamp Works of the General Electric Company, A. H. Meyer general manager, will move from its present location at 625 South Wabash Avenue, Chicago, to larger quarters in the newly completed Adams-Franklin Building, 22 West Adams Street, Chicago. Friends and customers of the Midland Lamp Division have been invited to a formal opening reception, at which the model illumination prepared for the new offices will be turned on for the first time.

This illumination of the Midland offices and demonstration room will be an example of modern lighting. Different rooms in the suite of offices will be lighted with different designs of fixtures in order to portray a variety of ideas, and each room will present the finest modern practice for office illumination.

## American Metallurgical Reports Active Sales

Sales for the first quarter of 1928, as reported by the American Metallurgical Corporation, Boston, show an increasing trend toward the use of electric furnaces. Among recent deliveries are pot type furnaces to Pratt & Whitney Company, Hartford, Conn.; Ames Shovel & Tool Company, North Easton, Mass.; Union Hardware Company, Torrington, Conn.; Greenfield Tap & Die Company, Greenfield, Mass., and others. A number of box type furnaces ranging from 15-kw. to 70-kw. capacities were placed. In addition, the demand for special types is of interest with high-speed heating, special enameling and continuous types deserving attention. Repeat orders make up a good proportion of total sales.

## Consolidation of Sta-Warm and Price Pyrometer Effected

A consolidation of the Sta-Warm Company of Ravenna, Ohio, and the Price Pyrometer Company of Cleveland recently has been effected by H. C. Beckwith and will be known as the Beckwith Machine Company. Mr. Beckwith for ten years was active head of the Byers Machine Company of Ravenna. He resigned as general manager of the Byers company a little over a year ago, but recently was elected president and will continue in active association with Byers as well as with his other companies. Associated with Mr. Beckwith are J. Edwin Jensen, who will fulfill the duties of general manager, and H. E. Black, manager of the Cleveland branch office. Mr. Jensen was formerly general manager of the Sta-Warm Company, while Mr. Black was associated with the Price Electric Company.

The Beckwith Machine Company will continue the manufacture of Sta-Warm electric heating pots for glue, babbitt, wax, paraffin and similar products under the trade-name Sta-Warm. All of the manufacturing equipment of the Price Electric Company has been transferred to the Ravenna plant, where the production of resistance and thermo-electric pyrometers will be continued and marketed under the Price name.

THE STEINMETZ HEATING COMPANY, INC., 30 Church Street, New York City, announces that it is now marketing the "Wilnik" hot water bag heater and plain immersion heater. These units are automatic and will not operate unless immersed in water.

THE COPELAND SALES COMPANY, 630 Lycaste Avenue, Detroit, has started a series of sales schools to keep the field force in touch with the latest developments in its line of electric refrigerators. The first school was started by Vice-President W. D. McElhinny, with a meeting of the Michigan distributors, dealers and salesmen at the Strelinger-Copeland salesrooms, Detroit, on March 20. V. E. Vining, of the sales department, is assisting Mr. McElhinny in this work, which will completely cover the United States.

THE TRUMBULL-VANDERPOEL ELECTRIC MANUFACTURING COMPANY, Bantam, Conn., manufacturer of safety and knife switches, panelboards, etc., announces the opening of a new branch office at 10 High Street, Room 309, Rice Building, Boston, with Frank W. Garner as district sales manager.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, 120 South Sangamon Street, Chicago, announces the appointment of G. B. Weber as manager of refrigerator sales. Mr. Weber, for several years assistant to the vice-president, has been in charge of sales of the commercial stamping and enameling division. R. W. Staud, advertising manager of the company, will direct advertising and sales promotion of the refrigerator division.

THE LINCOLN ELECTRIC COMPANY, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces the appointment of Jacob F. Savela as welding service manager for the Detroit district under the direction of J. M. Robinson, district sales manager.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY, 514 Charlotte Street, Utica, N. Y., announces the removal to its new quarters in the recently finished building of the Westinghouse Electric & Manufacturing Company at 113 North Genesee Street. James Sidway, formerly manager of the company and of the Robertson-Cataract Electric Company in Utica, has been appointed vice-president and general manager of the Earner Electric Company at Cleveland, which, like the Utica firm, is another Westinghouse agent jobber. The shops of the Westinghouse company, now located at 19 Pine Street, will be removed to the new building about May 1.

THE HURLEY MACHINE COMPANY, 22d Street and 54th Avenue, Chicago, manufacturer of "Thor" washing machines, ironers, etc., announces the organization of the Thor Canadian Company, Ltd., for the manufacture and distribution of "Thor" products in Canada. The new plant is located in Toronto, Ont. F. H. Chapman is president, and J. F. Terry has been appointed vice-president in charge of sales.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Shell Pipe Line Corporation, Shell Building, St. Louis, for electrical equipment for fourteen pumping stations in connection with a 700-mile pipe line running from McCamey, Texas, to Cushing, Okla. Each pumping station will have three 400-hp. motors and pumps and a four-panel switchboard.

THE STOW MANUFACTURING COMPANY, INC., Binghamton, N. Y., manufacturer of Stow flexible shafts and portable tools, announces that it is now offering the Stow direct connected suspended unit for industrial purposes.

DECELECO, INC., Wayne, Mich., manufacturer of precast slabs for switch cell construction in power plants and substations, has appointed the Van Rosen Company, Statler Building, Boston, as New England agent.

THE GENERAL ELECTRIC COMPANY has secured a contract for furnishing approximately $40,000 worth of motors to be installed in the "Kraft" paper mill now under construction in Tacoma, Wash., for the Union Bag & Paper Company. The motors, 250 in number, will range from 300 hp. to 2 hp.

THE W. N. MATTHEWS CORPORATION, St. Louis, manufacturer of electrical specialties and mechanical painting equipment, announces the opening of a new office in the Real Estate Exchange Building, Philadelphia, in charge of J. B. Harris. The territory will be Pennsylvania, east of Altoona, and the state of Delaware. The company also announces that A. L. Link will open an office at 40 West Seneca Street, Buffalo, N. Y. Mr. Link's territory will be that part of New York state west of, but not including, Albany. The E. S. Stickle Company, 934 Union Trust Building, Pittsburgh, will succeed M. P. McClure as the company's representative in the Pittsburgh territory covering Pennsylvania, west of Altoona, West Virginia and parts of Ohio.

# New Equipment Available

## Magnetic Switch

A magnetic switch, suitable for throwing squirrel-cage motors directly across the line, or for use as a primary switch for a wound-rotor motor, has been introduced by the General Electric Company. It bears the designation CR-7006-D-31. The switch consists of a triple-pole, restricted-blowout type, magnetically operated contactor with normally open interlock, and two hand-reset, temperature overload relays, all mounted on a molded base and inclosed in a drawn-shell, steel inclosing case. It is designed for use on standard voltages and frequencies, and the maximum horsepower rating at 220 volts is 50 for two or three-phase three wire and 60 for two-phase four-wire.

## Gas-Engine Driven Welder

A new model gas-engine-driven "Stable-Arc" welder, known as the S-1960 model has been placed on the market by the Lincoln Electric Company, Cleveland. The new unit has a rating of 200 amp. according to N.E.M.A. standards, with a current range for welding duty of from 50 amp. to 300 amp. and operates at a speed of 1,500 r.p.m. Motive power is provided by a four cylinder Continental "Red Seal" engine, type H-9.

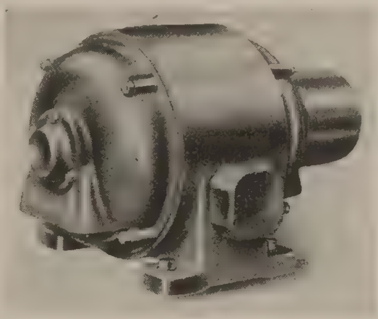
The welding generator and engine are mounted on a structural base welded into a solid piece of steel. This welded steel base provides a maximum stiffness and rigidity with a minimum weight; the whole unit weighing only 1,580 lb. and being only 76 in. long by 25 in. wide.

The generator also is constructed of steel, not only reducing the weight but also reducing the possibility of breakage in the field. The complete magnetic circuit of the generator is of laminated steel structure. A steel switchboard is provided. It is stated by the company that this unit is not designed to replace its present heavy duty engine driven equipment but to meet the need for a light but sturdy unit.

**Motor-Generator for Projection Work.**—A line of constant-potential, multiple-arc, induction motor-generator sets has been designed especially for motion-picture projection by the General Electric Company. These sets will operate on 50- or 60-cycle alternating current from the power lines. The line includes sets driven by single or polyphase, squirrel-cage, induction motors or by high-reactance, squirrel-cage, induction motors. All sets are given a continuous rating in kilowatts, ranging from 1.6 kw. on some types to 30 kw., and are designed to carry overloads of approximately 100 per cent for periods of three minutes occurring at fifteen-minute intervals. To secure stable operation of the arc, a ballast rheostat must be used in series with each projector, spotlight, etc. This will reduce the voltage from that furnished by the generator to that required by the lamp. A line of generator panels for wall mounting, suitable for use with these sets, is also announced by the General Electric Company.

## General Purpose Motor

A line of ball-bearing general purpose motors in sizes from ¼ hp. to 30 hp. has been developed by Sterling Electric Motors, Inc., Los Angeles, Cal. The motor is interchangeable for 220 or 440 volts and is of the across-the-line type.



*Protected general purpose motor for 220 or 440-volt use*

It is a semi-inclosed unit and can be furnished for single-phase operation with condensers for starting and improving the power factor. This protected motor can also be used as a totally inclosed unit, totally inclosed pipe ventilated or totally inclosed ventilated. The cast rotor used is guaranteed for the life of the motor, and the stator frame is of one piece construction.

## Open Type Fused Switch

An open type "Fuswitch" which has been designed for rural and farm lighting and railroad use to meet the demand for a low-priced switch of high rupturing capacity has been placed on the market by the W. N. Matthews Corporation, St. Louis. The switch is known as the No. 1317, and has a rating of 100 amp. at 7,500 volts. It is of the vertical type and is especially designed for 6,600-volt and 6,900-volt service but is adaptable to 2,300-volt and 4,400-volt service.

The switch is equipped with the Matthews double tube horn fiber vacuum cartridge. The insulators are of special design wet process porcelain with a flashover value of 22 kv. The switch can be quickly converted to a disconnecting switch with a rating of 125 amp. at 7,500 volts by substituting the solid disconnect blade made for the purpose.

## Single-Phase Condenser Type Motor

A complete line of condenser-type single-phase motors in all speeds and sizes up to 30 hp. has been placed on the market by the Howell Electric Motors Company, Howell, Mich. These motors are built in a range of speeds from 3,600 r.p.m. to 300 r.p.m., and are said to be particularly adapted to slow speeds owing to the high power factor. In most sizes the line is mechanically interchangeable with Howell polyphase motors. They are built with standard sleeve bearings or Timken tapered roller bearings and are obtainable in horizontal, vertical, open, totally inclosed, or inclosed ventilated types. The motor is suitable for plugging or for use on reverse speed duty with the use of a three-phase reversing switch.

The condenser used with the motor is contained in an auxiliary box for connection external to the motor. The type of condenser furnished is dependent on the starting torque requirements. The manufacturer claims that the starting torque of the motor can be made as great or greater than that of a polyphase motor. The power factor of the motors range from 80 per cent to 100 per cent and the efficiency from 70 per cent to 90 per cent.

## Disconnect Switch and Fuse Mounting

A combination disconnecting switch and fuse mounting known as the type "GFB-232" for underhung mounting on double cross arms has been placed on the market by the Delta-Star Electric Company, Chicago. This unit is particularly applicable for use on two pole platform type substations placed directly under the transmission line. Fuses are easily removed and disconnecting switches readily opened by an operator standing on the platform. Where there is possibility of a back feed a disconnecting switch may be furnished on both sides of the fuse to provide maximum safety.

**Pot-Type Electric Furnaces for Lead Hardening.**—An addition to its line of electric heating equipment in the form of a pot-type electric furnace for lead hardening, designed to operate at temperatures up to 1,650 deg. F. has been made by the General Electric Company. It is being marketed in four sizes. This furnace, the manufacturer claims, consumes less current than any other pot-type furnaces of similar size and capable of doing the same work. It utilizes the standard method of submersing the work in a bath of molten lead. The four sizes now in manufacture cover a wide range of production conditions and are suited to a multiplicity of applications. The smallest has a maximum capacity of 75 lb. of steel per hour at 1,500 deg. F. The largest unit has a capacity of 250 lb. of steel per hour at 1,500 deg. F.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued March 20, 1928)

1,663,334. Support; H. P. Chandler, Mansfield, Ohio. App. filed July 27, 1926. Support for suspending and insulating a trolley conductor.

1,663,343. Renewable Fuse; M. M. Lear, Jamestown, N. Y. App. filed March 17, 1926.

1,663,357. Lighting Fixture; G. Stefan, Chicago, Ill. App. filed Feb. 2, 1927.

1,663,421. Line Breaker; E. L. Stubbings, Huntington, N. Y. App. filed March 10, 1927. For breaking the loops in street lighting circuits.

1,663,466. Neutralizing Bar; A. J. Rostal, Chicago, Ill. App. filed Aug. 28, 1924. For application to a printing press or other machine through which paper is passed for removing static electricity from the paper.

(Issued March 27, 1928)

Reissue 16,917. Exit-Lighting System; R. T. Williams, Chicago, Ill. App. filed Dec. 3, 1926.

1,663,550. Lamp Stem Holder; J. J. Higgins, East Orange, N. J. App. filed Dec. 3, 1924.

1,663,551. Alternating-Current Relay; E. L. Holmes, New York, N. Y. App. filed Jan. 24, 1925.

1,663,552. Electrolytic Rheostat; E. L. Holmes, New York, N. Y. App. filed Jan. 24, 1925.

1,663,558. Electric Heater; N. Lawner, Brooklyn, N. Y. App. filed May 20, 1927. To be used as a vaporizer for the treatment of certain diseases, such as asthma.

1,663,560. Filament for Incandescent Lamps; G. W. Meister, Irvington, N. J. App. filed Feb. 20, 1926.

1,663,564. Refractory Metal Filament; M. N. Rich, East Orange, N. J. App. filed Oct. 30, 1925.

1,663,607. Electric Power Transmitter; J. M. Naul, Plainfield, N. J. App. filed Nov. 21, 1924. Used in the individual drive and control of small machines such as sewing machines.

1,663,654. Lighting Fixture; E. F. Guth, St. Louis, Mo. App. filed July 13, 1925.

1,663,655. Supporting Means for Lighting Fixtures; O. D. Guth, St. Louis, Mo. App. filed July 15, 1925.

1,663,657. Lighting Fixture; E. F. Guth, St. Louis, Mo. App. filed Feb. 17, 1926.

1,663,674. Limiting Device for Electric Regulators; A. Ytterberg, Furuhall, Ludvika, Sweden. App. filed April 6, 1926.

1,663,675. Electric Cigar Lighter; J. R. Ayotte, Chicago, Ill. App. filed April 24, 1926.

1,663,680. Electric Switch; N. G. Copley, Detroit, Mich. App. filed June 27, 1925. Small automatic overload switch.

1,663,698. Spacing and Supporting Bridge for Storage-Battery Plates; W. E. Gossling, Indianapolis, Ind. App. filed Sept. 5, 1923.

1,663,711. Electrical Apparatus; J. M. Laler, Burlingame, Calif. App. filed March 23, 1925. Terminal boxes and connecting plugs.

1,663,741. Secondary Battery; J. Vaughan-Sherrin, Ruckinge, England. App. filed Aug. 4, 1926.

1,663,768. Electrical Measuring Instrument; J. H. Miller, Oak Park, Ill. App. filed March 25, 1922. With means extending externally of the instrument housing through which the conductor may be passed, and which will act to produce the necessary torque on the vane of the indicating needle of the instrument.

1,663,807. Chart-Recording Meter; F. Maurer, Zug, Canton of Zug, Switzerland. App. filed June 16, 1922.

1,663,810. Electric Heater; S. Morse, Cleveland Heights, Ohio. App. filed Feb. 6, 1926.

1,663,874. Heating System; W. W. Brisson, Norway, Mich. App. filed April 7, 1927. For railway switches.

1,663,878. Multiple-Conductor High-Tension Cable; L. Emanueli, Milan, Italy. App. filed Sept. 2, 1925.

1,663,885. Electromagnetic Device; N. H. Holland, West Orange, N. J. App. filed Aug. 14, 1924. As used in sound recording and reproducing apparatus.

1,663,890. Electrical Control System; H. M. Stoller, Mountain Lakes, N. J. App. filed Nov. 19, 1924. For controlling the speed of dynamo-electric machines.

1,663,891. Regulator System Employing-Electron Discharge Devices; H. M. Stoller, Mountain Lakes, N. J. App. filed July 24, 1926.

1,663,970. Means for the Electric Welding of Can Bodies; J. Brenzinger, Fairfield, Conn. App. filed July 1, 1925.

1,664,022. Electric Welding Apparatus; A. Churchward, New York, N. Y. App. filed Feb. 17, 1927. Auxiliary regulating means.

1,664,030. Method of and Apparatus for Electric-Resistance Welding; J. H. Gravell, Elkins Park, Pa. App. filed March 23, 1926.

1,664,031. Electric Jet-Wave Commutator and Interrupter; J. F. G. P. Hartmann, Copenhagen, Denmark. App. filed Feb. 25, 1926.

1,664,089. Thermostatic Control for Generators; C. Ringwald, Chicago, Ill. App. filed Feb. 23, 1926.

1,664,090. Attachment-Plug Adapter; H. R. Sargent, Bridgeport, Conn. App. filed Feb. 27, 1923.

1,664,097. Protective Device; O. C. Traver, Schenectady, N. Y. App. filed Feb. 1, 1924. For the protection of high voltage electric circuits upon the occurrence of abnormal conditions, such as excess current.

1,664,100. High-Tension Installation; A. O. Austin, Barberton, Ohio. App. filed Oct. 20, 1921. The combination with a conductor, of an openwork conducting cage surrounding the conductor and spaced outwardly for increasing the effective diameter of the conductor.

1,664,104. Electromagnetic Device; E. R. Carichoff, Schenectady, N. Y. App. filed Feb. 9, 1924. Magnetic switch.

1,664,107. Electric Bell; W. F. Hendry, Ossining, N. Y. App. filed Sept. 12, 1924.

1,664,126. Dry-Battery Construction; E. E. Meisekothen, Madison, Wis. App. filed Aug. 28, 1925.

1,664,132. Electric Furnace; I. Rennerfelt, Djursholm, Sweden. App. filed Aug. 18, 1926. Metallic resistor type.

1,664,134. Speed-Control System; L. Schombourger and H. K. Schrage, Paris, France. App. filed May 6, 1925. For an induction motor.

1,664,165. Dimmer Wall Switch; G. Freeman, New York, N. Y. App. filed April 1, 1927.

1,664,171. Electrical Baseboard Heater; W. W. Hicks, San Francisco, Calif. App. filed Dec. 17, 1925.

1,664,172. Insulator; J. R. Holler, Ellwood City, Pa. App. filed July 20, 1926. For supporting electric cables in mines, or elsewhere.

1,664,173. Electric-Welding-Machine Attachment; C. W. Holstein, Warren, Ohio. App. filed July 11, 1927. For spot welding machines of the pivoted conductor-carrier type.

1,664,177. Electric Heater; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. App. filed Aug. 26, 1926.

1,664,185. Braking System for Motor-Driven Machinery; T. H. Rodman, New York, N. Y. App. filed Oct. 25, 1922. Applicable to high-speed printing presses.

1,664,194. Protective Device; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 5, 1924. Whereby abnormal potential charges, such as atmospheric disturbances, static accumulations, etc., may be carried off without injury to the apparatus.

1,664,201. Thermostatic Switch; C. J. Fay, Mansfield, Ohio. App. filed March 10, 1927.

1,664,208. Insulator; G. I. Gilchrest, Derry, Pa. App. filed Sept. 16, 1922. Suspension insulator adapted for high-potential circuits.

1,664,215. Annunciator Relay; L. F. Hunt, Los Angeles, Calif. App. filed April 21, 1923.

1,664,216. Motor-Control System; H. D. James, Edgewood Park, Pa. App. filed Sept. 2, 1922. For preventing the opening of circuit-controlling devices while excessively heavy current is traversing the circuit.

1,664,228. Switchboard Lamp; H. P. Sparkes, Pittsburgh, Pa. App. filed May 7, 1923.

1,664,229. Drier-Control System; S. A. Staege, Pittsburgh, Pa. App. filed July 23, 1925.

1,664,234. Coil-Ironing Machine; J. R. Weaver, North Irwin, Pa. App. filed July 14, 1923. Adapted to iron the insulating coils formed about electrical conductors such as coil members comprising windings of dynamo-electric machines.

1,664,242. Gas-Electric Power System; A. H. Candee, Wilkinsburg, Pa. App. filed Feb. 19, 1927.

1,664,243. Maximum-Demand Meter; L. W. Chubb, Edgewood Park, Pa. App. filed Dec. 11, 1922.

1,664,250. Variable Resistance Indicator; T. M. Eynon, Philadelphia, Pa. App. filed Aug. 10, 1922.

1,664,265. Liquid Gage; F. Rieber, Berkeley, Calif. App. filed July 28, 1924.

1,664,325. Motor Regulator; P. F. Shivers, Wabash, Ind. App. filed March 21, 1924.

1,664,326. Relay Operation Indicator; H. P. Sleeper, East Pittsburgh, Pa. App. filed March 10, 1923.

1,664,358. Lighting and Battery-Charging System; J. T. Fitzsimmons, Dayton, Ohio. App. filed Nov. 29, 1924.

1,664,380. Snap Switch; S. A. Meyers, San Francisco, Calif. App. filed July 15, 1926

# New Trade Literature

ANCHORS.—The W. N. Matthews Corporation, 3722 Forest Park Boulevard, St. Louis, has issued a price sheet covering its "Xpandix" anchors. This supersedes price sheets P and Q.

ELECTRICAL MATERIALS. — Catalog No. 25-1400 issued by the Truscon Steel Company, Youngstown, Ohio, covers the Truscon electrical materials for line construction. It contains a complete list of pole line hardware and specialties and the various products listed are all illustrated and described. An alphabetical and numerical index section at the end of the catalog gives instant reference to any article.

ELECTRIC SPECIALTIES.—The G & W Electric Specialty Company, 7780 Dante Avenue, Chicago, has issued catalog No. 27, in which it fully illustrates and describes the G & W electric specialties, including potheads, boxes, combination air and oil break, disconnects, vault units, cable terminal devices, distribution specialties, etc.

TRANSMISSION BELTING.—A booklet issued by Alexander Brothers, Inc., 14 South Street, Philadelphia, describes in detail the construction of "Tentacular" transmission belting. It contains typical installations and complete information, including horsepower ratings, etc. A chapter is devoted to the design of a "Tentacular" drive and an example illustrates the application of the principles.

LIGHTNING ARRESTERS.—"The Economics of Lightning Protection" is the title of booklet No. 250, the sixth of a series describing the technical features of the crystal valve lightning arrester as they apply to modern lightning protection and which is being issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Milan, Italy (No. 30,547), of rubber-covered spark cable.

Purchase and agency are desired in Naples, Italy (No. 30,597), for personal electrical equipment and electric stoves and water heaters.

Purchase or agency is desired in Munich, Germany (No. 30,555), for household electrical appliances and bare and insulated copper wire.

An agency is desired in Quebec, Canada (No. 30,556), for household electric washing machines, ironers, and clothes-drying cabinets.

A sole agency is desired in San Juan, P. R. (No. 30,579), for domestic lighting fixtures.

Purchase and agency are desired in Bilbao, Spain (No. 30,558), for electric refrigeration units.

Aktb. Sundell and Company, Sodra Kungstornet, Stockholm, desires an agency (No. EE-1071) for 2-volt storage batteries in glass jars.

# Electrical World

*McGraw-Hill Publishing Company, Inc.*
James H. McGraw, *President*

W. H. Onken, Jr.
*Editor*

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## *What Is the Significance of the Portland Election?*

WHEN at a special election last week the people of Portland, Ore., refused by a two-to-one vote to sanction the sale of the Northwestern Electric Company to its competitor, the Portland Electric Power Company, they indicated a preference to maintain competition in the public utility field rather than accept a guaranteed 10 per cent rate reduction for a period of five years. The proposed consolidation would have meant an aggregate saving to Portland consumers of approximately $3,000,000 during the next ten years. Under the present franchise of the Northwestern company, which has ten years to run, the city of Portland receives a 3 per cent gross earnings tax.

There was little outward opposition to the consolidation, which by virtue of a requirement in the franchise of the Northwestern company had to be sanctioned by the City Council. The Council had expressed its approval of the merger, but officials of the two companies, desiring to have a full expression of public opinion, defrayed the expense of a special election at which no other issue was involved. The returns would seem to indicate that either the people lacked confidence in the companies and the set-up proposed or felt that competition in the public utility field is the surest safeguard to low rates. It was to check the arrogance of the old Portland Railway & Light Company under the late Mr. Josselyn that the city invited the Fleishhackers to start the Northwestern company. This and the fact that telephone rates in Portland were increased following the absorption of a small independent telephone company by the larger company may have had a bearing on the result. The fact remains, however, that 50 per cent of the registered voters of Portland refused to indorse the proposition. That is significant enough to cause the industry in that section to indulge in some introspection.

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## *National Authority Must Not Trespass on Domain of Business*

PRESIDENT COOLIDGE voiced the above sentiment in an address last Monday night to the Daughters of the American Revolution. He was even more firm in his conviction that the policy of keeping the government out of business was one of the essential declarations of the Revolutionary period. The President has expressed himself in a similar strain on many other occasions, but such is the temper of Congress that the principle cannot be reiterated too often.

"Society requires certain public activities like highways and drainage, which are used in common and can best be provided by the government," he asserted; "but in general the country is best served through competition of private enterprise. If the people are to remain politically free, they must be economically free. Their only hope in that direction is for them to keep their own business in their own hands."

Before Congress at the present time are two major measures of interest to the nation and of chief import to the electric light and power industry—those concerning Muscle Shoals and Boulder Canyon. In both of these cases the government, or rather a minority in Congress, seeks an innovation which is at variance with the established practices of the nation. Not only would these men plunge the government into business; but in the Boulder Canyon measure, for example, they seek to coerce the states. Before the six or seven states involved in this legislation have even ratified a treaty, Congress, whose function in this case should be to confirm the agreement, seeks to initiate a movement which cannot become effective until the states and the Congress itself sign the treaty. All this is contrary to the policy of the administration and to the best traditions of the United States.

The electrical industry should press for a decision on the pending legislation now being debated in Congress in keeping with the principles enunciated by the President. Senator Norris ought not to be able to thwart the will of the people and of the Congress indefinitely, nor should Senator Johnson of California succeed in hoodwinking the nation into pouring millions into that already doubly blessed state at the expense of its neighbors. The rights fought for by the founders and the ideals they set up have proved their worth. To maintain them unshaken is both an ideal and a duty.

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## *British Electrical Performance and Its Handicaps*

A COMPARISON of the performance of the electric light and power industry of Great Britain with that of the United States is interesting. While the showing is highly complimentary to the utility companies of this country, it is not altogether bad for Great Britain if all the facts are taken into consideration. It does indicate, however, that there is opportunity for great improvement and that the Electricity Commissioners, if adequate powers are granted them, can work wonders in a country possessing abundant fuel, manifold industries and congested population.

The annual analyses and summaries of electricity output in Great Britain for the year ended March 31, 1927, have just been published by the Electricity Commissioners. They show a total output of 8,365,857,198 kilowatt-hours, an increase of less than 3 per cent, from a fuel consumption of 8,856,938 tons, an increase of 4.8 per cent over 1926. The average fuel consumption increased from 2.40 pounds to 2.43 pounds per kilowatt-hour, the best showing having been made by the Barton station of the Manchester Corporation, which on a load factor of 53.2 per cent generated a kilowatt-hour from 1.33 pounds of coal. Of course, heat units rather than pounds of coal would have been a better yardstick; but pounds of coal will suffice. Moreover, the Barton station, because of inadequate condensing water, depends on cooling towers, like many other stations in Great Britain, and therefore is at a disadvantage compared with American stations possessing ample condensing water.

The total production of electricity from public utility stations in the United States in 1927 was approximately 80,000,000,000 kilowatt-hours. In kilowatt-hours the electricity produced by the use of fuel increased about 5½ per cent, and notwithstanding that 2,500,000,000 more kilowatt-hours of electricity was generated from fuel in 1927 than in 1926, the fuel consumption decreased about 150,000 tons. The average of all steam stations was 1.83 pounds per kilowatt-hour, compared with 1.95 pounds in 1926, and our best stations consumed less than a pound of coal per kilowatt-hour. This is a wonderful record compared with that of Great Britain and indicates that private initiative is more alert and responsive in the United States than in Great Britain, where the municipalities make the better showing. There are, of course, reasons for this; but even at best Great Britain's municipal showing is only about half as good as our best privately owned system. We produced approximately 50,000,000,000 kilowatt-hours from fuel last year and consumed 45,709,000 net tons of fuel. When Great Britain's superpower system becomes effective, our cousins will be able to do better; but, owing to municipal opposition, economic reforms are hard to effect on that conservative island so important in the world's industry.

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## *The Salesman's Approach to the Executive*

FOR a long while the sales managers of the power industry have complained of the lack of executive interest and support in their work. The executive, they say, is so absorbed in operating, engineering and finance that he will not give much thought to selling. This has been true, and because of the nature of the business in past years it is not hard to understand, for the market has always grown on insistently. But has it occurred to the commercial men that a little study of their own methods will disclose one reason why it has been so difficult to get the president or the general manager really interested in sales methods? The salesmen have not been accustomed to presenting their plans and purposes in the form that appeals to the executive.

After all, this is a business enterprise, the operation of a power company. Behind the executive stand the banker and the stockholder. When the president goes before his board of directors with a project to build a new station he must bring a full story—the necessity for it, the plan, the cost involved, the benefits to be expected, and what is involved in financing, in engineering, in operating and in organization. It is a complete picture. And that is what the president likes to see when a subordinate submits a proposition. Moreover, he is accustomed to this approach to a decision on engineering programs. Is it any wonder, therefore, that he has at times failed to react to sales plans that are reared on a substructure of enthusiasm and opportunity?

The central-station commercial man has been too inclined to feel that if he sets up a sales program and volunteers to put it over, he is doing his share of the job and can leave all questions of the capital required and how to raise the money to the chief executive, disregarding the fact that any large development of market also entails the extension of lines, the substitution of heavier transformers and feeders and often the purchase of additional station equipment. Such an attitude naturally discredits the sales department. It suggests a lack of broad judgment and responsibility. But if a proposal for a market-building project was submitted as a complete business proposition, embracing all considerations of finance, engineering, operating and sales organization and promotion, it would have a very definite reception. The executive could weigh it in its entirety. He would not have to reconcile it to other department plans, for all that would have been done in advance. It would bring new dignity to the sales department in the mind of the executive.

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## *Cables in Surface Trenches*

DIFFERENCES between American and European practice in the installation of high-voltage cables underground have always presented an interesting question for analysis and speculation. In this country it is the almost universal practice to draw such cables into rigid underground conduits or ducts, usually placed a greater or less distance below the surface, access to the ducts being had through manholes spaced at intervals determined by the cable lengths and the mechanical stresses necessary to pull them in. Abroad it is common practice to place the cables in trenches open from the surface, the necessity thereby arising for armoring the cables against mechanical injury and for protecting the covering against various difficulties arising in the contact with the soil. The highly developed duct bank of this country obviously offers greater economy of valuable space beneath city streets. Further, there is the greater facility for inspection and for removal of defective cable sections. For these and other advantages payment must be made in the increased costs of material and construction.

An advantage of the European practice that is sometimes lost sight of is the smaller degree of handling to which the cable is subjected, particularly in the matter of bending, resulting from the simple process of unreeling into an open surface trench. This undoubtedly imposes less mechanical strain on the insulation, less probability of the breaking of paper tapes and of the formation of gas voids between insulation and sheath. With this danger lessened it is possible to wrap a tighter cable, with resulting improvement in its insulating properties. It is therefore of interest to note that at the recent meeting of the underground systems committee of the National Electric Light Association in Louisville the subcommittee on conduit and manhole construction reported two instances of the laying of cables in open trenches. In one of these cases a special concrete cable way was made, and in the other the cable was laid directly into soft earth. In each case protection from above was afforded by concrete slabs. The essential features, however, were the simplicity of the process of installation, resulting from the straight travel of the reel over the open trench, and the economy in the matter of cost. In view of the tendency to higher voltages for underground cables and the limitations which are imposed by present methods of manufacture and knowledge as to the ultimate properties of impregnated paper, it seems not improbable that a substantial increase in voltage limits and reliability of service might be looked for by taking advantage of the increased freedom in design permitted for cables which are to be installed in open trenches.

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## *An Industrial Plant's Tribute to the Electrical Industry*

THE manner and the extent to which electrical energy and electrical equipment are used in the fabrication of a finished product and their effect upon its quality may be accepted as the true measure of the value of the electrical industry's service to an industrial plant. A case in point is the electrification of the Timken Roller Bearing Company's plant at Canton, Ohio, where all power is purchased from the Ohio Power Company. This plant now has a maximum demand of 30,000 kilowatts, which is steadily increasing. The fact that, with such a large demand for power, the plant finds it most economical to purchase its requirements is proof positive of the superiority of central-station service under the conditions presented.

If any further proof of the value of electrical apparatus were needed, the methods of utilization and their effect upon the finished product would supply it. At this plant there is in operation a battery of electric steel-melting furnaces producing 350 tons of steel a day. All of this electric steel, and this steel only, is used in the manufacture of the company's products, although it is also operating an open-hearth furnace for the production of merchant steel. So highly does this industrial plant value the quality of electric steel that it will soon double its capacity in steel-melting furnaces. In addition to this, more than 3,000 kilowatts in electric heat-treating equipment has been installed within the past year to take further advantage of the refinements in production which electric service and electrical equipment afford. The quality of its product, its uniformity and its wide field of application in other industries are attributed by the Timken company largely to the utilization of electrical energy and electrical equipment in its own fabricating processes. Surely the electrical industry can ask for no higher tribute to the value of its own service and its own products.

* * * *

## *The Urban Trend in Management*

GOOD relations with customers are leading to a rapid decentralization in local utility management under the holding-company principle. The rewards of putting a responsible resident manager in each important regional area are very attractive, and the policy will be continued for some time in progressive organizations. When one comes to the larger tasks of company administration, however, it is apparent that centralization of executive and technical allied and advisory functions is steadily increasing. The trend is away from the smaller town or city to the larger one or to the more conveniently located community with regard to banking connections, concentration of engineering and sales ability, access to specialist service and general business facilities.

The time is at hand when a large part of the development work of major property groups will be carried on under conditions more favorable to highly organized treatment than ordinarily obtains in the more isolated centers. Policies will be determined on the basis of local experience no less than before, but a better co-ordination will be realized in engineering, purchasing, general direction of sales activities, accounting and financing work, if strong ties between headquarters and district offices are maintained and the resources of the larger or more favorably manned centers are utilized with sound judgment and never-failing perspective. It would be ridiculous to imply that a first-class administration of a modern group of utilities cannot be conducted from a country-town office, and no such intimation is intended; but the massing of business facilities characteristic in urban centers and the increasing complexity of operating, engineering and development problems, the need of the most experienced legal advice and of the most competent financial opinion and support lie behind the present trend toward the larger city as the base of executive operations. The best resources of modern business must be made as convenient as possible to the administration of the immense aggregations of capital now invested in the light and power industry.

* * * *

## *Profitable Rural Service*

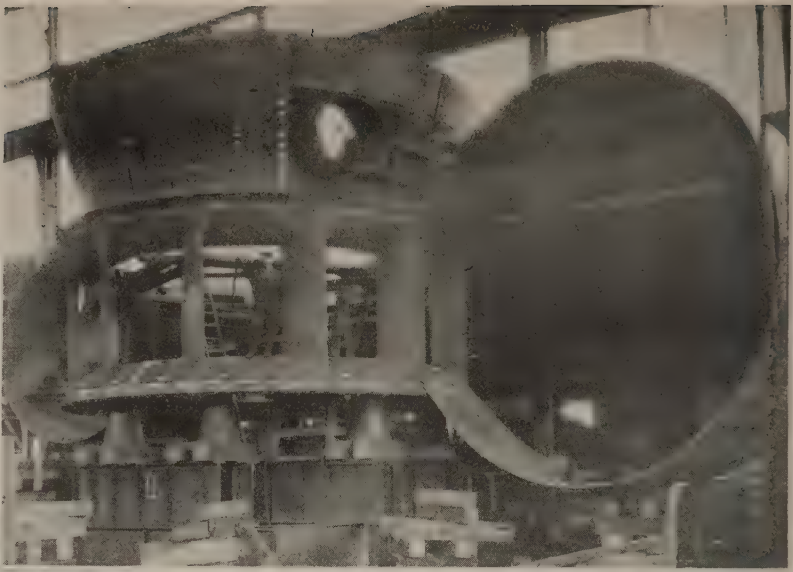
RURAL service lines, with few exceptions, are at first unprofitable. It is not unusual for such an extension to continue as a losing venture for many months, even years, after it is energized. Many suggestions have been offered to improve this condition, but the fundamental consideration cannot be avoided. A profitable line depends entirely upon the utilization of the electrical service provided by that line.

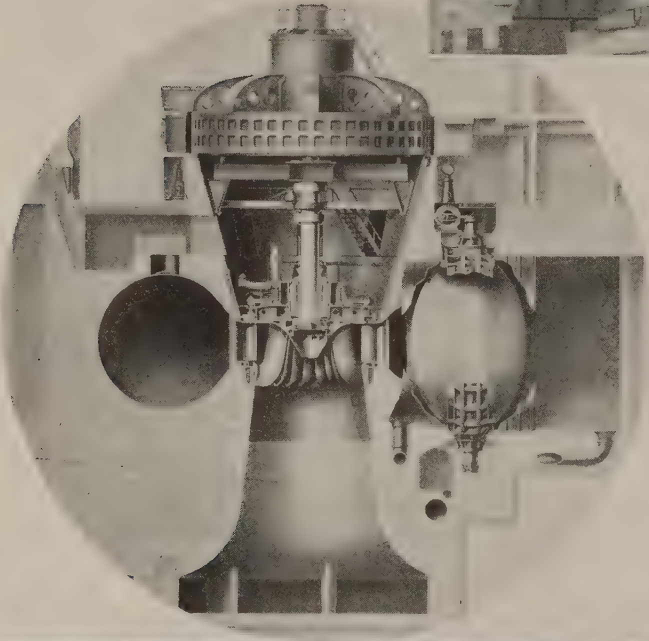
A number of operating companies in one large system have been able to shorten the period of unprofitable service through intensive efforts to have each property owner along the route "signed up" as a customer before the construction work is undertaken. The policy on this system is to start work only when 80 per cent of the potential customers have signed contracts for service. Experience has shown that such agreements can be obtained as a result of adequate effort.

There is an excellent way in which existing lines and those planned for future installation may comprise improved revenue factors. Highway-lighting practices in rural districts are consistently inadequate. A lighting load of sixteen or eighteen 600-cp. lamps per mile offers sufficient illumination to increase safety conditions along the roadway and at the same time augment the load on the extension. It is estimated that such a minimum specification represents an average annual cost of $700, and, as the highway construction requires a probable $35,000 per mile, the expenditure for illumination amounts to a potential expense increase of 2 per cent per year. A Middle Western utility supplies such a service for $48 per mile per month along 343 miles of rural roads.

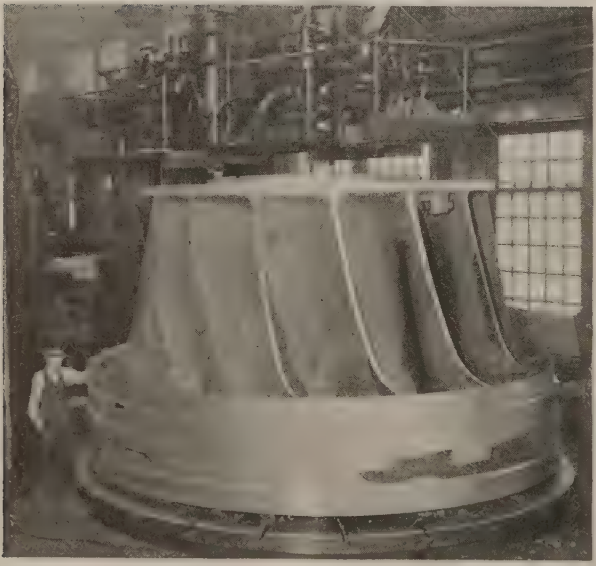
There is a certain obligation upon a community to assist in the illumination of highways just as there is a definite obligation upon it to provide the highway. Adequate lighting will place a portion of the burden of the cost of line extensions upon the members as a whole. After all, it is, definitely, a community matter, this provision of safe highways and better homes.

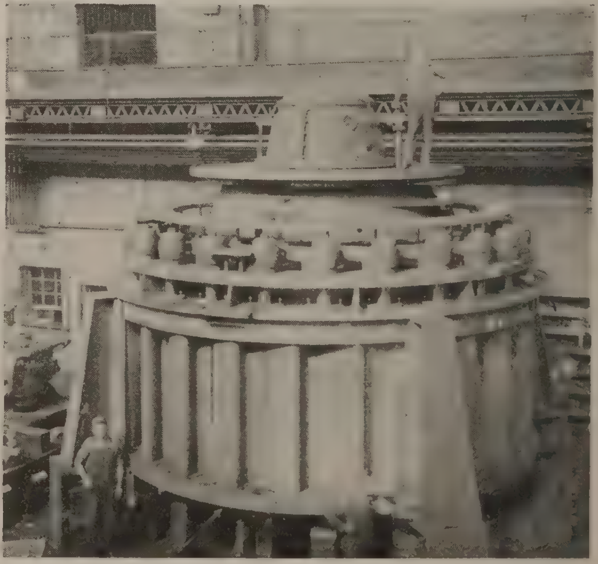
# *Conowingo Units Now on Line*





ON MARCH 1 the Conowingo hydro-electric development of the Philadelphia Electric Company commenced feeding Philadelphia. It is tied in with the Pennsylvania Power & Light Company and will be eventually with the Public Service Electric & Gas Company of New Jersey. The plant, with its initial equipment of seven 54,000-hp. turbines designed for 89-ft. head, was completed and placed in operation in virtually two years. The total cost will be around $52,000,000. The types of runner, spiral casing and speed ring used in four of the units are illustrated.





# *Relation Between*
# Steam and Hydro Generation

Too much emphasis placed on competition.
Both types of power generation have field.
Opportunities exist for lowering hydro costs

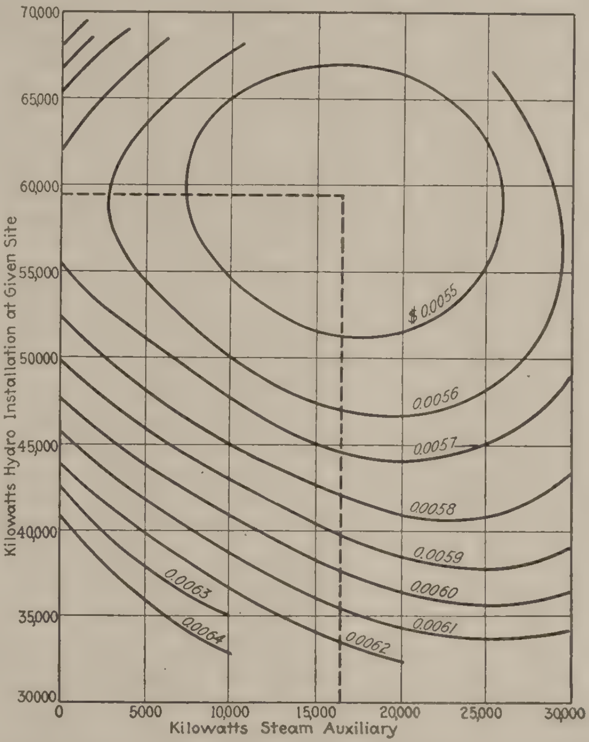
By C. P. Dunn
*Chief Engineer Portland Electric Power Company, Portland, Ore.*

DISCUSSIONS of problems concerning the relative economy of steam-electric and hydro-electric power generation have appeared in the technical press during the past year or two. In the opinion of the writer, the idea of steam versus hydro has been presented with too much emphasis on the thought of direct competition between the two methods of generating power. It is true that to a certain extent a direct comparison may be made, but, in general, the two methods of obtaining electric energy are inter-related in so many ways, and each makes such an admirable supplement to the other with respect to suitability for carrying different types of load, or different parts of the annual or daily system load, that in districts where both types of generation are available we must regard them as inseparable. They will remain so until a better way is invented of obtaining electric energy than from a properly balanced group of steam and hydro stations.

In districts where both sources of generation are available at reasonable cost the two working together will usually produce power more economically than either alone. The exceptions are: (a) Districts where hydro possibilities are so meager as to allow of little or no development in competition with modern steam plants, and (b) districts so favored with economical hydro sites (including storage) as to preclude the economical operation of steam plants, even for carrying peaks. This latter condition is extremely rare because of the scarcity of good storage sites. Lack of economical storage reservoir sites usually makes it necessary to have steam auxiliaries for carrying load in the low-water season.

Recent developments in automatic control have made it economical to use kilowatt-hours from small hydro sites which were formerly out of reach because of operating cost.

It is true that even in the western part of the United States, where enormous supplies of hydro energy lie undeveloped, the ratio of steam to hydro is rapidly increasing. This is the natural result of changing economic conditions. The rapid changes in methods of doing things which are taking place in all lines of human activity make it necessary to look forward, and to be flexible. The cost of new hydro has been increasing of late years because the best sites have been developed, the remaining sites of ordinary size require a greater investment per kilowatt and the rate of growth of demand for power does not yet justify the construction of the large hydro developments which can be built at a low unit cost, and which would be economical if they could be loaded quickly. The cost of steam power has been coming down because of increased efficiency due to the recent great advances in the art of generating power by steam.



*Typical analysis of economic relation between size of hydro installation and steam auxiliary*

Cost per kilowatt-hour of maximum usable power delivered by various combinations is shown by the "cost contours." For the given conditions covered by the chart the most economical development would be 59,000 kw. hydro and 16,500 kw. steam as shown by the dotted lines.

Some of the very large hydro-electric sites in the West appear to offer very cheap power, but when consideration is given to the fact that this apparently cheap power is located so far from the consumer that 220 kv. transmission is necessary, and construction of both generating stations and transmission lines are of a nature to require capital outlay for large steps in capacity, putting at the disposal of the consumer more power than he can use for a period of several years, but nevertheless burdening him with the cost of having this capacity available, the picture of cheap power from falling water disappears and thought is given to steam. Steam can be installed in steps or units as small as may be desired, but the greatest thermal efficiency is not available to systems which cannot readily absorb the output of a unit of 30,000 kw. capacity or more.

The two methods of obtaining power are, in general, about on a par as to reliability. Steam-generating units alone are less reliable than hydro-generating units, but when the chances for trouble in hydro plants other than in the unit itself, such as trouble on transmission lines, trouble with ice, conduits, valves, or gates, are charged against the hydro installation they are about equal. In the case of the steam plant, there is seldom an outage due to any cause except the unit itself, because of the custom of providing spare boiler and fuel-handling equipment.

### Field for Both Steam and Hydro

In comparing steam with hydro, or one hydro plant with another, there is too often a tendency among those not fully informed to give attention only to the particular development under consideration, with not enough study of the effect the development will have on the system to which it will be connected. The economic design of any individual development, if correctly worked out, must be influenced by the characteristics of all existing plants and other potential developments within reasonable transmission distance. There is no way really to measure the usefulness of a proposed development except to make detailed calculations of system operation, not plant operation. In a new development the thing to be accomplished is to build not just a plant which will produce power but a plant which will produce a certain amount of power at certain times, and to fit the new plant as nearly as possible to the work it has to do. Power spoken of as "kilowatt-hours," with no qualifying terms, has no clearly defined value. The value of a kilowatt-hour is determined not by the fact that it is a definite amount of energy, but by the ability or inability of the seller to deliver it, on demand, at any hour of the day or night or at any season of the year. Electric service consists of carrying both peaks and kilowatt-hours; the mention of either without a very specific definition of the relation between the two results in an incomplete description of the service in mind.

The cost of installation is, in the case of steam plants, from $80 to $120 per kilowatt, and in the case of hydro from $150 to $300 per kilowatt. This, with the fact that steam-operating costs and rates of depreciation are much greater than hydro, tends to make the steam plant more desirable for peak generation and the hydro plant more desirable for carrying the base of the daily load curve.

As for the contest between steam and hydro, if it may be said that a contest exists, there is usually a place for a good steam plant on the daily peak in a district where hydro is economically predominant, and there will always be a welcome extended to the intermittent hydro kilowatt-hours, which help reduce the coal bill in a district where steam is predominant. Economic laws will dictate the proper procedure in any given district.

The determination of the proper size of steam installation to suit a given set of conditions as to fixed charges, operating costs, stream flow characteristics and load characteristics is a very complicated problem. The fact that it is complicated makes it desirable to avoid decisions based on incomplete study. The only way to get a true picture of all the factors bearing on the problem, in their proper sequence and magnitude, is to analyze loads, costs and system and plant performance graphically. The accompanying chart is submitted as an illustration of graphical analysis of a problem of this nature. The detail calculations and numerous other graphs which make up the supporting data are necessarily omitted from this article.

### Efficiency and Construction Costs

We read in the current discussions of steam versus hydro that there is still room for further advances in steam economy, while hydro efficiency has practically reached the ultimate, with the present 92 or 93 per cent efficiency obtainable in hydraulic prime movers. This sort of statement is only partly true and is misleading. It is true that there is room for further improvement with respect to thermal efficiency in steam plants, and some such improvement will no doubt take place in the near future. The economic benefits of this improvement will be partially offset by the gradual upward trend of fuel prices. It is true that the efficiency of waterwheels and generators has practically reached the theoretical limit, but this does not by any means indicate that the ultimate economy in hydro construction has been reached. The machinery installation represents only 10 or 15 per cent of a hydro plant; there is still an opportunity for improvement in the economic efficiency of hydraulic installations by improvement of designs of hydraulic structures, by elimination of unnecessary refinements and, greatest of all, by improvement in methods of planning and executing hydro-electric construction. The most modern hydro plant designs tend toward extreme simplicity, and more thought than ever before is being given to the cost of hydraulic structures and to the elimination of non-essentials.

Steam plant construction is relatively simple; the procedure can be standardized to some extent. A hydro-electric project presents the most difficult problems imaginable in organization and management, difficult because each project has its own individual peculiar problems which must be solved without the guide of precedent, and it is possible to standardize and systematize only to a very limited extent. These projects are nearly always managed in a creditable manner, but even where the performance has been unusually creditable, after the work is finished those connected with it can see where it might have been done more efficiently. Here, rather than in the design of machinery, is where there is room for improvement in hydro development. Because of the fact that so large a percentage of the cost of a hydro-electric project is in structures rather than in machinery, it is obvious that there is no economy in buying anything but high-grade machinery, in order that full utilization may be made of money invested in structures.

### Hydro Economy Must Come Through Construction

If a hydro plant which could be built for $3,000,000 costs $4,000,000, no amount of effort expended in scientific design of the waterwheel and generator can make it a perfect plant. Even with the machinery 100 per cent efficient the plant could never attain more than 75 per cent commercial efficiency. Commercial efficiency, in its broadest sense, is the thing to be achieved. The simplification of hydro construction is being, in part, attained by carrying out the idea that a given amount of money which is available for reserve or for protection can be spent to better advantage by installing an additional plant or unit, rather than by partial duplication of equipment in a number of plants.

The present marked increase in the proportion of steam to hydro in Western construction programs will tend to lessen the danger of communities being stampeded into disastrous public ownership ventures. The alleged "romance" is departing from hydro-electric engineering and construction. Certainly there is no romance connected with the financing of a hydro project. When this is thoroughly understood by the general public, and it becomes generally known that with very few exceptions steam generation usually enters into a truly economical scheme of things, there will be less encouragement given to the proponents of state ownership of power. With the fallacy of "harnessing the waterfall" almost at no cost exploded, there is little romance left. A man seeking office would not get many votes if he told the public that if elected he would build a steam plant with their money; somehow it has no appeal to them. In possession of the true facts they are no more likely to vote in favor of the state going into the power business than they would be to vote for state ownership of grocery stores or filling stations.

## Automatic Substation Inspections

By O. M. Ward
*Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.*

THE IMPORTANCE of detailed inspections of equipment in automatic substations is evidenced by the inspection report form reproduced below, in use on the system of the Milwaukee Electric Railway & Light Company. These inspections are made at intervals of one week and the reports are made in duplicate, one copy going to the chief operator and the other kept at the substation for reference in future inspections.

*Items Checked on Inspection Report of Automatic Substations*

Station. Date. *Master Element*—Contacts. Mechanical operation. *Time Delay Starting Relay*—Contacts. Mechanical operation. Time setting. *Master Relay*—Contacts. Mechanical operation. *Master Contactor*—Contacts. Mechanical operation. *Starting Contactor or Breaker*—Mechanical operation. Main contacts. Interlock contacts. *Auxiliary Relay for No.* — Contacts. Mechanical operation. *Polarized Motor Relay*—Lubrication of motor and gears. Brushes and commutator of motor. Mechanical operation, A contacts. B contacts. C contacts. D contacts. *Field Reversing Relay*—Contacts. Mechanical operation. *Overspeed Limit Device*—Contacts. Mechanical operation. *Synchronous Speed Device*—Contacts. Mechanical operation. *Equalizer Contactor or Breaker*—Mechanical operation. Main contacts. Interlock contacts.

*Transformer*—Auto-transformer, or compensator temperature relay. Contacts. Mechanical operation (check by heating element). *Alternating Current Under-Voltage Relay*—Contacts. Mechanical operation. Voltage setting. *Resistor Thermal Relay*—Contacts. Mechanical operation (check by heating element). *Annunciator Lockout Relay*—Contacts. Mechanical operation. Targets. *Field Flashing Contactor*—Mechanical operation. Main contacts. Interlock contacts. *Direct-Current, Reverse-Current Relay*—Contacts. Mechanical operation. Reverse-current setting. *Motor-Operated Master Switch*—Stationary contacts. Drum contacts. Motor lubrication. Brushes and commutator. Magnetic brake. *Brush-Operating Mechanism*—35-A or X contactor. Oil in gear case. Grease on exposed gears. Do brushes lift clear of commutator. Do brushes seat fully. Contacts. Do they make and break correctly.

*Polarity Relay*—Contacts. Mechanical operation. *Under-Current Relay*—Contacts. Mechanical operation. Current setting. *Bearing Thermal Relay*—Contacts. Mechanical operation (check by heating element). *Field-Killing Contactor*—Contacts. Mechanical. *Alternating-Current Machine Field Relay*—Contacts. Mechanical operation. *Field Contactor*—Upper contacts. Lower contacts. Interlock contacts. Mechanical operation. *Running Contactor or Breaker*—Mechanical operation. Main contacts. Interlock contacts. *Running Contactor Control Relay*—Contacts. Mechanical operation. *Transfer Relay, Machine Sequence Switch*—Contacts. Mechanical operation. *Emergency Starting Relay*—Contacts. Mechanical operation.

*Reverse Phase or Phase Balance Current Relay*—Contacts. Mechanical operation. Does relay shut down machine while in normal running position. Does relay lock out machine if it operates when machine is starting. *Single or Reverse Phase Voltage Relay*—Contacts. Mechanical operation. Does relay shut down machine while in normal running position. Does relay lock out machine if it operates when machine is starting. *Starting Protective Relay*—Contacts. Mechanical operation. Time setting. *Auxiliary Relay for No.* — Contacts. Mechanical operation. *A.C. Thermal Relays*—Contacts. Mechanical operation. *Short-Circuit Selective Relay*—Contacts. Mechanical operation. *A.C. Over-Current Relay*—Contacts. Mechanical operation. *Oil Circuit Breaker*—Main contacts. Interlock contacts. Mechanical operation.

*Auxiliary Relay for No.* — Contacts. Mechanical operation. *D.C. Reverse Power and Underload Relay*—Contacts. Mechanical operation. *Auxiliary Relay for No.* — Contacts. Mechanical operation. *Current Regulating Relay*—Contacts. Mechanical operation. *Voltage Regulator Relay*—Contacts. Mechanical operation. *Time-Delay Stopping Relay*—Contacts. Mechanical operation. Time setting. *Flashover Relay*—Contacts. Mechanical operation. *Motor-Operated Field Rheostat*—Contacts. Lubrication of contacts. Lubrication of mechanism and motor. Interlocks. Remarks. *D.C. Emergency Contactor or Breaker*—Contacts. Interlocks. Mechanical operation. Remarks. *D.C. Breaker or Contactor*—Main contacts. Interlocks. Mechanical operation. Remarks. *Load-Limiting Resistance, Shunting Breakers*—Main contacts. Interlocks. Mechanical operation. Remarks. *D.C. Over-Current Relays*—Contacts. Mechanical operation. Remarks. *Commutation Control Relay*—Contacts. Mechanical operation. *D.C. Voltage Direct Control Relay*—Contacts. Mechanical operation. Setting.

## Generator Rotor Assembly Improved by Bolt-Stretching Device

A HYDRAULIC machine for tightening the long axial bolts that extend through the rotors of large high-speed turbo-generators has recently been developed by the Westinghouse Electric & Manufacturing Company and has been in successful operation for several months.

*Hydraulic service tightens rotor through-bolts*

The rotors are composed of rolled or forged steel plates and forged shaft ends held together by long axial bolts. This construction permits the rigid inspection and test of materials necessary to safeguard the machine for high operating speeds. Previous to the use of such large rotors these axial bolts were tightened by measuring the torque applied to the nut, and later, as an added precaution, the elongation of the bolt from relaxed to loaded conditions was carefully measured. Variation in friction, either under the seat of the nut or in the threads, caused a variation in the pounds pull required to obtain the required stretch; also, the use of the wrench was awkward.

To remedy this difficulty the hydraulic machine was built with two diametrical pulling heads which permit simultaneous stretching of two opposite rotor bolts. Each pulling head of this inverted press can exert a force of 1,000 tons. The carriage is movable and can be changed for different lengths of rotors. The motors and pumping equipment are located beneath the floor.

After the rotor is assembled temporary through-bolts are inserted. One bolt is removed at a time and the longitudinal hole reamed to an exact bore. The finished bolt is then inserted and the nuts tightened by hand sufficiently to lift the rotor. The rotor is then brought to the pulling machine. Nuts are run up until they just touch their seat, which leaves a portion of the threaded bolt still exposed. The rotor can be raised, lowered or turned by various supports. The end of one piston is visible, in the accompanying illustration, projecting through the end head, and an adapter connects the end of the piston to the threaded portion of bolt extending past the loosely run-up nut. Two diametrical bolts are pulled up to 40 per cent of final load, the nuts tightened until they relieve the stretcher of this tension, and the adapters are then removed. The rotor is turned and two more bolts treated in the same manner. Means are provided to prevent overloading the bolt.

This procedure is continued, gradually tightening the bolts in pairs until 125 per cent normal load is carried. The overloading irons out any irregularities in the structure. The rotor is then removed from the stretching machine and slotted for windings. Following this operation the rotor returns to the stretcher and the tension on the bolts is released to normal. Careful record is kept of the stretch of each bolt while in the machine and each stud is numbered for future reference.

## Shooting Slag Off Boiler Tubes

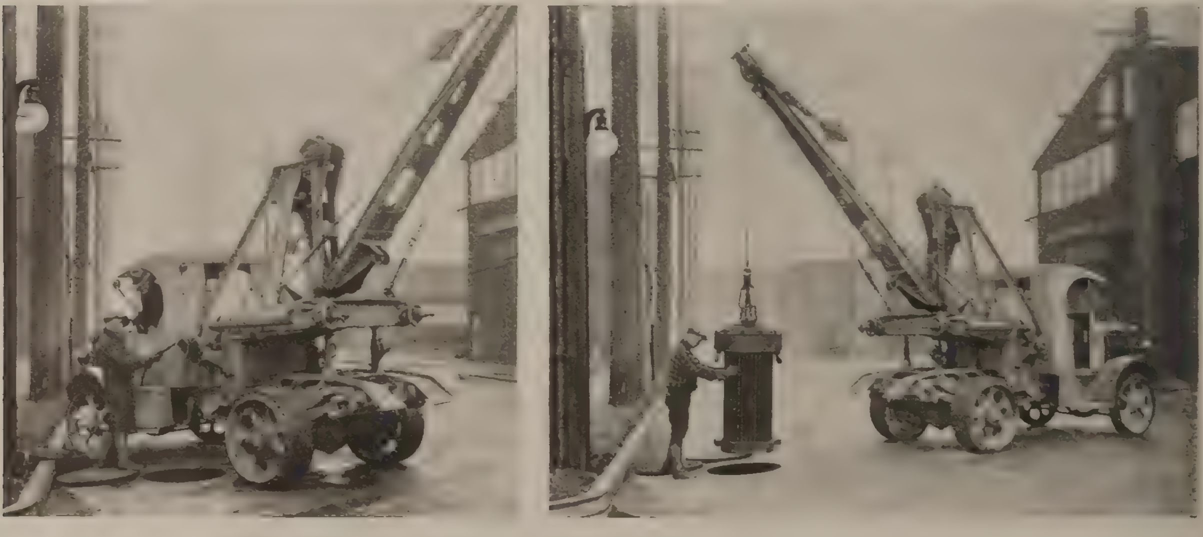
IN CONNECTION with the operation of the pioneer mercury boiler at the Dutch Point station of the Hartford Electric Light Company with pulverized coal fuel trouble was experienced last year from slag accumulation on the tips of the boiler tubes, with resultant choking of gas passes. These tubes are mounted directly above the heart of the combustion chamber, the tips being exposed to intense heating, and after shut-down the experiment was tried at the suggestion of T. H. Soren, vice-president of the company, of shooting the slag off the tube tips. Forty-six loads of No. 6 shot were fired at the mass from a shotgun, with the result that the slag was completely broken up. Following these tests on a cold boiler and setting, the shotgun was later used on a boiler in service and served to remove dense masses of slag, threatening shut-downs. It was found by these experiments that at the temperatures attained by the metal of the boiler tubes the ordinary shell load gave too high a muzzle velocity to the shot charge, with a consequent tendency to dent the tubes. The Remington Arms Company, Bridgeport, Conn., co-operated in the development of a shell to give a lower muzzle velocity, and no further difficulty occurred in the way of denting. This method of slag removal has proved thoroughly successful.

## Heavy Equipment Handling Simplified by Derrick Truck

By D. A. Hord
*Superintendent of Distribution Northwestern Electric Company, Portland, Ore.*

ONE of the most useful pieces of equipment of the distribution department of the Northwestern Electric Company, Portland, Ore., is the truck-tractor derrick shown in the accompanying illustrations. The derrick, which was designed by the company, is entirely of structural steel with incidental steel castings. The chassis was made by General Motors and is its standard 10-ton truck-tractor, type L-10T.

The derrick is constructed to allow clearance for the gooseneck coupling of a trailer which is used for hauling heavy equipment. The framing of the derrick is so made that the mast gudgeon is directly over and coincident with the rear axle center line, giving great lifting stability. With the boom straight back and set for a 10-ft. radius it is impossible to tip the truck over when lifting the capacity load of 3 tons. The truck and derrick are utilized for many purposes, including loading, unloading and hauling poles and other material and equipment. The total cost of the equipment as shown was approximately $12,000.



*Pulling cable and lowering subway transformer with truck-mounted derrick*

# *Simplified*
# Distribution Planning*

Methods of calculating the economical characteristics of electrical distribution systems, particularly transformer spacing and sizes of line conductor

By W. R. Bullard
*Electric Bond & Share Company, New York City*

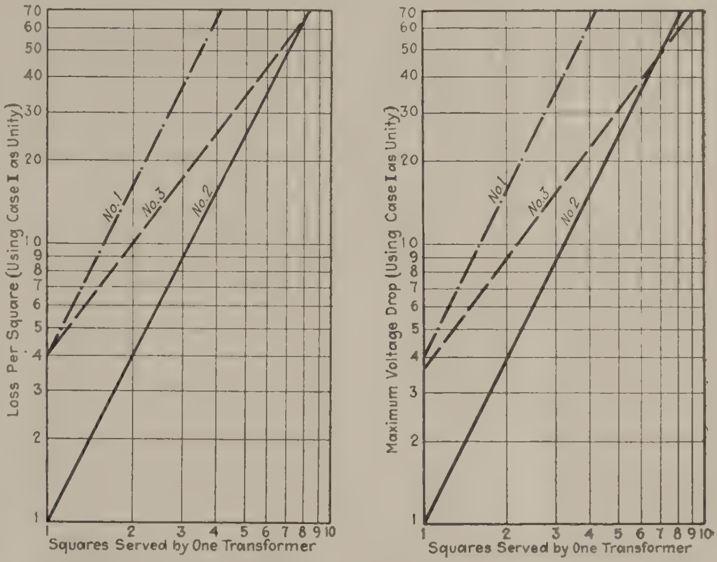
IN CONSIDERING the characteristics of the secondary distribution system where the conductors have branches or network arrangements of feed simple empirical relations between transformer spacing, energy loss and voltage drop are developed. These relations are used in the development of equations of economics similar to those previously given for straight line feeds.

Where the low-voltage mains do not consist of a simple straight line of circuit the conditions are somewhat more complicated. For any particular arrangement of branches or network feeds the voltage drop and power loss can of course be calculated by means of Kirchoff's laws. Such calculations, however, lead into extremely complicated equations that are not applicable in practice to calculations of the economics of transformer spacing and copper sizes. However, a comparatively simple empirical relation between transformer size, voltage drop and power loss in a network of conductors can be derived by assuming a network formed by the intersecting streets of a district in which the blocks are exactly square, then taking several symmetrical spacings of transformers and calculating the voltage drop and power loss for each spacing.

Fig. 3 shows ideal transformer spacings for serving secondary networks from street intersections. Fig. 4 shows the same thing for cases where the transformers are placed at intermediate locations between street intersections, and Table I gives the relative values of voltage drop and power loss for the different cases shown in Figs. 3 and 4.

TABLE I

| Case No. | No. of Squares per Transformer | Type of Feed | Maximum Current in Line | Maximum Voltage Drop | Copper Losses per Square for Fixed Cross Section |
|---|---|---|---|---|---|
| 1 | 1 | Four way | 1 | 1 | 1 |
| 2 | 2 | Four way | 2 | 4 | 4 |
| 3 | 4 | Four way | 4 | 16 | 16 |
| 4 | 8 | Four way | 8 | 32 | 40 |
| 5 | 1 | Two way | 2 | 4 | 4 |
| 6 | 2 | Two way | 4 | 8 | 10 |
| 7 | 4 | Two way | 8 | 24 | 28 |
| 8 | 8 | Two way | 16 | 48 | 64 |



*Figs. 1 and 2—Power loss and maximum voltage drop in secondary mains*

(One square is equivalent in length to two blocks)
No. 1—Two-way straight line feed. No. 2—Four-way network feed.
No. 3—Two-way network feed.

Values thus obtained, when plotted on logarithmic paper as voltage drop or power loss versus the number of squares served by a single transformer, will within a reasonable range of values give a straight line. (See Figs. 1 and 2.) These lines, when interpreted, give exponential relations between the quantities that are mentioned.

Since the quantities involved are considerably different where transformers are located at street intersections and feed in four directions than where they are located between street intersections and feed in only two directions, two different sets of relations must be derived. Curves 3 in Figs. 1 and 2 are for the case where transformers feed in two directions only and show that, for the range between one square and eight squares served by each transformer, the power loss per square and maximum voltage drop are approximately proportional to the four-thirds power of the number of squares served.

Curves 2 are for the case where each transformer is located at a street intersection, and in this case, for the same range as before stated, the voltage drop and power loss are proportional to the square of the number of

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**The first article of this series appeared in* Electrical World, *March 10, 1928; the second, March 24, 1928. The fourth and last article will be published in an early issue.*

squares served, or, in other words, to the square of the size of each transformer. The larger exponent in this case is due to the fact that where the transformer feeds in four directions there are a larger number of straight line feeds and a less number of branch feeds, thus making this case almost the same as the straight line feed relation before described. Curves 1 are for a straight line feed and are included merely for comparison.

Reducing these theoretical relations to practical form and allowing a 100 per cent factor of safety, as in the previous case, we have the following equations, the second two of which contain a new term—namely $L$, which represents the length of block between the street intersections in 100-ft. units. This term, of course, applies to blocks that have the same dimensions in each direction—that is, square blocks—but the formulas will generally apply, in the case of rectangular blocks, if $L$ is expressed in terms of the average length of block for both directions.

Four-way feed:

$$W = \frac{0.04575\, I_T^2}{1{,}000\, a} \tag{1}$$

$$V = \frac{0.0685\, I_T^2}{aD} \tag{2}$$

Two-way feed:

$$W = \frac{0.2905\, D^{2/3} L^{2/3} I_T^{4/3}}{1{,}000\, a} \tag{3}$$

$$V = \frac{0.391\, L^{2/3} I_T^{4/3}}{aD^{1/3}} \tag{4}$$

Due to the considerably lower voltage drop and power loss where transformers are located at street intersections and feed in four directions, it is of considerable advantage so to locate them when physical conditions will permit. This arrangement can usually be utilized in underground systems, particularly when separate transformer vaults under the street surface are used, these being located a few feet away from the street intersections, but connected to the four-way intersections of low-voltage mains by short lengths of heavy conductors. In overhead systems, however, due to congestion of lines, it is the usual practice not to install transformers on poles at street intersections, but rather to locate them on poles intermediate between the intersections. Therefore in general the four-thirds power relations given in the above equations are generally applicable to overhead systems, whereas the square relations (for four-way feeds) are generally applicable to underground systems.

In developing equations of economics of transformer spacing and copper size for cases where transformers feed individual small networks of copper the cost of primary must be taken into consideration, since, generally speaking, the amount of primary in the case of a distribution network varies with the number of transformers.

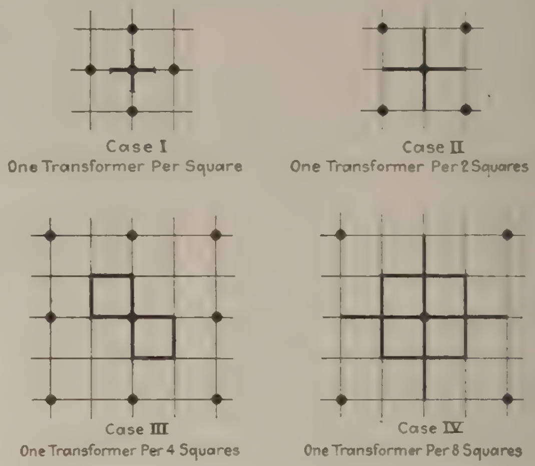
By plotting typical cases of transformer spacing it can easily be shown that the amount of primary laterals varies as the square root of the number of transformers or inversely as the square root of the size of the transformers.

If $C_3$ equals the annual fixed charges on the cost of primary per 100 ft. of circuit (including an allowance for additional pole height, additional hardware, insulators, etc.), then the annual cost of primary per 100 ft. of secondary in a radial system is given by the expression

$$0.707\, C_3 \sqrt{\frac{LD}{I_T}}$$

where $L$ is the average distance between street intersections in 100-ft. units.

This expression does not take into account the cost of losses in primary laterals, but the latter are usually proportionately small in systems where the load configuration is such as to require network feeds. And in practically any case no great error will be introduced by neglecting these losses. The derivation of equations for economics of copper size and transformer spacing in network feeds using the above expression for primaries is given later in this article.

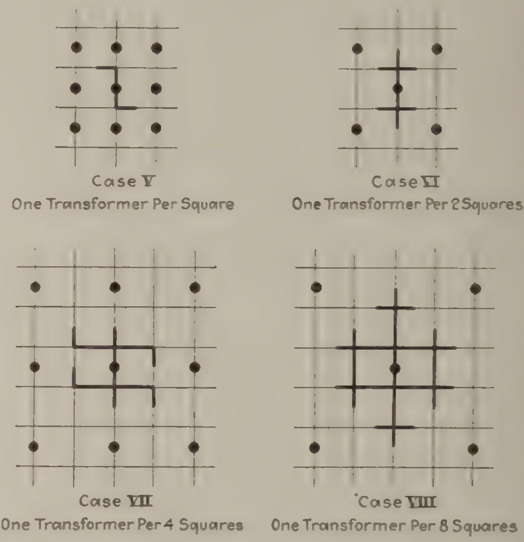

Case I
One Transformer Per Square

Case II
One Transformer Per 2 Squares

Case III
One Transformer Per 4 Squares

Case IV
One Transformer Per 8 Squares

*Fig. 3—Symmetrical arrangement of transformers placed at street intersections*


Case V
One Transformer Per Square

Case VI
One Transformer Per 2 Squares'

Case VII
One Transformer Per 4 Squares

Case VIII
One Transformer Per 8 Squares

*Fig. 4—Symmetrical arrangement of transformers placed between street intersections*

In a multiple feed network system with interlaced primaries the amount of primary lateral is dependent upon the number of feeders. However, the application of the equations derived by the use of the above expression to such a network system can easily be corrected by multiplying the estimated value of $C_3$ by $\left(1 + \frac{X - 1}{4}\right)$ where $X$ is the number of primary feeders serving a single network. The expression $\left(1 + \frac{X - 1}{4}\right)$ is empirical, but will give very nearly correct values where the interlacing of primaries is thoroughly carried out.

In a multiple feed network system with solidly interconnected secondary mains care should be taken to insure that the system characteristics selected are not such as to prevent burning off low-voltage short circuits. With thoroughly bonded cables of ordinary sizes installed in ducts sufficiently large to avoid undue crowding, it can be assumed that even a solid copper-to-copper short circuit will clear itself if sufficient current can flow to open the metallic circuit. Tests have indicated that the voltage drop along the conductor under short-circuit conditions should exceed 6 volts per 100 ft. to melt soldered joints, or 24 volts per 100 ft. to fuse the conductors. (See "Underground Alternating-Current Network Distribution for Central Station Systems," by A. H. Kehoe, *Journal A. I. E. E.*, June, 1924.) The proper value to insure the self-clearing feature of the network probably lies between these two limits. If the intermediate value of 15 volts per 100 ft. is selected, then the transformer spacing on simple straight line feeds is limited to something less than 770 ft. for systems with 115 volts nominal between line and neutral. The exact maximum allowable spacing would depend upon the relative amount of transformer and primary circuit impedance with respect to that of the low-voltage cables.

The equations for economical transformer spacing and secondary copper sizes will now be developed.

The cost of losses in the secondary conductors equals $WnfC$.

The fixed charges on cost of secondary copper equal $C_2n_1a$.

The fixed charges on the transformer installations and the cost of losses in the transformer equal $\frac{C_1D}{I_T}$

The fixed charges on the primary equal

$$0.707\,C_3\sqrt{\frac{LD}{I_T}}$$

The total annual cost of 100 ft. of secondary system equals

$$WnfC + C_2n_1a + \frac{C_1D}{I_T} + 0.707\,C_3\sqrt{\frac{LD}{I_T}} \qquad \textit{(Formula b)}$$

Only those costs which vary with the size of copper and transformer spacing are included in the above formula.

### Economics of Four-Way Network Feed

Substituting the value of $W$ from equation 1 in formula $b$ we have:

$$\text{Total cost} = \frac{0.04575\,I_T^2}{1{,}000\,a} + C_2n_1a + \frac{C_1D}{I_T} + 0.707\,C_3\sqrt{\frac{LD}{I_T}} \qquad \textit{(Formula c)}$$

*For Complete Economics.*—A size of secondary conductor must be found that reduces the sum of the cost of copper losses and fixed charges on copper to a minimum with a given value of $I_T$.

By equating the derivative of $\frac{0.04575\,I_T^2}{1{,}000\,a} + C_2n_1a$ with respect to $a$ to zero and solving for $a$ we get:

$$a = 0.00676\,I_T\sqrt{\frac{nfC}{n_1C_2}} \qquad (5)$$

Substituting the expression in formula $c$, we have:
Total cost =

$$0.01352\sqrt{nn_1fCC_2}\,I_T + \frac{C_1D}{I_T} + 0.707\,C_3\sqrt{\frac{LD}{I_T}}$$

Differentiating the total cost with respect to $I_T$ and equating to zero, we have an expression of the form:

$$A_2 = I_T^2 - B_2I_T^{1/2} \qquad (6)$$

where $$A_2 = \frac{74\,C_1D}{\sqrt{nn_1fCC_2}} \qquad (7)$$

and $$B_2 = \frac{26.15\,C_3\sqrt{LD}}{\sqrt{nn_1fCC_2}} \qquad (8)$$

Graphical solutions for equation 6 and subsequent working equations will be given in the fourth of this series of articles.

*If Voltage Drop Determines the Size of Conductors.*—If it is desired to design a system for the most economical characteristics that will give a certain voltage drop, we have, by substituting the value of $a$ from equation 2 $\left(a = \frac{0.0685\,I_T^2}{DV} \text{ equation 9}\right)$ in formula $c$ and differentiating:

$$\frac{d(\mathit{Total\ Cost})}{d(I_T)} = \frac{0.137\,C_2n_1I_T}{DV} - \frac{C_1D}{I_T^2} - \frac{0.3535\,L^{1/2}D^{1/2}C_3}{I_T^{3/2}}$$

Equating to zero, we get an expression of the form:

$$A_3 = I_T^3 - B_3I_T^{1/2} \qquad (10)$$

where $$A_3 = \frac{7.3\,C_1VD^2}{n_1C_2} \qquad (11)$$

and $$B_3 = \frac{2.58\,C_3VL^{1/2}D^{3/2}}{n_1C_2} \qquad (12)$$

*If Current-Carrying Capacity Limits the Size of Conductors.*—If the current in the secondary nearest to the transformer, $\frac{I_T}{4}$, derived from the above equations exceeds the current-carrying capacity of the conductor, the equations must be applied which are derived by first limiting the size of $a$ to the proper function of $I_T$ from a heating standpoint.

The value of $a$ when it is limited by temperature in underground conductors is given approximately by

$$a = \frac{I_T^2b}{160{,}000} \qquad (13)$$

Substituting the value of $a$ from equation 13 in formula $c$ and differentiating, we have:

$$\frac{d(\mathit{Total\ Cost})}{d(I_T)} = \frac{C_2n_1bI_T}{80{,}000} - \frac{C_1D}{I_T^2} - \frac{0.3535\,L^{1/2}D^{1/2}C_3}{I_T^{3/2}}$$

Equating to zero, we get an expression of the form

$$A_4 = I_T^3 - B_4I_T^{1/2} \qquad (14)$$

where $$A_4 = \frac{80{,}000\,C_1D}{C_2n_1b} \qquad (15)$$

and $$B_4 = \frac{28{,}280\,C_3\sqrt{LD}}{n_1bC_2} \qquad (16)$$

### Economics of Two-Way Network Feed

Substituting the value of $W$ from equation 3 in formula $b$, we have for the total cost:

$$\frac{0.2905\,nfCD^{2/3}L^{2/3}I_T^{4/3}}{1{,}000\,a} + C_2n_1a + \frac{C_1D}{I_T} + 0.707\,C^3\sqrt{\frac{LD}{I_T}} \qquad \textit{(Formula d)}$$

*For Complete Economics.*—The size of secondary conductors $a$ must be found that will reduce the sum of the cost of copper losses and fixed charges on copper to a minimum with a given value of $I_T$.

By equating the derivative of $\frac{0.2905\, nfCD^{2/3}L^{2/3}I_T^{4/3}}{1{,}000a}$ $+ C_2n_1a$ with respect to $a$ to zero and solving for $a$ we get:

$$a = 0.01703 \sqrt{\frac{nfC}{n_1C_2}}\, D^{1/3}L^{1/3}I_T^{2/3} \qquad (17)$$

Substituting this expression in formula $d$, we have

$$\text{Total cost} = 0.0341\sqrt{nn_1fCC_2}\, D^{1/3}L^{1/3}I_T^{2/3} + \frac{C_1D}{I_T} + 0.707\, C_3\sqrt{\frac{LD}{I_T}}$$

Differentiating the total cost with respect to $I_T$ and equating to zero, we have an expression of the form:

$$A_5 = I_T^{5/3} - B_5I_T^{1/2} \qquad (18)$$

where $$A_5 = \frac{44\, C_1}{\sqrt{nn_1fCC_2}}\left(\frac{D^{2/3}}{L^{1/3}}\right) \qquad (19)$$

and $$B_5 = \frac{15.58\, C_3L^{1/6}D^{1/6}}{\sqrt{nn_1fCC_2}} \qquad (20)$$

*If Voltage Drop Determines the Size of Conductors.*—If it is desired to find the most economical characteristics that will give a certain voltage drop, we have, by substituting the value of $a$ $\left(a = \frac{0.391\, L^{2/3}I_T^{4/3}}{VD^{1/3}} \text{ equation 21}\right)$ from equation 4 in formula $d$ and differentiating:

$$\frac{d(\mathit{Total\ Cost})}{d(I_T)} = \frac{0.521\, C_2n_1L^{2/3}I_T^{1/3}}{VD^{1/3}} - \frac{C_1D}{I_T^2} - \frac{0.3535\, L^{1/2}D^{1/2}C_3}{I_T^{3/2}}$$

Equating to zero, we get an expression of the form:

$$A_6 = I_T^{7/3} - B_6I_T^{1/2} \qquad (22)$$

where $$A_6 = \frac{1.92\, VC_1D^{4/3}}{n_1C_2L^{2/3}} \qquad (23)$$

and $$B_6 = \frac{0.678\, C_3VD^{5/6}}{n_1C_2L^{1/6}} \qquad (24)$$

*If Current-Carrying Capacity Limits the Size of Conductors.*—If the current in the secondary nearest to the transformer exceeds the current-carrying capacity of the conductors, then equations must be applied that are derived by first limiting the size of $a$ to the proper function of $I_T$, from a heating standpoint.

The value of $a$ when it is limited by temperature in overhead conductors is given by:

$$a = \frac{I_T^{4/3}b}{1{,}170} \qquad (25)$$

Substituting the value of $a$ from equation 25 in formula $d$ and differentiating, we have:

$$\frac{d(\mathit{Total\ Cost})}{d(I_T)} = \frac{4\, n_1bC_2I_T^{1/3}}{3 \times 1{,}170} - \frac{C_1D}{I_T^2} - \frac{0.3535\, L^{1/2}D^{1/2}C_3}{I_T^{3/2}}$$

Equating to zero, we get an expression of the form:

$$A_7 = I_T^{7/3} - B_7I_T^{1/2} \qquad (26)$$

where $$A_7 = \frac{877.5\, C_1D}{C_2n_1b} \qquad (27)$$

and $$B_7 = \frac{310\, C_3}{C_2n_1b}\sqrt{LD} \qquad (28)$$

# Broken Insulators Withstand Normal Voltage

By R. Rader
*Office Engineer Puget Sound Power & Light Company,* Seattle, Wash.*

To test the ability of modern pin-type insulators for operating voltages of 50-70 kv. to withstand normal voltage after the shells have been broken off, a condition which may obtain under operating conditions due to rocks being thrown at insulators or the petticoats being shot off, the Puget Sound Power & Light Company tested a few standard types for wet and dry flashover under this extreme condition. New insulators of five makes were selected and the shells broken off with hammer blows. Each type was treated as nearly equally as possible, as shown by the accompanying illustration. One of the specimens was exceptionally brittle.

*Pin-type insulators stripped of shells and subjected to flashover tests to simulate line conditions which may obtain*

After stripping, the remains were subjected to dry and wet flashover tests in accordance with A.I.E.E. standards. The wet tests were conducted after the dry tests had been completed and after the insulators had been sprayed with water for five minutes while in an upright position. The initial voltage for the dry tests was 30,000 volts, which was raised in increments of 1,000 volts per second until flashover occurred. The wet tests began at 15,000 volts, the voltage being increased at the same rate as in the dry tests. Results are given in the following table:

| Insulator (Reading from Left to Right in the Illustration) | Dry Flashover Voltage | Wet Flashover Voltage |
|---|---|---|
| No. 1 | 73,500 | 39,000 |
| No. 2 | 72,000 | 32,000 |
| No. 3 | 72,000 | 31,000 |
| No. 4 | 73,000 | 35,000 |
| No. 5 | 73,000 | 32,000 |

The dry flashovers show a remarkable uniformity, as opposed to the wet flashover values. It seems that the insulator design has much to do with the flashover values even with the shells removed. The company's standard specifications now contain the clause: "The general design of insulators shall be such that when all the outer rims are stripped off by breakage the insulators will not have a wet flashover value less than maximum operating voltage of the classification specified."

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**Stone & Webster, general managers.*

# Useful Nomogram for Photometric Work

By Hempstead S. Bull
*Instructor in Electrical Engineering*
*University of Michigan*

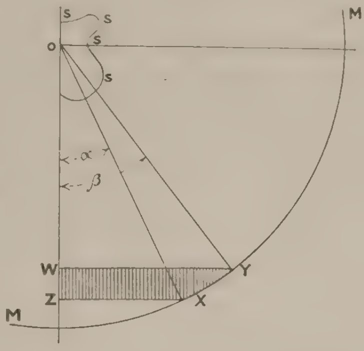
The accompanying chart provides a means of obtaining the zonal lumens output of a luminaire when its polar candle power distribution curve is available. This method possesses, in addition to the inherent advantages of all nomographic charts, a feature in common with the Rousseau diagram which facilitates accurate work, in that zones of varying central-angular width may be selected to conform to the irregularities of the candle power curve.

In the figure is shown half of a typical candlepower distribution curve *S*. Let *M M* be a portion of the surface of a sphere inclosing the light source and with its center at the center of the light, *O*.

*OX* and *OY* are the traces of two coaxial cones making angles *a* and *b* respectively with the axis. It is known that the solid angle at *O* subtended by the zone *XYWZ* on the surface of the sphere is equal to 2 (cos α—cos β).

To obtain the lumens output in this zone it is necessary to multiply the solid-angular content of the zone in steradians by the average candlepower for the zone as obtained directly from the candlepower distribution curve. This process can be carried out graphically on the accompanying nomogram.

Scales *A*, *B* and *C* form a subtraction chart by which the quantity (cos α—cos β) can be determined for any values of α and β. The value of this quantity can then be transformed to steradians by multiplying by 2, which process is performed by projecting from *P* through the value on scale *C* to scale *D*. Scales *E*, *F*, and *G* form a multiplication chart by which the product of steradians times average candlepower can be carried through to obtain zonal lumens. It is merely necessary to set the value of steradians on scale *E* as soon as it is obtained on scale *D*, and the candlepower value on *F*, and read lumens output on *G*.



*Typical candlepower distribution*

For example, let the values of α and β be 15 deg. and 30 deg. respectively. Line 1 drawn through these points on scales *A* and *B* cuts *C* at 0.10 and line 2 drawn from *P* through 0.10 on *C* cuts *D* at 0.63. Line 3 drawn from the value 0.63 on scale *E* to the value of the average candlepower for this zone, which was here assumed to be 90, cuts scale *G* at 56.5, which is the value of lumens emitted in this zone.

The original of the accompanying chart covers most of a 12 x 19 sheet. For the information of any one wishing to reproduce this chart to the original scale the dimensions of the various scales used are given below.

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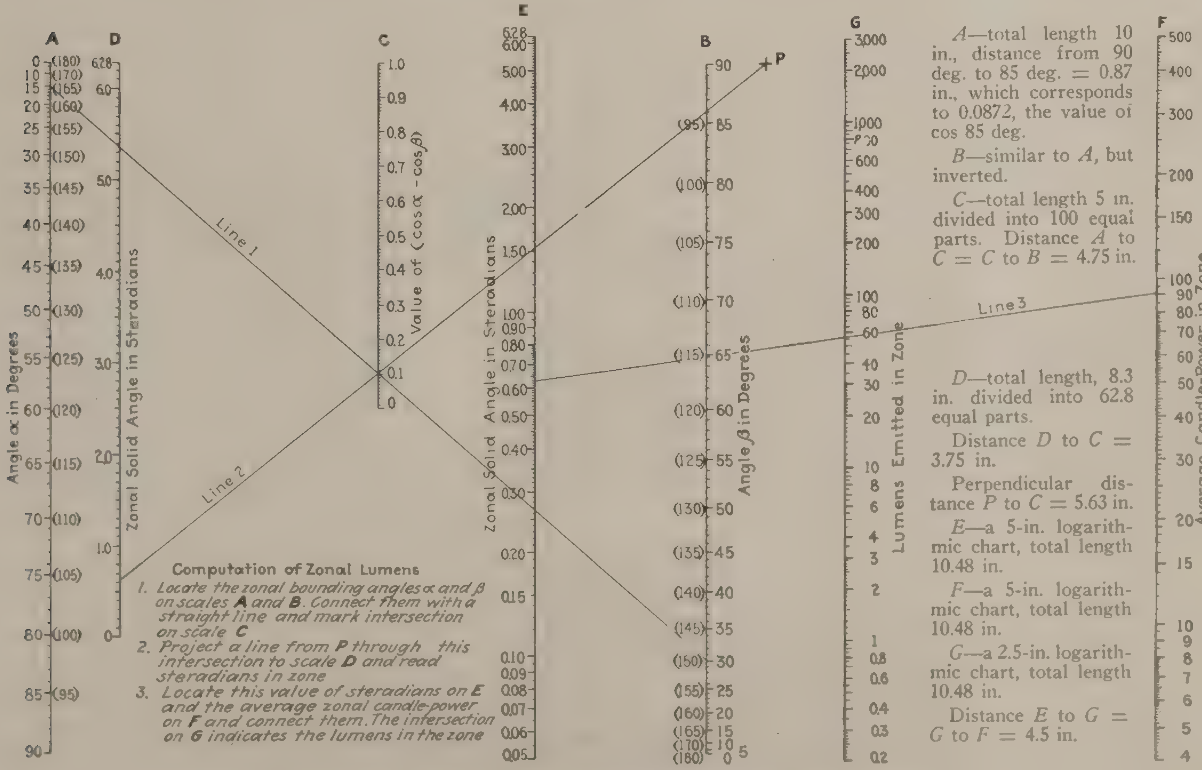
Two references on nomograms or alignment charts:
"Graphical and Mechanical Computation," Joseph Lipka; Wiley & Sons.
"Alignment Charts for Engineers and Students," Kearton and Wood; Griffin, London.



**Computation of Zonal Lumens**

1. *Locate the zonal bounding angles α and β on scales* ***A*** *and* ***B****. Connect them with a straight line and mark intersection on scale* ***C***
2. *Project a line from* ***P*** *through this intersection to scale* ***D*** *and read steradians in zone*
3. *Locate this value of steradians on* ***E*** *and the average zonal candle-power on* ***F*** *and connect them. The intersection on* ***G*** *indicates the lumens in the zone*

*A*—total length 10 in., distance from 90 deg. to 85 deg. = 0.87 in., which corresponds to 0.0872, the value of cos 85 deg.

*B*—similar to *A*, but inverted.

*C*—total length 5 in. divided into 100 equal parts. Distance *A* to *C* = *C* to *B* = 4.75 in.

*D*—total length, 8.3 in. divided into 62.8 equal parts.

Distance *D* to *C* = 3.75 in.

Perpendicular distance *P* to *C* = 5.63 in.

*E*—a 5-in. logarithmic chart, total length 10.48 in.

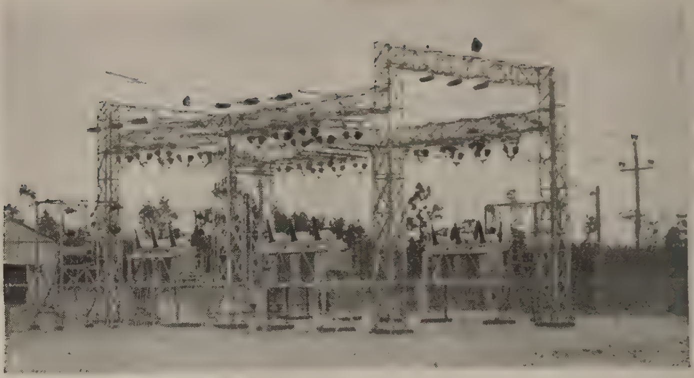
*F*—a 5-in. logarithmic chart, total length 10.48 in.

*G*—a 2.5-in. logarithmic chart, total length 10.48 in.

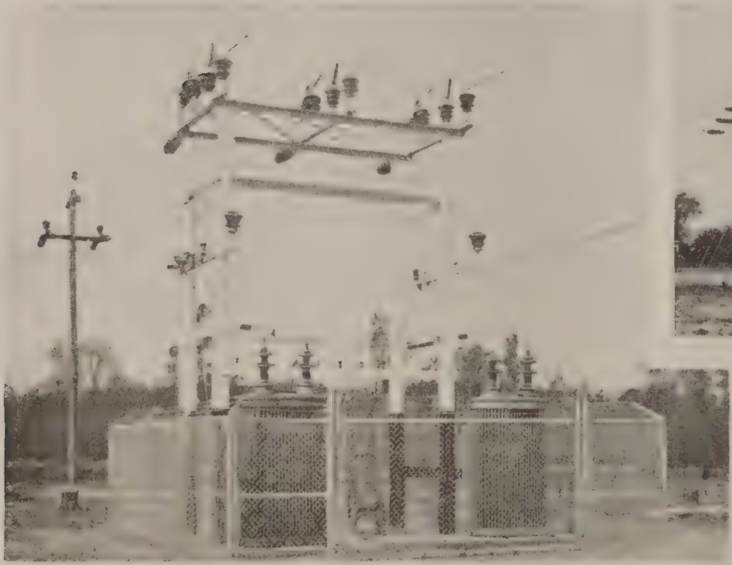
Distance *E* to *G* = *G* to *F* = 4.5 in.

*Nomogram permits rapid calculation of zonal lumens when distribution and candlepower are known*

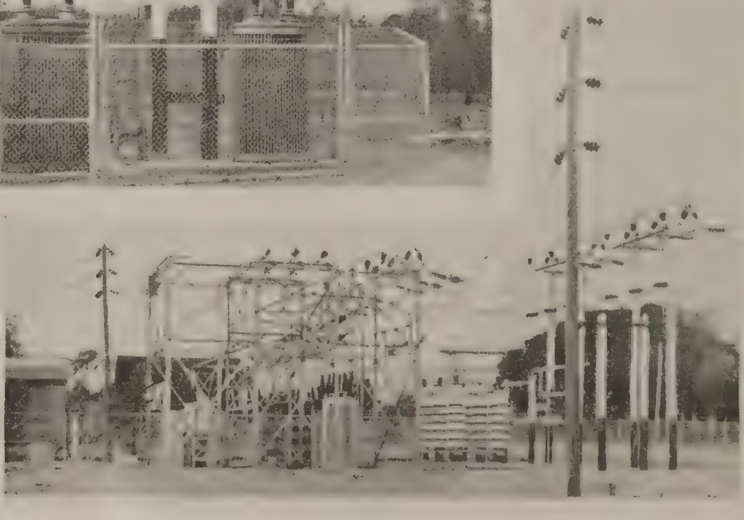
# *Construction Practices on Florida-Georgia Lines*

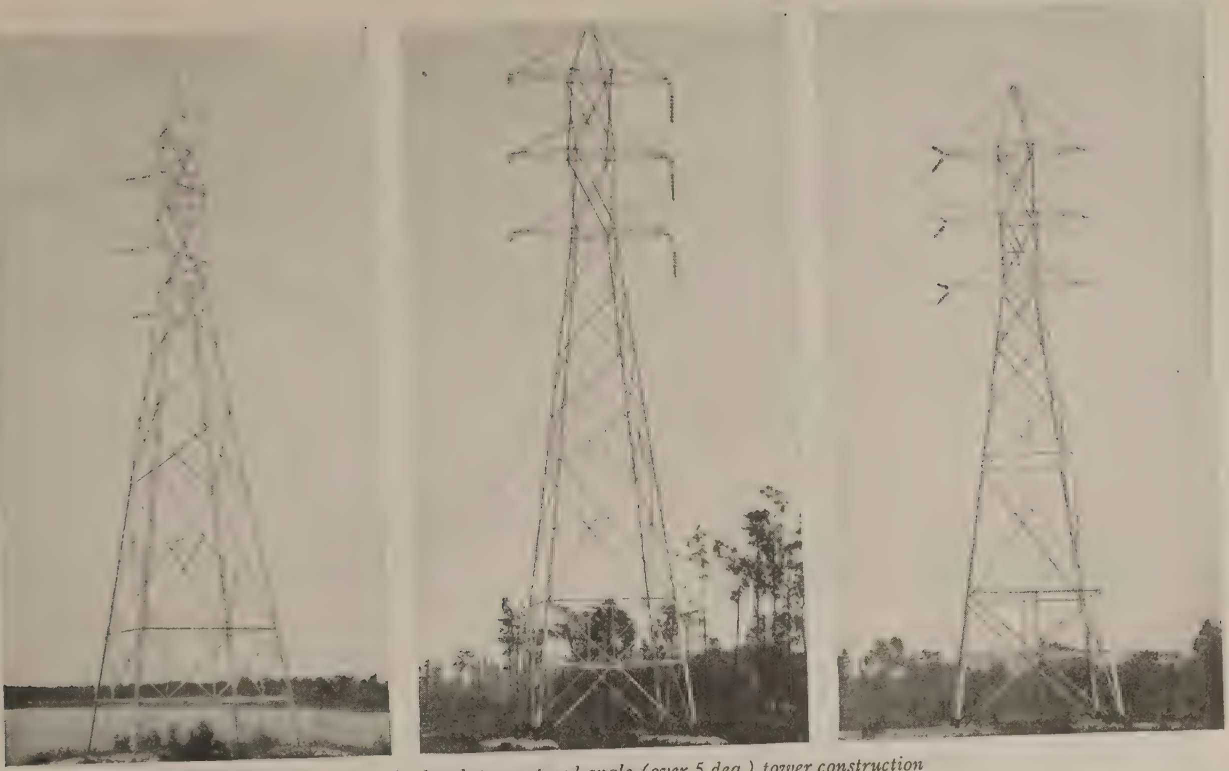

*Standard 66-kv. steel switching structure at Croom, Fla.*

THE methods of erecting the new Southern lines of the National Public Service System were described by M. J. Idail and C. E. Bland in the March 17 issue of ELECTRICAL WORLD. The structures used for substations, 110-kv. transmission towers and 66-kv. pole lines vary with local conditions and representative types are shown in the accompanying illustrations. In order to keep the standard of service in step with the increased load, certain existing lines were reinforced and revamped. The interconnection of relatively small isolated properties and the new 25,000-kw. base-load power station at Inglis was accomplished in this construction program. After the completion of this work there were more than 730 miles of 66-kv. line and 178 miles of 110-kv. trunk line.

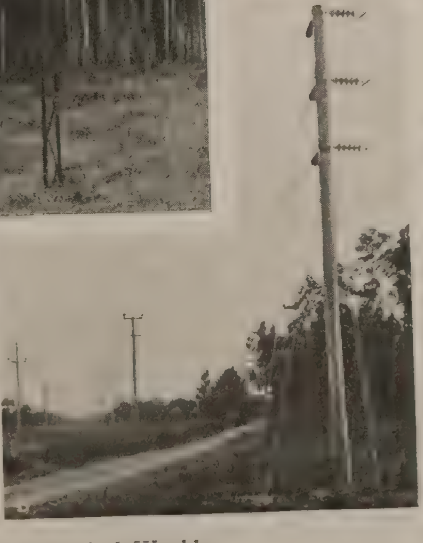

*Standard 66-kv. wood-pole substation at Inverness, Fla.*

*66-kv. switching station at Wildwood, Fla.*


*Combination wood and steel station under construction at Leesburg, Fla.*



*110-kv. dead-end, tangent and angle (over 5 deg.) tower construction*



*A — 44-kv. steel pole line rebuilt for 66-kv.*

*B—Standard line sectionalizing switch*

*C — Typical 66-kv. long-span construction*

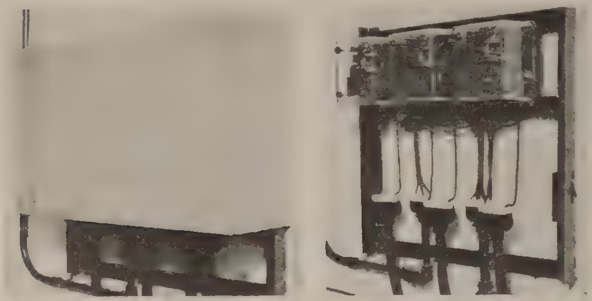
*D—66-kv. wood-pole line*

*E — 66-kv. road crossing showing dead-end construction*

## Transformer Vault Relay Protection

IN MANY of the transformer vaults of the distribution network of the Dallas Power & Light Company which may possibly be flooded the relays controlling the automatic operation of the network switches are provided with open bottom covers that are, in effect, diving bells. If a vault becomes filled with water the cover will entrap enough air to prevent the water from reaching the relays.

It is not always wholly satisfactory to inclose the relays in air- and water-tight cases because of the effect of temperature rise due to lack of ventilation. Ventilation is provided by the open bottom cover and it is just as effective in keeping the relays out of the water as a closed case would be.



*Underground network relays protected from water by welded steel case*

The accompanying illustrations show the manner in which the cover is used and a close inspection of the pictures will reveal the gravity latches which hold the cover in place as the water rises in and around it.

## Utility Training Course for College Graduates

TWO training courses for college graduates have been established by the Puget Sound Power & Light Company with the object of selecting a limited number of graduates from recognized universities from which to develop suitable material to fill permanent positions in the organization from time to time. One is an engineering apprentice course and the other is a course in business administration. The company will make selections for both courses from students who expect to graduate in June and who file applications prior to specified dates early in the calendar year.

The engineering course will cover a period of three years with allotment of time according to the following schedule:

| | Months |
|---|---|
| 1. Testing and inspection—service division | 6 |
| 2. Engineering plans | 8 |
| 3. Construction and installation | 8 |
| 4. Operation and maintenance | 6 |
| 5. Sales, accounting and statistical | 6 |
| 6. Elective | 2 |
| Total | 36 |

Applicants selected will be started at $100 per month and their salary will be adjusted at the end of each six months on a merit rating basis. Men will be rated from 70 to 130 per cent of a normal average. A rating of 80 per cent will be necessary for the man to continue in the company's employ at the same salary, 100 per cent will entitle him to an increase of $5 per month and a rating of 120 per cent or over will entitle him to an increase of $10 per month.

The business administration course will cover a two-year period with time divided as follows:

| | Months |
|---|---|
| 1. Purchasing and stores | 4 |
| 2. Sales | 2 |
| 3. Customers' billing | 3 |
| 4. Credit and collections | 2 |
| 5. Accounting | 6 |
| 6. Insurance department | 1 |
| 7. Corporate subjects | 5 |
| 8. Personnel department | 1 |
| Total | 24 |

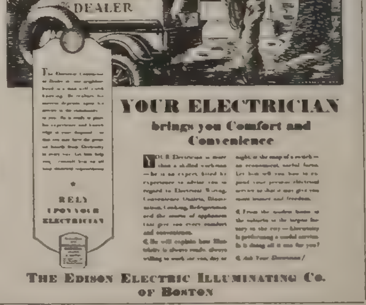
Students in the business administration course will be started at a salary of $90 per month, which will be subject to adjustment as merited during the period of training. At the end of the period of each course the company is under no obligation to give permanent employment, but will give first consideration to those who have made satisfactory records in the courses. If desired, the company will give a student a certificate on its letterhead setting forth the time spent in each subdivision of the course and a statement of the ability, personality and qualifications of the individual.

The proposed courses have been prepared after very careful consideration of similar courses given by other utilities.

## Urges Public Acquaintance with Neighborhood Contractor

ON THIS advertisement run by the Edison Electric Illuminating Company of Boston it says:

> The electrical contractor or dealer in your neighborhood is a man well worth knowing. He realizes his success depends upon his service to the community—to you. He is ready to place his experience and knowledge at your disposal, so that you may have the greatest benefit from electricity in every way. Let him help you; consult him on all your electrical requirements.
>
> Your electrician is more than a skilled workman; he is an expert, fitted by experience to advise you in regard to electrical wiring, convenience outlets, illumination, cooking, refrigeration and the scores of appliances that give you every comfort and convenience. He will explain how electricity is always ready, always willing to work for you, day or night, at the snap of a switch—an economical, useful force. Let him tell you how to expand your present electrical service so that it may give you more leisure and freedom. From the modest home in the suburbs to the largest factory in the city, electricity is performing a useful service. Is it doing all it can for you? Ask your electrician.



# The Purchasing Agent Speaks

A frank discussion of some of the causes of price cutting in this buyers' market. A bit of background and a few suggestions from the head of the purchasing agents' association

By Lewis A. Jones

*Vice-President New York Power & Light Corporation and President of the National Association of Purchasing Agents*

*The subject of price cutting is under very general discussion. For the purpose of crystallizing some of the principles and practices involved, two articles by Earl Whitehorne have been published in recent issues of the* Electrical World, *one entitled "Who Pays the Cost of Price Cutting?" the other "Some Experiences in Price Cutting." Many interesting letters of comment and criticism have been received from both buyers and sellers and will form the basis of further recommendations upon this theme. Meanwhile, this message from the head of the national organization of the purchasing agents is pertinent and interesting as a frank opinion.*

I HAVE read your recent article entitled "Who Pays the Cost of Price Cutting?" It is most interesting. I have a lot of things which I would like to say, but which are difficult to put on paper.

I have no grievance against the sales organizations of the country, but I have many thoughts based upon some sad experiences which I have discussed much and often with venders. Unless carefully expressed, they would carry, perhaps, an impression of a controversial attitude, which I want to avoid. This feeling is based simply upon the fact that I think the day must come when the purchasing agents of the country and the sales organizations will get together and study some of their mutual problems, in a definitely constructive frame of mind. This is as it should be, and this year, as president of the National Association of Purchasing Agents, I have had a definite plan to call together some of the leading industrial executives to discuss this very topic. So much for the preliminaries.

I believe this article to be thoroughly constructive in its intended purpose. Of course, with a just amount of pride in my work, it hurts to have implications made against purchasing agents. I know all too well, however, that there are men in our work who do represent the attitude which you emphasize. These, however, I do earnestly believe are becoming each year fewer in number. Through our national association a vast amount of good is being done to recognize the ethics and economics of the problem.

### A Bit of Background

There are about 8,000 concerns in the country, I believe, whose annual purchases amount to a million dollars or over and who may properly be supposed, therefore, to maintain central purchasing departments. There are nearly 5,000 men holding membership in our national association. About 60 per cent of every transaction is represented by purchase function, 20 per cent sales and 20 per cent executive. In the old days of barter, selling was recognized as the primary function, and in its activity was considered ahead of production and of purchasing. Of necessity, as the industrial picture expanded, sales took precedence over other activities in the minds of the public because of the prominence of advertising. Salesmen also were among the first to organize.

The executives did most of the buying, and later, as industry developed, men or clerks were given the title of "purchasing agent." But they were too often designed by the executive not from the standpoint of efficiency but to give some man a job, or identify a certain part of his business, while he himself still really carried on the activities. There are still examples of this practice, too. The natural result was that sales organizations rebelled at being asked to deal with men having no authority, and in a very natural way were forced, in order to meet the requirements of their own companies, to go over the head of the so-called purchasing agent. Still being handicapped, they began to go into the shops and the factories, to see the foremen, and in every possible way to seek direct contact. In this respect purchasing agents themselves were to blame largely, because instead of working with these men they attempted to establish a position, a dignity and a name which they had not earned, and which the executives had not given them. Instead of working frankly and openly with the salesmen they antagonized them. This practice is still in vogue in many similar fields and is a "thorn in the flesh" of those men in the purchasing work who have a larger vision.

Because of all this, sales organizations have been and are in a great degree very antagonistic to the purchasing work. I well recall at one of our national conventions, when a certain sales organization was asked to provide a speaker on our program, it sent an advertising man to come before us, and he spent the entire time allotted to him in telling us of our faults, condemning our attitudes and emphasizing the high qualifications of salesmanship as against the evil practices of purchasing. Where we had looked for a constructive piece of work and a chance to co-ordinate our activities, we were driven farther apart.

Sales managers today send men out on the road who are very poorly prepared. In my office, for instance, we interview many hundreds of men in the course of a month, and they are a most exceptional lot, I believe, in character and capabilities. And I find that in almost every instance where they are not prepared to give me the information and service which I have a right to expect when I grant an interview, it is almost entirely the fault of the sales manager or the executives back in the home office. My sympathy is completely with the man on the road, who, if his concern functions properly, should be to me the main point of contact and should represent his concern in all that is best of constructive thought, effort and service.

### Need for Authority

When you ask "Who is at fault?" each side will answer that the other man holds the crown. But as I have spent a great many hours in thinking about and discussing this problem, as I have met hundreds of purchasing men at our public utility meetings, at our national conventions, in their private offices, in community work, etc., I have in the last eleven years found a marvelous improvement in the caliber of purchasing men, and great anxiety for the improvement of the ethics of our work. We have a high type of men in every way. From among their number there are being selected today some of the highest executives of industry. For instance, A. L. Salt, for years purchasing agent of the Western Electric, is now the president of the Graybar Electric Company. There are many others. I do not in any way evade or overlook the methods of small-caliber purchasing men, but you will find an equal number or more in the ranks of salesmen.

Who is most at fault, the buyer or the seller? I think it is at least a 50-50 break and needs only a Moses in industry to eradicate 90 per cent of the misunderstandings which exist today. This Moses, however, will have to improve the ethics of selling as definitely as he improves the ethics of buying, and I firmly believe that this can be done through a co-ordinated effort on the part of the executives, working with and through purchasing departments as definitely as they work with their sales organizations.

The trouble is that so many executives give the men the title of "purchasing agent" and then withhold the authority. And I can speak quite frankly here, because in my own work I think I have about the finest situation in this respect that any man could ever hope for.

### A Few Examples

Every transaction between a purchaser and a vender should be on a basis of mutual profit, benefit and satisfaction. Otherwise, sooner or later one or the other will be a loser. The best purchase work can be done on a basis of complete confidence. Three things must be considered: First, the quality of the article to be obtained to best fit the need. Second, the consideration generally covered by the misused word "service," which the vender will give to the purchaser's need. Third, price.

As an example, I am at the present time buying a certain commodity running into many thousands of dollars. Every possible consideration is given to me from the standpoint of providing the proper quality and the vender has gone to extremes in trying to meet our needs. The consideration given to our requirements by way of shipment, etc., is without criticism. But the price, he frankly states, is way below his costs, and we are quite sure that this is true. Still, we buy, though in the usual meaning it is an unethical situation. However, it happens to be a very special case, because this concern is shipping its product to myself and others at a loss, and in doing so is following an established policy. But he is fighting for the establishment of a certain principle of business conduct, and if he wins we will win in the long run. And while at the moment it is an unethical transaction as most men will view it and we are reaping the benefit of what he claims to be too low a price, there will come a time when we will be asked to, and should, work with him to help equalize the situation. As a purchasing agent I believe I owe that man a definite responsibility, if I accept the situation which he offers now, to go through with him to the end.

You emphasize the fact that we are now in a buyers' market and have compared activities of purchasing agents now to comparable activities of salesmen when there is a sales market. But even in a buyers' market such as we now have a large part of the trouble, I firmly believe, is caused by the producing agencies themselves, a weakness which you have designated as "lack of price courage." For instance, a few months ago I had a special piece of apparatus to buy. It had to be made up. I asked for bids, and then one day the executive of one of the companies came in to see me. Recognizing the extreme pressure and competition which was on, I told this man that before I asked for my file of prices, which I had not checked through, I wanted to know whether or not he had given me what he considered an equitable price and the best which he had to offer, because I did not propose to "horse trade" with him. I wanted each man whom I had asked to bid to be given an equal opportunity at the business, and the fact that this man sat at my desk would have no bearing whatever on the final decision. He thereupon informed me that he had not quoted the best price, that he could reduce the quotation $300 and still make a profit for himself. Being thus assured, I was given the papers from my file, checked them and found that he was the only man who could furnish the material and the only one who had quoted.

I felt that, having his assurance that his revised price was legitimate and carried a profit, I was not unethical in accepting it. And he never knew that he had bid himself out of $300. This is a concrete example of what you term "lack of price courage."

In the small matter of printing, a few months ago I asked for bids of exact specifications, quoting the weight, watermark, size of paper, style of type and quantity. The seven bids ranged in price from $14.50 to $107 for this lot. I had been accused by this crowd of being a "price hound," and on that basis would have paid $14.50 and gloated at the other fellow's discomfiture when he found out his loss. The high man, I knew, was unreasonable, and so I paid $67, and was assured that the man who furnished the goods was satisfied with the transaction and made a profit.

Still another case: A vender quoted me a certain price. It was one of the strongest buyers' markets that I have ever known, but I quickly realized that he was using me to get the last cent possible without being frank about the situation. In fact, he used many clubs and sticks, took much unfair advantage of our situation, pulled all the wires possible to make me pay a high price on a low steel market and finally, absolutely by his own activities, drove himself to the point where he sold me the equipment for $10,000 less than he originally bid.

In a contract which I am at present negotiating on a large scale for service in our entire territory a nationally known vender with whom I have had many years of well-established contact and from whom I have received very special consideration has in this instance, I now learn, adopted a definite policy of trying subterfuge. The contract submitted carried two or three "jokers," which he acknowledged as having been intentional on his part. He has thus chosen to jeopardize a confidence which we had built up with each other over a period of probably twenty years. What should a purchasing agent do in a case of that kind? There is only one answer.

Still another case: A concern with which, for very special reasons, I desired to place a particular piece of business deliberately added a 3 per cent unnecessary profit. Its representatives talked much and did little, but when—without mentioning the amount which it had added, but with which I was perfectly familiar—I said that we would not pay them the price which they had quoted, they immediately said, "We will take off the 3 per cent."

### What to Do

These are some of the faults perpetuated by venders. Again, however, the purchasing agents are to blame, as I see it, through failure to take advantage of their own opportunities. As an example: For some three years one of my assistants has been experimenting with a certain particular system of order writing. As the work has grown, it was necessary either to find ways and means to reduce the cost of writing orders or put on extra people. He developed a very simple and very economical method, and a few days ago the representative of the manufacturing company told us of this young man's activities and that the results which he had obtained by working so closely with it had opened up for his concern an entirely new field of endeavor. It was a work with purchasing departments which the company had never suspected could exist, and it is going out now to cash in on that. This is simply and solely the result of the work in this purchasing department by a young man who had enough interest to study his job. This vender in showing his appreciation of this kind of co-operation stated that usually the purchasing agent he or his people called on refused to work with them, sent them to many other departments and so lost the value which might have accrued to them and the credit which would come in a constructive piece of work of this kind.

Well, what should be done to help the general situation? I think I have answered this question in the beginning. But to emphasize a bit:

(a) Executives should not give a purchasing agent a title without the responsibility.

(b) The man so selected should exemplify all that is best in business ethics in his association with the sales departments of other companies.

(c) Sales managers should insist that before they contact with a company their salesmen become intimately acquainted with the routine therein. This will eliminate much misunderstanding.

(d) Manufacturers and organizations of purchasing men should co-operate to meet this problem on a constructive basis with a real determination to eliminate the present misunderstanding. It can be done! And I hope to start the work through the auspices of the National Association of Purchasing Agents.

## High-Pressure Pipe Line Fabricated by Electric Welding

A 45-MILE, high-pressure oil pipe line fabricated entirely by electric welding and running from Lamkin to Hodge, La., has recently been completed. The welding was performed under the direction of B. K. Smith of the Big Three Welding & Equipment Company, Houston, Tex.

Oxyacetylene welding was originally applied to such service with excellent results, but estimates indicated that electrically welded joints could be produced at a lower cost. The lowest bid for welding this line by the oxyacetylene method was $2.75 per joint and the bid submitted for electric arc welding was $1.25 per joint. The latter price was considered fair by the Big Three Welding & Equipment Company and in practice proved satisfactory.

The country over which the line runs is rugged and broken. There are hills, deep ravines, woodlands and swamps. There is a river to cross. Despite these physical obstacles the line was laid without difficulty. A total of five gas-engine-driven "Stable-Arc" welders, manufactured by the Lincoln Electric Company, Cleveland, Ohio, were used. In doing the work in the field the welders, of course, operated as a team; that is, four men simultaneously welded four consecutive joints and moved on. The lengths thus formed were joined together by a bell hole operator.

*Portable welding equipment used in pipe line construction and electrically welded pipe line before laying in trench*

The line was built in 5-mile stages, each stage being finished and tested under hydrostatic or gas pressure before further pipe was laid. The joints were all made in two layers, and with this construction, which was developed by Mr. Smith of the welding company, only fourteen pinholes occurred in 11,000 joints.

Shortly after the completion of construction and before the trench was filled a northwesterly storm swept Louisiana and the temperature dropped to six above zero. It had always been the belief of pipe line men that line built during warm weather would break if left exposed to bitter cold of a winter blizzard. In the past, with mechanically fabricated lines, the belief may have been justified, but the new arc-welded line showed no sign of rupture upon exposure to the lowest temperature that Louisiana has known in 30 years.

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# Benefits of Standard Specifications

Desirability of enlarging N.E.L.A. guides into complete purchase specifications is pointed out. A broader engineering outlook is needed

By James D. Winans
*Public Service Production Company*

SPECIFICATION standardization is one phase of the general subject of standardization which has been receiving a good deal of consideration from the industry and is discussed at every committee meeting in one form or another. Some of the greatest minds of the industry have been concentrated in the last twelvemonth on the selection of suitable voltage ratings. Many of the things that have been said as regards voltage standardization might well have been applied to specification standardization. The formulation of complete purchasing specifications for electrical apparatus and equipment may be classed as the pièce de résistance of standardization.

If one is permitted to put words into the mouths of F. C. Hanker and H. R. Summerhayes, and to imagine what they might have said at the 1927 winter convention of the A.I.E.E., one has only to substitute specification standardization for voltage standardization to obtain the following: "The lack of a logical and co-ordinated standardization of electrical apparatus extending from the initial supply to the utilization devices has resulted in an unnecessary expense to the industry. Specification standardization up to this time has been largely a matter of individual efforts on segregated types of apparatus. There has been a considerable tendency for the users of apparatus to buy equipment of special nature to suit their own particular conditions. Since these conditions would naturally vary somewhat from operator to operator, the special apparatus ordered by them does not constitute a new but unofficial line of standards but a truly special line of apparatus for each operating company.

"Considerable attention has been given to this tendency to deviate from the established standards recognized by the A.I.E.E., N.E.L.A. and N.E.M.A., since although the use of special apparatus might be advantageous from the point of view of the individual operator, it nevertheless places a burden on the industry as a whole, including those purchasers who believe they are being supplied with special apparatus at standard price. Users of standard apparatus help to bear this as well as the users of special apparatus, since the development costs and extra supervision and manufacturing costs caused by the production of specials tend to raise the cost of standard apparatus. The special tools often required for the production of specials also raise the investment in manufacturing plant, and this extra cost is usually borne by the standard as well as the special product. Furthermore, special apparatus entails longer deliveries, both on the initial apparatus and on renewal and repair parts."

R. E. Argersinger in speaking on voltage standardization at the 1927 winter convention of the A.I.E.E. also might well have used the words specification standardization instead of voltage standardization and thus would have said: "Specification standardization is of value to the consumer principally in two ways: First, that equipment may be used under a variety of operating conditions, and, second, that it may be obtained more quickly and at less cost. If the first result can be secured the electrical manufacturer's production problems should be so simplified that the second would follow readily. It should be remembered that in discussing the possibility of securing apparatus at lower prices by standardization comparisons should be based on the cost of equipment actually purchased at present rather than on the cost of the present standard equipment, since it appears that less that half the major equipment purchased is standard.

### Present Standards Not Followed

"The present standards have not been closely followed because, first, the operating companies in general have given too little consideration to simplifying their requirements, and, second, in designing for standardization the manufacturers have placed too much emphasis on cost reduction and have paid too little attention to flexibility of use."

The manufacturers' viewpoint on specification standardization was presented before the electrical apparatus committee of the National Electric Light Association at Pittsburgh on May 3, 1927, by T. J. Pace of the Westinghouse Electric & Manufacturing Company when he said: "If the utility engineers realized what these special orders mean to the manufacturer and the purchaser alike, in the way of cost and delay, compared to an order for something that had been built before and which often would serve the purpose about as well, they surely would be glad to lend their help. It doesn't solve the problem to buy the special thing at the standard price, for that only transfers the burden. The industry, in the final analysis, must assume it just the same. It may surprise you to know that 75 per cent of our orders for power apparatus call for special features of design. It means several million dollars a year, and it would be worth while if it always brought forth improvements. But we feel rather strongly that a good deal of this expense might be saved if the industry would adopt more nearly common standards. What we need is the opportunity to do some manufacturing instead of building so many things to order. Our business at present is too tailor-like, and we all know the difference in cost between a tailor-made garment and a stock garment."

### WORK TO BE DONE

Specification standardization, or any near approach thereto, can be accomplished only by the adoption of standard forms for requests, for quotations and for contracts and by the education of the industry to the point where orders cover equipment manufactured "in accordance with Standard Specification No. A, with the following exceptions," and may these exceptions be the exception and not the rule. J. C. Parker, in the May 29, 1926, issue of the ELECTRICAL WORLD pointed out that it is the essence of any standard that it must be an expression, not of the will of a narrow majority, but of the preponderating thought and feeling of substantially an entire group. Is it not possible for the N.E.L.A., representing, as it does, both the purchaser and the vender, to prepare and sponsor standard specifications that will be acceptable to and adopted by all but the bitter-enders?

It is not to be inferred that every point at issue could easily be settled or that it would be desirable to cover some of these even if agreements could be reached. Examples of the lines along which work might most readily progress are the relation of speeds to capacities of rotating machinery and nameplate data on transformers, voltage regulators, rotating machinery, relays, etc.

Even the field of voltage standardization has not been completely harvested, for not only have the tentative proposals to be more generally accepted, but the tap voltages, which for a great many ratios of transformation cannot be settled merely by the specifying of a percentage within certain limits if satisfactory paralleling is to be obtained, must be prescribed in some such manner as is outlined in the recent article on the power-transformer situation by F. W. Gay and J. D. Winans in the March 12, 1927, issue of the ELECTRICAL WORLD. It has been demonstrated as necessary to tabulate an approved list of secondary turns and corresponding primary full-winding and tap turns for transformers in the so-called power or substation class, and extension of the principle has already been made to transformers for use with synchronous converters.

In considering a piece of apparatus as well established and commonly used as the power transformer, it may be well again, to quote from Mr. Pace, speaking from the manufacturers' viewpoint, when he said: "We furnish somewhat in excess of 2,000 of them a year. We are able to manufacture for stock less than 5 per cent of that number. We cannot escape the endless combination of primary and secondary voltages, the different types, self-cooled, water-cooled, air-blast, etc., not to mention mounting and other requirements for different conditions."

Another important line of product which Mr. Pace used as an illustration is the industrial motor, in the case of which he stated that the Westinghouse company has standardized on 22,000 different machines, but still has its business nearly 50 per cent "special." We cannot blame the manufacturers if they feel a bit disheartened under the circumstances.

It would, it is true, be hard to point out the line of demarcation between such standard specifications and the A.I.E.E. standards. Possibly there should be no difference, the present rules being incorporated in the new specifications, in which case, of course, the duty of preparation and presentation to the A.E.S.C. would devolve upon the A.I.E.E., or at least upon a joint committee of the N.E.L.A. and the A.I.E.E.

L. W. W. Morrow in the May 21, 1927, issue of the ELECTRICAL WORLD pointed out the chaotic conditions existing at the present time in regard to standardization as a result of overlapping jurisdiction and non-co-operative effort on the part of organizations which are as the sands of the sea in number. It would seem better to have the proposed director of standards occupy some such position as executive manager of the American Engineering Standards Committee.

### N.E.L.A. SPECIFICATION GUIDES AS A BASIS

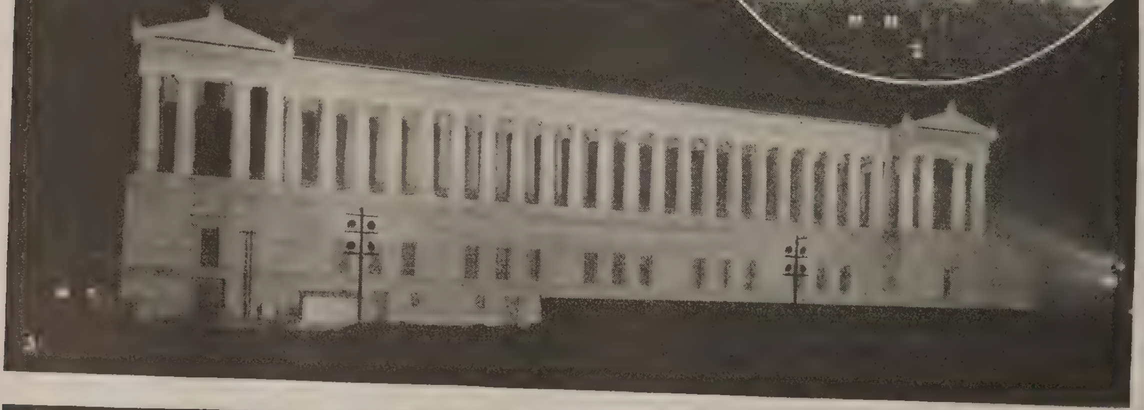
By means of serial reports of the electrical apparatus committee of the N.E.L.A., some sixteen so-called guides for specifications have been presented to the industry in the last year or so, each "intended to serve as a reminder of the points which may be necessary in a specification and as an indication of the logical order in which they should be enumerated." The proposition is then that some group in the electrical industry set out to make a standard, a purchase standard for all apparatus and equipment, by amplifying these guides until they become purchase specifications completely covering, in conjunction with the A.I.E.E. standards, the manufacturing and testing of electrical apparatus and equipment from the viewpoint of the purchaser; not the viewpoint of the purchaser in the narrow sense, as opposed to the best interests of the manufacturers, but in the wider sense, as covering the points in which the purchaser is chiefly interested, and leaving to the manufacturers the greatest flexibility in design in order not to stifle progress.

C. F. Hirshfeld, in an address before the public-utility group of the National Association of Purchasing Agents (see the ELECTRICAL WORLD, Feb. 12, 1927), states that the wise purchasing agent buys most things on specifications of some sort. It is up to the engineer to furnish these specifications, and certain it is that he would have a much easier time justifying his requirements if they were based for the most part on standard purchase specifications recognized by the industry as a whole.

## Large Output in Switzerland

ACCORDING to a report recently presented to the Association Suisse des Electriciens by M. O. Ganguiller, the output of electric generating stations in Switzerland, excluding that from plants having a capacity of less than 1,000 kw., amounted last year to 3,515,000,000 kw.-hr. from run-of-river hydro stations, 439,500,000 kw.-hr. from storage plants and 1,700,000 kw.-hr. from steam stations; 20,500,000 kw.-hr. were "imported" from adjoining countries, giving a total of 3,976,700,000 kw.-hr. This figure does not include the output from state plants serving the Federal Railways.

# *Civic Attractiveness at Night Obtained by Floodlighting*



No. 1. Effective illumination of Soldiers' Monument at Highland Park with two 250-watt units.

No. 2. Wrigley Building, Chicago. Floodlighting has a definite financial value here.

No. 3. Soldiers' Field Colonnade, Chicago. Lighted with twelve 1,000-watt units.

No. 4. Bank building floodlighted with two 500-watt units.

No. 5. An interesting old landmark in Mount Emblem Masonic Cemetery made conspicuous for miles around by use of sixteen 500-watt projectors.

# Fields for Floodlighting

Night illumination of parks, beaches and athletic fields increases their value to public. Floodlighting of private buildings a profitable investment. Fields of application

By A. H. Smith

*Illuminating Engineer Public Service Company of Northern Illinois, Chicago*

SEVERAL years ago when a building in Chicago was first illuminated a humorous-minded newspaper reporter wrote a facetious story in which he estimated the number of sticks of chewing gum represented by the bill for electricity. At that time the nightly expenditure of about $60 for illumination was generally regarded more as a publicity stunt than as a sound business expenditure.

Since that time, however, interest in architectural floodlighting has become so widespread and its development so rapid that today there is hardly a city of importance in the country without examples of floodlighted buildings, and leading architects are incorporating in the design of their buildings special features and adequate provision for the effective use of light as a means of architectural embellishment.

### Floodlighting Lengthens the Day

Moreover, floodlighting is finding an increasing application not only in the lighting of outdoor spaces, such as parks, beaches, athletic fields and other public places, but in the fields of industry as well it is being used to illuminate night work so that 24-hour operation can be carried on with maximum efficiency. Railroad yards, construction work, quarries, docks and outdoor operations such as oil field or refinery work and the like can now be so efficiently floodlighted that hardly any slowing down of work is necessary due to darkness.

For that reason some consideration of the sales factors that influence the use of floodlights and a brief outline of the equipment and methods used in up-to-date installations are of interest to the public utility concerned with supplying the energy for operation.

Floodlight illumination of buildings falls into two general classes—public buildings or monuments and private structures. The chief factor governing the use of light on public monuments and buildings is, of course, civic pride. The use of abundant light in making a public place or monument attractive is just as effective when it is used to draw crowds to a civic community house as it is when used to draw crowds to a theater. People at night time instinctively tend to congregate in a brightly lighted spot, and the brilliant illumination of a public building or monument is one of the simplest and most logical means of increasing its effectiveness and extending its usefulness. With modern methods of city planning and the recognized importance of focusing the city's life around certain definite civic centers, the use of floodlighting becomes one of the most certain and most economical methods of drawing the community's life to the desired points.

In the floodlighting of areas other than buildings the same reasons that lead to the use of floodlights on buildings and monuments are applicable to public parks, beaches, playgrounds, athletic fields, etc.—namely, civic pride and increased usefulness. There is little doubt that the factory worker and the city dweller in general favor daylight saving time schemes because they permit an extension of recreational activities into the hours after work. Floodlighting public recreational facilities serves exactly this same end and accomplishes it without the annoyance of manipulation of the clock.

*Standard tower for mounting floodlighting projectors*

When a community properly illuminates its bathing beaches, its athletic fields or its playgrounds, the result is the same in a way as opening up additional beaches or building increased playground facilities. There is perhaps no cheaper and easier way of quickly providing increased recreational facilities than by this means. Attendance figures in instances where public recreational facilities have been adequately illuminated show that a comparatively small expenditure of this kind will make these facilities available to thousands of persons who might otherwise seldom be able to use them. When the total amount of money involved in the construction and the maintenance of public parks and playgrounds is taken into consideration, the expenditure required for adequate illumination is a comparatively trifling sum. And getting the maximum use out of a plant or an investment is just as sound business in the case of a public institution as it is in the case of a private one.

In addition to the fact that floodlighting increases the usefulness of public facilities, one of the prime considerations is the added safety that proper illumination assures. This is particularly true of bathing beaches, and the safety factor is of almost equal importance in any large open space where people congregate in large numbers. The value of good illumination as an aid to adequate police surveillance is, of course, too obvious to need pointing out.

*One bank of thirty 1,000-watt projectors on the Wrigley Building, Chicago*

Nowadays a municipal stadium is certainly not complete without adequate provision for night illumination. One outstanding example of the increased effectiveness of a stadium made possible by night lighting is that of the Soldiers and Sailors Field at Chicago. During the outdoor season this great public institution is almost as effectively operated after dark as during the daylight hours. Recognizing the necessity of night lighting from the start, the design of the field was planned with this idea in mind and provisions were made for an effective floodlight installation. Properly designed platforms and columns that support the necessary floodlight projectors are an architectural part of the structure itself.

The result is that large religious gatherings such as the great Eucharistic Congress of 1926 and events such as the Chicago Rodeo, etc., are as effectively held after sundown as by the light of day. Although the Chicago installation is a large one involving the use of approximately a hundred 1,000-watt projectors, the cost of its installation and operation is insignificant compared with the public benefits derived.

In the field of private institutions, efficient floodlighting of a building can in many cases have a definite financial value. It may not have been anticipated in the case of the Wrigley Building that the nightly illumination would be of value in keeping rental space filled with tenants. And yet that was one of the most striking results.

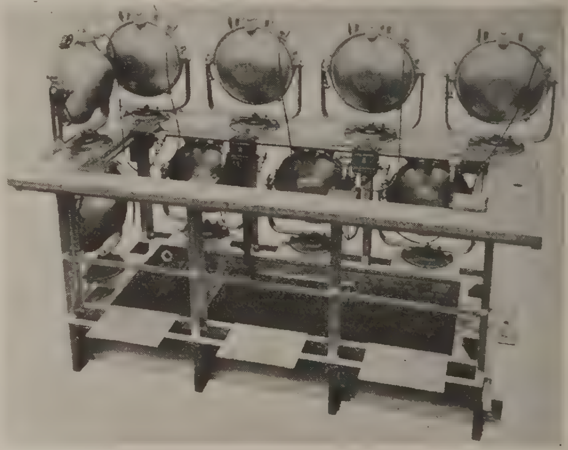
A recent article in *Building Investment and Maintenance,* devoted to the interests of building management, says:

"One of the principal things being sold by the owners of office building space, whether the building is occupied principally by one company or whether it is divided up among a large number of individual tenants, is a well-known address. Tenants buy this feature of established location, and particularly in the case of a new building is it necessary to get the building known quickly. No other method does this job so quickly and so satisfactorily as floodlighting of a building where there are any striking features worthy of the lighting. The cost of the floodlighting comes back in quicker rental, sometimes in a higher rental scale, and certainly in satisfaction to the tenants."

Another effective use of floodlighting is found in the increasing practice of real estate companies and builders of illuminating newly constructed homes as a means of advertising them. Although the temporary nature of installations of this kind does not make it particularly desirable business for a public utility, it has been found that such installations are an effective means of stimulating interest in the possibilities of floodlighting and frequently pave the way for large permanent installations for other uses.

The industrial uses of floodlighting over large outdoor areas cover an extraordinarily wide range. The use of floodlights to enable construction operation to continue at night is having an increasingly wide application. The value of adequate light in speeding up any kind of work is none the less effective because a workman is employed outdoors rather than at a bench. In addition, the insurance value of adequate general lighting in the prevention of theft and tampering where machinery and material must be left outdoors is an important item.

Although floodlight installations on construction work may be of minor interest to the public utility, due to their temporary nature, the value of other industrial uses is easily recognizable. There are few factory establishments with extensive open storage yards that are not legitimate prospects for floodlighting installations. The value of such lighting equipment where the factory is likely to be operated at night is obvious. Driveways, loading platforms, storage piles and the like are perhaps more effectively lighted by this method than by any other. Particularly in the case of lumber yards, coal yards and similar areas where the theft of material is a constant hazard the use of floodlights is one of the most effective means of prevention.



*Tower basket with capacity for eighteen projectors*

It is designed for permanence with a view to easy maintenance and safety. Conduit is an integral part of the basket and entrance is through a trapdoor in the floor.

Some of the most important installations of floodlights for the illumination of extremely large areas is to be found in the recently adopted practice of several railroads to illuminate their switching and storage yards by this method. Since switching operations must be carried on at night as well as by day and since a railroad yard usually represents a sizable piece of property, the illumination of these large areas has been until recently extremely difficult. It is constantly necessary for switchmen to be able to recognize the numbers and designations of freight cars while they are in motion, and carefully planned floodlighting has made this possible in every instance. As might be expected, the job of a switchman in a dark yard filled with moving trains is a highly hazardous occupation, hence floodlighting is an important advance from the standpoint of safety. One of the notable recent installations of this kind is that which was made in the Wabash Railroad's classification yards in Chicago.

Since the development of floodlighting has taken place only within the past few years and since the best equipment is nearly all of comparatively recent design a brief review of the general principles involved and a description of the most successful types of equipment are important. Primarily the development of the high-wattage Mazda lamp has made possible present-day development of floodlighting projectors. These lamps have supplied the illuminating engineer with a source of light of great volume and high efficiency that can be operated effectively throughout the life of the lamp. Using these lamps as a basis, it has been the attempt of the illuminating engineer and far-sighted manufacturers to develop projectors that afforded maximum projection for the light flux emitted.

*Construction work at night made possible and safe through floodlighting*

Although illumination can be obtained by simply disposing high-powered light sources at various points and equipping them with the conventional type of open reflectors, the results obtained by this method cannot compare either in brightness or in efficiency, much less in installation cost, with a method that assures maximum control of the light by placing the lamp in a scientifically designed projector, which projects the greater portion of the light rays into a single beam and, by the use of properly designed optical lenses, diffuses and focuses the rays effectively over the area to be illuminated.

For example, a Chicago advertising company recently desired to illuminate a large sign covering almost the entire side of a fifteen-story building on Michigan Avenue, and extreme brightness was desired. The preliminary estimates involving a certain type of projector indicated that approximately 4.5 watts per square foot would be required. Upon a revision of the estimate, however, by an illuminating engineer, it was found that by the use of eight 1,000-watt projectors equipped with rectangular divergence lenses that would refract the rays of light and distribute the illumination evenly over the entire area it was possible to get an even brighter illumination than had been contemplated with only a little more than 1 watt per square foot. It is evident that the use of properly designed equipment improves results and minimizes current costs, thereby increasing greatly the number of available prospects by getting current requirements down within reason.

The application of properly designed reflectors equipped with carefully designed optical lenses for control of the beam makes possible the illumination of comparatively large areas with a very small number of units of high wattage. As a general rule it has been found that a smaller number of large projectors of great capacity give much more satisfactory results than a large number of smaller units. Certainly it simplifies the problem of installation and maintenance and at the same time permits the illumination of many areas that could not be lighted with small units except at prohibitive expense.

The economical use of units of high capacity may be said to have been made possible by the development of suitable lenses so that adequate control could be had over the distribution of light. The parabolic reflector with which the projector is equipped serves to concentrate the light, but has the disadvantage of projecting simply an image of the filament. Where the beam is to be thrown across long distances and concentrated as much as possible within a small area, there is sufficient diffusion of the filament image so that a lens is not needed and the best results follow the use of a clear cover glass made for the door of the projector.

However, in case the projector is intended to illuminate larger areas or areas of rectangular shape, other means must be provided for diffusing and distributing the light over the desired area without too great loss of efficiency. As a means of getting efficient distribution and an even spread of light the best practice now is to use suitable lenses in the door of the projector. The simplest form is a door of stippled glass, which scatters the light. The efficiency of this sort of diffusion is very low, however, and has resulted in the development of optically correct lenses that gather the light, confine it entirely to the desired area and effect a perfectly uniform distribution without filament images or streaks. A complete range of such lenses has been developed and their proper use enables some distinct economies in the amount of light needed and at the same time assures perfectly even distribution.

A so-called rectangular diffusion lens has been developed that projects a rectangular-shaped beam in which all the light is concentrated and which cuts off sharply at the edges so that none is wasted and so that one beam may be placed alongside another without streaks and dark patches where they overlap. Other types of lenses effect what is called circular diffusion over a 45 deg. arc and replace the wasteful stippled glass door where a broad area is to be illuminated close at hand by one or more high-power projectors.

The earlier types of projectors for the most part made use of silvered-metal reflectors similar to those used in automobile headlights. The superior efficiency of the silvered-glass reflector, however, has led to its adoption in the better designs, the best practice being to place the silvering on the side of the reflector away from the lamp.

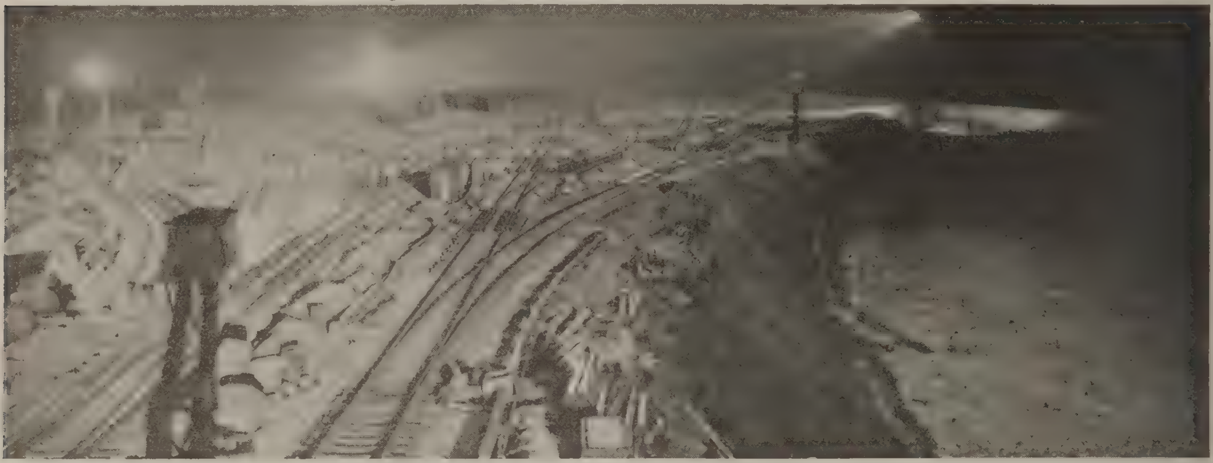
The earlier types of large-capacity projectors were practically all of the ventilating type. That is, in order to carry away the considerable amount of lamp heat it was necessary to circulate air through the lamp for ventilation. This practice had the disadvantage that dust and smoke were deposited on the inside of the lamp so that the efficiency of the projector was soon impaired by dirty reflectors and lamps, making frequent cleaning necessary.

Severe corrosion of the heated metal parts was likely to be set up by the circulating air and breakage of lamps and reflectors was excessive due to the fact that particles or even drops of water were often carried into the projector by the air stream and deposited on the heated lamp or reflector. It became necessary to evolve a non-ventilating type of projector so designed that the heat of the lamp was carried away by radiation rather than by direct ventilation.

Some manufacturers are now producing non-ventilating projectors that are entirely airtight, thus keeping all smoke, dirt and moisture out of the inside of the projector and eliminating all necessity for maintenance or opening except for lamp renewal. Practically the only maintenance necessary on good equipment now is a periodical washing of the outside face of the projector in order to remove the smoke and dirt deposit.

Another point of importance is the construction of projectors from materials that will not corrode due to the action of smoke and gases. This is particularly true in the cases of installations in railroad yards and industrial districts. The use of bronze and aluminum throughout is the best sort of economy.

Projectors are also fitted with suitable focusing devices and with mountings that permit a permanent setting of the direction in which the projector is pointed and yet permit it to be released so that it can be turned into convenient position for cleaning and then returned to the same fixed, permanent adjustment.



*Night view of Wabash classification yards, Chicago*

When the projector is intended for the illumination of ground surfaces, it is well to place it as high above the ground as practical, on buildings, water tanks or steel towers that have been developed for this special purpose in a standardized form that reduces the cost considerably.

When the projector is used for illumination of signs or wall areas, it should be placed below the eye level if possible or at such an angle that the angular reflection of the beam is not directly at the observer.

The methods of disposing projectors for the illumination of large areas such as railroad and factory yards, quarries, storeyards, etc., is well illustrated in the recently installed floodlight system used for the Wabash Railroad classification yards at Chicago. Lighting this yard, which is almost a mile in length, involved the lighting of an area of more than one and a quarter million square feet of tracks, one-third of which comprised the ladder tracks, requiring an illumination to the intensity of 0.145 lumen per square foot, whereas the remaining two-thirds, comprising storage tracks, called for an intensity of 0.073 lumen per square foot. This was accomplished by the use of fourteen standard 1,000-watt projectors, which were divided among three 100-ft. standardized floodlighting towers. Where beams of wide divergence were required to illuminate the areas close to the towers, the projectors were fitted with 45 deg. circular divergence lenses; on the longer throws clear lenses of heat-resisting glass were used. One tower was located approximately at each end of the yard and the third tower was placed in the center of the yard so that the projectors cast light in both directions.

The towers used in the Wabash yards are of a standardized design evolved especially for floodlighting work by the engineers of the American Bridge Company and the Pyle-National floodlighting engineers. The towers are completely fitted with integral electrical fittings, and it is interesting to note that they are assembled on the ground on this particular installation and raised into position in less than ten minutes, the entire installation of the floodlighting system being installed in a few days' time.

## Electricity Consumption on the Farm

By Frank D. Paine

*Supervisor Iowa Project on Rural Electrification, Garner, Iowa*

FROM records of the rural electrification project at Garner, Iowa, there is presented here an analysis of the consumption of electricity for various uses on a dairy farm of 195 acres. In the home there were used in one year 816 kw.-hr., according to the tabulation:

| | Kilowatt-Hours | | Kilowatt-Hours |
|---|---|---|---|
| Lights | 360 | Water supply | 245 |
| Washing machine | 65 | Radio | 100 |
| Iron | 40 | Vacuum sweeper | 6 |

The above uses are listed in the order of their preference by the wife of the farmer. She would like to add to the list a refrigerator and an ironer, which would use 550 kw.-hr. and 72 kw.-hr., respectively.

The consumptions in the farmstead were as follows:

| | Kilowatt-Hours |
|---|---|
| Building lights | 120 |
| Milking machine (24 cows) | 540 |
| Separator | 54 |

These farm uses of electricity are not extensive. Grinding oats and barley would easily add 320 kw.-hr. Ensilage cutting, corn grinding and grain elevating could be done electrically, too.

The actual use of electricity on this farm in one year was 1,548 kw.-hr. To get a complete idea of how much energy this farm might easily use, there must be added to this figure the consumptions of the refrigerator, ironer and feed grinder that are next on the list for purchase. This makes the annual consumption rise to 2,472 kw.-hr.

Another case—a stock farm of 320 acres. Actual consumption was:

| In the Home: | Kilowatt-Hours Per Year | On the Farm: | Kilowatt-Hours Per Year |
|---|---|---|---|
| Lights | 372 | Building lights | 120 |
| Water supply (for both hard and soft water) | 49 | Milking machine | 212 |
| Washing machine | 22 | Separator | 38 |
| Iron | 38 | Elevating grain (7,000 bu.) | 64 |
| Refrigerator | 365 | Corn shelling (1,000 bu.) | 40 |
| Radio with battery charger | 64 | Sawing wood | 20 |
| | | Incubator | 300 |
| | | Feed grinding | 400 |

## Business Allocation at Cambridge, Mass.

AN INTERESTING exhibit of the Cambridge Electric Light Company in the recent rate case before the Massachusetts Department of Public Utilities presented the ratios of different classes of business handled by the company in 1926 to total business, as given in the accompanying table. This company serves a diversified industrial and residential community with a population of about 150,000 (including Belmont, which is supplied at wholesale). Its gross electric revenue in 1926 was $2,024,377, its total operating expenses $1,367,835 and the present value of its property on the reproduction cost basis was computed at $8,035,469. The total sales of energy were 53,675,929 kw.-hr., of which 14,115,232 kw.-hr. was for metered lighting, 34,576,077 kw.-hr. for power, 1,823,183 kw.-hr. for municipal arc and incandescent lighting, 260,262 kw.-hr. domestic power sales and 2,901,175 kw.-hr. sales to other companies.

CLASS CHARACTERISTICS IN PER CENT OF TOTAL 1926 BUSINESS
CAMBRIDGE ELECTRIC LIGHT COMPANY

| | | | —No. of Customers— | |
|---|---|---|---|---|
| Class | Demand Responsibility | Kw.-Hr. at Buses | Average During Year | Average End of Year |
| Residence lighting | 23.25 | 12.32 | 79.94 | 80.40 |
| Commercial lighting | 18.37 | 12.36 | 14.33 | 13.75 |
| Refrigeration and cooking | 0.87 | 0.73 | 1.48 | 1.82 |
| Primary lighting | 10.39 | 7.27 | 0.01 | 0.01 |
| Power | 44.72 | 64.09 | 4.24 | 4.02 |
| Street lighting | 2.40 | 3.23 | ...... | ..... |
| Totals | 100.00 | 100.00 | 100.00 | 100.00 |

It is seen that while the kilowatt-hours for lighting are about equally divided between residential and commercial, the demand responsibility of the former is more than one-fourth (26 per cent) greater than that of the latter, in itself justifying a higher unit price for residential use, since the delivery of 1 kw.-hr. ties up more equipment. Further, less than half the demand responsibility falls on the power load (44.72 per cent), while nearly two-thirds of the output goes to it. Here again the proportionate share of plant is much smaller than the proportionate share of load.

Returns also show a much smaller relative demand responsibility, and therefore a smaller proportionate share of investment per kilowatt-hour for refrigeration and cooking than for lighting, definitely justifying a separate and much reduced rate for refrigeration and ranges, though it should, from the data, average higher than the rate for big power.

## Electric Pumping Service for Oil Pipe Line

AN OIL pipe line about 400 miles long from the West Texas fields to Cushing, Okla., is now being laid by the Shell Pipe Line Company, according to a paper presented at the Oklahoma Utilities Association convention by O. A. Jennings. The line, of 10-in. pipe, will contain fourteen pumping stations, all electrically driven and supplied with energy from the systems of the Oklahoma Gas & Electric Company, the Southwestern Light & Power Company, the Texas Power & Light Company and the West Texas Utility Company. Each station will contain three 400-hp., 2,200-volt motors direct connected to centrifugal pumps. Two units in each station will be in normal operation, the third being held for stand-by. The annual load factor of this business will be about 90 per cent according to preliminary estimates and surveys of operating factors for such service.

This installation will be one of the first completely electrified pipe lines in the country. The decision of the Shell Pipe Line Company to use electric drive throughout was made after careful comparison of electricity with other forms of power. The principal virtue of the use of electric power is the lower initial cost, about one-third less than steam or oil. The need for only one attendant per station reduces labor charges. Repairs, maintenance and depreciation are much less. Centrifugal pumps, which on account of their high operating speeds are best driven by electric motors, possess peculiar advantages over reciprocating pumps for pipe lines. If the line becomes plugged the pressure will not exceed a predetermined definite amount, which may be provided for in the design of the line. If any pump stops it does not constitute a complete obstruction because the oil, under pressure from the other pumps, can continue to flow through it. These considerations, and others, decided the Shell Pipe Line Company to go to all-electric operation of the new line.

# Letters from Our Readers

## *Economical Installation of Wiring*

*To the Editor of the* Electrical World:

The subject of more economical wiring installations has had considerable discussion by the N.E.L.A. wiring section and jointly with other associations. It appears to lead to one conclusion, namely, that a more suitable design of conductor is desired. This thought has brought about a number of methods and materials which their advocates claim substantially reduce the expense of installing wires. Today we have advocates for concentric conductors, non-metallic sheathed cable with all wires insulated and also with one wire bare, and flexible steel conduit with one bare wire and those that demand both wires insulated, as in the past. Also the old favorite knob and tube method, which will always have many advocates. It is a fair question to ask if any of these methods, made into a standard, will relieve the cost of installing wiring or of making extensions to a sufficient degree to warrant all this effort, with also the possibility of some new material being designed to replace all or some of the existing materials?

Another item of considerable moment, which also pertains or rather is related to this subject, is the automatic protection of circuits. Favorable action will no doubt be taken soon on some design adaptable for recognition and inclusion in the code. The present activities concentrate on branch circuits, but this should be carried through to as large capacities as the type will permit. Such acceptance will give advantages to the entire industry and offer many economies that will be difficult to obtain through any other medium.

Regardless of the style of wires, we are compelled to utilize two, and very little is to be gained by reducing the quality of the insulation, considering the possible hazard involved. It might be policy to permit the grounding or solid wire to remain in its present insulated condition and place a better quality of covering on the outside wire and allow these to be run under the present rules for non-metallic cable. This has the advantage of allowing the installation of switches without requiring a loop system. This system has some advantages, but they are more than offset by the additional cost.

Many central-station companies, to combat the evil of overfusing and bridging of circuits, have required that the main service fuses be sealed. Several of these concerns have stated that with the acceptance of a type of fuse and cutout or other means to prevent this abuse they will gladly discontinue sealing the main fuses, thereby eliminating one type of equipment that is causing a large amount of the present-day expense of installing wires, namely, the carrying of many duplicate styles of merchandise for the same purpose. Some few years ago we had the condition of 37 or 38 attachment plugs and out of the confusion a satisfactory standard was adopted with benefit to all concerned. The situation is similar to the practice in vogue on safety switches. One jobber carries fifteen different types, while any one of them would answer the need for a proper disconnect means. Such circumstances should be corrected before a great deal of stress is placed upon the necessity for a more economical conductor.

Another feature for reducing the cost of construction in this class of building would be for some organization to group together all the possible tools and a list of the manufacturers and try to improve or redesign, with the view of providing a quicker method to facilitate the workmen in their problems, and more particularly relating to finished house extensions. The field offers an opportunity for the inventive minds of the artisan as well as the executive. Some action to promote interest in such a proceeding should bring about improvements of a decided nature. Anything that can reduce the labor expense will offer greater possibilities than a small reduction in material costs of conductors. Without question this would increase consumption through the added convenience of installing additional outlets. The labor item on this class of buildings is considerably in excess of material costs. The experience of all trades in reducing the labor required for a given task is satisfactory proof that a larger amount of business can be expected through any effort of a concerted nature to lower this item.

The rule calling for twelve outlets on a circuit may now be omitted, under certain conditions. This has probable advantages, but it should not be encouraged until such a time as the rules recognize a type of fuse that cannot be overfused or easily bridged. When this condition arrives—and it should at an early date—the requirements for twelve outlets on a branch circuit can be dropped from the code, and allow, perhaps, any number of outlets, as circumstances warrant, with a possible floor-area limitation. Such a condition appears to the minds of many as the ideal arrangement and would constitute one of the most economical means for reducing the outlay for new work and extensions in old buildings.

If the various interested organizations would combine and employ a field secretary and instruct him to tabulate all such information and work in conjunction with any cause along these lines a probable benefit would accrue to every branch of the industry. A great deal of improvement could be accomplished through such proceedings to the welfare and betterment of the fraternity.

C. W. Cowles.

23 Lakeview Avenue,
New Britain, Conn.

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Pulverized Fuel at Derby.* — The results of the first eight months of operation of a pulverized fuel plant at the Derbyshire Corporation station are summarized in this article. The equipment used is outlined and the economies and operating conditions involved are offered for average conditions. The mills are of the Raymond type and pulverization is effected by rollers running in contact with a steel ring.—*Electricity (England)*, March 15, 1928.

*Electricity and Fuel Conservation.*—W. T. Townend.—The economic considerations involved in the generation of electricity and the combustion of coal have been reviewed by the author with particular reference to the generation of electrical energy in plants producing coke, and at mine-mouth operations. The discussion refers particularly to the possibilities in Great Britain and because of the local factors involved is particularly applicable to that country.—*Electrical Review (England)*, March 30, 1928.

## *Transmission, Substations and Distribution*

*Load-Ratio Control Transformers.*—M. Cornudet. — Transformers with voltage taps, and an electro-mechanical arrangement for the change of these taps without load interruption, will, according to the author, give an apparatus which is less expensive than an induction voltage regulator or a synchronous converter. They are, in addition, applicable to high voltages, while the regulator and the converter cannot be built safely for more than 6,600 volts. A Swedish concern has developed such a transformer tap-switching arrangement or load-ratio control for voltages up to 77 kv. and 350 amp. The apparatus is built in three types, suitable for 10,000, 33,000 and 77,000 volts, but the basic principle is essentially the same for all. When changing from one tap to the next the step is first prepared by closing an auxiliary contactor, which establishes a current by-pass over an ohmic resistance, then the main tap contact is moved to the next position, whereupon the by-pass is opened again. Since the whole cycle takes but two seconds the load current flows through the resistor only for a very short period. During this transient period, when stopping of the mechanism would burn out the resistor, a warning signal is given. A three-phase transformer with five regulating positions requires seven contactors per phase, or a total of 21 switches, which are mounted in three switch tanks, suitable for outdoor use. A great number of transformer connection diagrams are given, to show the use of such equipment for various applications, such as power transformation, regulating transformers and tie-in transformers.—*Bulletin de la Société Française des Electriciens,* Vol. 77, 1928.

*Systematically Sectionalizing Primary Circuits.*—Vernon W. Palen. — The practices developed as a result of many years' experience with the sectionalizing of primary circuits is offered by the author in this exposition of suggested procedures. The discussion centers largely around operating and test methods of particular interest to operating men. It is stated that in sectionalizing primary circuits to lessen trouble and restore service to all consumers at the earliest possible moment one company has found it advisable to avoid manipulation of potheads whenever possible and to arrange sectionalizing so as to restore the service furnished to consumers who, due to size of establishment or nature of work, will be the most handicapped by a prolonged shutdown. On single-feed circuits it is suggested that the tests be carried out after underground cable is tested from the end of the primary nearest the substation, picking up the load of each tested section from the outside primary coil. On single-loop circuits with the open loop at the center the procedure for testing from the center of the loop to substation, taking up load at each testing section, is advocated. On double-loop circuits a similar procedure is advised, since each individual loop of a double-loop circuit has its own circuit breakers and disconnecting switches, and, therefore, is held to be independent and may be treated as a single loop. — *Electrical Times (Australia)*, Feb. 27, 1928.

## *Generation, Control, Switching and Protection*

*The Static Balancing of Rotors.*—B. P. Haigh.—The balancing of rotors for electric machines involves, according to the author, two fundamental methods, the theoretical and the practical. While the theoretical principles have long been firmly established on the basis of Newton's laws of motion and probably no longer admit of any important development, the practical art of balancing is said to change from year to year and to vary according to the character of the rotor and the requirements of the circumstances under which it will be used. The various conditions of unbalance, that is, static, dynamic, internal and their combinations, are discussed by the author in connection with mathematical expressions for the significant factors. The subject of the critical speed has received particular attention in this first of several articles. The ratio between the two critical speeds, the secondary or dynamic and primary or static, has been expressed in connection with this consideration.—*Engineer (England)*, March 23, 1928.

## *Units, Measurements and Instruments*

*The Thermal and Electrical Conductivity of Some Aluminum Alloys and Bronzes.*—Ezer Griffiths and F. H. Schofield.—The primary object of the investigation undertaken by the authors was to obtain approximate values for the thermal conductivities of alloys employed in the construction of aero-engines. The measurement of the electrical conductivity of the alloys was undertaken to throw light upon its relation to the thermal conductivity. For this purpose an accuracy of 1 per cent was assumed to be sufficient. The method used consisted in a comparison of the drop of potential across a measured length of the specimen with that across a standard resistance arranged in series with it, when a steady current of the order of 20 amp. was passed through the two. Two thermocouples of copper-constantan were pegged into the specimen, serving not only to measure the temperature but as potential leads for resistance measurement. By appropriate switch arrangements the thermocouple wires were arranged to be rapidly altered so as to serve either purpose as required. As any temperature difference between the two ends of the bar would give rise to a thermal electromotive force, when measuring the potential difference across the bar, readings of the latter were obtained for the two directions of the current, so that by taking the mean of these values the effect of the thermal electromotive force was eliminated. In determining the resistivity the usual procedure was to take measurements on a series of rising temperatures and to repeat the process until a steady state had been reached.—*Engineering (England)*, March 9, 1928.

## *Illumination*

*A New Art in Electric Lighting.*—W. E. Bush.—The comparatively recent development of the use in lighting practice of sheet glass fixtures—that is, fixtures concealed behind glass panels—and of other modern innovations in the lighting art are reviewed by the author. It is stated that one feature of the new lighting practices is the tendency, and in some cases the necessity, for planning by the architects to co-ordinate the scheme and the details of installation with the design of the building. This is particularly the case when glass panels must be installed flush with the walls, ceiling columns, etc. It is anticipated that such equipment will become one of the major features of importance in the design of homes and other buildings of the future. A factor in the new lighting which commends itself to illuminating engineers is the possibility of obtaining a high intensity of illumination with a low surface brightness of the lighting equipment. This is due to the much greater area of glass that is used than if ordinary fittings were employed and, secondly, it is generally necessary to use a number of the medium-sized lamps instead of a smaller number of large lamps. In either case, however, it is neccessary that a liberal allowance be made for a total wattage if pleasing results are to be obtained. The need for investigation by illuminating engineers upon this subject in order that a high degree of efficiency may be made possible by the use of reflectors and careful selection of a glass which combines good light diffusion with low absorption is pointed out.—*Electrician* (*England*), March 30, 1928.

## *Motors and Control*

*The "Electromersible" Pump.* — A specially designed centrifugal pump driven by an electric motor has recently been developed as a single unit. The machine consists of a three-phase squirrel-cage motor combined with a centrifugal pump the rotor of which runs in the water. The stator core and the windings are protected with a watertight, non-corroding inclosure which is filled with transformer oil. The oil forms a good cooling medium and also prevents condensation of the atmospheric moisture in the winding inclosure. In this device the water enters the suction at one end of the motor and passes through an annular space in the rotor which is joined to the impeller. The shaft therefore runs freely between the two end bearings without requiring any glands and the leakage water around the periphery of the impeller fills up the space around the stator winding inclosure and is drawn into the suction again at the running clearance of the rotor at the opposite end, thereby forming a very efficient cooling circulation when the motor is working above water. The oil- and water-tight inclosure is of a special alloy and is entirely stationary. Such devices have been manufactured for an output of 100 tons per hour against a 75-ft. head and are said to operate equally well above water as when submerged under 40 ft.—*Electrical Review* (*England*), March 30, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*Electrolysis and Its Mitigation.* — W. B. Buchanan.—The author has reviewed the general problems involved in the prevention of electrolytic destruction of water pipes and other metallic conductors located under ground, has analyzed the effects of stray currents and of electrolysis conditions and offers a survey procedure for the elimination of the difficulties. The necessity for good conductivity in the joints of pipe lines is particularly emphasized, as it is stated that if the potential drop across the joint due to the flow of stray direct current is a fraction of a volt, part of this current will be shunted by the soil which is in contact with the adjacent ends of the two pipes. The amount of current, of course, depends on the electrical resistance of the soil as well as the difference in potential, but any tendency whatever in shunting of current in this manner is hazardous and should be avoided. The meters and measurements which may be utilized in analyzing the conditions covering electrolysis are mentioned as important, even though great precision in the measurement of current is not attainable. — *Electrical News* (*Canada*), March 15, 1928.

## *Heat Applications and Material Handling*

*Resistance Welding Machines.*—A. Hilpert.—During the last ten years metal industries have adopted electric resistance welding to a wide extent, since the joining of straight or round pieces to produce either a mechanical or a tight connection can be accomplished more quickly and cheaply than by riveting or folding. This article gives an extensive description of modern welding machines of European manufacture, covering butt-welders, spot-welders, seam-spot welders, continuous seam welders, rivet heaters and electric forges. Depending upon the cross-sections to be joined, butt-welders have a hand-operated, motor-driven or hydraulic compressing device. Spot-welders are frequently combined with a current-limiting device to prevent excess current demand and overheating. Seam welders are found useful for steel up to $\frac{5}{16}$ in. thickness. An interesting example of a double seam welder is shown for steel barrels, joining both heads simultaneously. All of these machines have transformers with adjustable winding ratio to accommodate the secondary current to the thickness of the welded piece. The present tendency of rivet heaters is toward air cooling, to avoid inconveniences and the possibility of freezing attendant upon water cooling.—*Zeitschrift des Vereines Deutscher Ingenieure,* March 3, 1928.

## *Traction*

*Suburban Railway Electrification.*—A description of the equipment and design of the suburban section of the Bombay, Baroda and Central India Railway. It is stated that as railway services under steam operating conditions proved unequal to the task of transporting the rapidly increasing number of suburban residents on the line, electrification was planned and carried out. Among the interesting features of this equipment are: Trains consist of unit equipment—that is, driving trailer coach, motor coach; the control equipments are capable of operating three four-coach units—that is a twelve-coach train accommodating 1,500 passengers; the capacity of the existing steam trains being about half this amount, a fully loaded train may be rapidly accelerated and it is possible to attain a speed of 27 m.p.h. within 30 seconds from the initial start; unusual conditions of heavy floods, often causing 2 ft. or more of water on the rails, requires the specification of watertight equipment. Operating factors and economies are considered.—*Electrician (England)*, March 23, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*Long-Distance Radio Receiving Measurements.* — Tomozo Nakai. — It is stated that measurements on radio wave intensity of the order of thousands of microvolts may be made by comparatively simple devices and arrangement, but that to measure quantitatively and accurately such a weak radio field intensity as is of the order of tens or units of microvolts per meter it is necessary to make use of a particular arrangement to which the greatest care should be paid in design, construction and calibration work, otherwise the errors of the measurement may be large. As a result of a scientific and technical investigation of the received radio wave intensity allowing for diurnal and seasonal variations the author undertook the construction of the receiving set unit and local signal oscillator unit with proper shielding devices and in the first discussion has detailed the methods of measurement, arrangement, calibration, accuracy and similar factors of importance.—*No. 217, Researches of the Electrotechnical Laboratory, Japan.*

## *Miscellaneous*

*French Tidal Power Schemes.*—The construction of tidal power stations forms part of a national scheme which is being carried out in France for the utilization of all available sources of energy with the object of rendering that country as far as possible independent of foreign coal supplies. Plans for tidal power installations along the coast of Brittany and the Channel have already been prepared representing a total of something more than 2,000,000 hp. The scheme receiving greatest consideration in this discussion is that of Defour, which utilizes the relative levels of two basins. In the Defour system the auxiliary basin, which only drives the turbines on a discharge into the sea, takes over the work when the head from the principal basin falls too low. There is thus a fairly regular output during the whole period of the rising and falling tides. This does not provide for peak loads and the problem would seem to be complicated by the tide advancing one hour in twenty-four hours. This makes it difficult to insure a concordance between the energy produced and the load curve. So far as theoretical considerations go, it is stated that the schemes are proving attractive to big electrical and mechanical engineering corporations.—*Engineer* (*England*), March 23, 1928.

# News of the Industry

## Boulder Dam Feasibility in Doubt, Says A.E.C.

### *Committee of Eminent Engineers Finds Unanimously that Colorado River Development Should Be the Subject of Further Expert Investigation*

A SPECIALLY appointed committee has just reported to the American Engineering Council against the acceptance of existing reports as evidence of the engineering feasibility of the Boulder Canyon Dam on the California River which the Swing-Johnson bill, now before Congress, would make it incumbent upon the federal government to build.

The personnel of this committee is of a nature to make its finding carry great weight in the engineering world. The chairman, Francis Lee Stuart, has been chief engineer of both the Erie and the Baltimore & Ohio Railroad and has had part in much important work involving hydraulic construction. In the last few years he has been a consultant in connection with the greater harbor project of Los Angeles, the lake-lowering controversy as it affects Chicago, the regulation of the great lakes, lake-to-gulf transportation and the "giant power" plan of Governor Pinchot. The four other members of the committee are Allen Hazen of New York, an expert on water supply; Clemens Herschel, a former president of the American Society of Civil Engineers and the inventor of the Venturi water meter; J. Waldo Smith, who was chief engineer for the New York Board of Water Supply from 1905 to 1922 and completed the new Croton Dam for that city, and Lewis B. Stillwell, former president of the A.I.E.E. and an outstanding electrical engineer, who has just been elected for the fourth time as chairman of the Engineering Foundation.

The committee's report follows:

> The undersigned, constituting the committee appointed by the American Engineering Council to examine the Boulder Dam project from an engineering standpoint and advise the council in regard thereto, respectfully report as follows:
>
> Your committee is unanimously agreed that the information set forth in the reports which have been submitted to us is not conclusive as to the engineering feasibility of the plan outlined in the Swing-Johnson bill, and that before either the government or private capital would be justified on engineering or economic grounds in committing themselves to the expenditure involved the development of the river for the purpose in view should be further and most thoroughly investigated to determine how the results which it seeks to accomplish can be secured with a reasonable assurance of success.

The bill of Senator King of Utah calling for an engineering investigation of the Colorado River situation was summarized in the ELECTRICAL WORLD for April 7 (page 723). On April 11 Representative Douglas of Arizona introduced a bill with a similar motive. It provides that the President shall appoint a board of five engineers of "unquestionable national reputation" who shall "examine into and investigate the Colorado River" and recommend "the most feasible method and cost of obtaining flood control, as to the best systematic program of development." Not more than one appointee shall be or have been in the employ of the Bureau of Reclamation or a resident of any Colorado River Basin state.

The Secretary of War is to build the flood-control structures recommended by this committee, $15,300,000 being appropriated for that purpose, including expenses and salaries of the engineers, but construction shall not begin until the Santa Fe compact shall have been ratified by the seven states and by the Congress, "or until all of said states and the Congress shall have agreed, by compact, that no title to waters, in excess of present perfected rights, which may be stored by such flood-control dam shall be acquired."

## Boulder Canyon Debate About to Start in Senate

As this is written the Senate apparently is ready to take up the Boulder Canyon bill. Prophecies are made that the measure will pass, but it will be in the face of determined opposition which will also have an important effect on the attitude of the House.

Notice was served on the rules committee of the House of Representatives on April 18 by the military affairs committee that if a rule for the consideration of its Muscle Shoals bill is not granted, the measure will be called up on May 2, when the committee will have the call of the calendar.

## United Engineering Society Seeks Endowment Funds

An endowment of $7,000,000 for the Engineering Foundation and the Engineering Societies library is sought by the board of trustees of the United Engineering Society, representing the national societies of civil, mining and metallurgical, mechanical and electrical engineers. One fund of $5,000,000, it is planned, will be applied to the research projects of the Engineering Foundation and a second fund of $2,000,000 to the maintenance of the library.

Secretary of Commerce Hoover has accepted appointment to the endowment committee, of which Col. Edward A. Simmons is chairman.

## Trade Commission Makes Its Second Report

### *Two Thousand Company Responses to Its Questionnaire Already Filed—So Far Little Beyond Routine Information Has Been Elicited*

THUS far in its investigation of the public utilities the Federal Trade Commission has not revealed a single misstatement of fact or any apparent indication on the part of the industries concerned to withhold information sought by the commission. Those who are following the investigation closely are said to be impressed by the fair and businesslike manner in which it has so far been conducted and praise the capacity of Edgar A. McCulloch, the commissioner in immediate charge. The progress which has been made has been facilitated by the ready way in which the utility associations have opened their files and co-operated in every other way.

That the commission has met a ready response to its questionnaire is indicated by the fact that, as made public in its second monthly report to the Senate, two thousand returns already have been filed. In this report the commission announces that additional schedules are being prepared to send to the companies operating in more than one state, to holding companies and to their subsidiary financial, management and construction companies. Special schedules also have been prepared for the municipal utilities. The commission announces that "systematic examination is being made of various sources of information with regard to particular transactions in the electric power and gas industries, in order to develop specific information regarding the growth of capital assets, the methods of issuing securities and other financial matters specifically mentioned in the resolution."

Hearings conducted last week developed only well-known facts. It has been no secret that the utilities have been opposed to the government in business. Full statements of the activities of the Illinois State Committee on Public Utility Information and of the New England Bureau of Public Service and Information were made by B. J. Mullaney, the director of the Illinois committee, who is vice-president of the People's Gas Light & Coke Company and of the American Gas Association; by R. R. McGregor, the assistant director of the Illinois committee, and by Samuel T. McQuarrie of the New England bureau. The testimony brought out that the utilities feel that a public service is being performed in making available the type of information and material handled by such committees, and that it also is necessary to meet unfair attacks and misinformation put out by those who are hostile to the utilities and toward their operation by private enterprise.

During the week representatives of the newspapers owned and controlled by the Copley Press and by Ira C. Copley were heard. Testimony was to the effect that their editorial policies had in no way been governed by outside influence and that no utility had any hand in financing them.

The commission announces that hearings will be resumed April 24, when officers of the National Electric Light Association and the American Gas Association will reappear, together with representatives of the Joint Committee of National Utility Associations.

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## Cincinnati Rate Reduction

*Union Gas & Electric Ends Litigation by Adoption of Schedule Based on Room Charge—Annual Saving to Consumers of $500,000*

NEW rates which will reduce electric light bills at Cincinnati sufficiently to effect a saving of $4,000,000 in seven years have been agreed to by the Union Gas & Electric Company, Cincinnati, according to a company announcement on April 14. "While feeling secure in its position, legal and otherwise," the company says, "in order to avoid long and expensive litigation for itself and the city, and with a desire to maintain cordial relationship with the consumers of electricity," the proposal, said to be acceptable to all members of the City Council, has been made.

The essential difference between the company's offer and the contested ordinance passed last fall is the basis of the rate structure. The minimum charge in the new rate will be based not on the number of outlets but on the number of rooms. Because it will be necessary for the company to check up on the number of rooms in the home of each of its patrons, the new ordinance will not become effective until September at the earliest, the prevailing rate in the meanwhile being continued.

It is estimated that the reduction involves, with the present number of consumers and their average of consumption, a saving of more than $500,000 a year, but it is calculated that the new basis and form of rates will result in a considerable increase of consumption. The new residence rates include a demand charge of 10 cents per room per month for a minimum of four rooms, plus an energy charge of 5 cents per kilowatt-hour for the first 6 kw.-hr. per room per month and 3 cents for all in excess of 6 kw.-hr. The minimum bill will be 75 cents.

It is understood that with the passage of an ordinance accepting this proposal, which had been scheduled for April 18, all litigation will be discontinued. The rates which the municipality sought to enforce last fall had been enjoined in the federal court pending a hearing. The company had won a suit brought by a taxpayer in the Common Pleas Court, and the municipality had appealed.

# Power Stations Featured at Baltimore

### Regional Meeting of A.I.E.E. Discusses Gould Street Station and Conowingo Development—Dielectrics, Turbo-Generators and Stability Also Among the Topics

MORE than 250 members and guests of the American Institute of Electrical Engineers attended the sessions of the regional meeting held in Baltimore this week.

Electrical insulation and related problems in dielectrics were considered at the opening session on Tuesday. A thermal method of standardizing dielectric power-loss measuring equipment was offered by J. A. Scott in a paper prepared in collaboration with H. W. Bousman and R. R. Benedict. This application involved investigations of dielectric power loss in cables utilizing the sheath temperature rise associated with the flow of heat due to power loss within the sheath. The method avoids the errors involved in the use of a reflecting astatic electrodynamometer wattmeter using an air capacitor for phase-angle compensation.

The practical considerations involved in the application of mica folium to the insulation of coils for high-voltage turbo-generators were pointed out in a paper prepared by C. H. Hill and read by J. L. Henderson.

A further report of determinations regarding the effects and characteristics of residual air and moisture in impregnated paper insulation was made by J. B. Whitehead, W. B. Kouwenhoven and F. Hamburger, Jr., in a paper read by the latter. Discussion ranged largely around this paper, it being contended in general that investigations involving a specially prepared short-length, nonreeled cable sample gave results widely divergent from those obtainable with standard materials and that methods applied here would be inapplicable to production manufacturing. This assumption was discounted by several members, who discerned a tangible advantage in the investigation of basic phenomena under favorable, controlled conditions. Dr. Whitehead disclaimed any attempt to simulate commercial manufacturing conditions in this laboratory work.

A lecture, "Sounds That Burn," was delivered by Dr. R. W. Wood on Tuesday evening, and following this the two regional prizes for the best paper and the best first paper of 1927 were both presented to Sigmund K. Waldorf for his exposition of a new amplifier to adopt the oscillograph to low-current investigations.

The new Gould Street generating station of the Consolidated Gas, Electric Light & Power Company was the subject of the Wednesday sessions. A general description of the features of this plant was presented by A. S. Loizeaux. The design studies which preceded the erection of the first section of the station and the engineering considerations leading to the specification of major items of equipment were detailed by F. T. Leilich. A. L. Penniman, Jr., and F. W. Quarles outlined the problems and experiences encountered in the operation of this station. As this was the first pulverized-fuel installation on the Baltimore company's system the operating personnel was carefully selected. A frank statement of early operating difficulties was made.

The Gould Street plant has several unusual features, including one boiler for each turbo-generator unit, condensers with rolled tubes at both ends, and bleeder heaters utilizing hairpin-loop, single-tube sheet construction. Water-cooled furnace walls are installed. The cost for the ultimate station of 160,000 kw. was given as $79 per kilowatt and the thermal performance obtained is 14,000 to 15,000 B.t.u. per kilowatt-hour.

Prof. A. G. Christie discussed the paper, dwelling on the points just referred to, and pointed out that the use of one boiler to one turbine made the boiler house shorter than the turbine house.

H. C. Sutton said the 450-lb. steam pressure permitted an interesting comparison with present-design plans for the Deepwater station on the Delaware opposite Wilmington, where only 1,380-lb. boiler pressure will be used. L. W. W. Morrow pointed to the unusually large use of automatic control in the plant and especially on the alternating-current auxiliaries, where wide speed ranges were desired.

A. L. Penniman said the station had come up to the expectations of the designers. Heavy maintenance on the pulverized-coal installation was required at first; the heat transfer in air heaters did not come up to expectations; radiation losses were larger than expected, but so was boiler-heat transfer. He said that lessons learned for building a new station were: (1) Do not start up a pulverized-fuel plant in winter. (2) Use 800-deg. to 825-deg. F. steam temperature. (3) Dry all pulverized coal in the preparation mill. It had been shown, he asserted, that all metal-wall furnaces would operate splendidly at very high ratings.

An inspection trip to Gould Street station was made on Wednesday afternoon and a dinner-dance was held that evening. Herbert A. Wagner, president of the Consolidated Gas, Electric Light & Power Company, was the speaker at the dinner. He paid tribute to the engineer and the work he had done to make possible modern life. President Bancroft Gherardi also spoke briefly.

The Conowingo development was covered in three papers presented on Thursday morning, and a large party was booked for an inspection trip there on Friday. On Thursday afternoon system stability and overexcitation were to be discussed, and, in addition, a paper on the communication features of the Conowingo project was scheduled.

## Argument in New Jersey Merger Suit

*Attorney for Public Service Corporation Maintains that the Public Good Should Take Precedence Over Stockholders' Rights Where These Conflict*

ARGUMENT was heard at Newark, N. J., last week before Vice Chancellor Baker in the suit brought by minority stockholders against the merging of five leased companies into the Public Service Electric & Gas Company of New Jersey. As previously reported (ELECTRICAL WORLD, July 2, 1927, page 34), the underlying companies involved are the Essex & Hudson Gas Company, the Paterson & Passaic Gas & Electric Company, the New Brunswick Light, Heat & Power Company and the Somerset, Union & Middlesex Lighting Company. The Public Service Corporation in bringing about this consolidation followed its settled policy of simplifying its organization and capital structure.

Robert H. McCarter, attorney for the Public Service Corporation, argued that the mergers were of benefit to the public and enabled the corporation to borrow money at a lower rate of interest than can be obtained where leased properties are concerned. He challenged the right of any stockholder to seek to prevent a business movement for the public good because the stockholder has an investment in a leased company.

Thomas G. Haight, counsel for the minority stockholders, argued that the merger would relieve the Public Service Corporation from paying rentals on the 900-year leases and that, since Public Service stock would receive dividends only when earned, the stockholders in the absorbed companies would be deprived of their right to an assured return. Mr. Haight maintained also that the market value of the stock of the leased utilities was less a measure of value than the equity behind this stock.

Mr. McCarter asserted that a majority of stockholders in the leased companies favored the merger plan and that only a catastrophe could affect the 6 per cent dividends of the Public Service stock. If such a catastrophe occurred, the leases would have to be canceled anyhow, he declared.

A decision on the case is expected in the near future.

## Electrical Men Meet with Oil Burner Makers

The fifth annual convention and exposition of the American Oil Burner Association, held at the Hotel Stevens, Chicago, on April 3, 4 and 5, brought together 1,500 representatives of the greatest variety of interests ever assembled to discuss the problems of oil heating, including many electrical men. The convention demonstrated that the oil-burner industry is impressing the value of its products upon the electrical industry.

A particularly pertinent address was given by Charles K. Nichols of the New York Edison Company, who spoke of the increased attention which electric light and power companies are giving to the possibilities of oil heating. "There is a great chance," he said, "for the oil-heating industry and the electric light and power central stations to help each other out." Mr. Nichols went on to say that his industry, through the National Electric Light Association and the Association of Edison Illuminating Companies, is investigating oil heating and, if satisfied with the information developed, is preparing to promote the use of domestic oil burners just as it is now pushing electric refrigerators. This interest is due to the desire to equalize the central-station "load."

The fact that the Board of Underwriters has placed its stamp of approval upon a large majority of representative oil burners now in use was cited as proof that the industry no longer need fear opposition to its products on the ground of danger from the burning of oil in domestic heaters. Government statistics were quoted to prove that oil prices today are practically the same as in 1913.

## Plans Forwarded for Chicago Industrial Museum

Impetus has been added to the plans for the Chicago Industrial Museum by the appointment as director of Waldemar Kaempffert, science and engineering editor of the New York *Times*, who will pass several months studying similar museums in Paris, London, Vienna and Munich before taking up his new work.

The Chicago Industrial Museum, which will have 400,000 sq.ft. of floor area — or about the extent that Sir Henry Lyons, director of the Science Museum of South Kensington, London, regards as ideal—has been made possible by a gift of $3,000,000 from Julius Rosenwald in addition to $5,000,000 appropriated by the South Park Commissioners to reconstruct for this use the fine arts building of the World's Fair of 1893. Mr. Kaempffert emphasizes the intention to make the museum more than a heterogeneous collection of machines. It is to be an educational institution for the presentation of scientific and engineering principles.

## Miami Draws 600 Men from Southeast

### Divisional Convention Discusses Merchandising, Rural Service and Other Industry Topics—Invited Speakers Give Outside Points of View

THE Southeastern Division of the National Electric Light Association, comprising North and South Carolina, Georgia, Florida, Tennessee and Alabama, as well as Porto Rico and Cuba, held its sixteenth annual convention on April 11 to 13, at the Roney Plaza Hotel, Miami Beach, Fla. The registration exceeded 600 and many guests of national prominence were present. From every standpoint the convention was one of the most successful in the history of the division.

After President Joe H. Gill had reviewed the year's divisional activities and H. T. Sands, president of the National Electric Light Association, had once more pressed home the duty of service and the need of eliminating public misunderstanding concerning the aims and methods of the industry, John M. Hager, director of market surveys, Domestic Commerce Division of the United States Department of Commerce, addressed the opening meeting on "Government Survey of Industry and Trade in the Southeast." Mr. Hager stated that the South has stepped ahead of the nation in growth since 1914, the South's increase being 307 per cent as compared with an average of 250 per cent in other sections of the country. Harrison Jones, executive vice-president Coca Cola Company, then gave a stimulating talk on merchandising that was well received. Mr. Jones said that 50 per cent of electric appliances were sold by the customers of the utility rather than the salesmen as the customer knows more about them than the salesman. He said that individuals get in the frame of mind to buy from reading advertisements and hearing what other people say about the appliances and that therefore the service of the appliances already sold was an important factor in sales work.

Comprehensive committee reports filled the sessions of Wednesday afternoon. The speech of Dr. J. S. Thomas, director of extension of the University of Alabama, who addressed a joint meeting of the Commercial and Accounting Sections on Thursday, was one of the best at the convention. Dr. Thomas dealt with the importance to culture of modern business methods and inventions. C. E. Greenwood, director of commercial activities at N.E.L.A. headquarters, and E. A. Davis, chairman of the Accounting National Section, also addressed this joint meeting, at which it was resolved to formulate plans looking toward accounting methods which would reflect merchandising costs in a better way.

Major H. S. Bennion, director of engineering of the N.E.L.A., at the Engineering Section meeting outlined what is being accomplished in the co-ordination of communication systems with the power transmission and distribution lines.

At the second general session, on Thursday, John F. Owens, chairman of the Public Relations National Section, spoke on the functions of that section and the chairmen of the Public Relations, Commercial, Engineering and Accounting Sections of the division gave reports, all of which brought forth considerable discussion. An impromptu speaking contest conducted by the women's committee was won by Miss Edith Wise of the Knoxville (Tenn.) Power & Light Company, to whom a free trip to the coming Atlantic City convention of the national association was awarded.

A feature of the third general session was the talk of Phillips B. Shaw, vice-president of the National Electric Power Company, on the operation of the merchandise department in relation to other phases of utility operation. Mr. Shaw thought that since utility companies are pushing their merchandising programs the greatest need is to educate the major executives into regarding merchandise activities as something which can be co-ordinated with the rest of the operations rather than carried on apart from them. He spoke in favor of the district representative methods of operation whereby such representative does service as well as sales work. Another speaker was Miss Eloise Davison, home economics adviser of the N.E.L.A.

Rural electrification was the subject of Forrest D. Banning of the Florida Power & Light Company, who gave an outline of its growth in the Southeast and told about the 120,000-acre small-farm development in Florida of J. C. Penny, where 90 per cent of the farmers are using electricity.

A feature of the entertainment program not common at N.E.L.A. conventions and much enjoyed was the deep-sea fishing. The following officers were elected for the coming year: President, Charles A. Collier, vice-president Georgia Power Company; first vice-president, Stuart Cooper, vice-president South Carolina Power Company; second vice-president, T. H. Tutwiler, president Memphis Power & Light Company; third vice-president, H. E. Cox, Birmingham Electric Company.

## Bay State Lower House May Ask Utility Inquiry

The postponement until next year's session of the bill asked by the Massachusetts Department of Public Utilities to govern rate regulation has not yet been agreed to by the House of Representatives, although the Senate, as reported on April 7 (page 723), adopted the joint legislative committee's report recommending this policy. In the House a substitute resolution was referred to the committee on ways and means, from which at the time of writing it had not been reported.

This substitute resolution provides that an unpaid special commission, consisting of one member of the Senate to be designated by the president thereof, three members of the House of Representatives to be designated by the Speaker, the chairman of the Commissioners of the Department of Public Utilities and two persons to be appointed by the Governor, "shall investigate ways and means for regulating the rates, valuations and capital issues of gas and electric companies in such manner as will be fair alike to the public and to the companies concerned," including the recommendations of the Governor and the department now before the Legislature. This special commission would be instructed to report to the Legislature not later than Dec. 1, 1928, with the drafts of recommended legislation.

## Cooper Applies Again

*Hydro-Electric Engineer Asks Federal Power Commission for Columbia River Permit—Porto Rico Company Seeks License—Storage in National Forests*

HUGH L. COOPER has applied again for a preliminary permit covering a project in "Z" Canyon on Clark's Fork of the Columbia River near the Canadian boundary. The Federal Power Commission, in April of last year, rejected an application from him for a preliminary permit because of the doubt of obtaining state rights and because of the lack of potential market. The objection of the state, which was based upon possible interference of this project with development of the Columbia Basin, has been removed (Electrical World, March 3, page 474), and Colonel Cooper advises that he is now in a position to demonstrate his ability to market the power. About 200,000 hp. of primary power is available at the site, and it is planned eventually to install 350,000 hp. Favorable reports have been submitted by the Forest Service and the Bureau of Reclamation with the usual provisos, and it is understood that a favorable report has been submitted to the War Department.

The Porto Rico Railway, Light & Power Company of San Juan has applied to the Federal Power Commission for a license covering a project intended to develop the power resources of the Blanco, Hicaco, Cubuy, Sabana, Prieto and Sojonto Rivers. This company previously had been denied a preliminary permit, owing to the fact that it was in conflict with an application submitted by A. L. Arpin and because neither applicant at that time had been granted territorial rights. In the meantime the light and power company has completed its surveys and has acquired the necessary franchise in Porto Rico. It is planned to construct a 1,200-acre-foot storage reservoir on the Hicaco into which the waters of the Sojonto and Prieto Rivers will be diverted. A power house will be constructed 1½ miles below the dam. Another dam will be built just below the power house, where another reservoir will be created to impound the waters of the Sabana and Cubuy Rivers. Another power house will be built 2 miles below that dam. It is planned to install 10,000 hp. The project is of particular importance in Porto Rico, where fuel is high.

Action having an important bearing on the rights of water-power licensees who plan to develop storage in national forests has been taken by the Federal Power Commission. In at least one important case private owners of lands lower down the river obtained an injunction against such storage on the ground that a reduction in flood heights affects injuriously the productivity of certain downstream lands enriched by overflow. The commission finds in that case, which affects the San Joaquin River developments of the Southern California Edison Company and the San Joaquin Light & Power Corporation, that these projects are desirable and justified in the public interest for the purpose of improving navigation. Recently this relation to navigation was investigated. It was found that the storage would aid navigation by the reduction of flood flows and by the increase in the low-water flow.

## Adjourn Royal Gorge Hearing Until May 2

Another hearing by the utilities commission of Colorado on the application of the Public Service Company of Colorado to build a hydro-electric plant in the Royal Gorge near Canon City was held at Pueblo on April 12, when Warden Richard Shaw of the State Reformatory, Mayor Alexander and other representatives of Salida, Colo., Chief Engineer Arthur Ridgway of the Denver & Rio Grande Western Railroad, Franklin P. Wood, consulting engineer, Denver, and others opposed the application. Hearing was adjourned to May 2, when testimony in rebuttal will be heard.

## Court Allows Six-Cent Rate at Worcester

Residential and commercial customers of the Worcester (Mass.) Electric Light Company are now being billed at a maximum net rate of 6 cents per kilowatt-hour on meter readings dating from April 1. Judges Bingham, Johnson and Lowell issued a decree last week in the United States District Court at Boston modifying the injunction against the Massachusetts Department of Public Utilities prohibiting the commission from enforcing its decision of last June ordering the company to reduce its maximum rate from 7 to 5 cents per kilowatt-hour. The injunction was modified to permit the company to charge a 6-cent rate as a result of a voluntary reduction from 7 cents recently announced by the utility.

Counsel for the commission and the company agreed upon the modification pending final determination in the federal courts of the propriety of the commission's 5-cent rate. The court finding requires the company to deposit a million-dollar bond for refunds to its customers in case it loses its case and allows the company to charge a 7-cent rate on bills remaining unpaid fifteen days after rendering. On the reproduction-cost-less-depreciation rate-base method the company maintained its right to a return on $17,837,965, while the commission set the maximum base at $10,000,000.

## St. Lawrence Notes Are Made Public

*Kellogg and Massey Arrive at "Acceptable Basis of Negotiation" for Waterway and Power Development—United States to Pay for International Section of River*

FOUR notes on the projected St. Lawrence River waterway exchanged since January by Secretary of State Kellogg and Vincent Massey, the Canadian Minister at Washington, have been made public there and at Ottawa. These notes are formal and in part repetitious of standpoints already taken by the American and Canadian governments. An "acceptable basis of negotiations" is defined in them as follows:

"That the prosecution of the improvement of the St. Lawrence waterway be based on the undertaking by the United States of the deepening of the necessary channels through the interconnecting waters of the Great Lakes and the improvement of the international section of the St. Lawrence both for navigation and for power, and the undertaking by Canada of the construction of the waterway in the sections wholly Canadian, that is, the Welland Canal and the works in the St. Lawrence below the international boundary."

No serious dissent on the part of Secretary Kellogg was made to a contention by the Canadians that the United States bear the somewhat larger portion of the cost of the work still to be done. The Ottawa government, in addition, declared that further consideration was necessary on its part as to some engineering phases of the problem, while other details, for constitutional reasons, required decisions by the Dominion Supreme Court in cases now pending. Mr. Massey asserted, nevertheless, that it was agreed the project was "feasible."

As for hydro-electric power, Canada made clear that "such power as may be rendered available on the St. Lawrence, whether from the wholly Canadian section or from the Canadian half of the international section, shall be utilized within the Dominion to stimulate Canadian industry and develop the national resources." It also declared that "the development of power on the Canadian side should not exceed the capacity of the Canadian market to absorb it."

To this Secretary Kellogg replied that "it would seem that the United States ought to be permitted to develop its power and use its half, the other half to be used by Canada or not as it should desire. The United States," he added, "fully recognizes the right of the Dominion of Canada to the ownership and use of the Canadian share of the power which may be developed in the international section of the waterway, as well as to all that developed in the national section, and it recognizes also that the disposition of the power is purely a domestic question. It recognizes further that this share is an inherent attribute of Canadian sovereignty, irrespective of the agency by which the power may be developed." Elsewhere the Secretary said that the United States "regards as acceptable the proposal that the design and operation of works in the international section of the river be under joint technical control and assumes that the design of all works on the waterway will comply in general with the plans agreed upon by the Joint Engineering Board as embodying the best principles."

A tentative expense table submitted by the Canadian government put the total cost of canalization and ultimate power development (3,148,900 hp.) at $400,830,000 for Canada and $383,183,000 for the United States. The figures for Canada include $85,560,000 representing the existing St. Lawrence and Welland Canals and Sault Ste. Marie Lock.

Addressing the Canadian Parliament, Premier King intimated his sympathy with the project and expressed the view that it was an undertaking bound to be carried out at some time in the course of North American development. It was the first intimation Parliament had had of the Premier's personal attitude with respect to the proposed enterprise.

## Purchases and Mergers

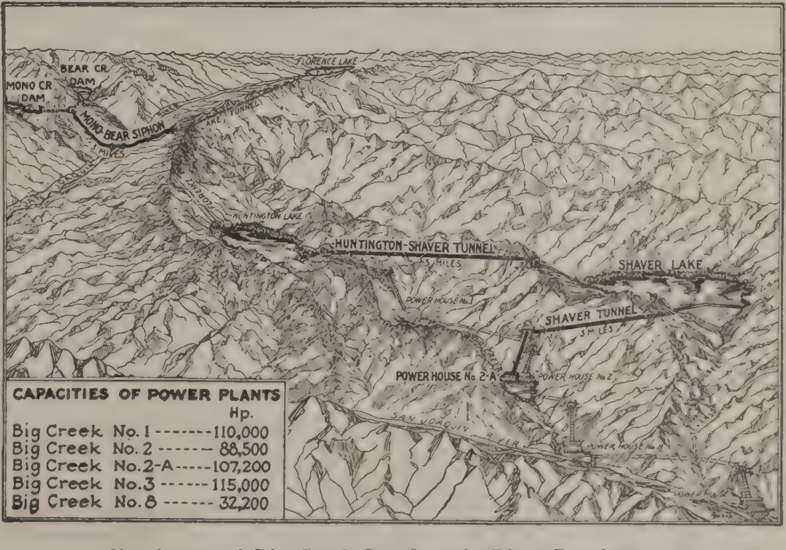
*Penn-Ohio Edison Preparing to Take Control of Northern Ohio Power—Scituate (R. I.) and Corsicana (Tex.) Properties Are Sold*

CONSOLIDATION, long awaited, of the Penn-Ohio Edison Company and the Northern Ohio Power Company began to shape itself into a reality last week when the directors of the former company voted to approve of an exchange of securities of both companies, which exchange will eventually give the Penn-Ohio Edison control of the Northern Ohio Power. A notice calling Penn-Ohio stockholders to a special meeting May 1, at which time formal approval of the transaction will be sought, will be mailed shortly. The Penn-Ohio Edison Company, incorporated in Delaware, has among its subsidiaries the Penn-Ohio Power & Light of Youngstown, the Ohio River Edison Company of Youngstown, the Grand River Electric Light & Power Company of Rock Creek, Ohio; the Zelienople (Pa.) Light &

## Southern California Edison's Advance

### Appropriations for 1928 Include Nearly $6,000,000 Each for Big Creek, for Long Beach and for Transmission-Line Extensions and Substations

INFORMATION from the Southern California Edison Company says that its Long Beach steam plant No. 3 is well advanced and that the first 93,750-kw. unit will be ready for operation about July 1. Foundations for another unit of the same rating are being laid, and the machine has been ordered. Eventually the plant may have eight units and a million horsepower. Construction work on Big Creek power house No. 2A is actively under way, and it will be ready for operation by midsummer. It will contain two turbo-generators with a total rating of 107,200 hp. and will utilize water from Shaver Lake under a drop of 2,419 ft. On account largely of this high head, the penstocks will be of special design and material. An appropriation of $5,982,000 for water-power development and one of $5,987,000 for steam-power development divide the two equally in the 1928 budget, which also provides $3,100,000 for extension and completion of the 220-kv. transmission system and $2,565,000 for betterments to secondary transmission lines and substations.



*Sketch map of Big Creek-San Joaquin River Development completed and in progress*

Power Company and other concerns. The Northern Ohio Power Company controls the Northern Ohio Traction & Light Company of Akron. Hodenpyl, Hardy & Company, to whose group the Northern Ohio belongs; E. W. Clark & Company and Bonbright & Company have agreed to deposit their holdings under the plan of exchange.

Sale of the Scituate (R. I.) Light & Power Company to the Narragansett Electric Lighting Company, negotiations for which had been under way for about a month, was consummated last week. No price was made public. The smaller concern has been obtaining its energy from the larger for some time.

Purchase of the Corsicana (Tex.) Power & Light Company, which controls also the Athens (Tex.) Electric Light & Power Company, by the Texas Power & Light Company is announced.

Permission refused last July (Electrical World, Aug. 6, page 279) by the Pennsylvania Public Service Commission to the Metropolitan Edison Company of Reading to take over eleven other General Gas & Electric subsidiaries has just been extended.

The plan previously published to consolidate the Buffalo, Niagara & Eastern Power Corporation and its associated companies into one operating company was approved by the directors of the various companies at a meeting in Buffalo on April 13. Chief companies included in the consolidation are the Niagara Falls Power Company, Niagara Electric Service Corporation, Buffalo General Electric Company, Niagara, Lockport & Ontario Power Company and Tonawanda Power Company.

John R. Macomber, a director of the International Paper Company, and his associates have, newspaper reports say, acquired the Northeastern Power Corporation's holdings in the New England Power Association, thus giving the International Paper a preponderating influence over the third large stockholder, Stone & Webster. Details of the transaction were not forthcoming.

Approval of the Missouri Public Service Commission has been given to the purchase of the Kirksville Gas, Heat & Electric Company and the Brookfield Gas & Electric Company by the National Gas & Electric Corporation of Battle Creek, Mich. The National Utility Company of Missouri, a newly formed subsidiary of the National Gas & Electric Company, will operate the properties, and the Kirksville and Brookfield corporations will be dissolved. The price reported was $212,500 for Kirksville and $125,000 for Brookfield.

The Mayor of Little Rock, Ark., has reported an offer of the Arkansas Power & Light Company to purchase the municipal lighting plant. He indicated that he would favor the sale if the company will agree to a substantial reduction in rates.

The City Council of Milton, Fla., has called a special election for May 15 to decide whether Milton shall sell its electric plant to the Gulf Power Company for $65,000 and grant the power company a 20-year franchise. The Council has approved the sale, subject to ratification.

The Canada Northern Power Corporation has commenced the consolidation of its component companies—Northern Canada Power, Northern Ontario Light & Power, Northern Quebec Power Company, Great Northern Power Corporation and the Porcupine Power & Telephone Corporation—by issuance of bonds for $15,000,000.

# Briefer News

New 50-Mile Transmission Line for Nebraska. — The Iowa-Nebraska Gas & Electric Company plans to build a transmission line from Blue Springs, south of Beatrice, to Humboldt, Neb. The proposed line will pass through Liberty, Burchard and Armour and cover 50 miles. From Humboldt the company plans to extend its lines to Sterling, Stella, Shubert and Verdon. Construction of the lines will cost about $75,000.

Rochester Gas & Electric Installs Twenty-seventh Substation.—Work will be completed early in May on Station 40, the Rochester Gas & Electric Corporation's twenty-seventh main substation, designed to serve the northeast section of the city. The new station is on Ridge Road, where it will relieve Station 1 of part of its burden, and will have a rating of 3,000 kw., Roger De Wolf, assistant superintendent of the utility, says.

Line from Greggs Falls to Nashua, N. H. to Be Built.—The Public Service Company of New Hampshire will construct a 60,000-volt transmission line from its Greggs Falls station in Goffstown to its station in Nashua, making also a 33,000-volt extension from Hillsboro to Henniker. The line from Goffstown will pass through the towns of Bedford, Merrimac, Litchfield and Hudson. The company already has a trunk line across the state and is now tying in points both north and south.

Public Service Company of Colorado to Erect New Business Building.—The Public Service Company of Colorado has taken out a permit to erect a building at West Third and Lipan Streets, Denver, to house nine departments now scattered in various parts of the city as well as to serve as a garage. The new structure will occupy about two and one-half city blocks and cost $500,000. The executive departments will continue to be housed in the Gas and Electric Building.

American Gas & Electric's Big Program. — No less than $40,000,000 will, according to official announcement, be required to carry out the expansion program now under way for the American Gas & Electric Company's subsidiaries, and a large part of this program will be completed this year. In the total sum are included the seventeen-million-dollar extension to the Philo generating station of the Ohio Power Company, where a 165,000-kw. generator with auxiliaries is being installed, and the new twelve-million-dollar Deepwater station in New Jersey, opposite Wilmington, Del., which is jointly owned with the Atlantic City Electric Company. More than $7,000,000 will be spent on major transmission lines, including the connection of the Indiana General Service Company with the main interconnected system of the American Gas & Electric Company; a 132,000-volt line from Philo to Fostoria, a new high-tension line across south New Jersey and other shorter lines. A number of important substations are being built, and $4,000,000, the company announces, will be spent on local distribution lines and customers' services.

Dublin (Ga.) Rejects Proposal for Competition with Georgia Power Company.—The City Council of Dublin, Ga., has refused the application of a number of business men who asked the privilege of operating a co-operative electric lighting plant to supply light to retail stores in the business section. The Council held that the proposal was unfair to the Georgia Power Company, which is operating under a franchise and investing a considerable amount of money in the city and surrounding territory.

Expansion in New Mexico.—The Texas-Louisiana Power Company has begun the construction of an electric power plant at Jal, N. M., and will connect it with its power transmission system by extending the line which runs from its power plant at Pecos to Kermit. The company has also just finished the construction of a transmission line from its Pecos plant to Fort Stockton, 55 miles, and to Toyah, 20 miles. It is supplying several other towns and the oil fields of this section with electric power.

Another Hydro Plant on the Shenandoah Projected.—The Shenandoah Milling Company of Shenandoah, Va., has obtained options on water rights for a proposed hydro-electric plant on the Shenandoah River, one mile south of Shenandoah. The dam would be approximately 20 ft. in height and 500 ft. long, extending over dry lowland on the east side of the river. The power house would probably be erected on the west side. The milling company recently sold its controlling interest in the Page Power Company's dam at Newport, about 10 miles north of Shenandoah.

Davidson Denies Political Partisanship.—A feature of the Republican primary campaign in Nebraska (referred to last week on page 778) was the appearance of a two-column advertisement signed by J. E. Davidson, general manager of the Nebraska Power Company, who had been accused of supporting Senator Howell, declaring in unequivocal terms that the company was not interested in the candidacy of either the Senator or his opponent and was supporting no one, that it did not belong to any power trust and that no such trust exists in the state.

Second Chelan Unit to Go on Lines About July.—Work is now progressing on the installation of a second 24,000-kw. generating unit in the power station of the Washington Water Power Company at Chelan, Wash. This second unit will be of General Electric manufacture and identical with the first, which was placed in operation last September. The waterwheel is already in place and the generator is scheduled to go on the line about July 1. Both units are fed through a two-mile tunnel, the dam being half a mile below Lake Chelan on the Chelan River. A second tunnel will be required for the further development of this site.

Eighty Additional Miles of Transmission for Southern Maryland.—The Maryland Public Service Commission has granted the Suburban Light & Power Company of Maryland, a newly formed utility, the right to erect 80 miles of transmission lines in three southern Maryland counties, St. Mary's, Charles and Prince George's, to serve a number of communities in that section. The company will purchase its power from the Potomac Electric Power Company of Washington. Decision was reserved on a petition to extend the lines into Calvert County. Such an extension would mean 20 more miles of line.

Table Rock (Mo.) Hydro Project Still Delayed.—More delay in construction of the hydro-electric dam at Table Rock, south of Springfield, Mo., where an ultimate expenditure of many millions is projected, was encountered recently, when the Stone County Court rejected a proposal submitted by representatives of the Empire District Electric Company to build five different sections of road, totaling 37 miles, in lieu of a bridge. The Doherty interests, which are back of these schemes, announced that they are ready to begin construction work as soon as the court waives its objection.

More Plans for Developing Nova Scotia's Water Power. — Announcement that a group headed by I. W. Killam of the Royal Securities Corporation, Montreal, will erect a large newsprint mill in Nova Scotia, probably at Liverpool, has been followed by the news that the Nova Scotia government intends, when the plans for the mill project are finally worked out, to undertake hydro-electric development on the Mersey River, part of the power to be purchased by the newsprint plant. The Mersey is capable of developing about 35,000 hp.; of this the newsprint plant will take about 20,000 hp.

Kewanee a Center of Distribution.—The Illinois Power & Light Company within the next 60 days will complete two more of its 132-kv. steel-tower lines connecting with the Kewanee substation, according to S. M. Cox, general manager at Kewanee. The Keokuk connecting line has been in operation a year and the Joliet line approach was being pushed through, with March 1 as the date for the initial electrification of that loop, but erection of a tower at Bureau, on the Illinois River, delayed this work, which will be finished within two or three weeks. The Peoria line will be cut into the Kewanee station within a few weeks. Half the concrete bases have been finished and 30 per cent of the towers erected. A fourth line, from Rock Island, is to be built later, making Kewanee a center point for these four distribution lines.

Third Unit at Harrah (Okla.) Plant Under Way. — Construction work on the third unit of the Harrah steam-electric station of the Oklahoma Gas & Electric Company near Oklahoma City, which when completed will provide additional generating capacity of 30,000 kw., bringing the station rating to 65,000 kw., is well under way. The original capacity in 1924 when this plant was put in service was 15,000 kw. Work is expected to be completed about Sept. 1, 1928. There are now five 63,000-volt lines through which power is supplied from this station to Oklahoma Gas & Electric Company power users. Two of these lines extend to Oklahoma City, one to Drumright, one to Shawnee and one to the oil fields by way of Etowah.

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]**

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Arizona Utilities Association—Prescott, Ariz., April 26-28. M. G. Sanders, Industrial Congress Bldg., Phoenix, Ariz.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

American Institute of Electrical Engineers—New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A.—Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

Progress Rapid at Chippewa Falls.—The power-house substructure for the Northern States Power Company's 27,000-hp. hydro-electric development at Chippewa Falls, Wis., is nearly 85 per cent complete, according to Vice-President H. W. Fuller of the Byllesby Engineering & Management Association. The development, of which previous accounts have been printed in these columns, calls for the construction of a dam about 1,030 ft. long and of a power house, approximately 280 ft. x 65 ft., on the north bank of the river. The plant is scheduled for completion Sept. 1 and will operate synchronously with the 42,000-hp. station at Wissota.

New Plant Planned for Texas Utilities Company. — Construction of a main power plant at some point in northwest Texas convenient to its present system of transmission lines and generating plants will be started soon by the Texas Utilities Company, according to J. B. Scott of Plainview, general manager of the company. A survey is now being made to determine the site for the proposed plant, he said. The power transmission system of the company extends to about 40 towns in the Panhandle, South Plains and eastern New Mexico. The company now owns power plants at Plainview, Lubbock and Canyon, all in Texas, and in Clovis, N. M.

Lively Intercompany War at Alliance, Ohio. — Commercial war between the Ohio Public Service Company, a subsidiary of the Cities Service Power & Light Company, and the Suburban Light & Power Company has been carried into two Ohio courts. The Suburban Light & Power was recently purchased by New York capitalists, and its headquarters were moved from Cleveland to Alliance. The Suburban constructed lines to territory where the Stark Electric Company had been distributing power under contract from the Ohio Public Service Company, planning to link its system with the Stark Electric lines. This was halted by a court injunction, and the Ohio Public Service Company is suing for breach of contract. The Ohio Public Service Company in its turn began to branch out in the Alliance territory, constructing a transmission line on a newly improved highway, and its workmen were arrested on trespassing charges. Then the Ohio Public Service Company secured an injunction which prevents the Suburban from removing poles erected by its competitor. The fight has spread to rural service. The Ohio Public Service has been charging rural customers more than $200 each toward line construction. The Suburban has discontinued its connection cost where the property owner agrees to pay $5 a month, for which he can receive 100 kw.-hr., all over 100 kw.-hr. to be paid for at the rate of 5 cents a kilowatt-hour.

Summing Up Nebraska-Iowa Storm.—Final reports from the snowstorm that swept over a considerable portion of eastern Nebraska and western Iowa on April 6 show a total loss to public service companies of more than a million dollars. Of this total $850,000 was the share of communication companies and the remainder that of the power companies, especially the Nebraska Power and the Iowa-Nebraska Light & Power. Nearly twenty-five thousand poles went down. Temporary repairs by nearly two thousand linemen, drafted from unaffected territory, made restoration of service within a few days complete, but it will be several months before permanent work can be completed.

Iowa Public Service Company's Troubles at Sac City and Emmetsburg.—The Iowa Public Service Company and the Sac City (Iowa) authorities have reached an agreement in the litigation involving the location of poles and wires on the streets of the city, the utility company removing its distribution system pending an election at which it is seeking to obtain a franchise in Sac City. If it succeeds, a new system will be installed. At present Sac City, Odebolt and Schaller are supplied with power from the Sac County Electric Company. The Iowa Public Service Company has joined citizens of Emmetsburg, Iowa, in petitioning for an injunction to prevent the Municipal Utilities Company from erecting a municipal plant there. The last-named company agreed to operate the plant until its earnings had paid for the investment, at which time—estimated at eight years—the city was to take it over. The project was indorsed by a three-to-one vote at a special election on March 21.

Salt River Valley Water Users Plan New Hydro-Electric Plant.—The Salt River Valley Water Users' Association will construct an additional dam at Stewart Mountain below Mormon Flat to impound 70,000 acre-feet of water for the operation of a hydro-electric plant. Electric power from this source will go to supplement that which the association is already distributing in that part of Arizona. The Central Arizona Light & Power Company desires to enter into a 50-year contract for the purchase of power from the association at a cost of not less than $240,000 a year, and that company will distribute power to urban communities as well as farms. Owing to the income from power, now mainly from mining companies at Miami, Superior and Ray, the farmers' annual cost of water, on a seven-year average, has been, it is reported, only $3.18 an acre, compared with from $9 to $14 on other reclamation projects.

## Recent Court Decisions

Function of Kansas Courts in Rate Making.—While the courts of Kansas have no rate-making powers, said the Supreme Court of that state in refusing an injunction asked for by the city of Hutchinson against the Hutchinson Gas Company to prevent it from putting a schedule of rates into effect pending the outcome of litigation, they may on proper occasion enjoin non-compensatory rates prescribed by the Public Service Commission and may also enjoin excessive rates promulgated by a utility company; but when a court declares the rates prescribed by the commission confiscatory, a company has the right to prescribe and collect rates of its own making until proper rates have been established by official authority, unless the company's interim rates are also declared unconstitutional. (264 Pac. 68.)*

Municipalities Should Not Operate Utilities at Loss to Taxpayers.—The Iowa Supreme Court, in Muscatine Lighting Company vs. City of Muscatine, has declared illegal an issue of bonds voted by the electors for the purpose of adding additional equipment to the city's electric plant. The company sued as a taxpayer to enjoin the disposal of the bond issue. The court said in part: "The establishment and construction of such a plant is not the exercise of those municipal functions which are in their very nature governmental but the exercise of those which are corporate and proprietary. The municipality in such undertaking incurs or may incur corporate liabilities which may greatly burden the taxpayer. It may therein bind itself by commercial contracts. It in practical operation furnishes heat, water, gas and electrical energy for commercial enterprises. If these are furnished at a loss or if the utility is not profitable, the loss falls on the taxpayer, who thereby is taxed not merely for his proportion of the cost of government, but for the city's loss and (perhaps) consumers' gain in commerce and industry. As a general proposition a municipality ought not to operate utilities at the expense of taxpayers any more than a private corporation ought to operate them at a loss to its stockholders. They should be made to pay their own way and the taxpayers ought not to be called upon to assume a burden that was never intended by the establishment." (217 N. W. 468.)

Poles, Wires, Conduits and Lamps Not Assessable as Real Estate.—The Commissioners of the District of Columbia have lost their appeal in the District Court of Appeals from a decision of the District Supreme Court that the poles, wires, conduits and lamps of the Potomac Electric Power Company are not assessable as real estate. Assessment was made and taxes were levied for the years 1917 to 1926, inclusive, and the power company sued for their cancellation and was sustained in the lower court. The company claimed that the act of 1902 requiring it to pay a tax of 4 per cent on its gross earnings was meant to include all the property of the company not otherwise taxable and covers the poles and conduits located on government property. The court admits that there is conflict of authority as to the exact status of such property of corporations in some states, but points out that the law of the District provides that all real estate shall be assessed in the name of the owner on a valuation to be determined as to each separate tract or lot of land, with the improvements thereon, and says it would require "a stretch of the imagination" to apply this statute to the poles, conduits, wires and lamps of the company erected upon the non-taxable property of the United States.

## Commission Rulings

Poor Agricultural Conditions Bring Reduction in Rates.—The Oregon Public Service Commission has suspended for one year a tariff filed by the Idaho Power Company covering rates charged eastern Oregon consumers for power for limited irrigation pumping service. In lieu of these suspended rates a schedule of service and energy charges approximating a 10 per cent decrease in the original tariff is ordered. An emergency is declared by the commission to exist in this matter on the ground that the territory served by the Idaho Power Company with irrigation pumping service is dry and arid and that for several years the agricultural patrons of the company receiving this class of service have been earning only a meager livelihood.

Hydro-Electric Company's Duty in the Matter of Fishways and Portage for Boats.—Complaint was made to the Wisconsin Railroad Commission that the Neshonoc Light & Power Company had failed to provide adequate fishways around a dam across the La Crosse River, and complaint was also made that no provision had been made for the portaging of boats. The commission dismissed the complaint, saying with respect to the request for fishways that the testimony did not establish the need for any additional facilities of this character, the testimony showing that at periods of high water it was possible for fish to swim up over the apron of the dam in the flow without making a jump of any kind. The company offered to provide access for the purpose of portaging boats around the dam to any persons desiring access for this purpose.

Receipt of Power from Allied Company Disapproved.—Rates of the Amesbury Electric Company have been reduced by the Massachusetts Department of Public Utilities on petition by the selectmen of the town. The utility company was receiving part of its power from an affiliated company, which arrangement the department disapproved, stating: "The great majority of the customers of a public utility are willing to pay a fair and reasonable price for what a commodity or service honestly and rightfully costs, but they do not want the officers and directors of that utility entering into contracts or agreements whereby a private company may profit financially at the public's expense; nor do they want to be required to go to the trouble and expense of a rate case to ascertain whether such private company is so profiting. Such a situation only tends to keep alive that feeling of suspicion and distrust which is not for the best interests of the company or its consumers."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

### *C. A. Ward Resigns as Head of Vehicle Company*

Charles A. Ward, president of the Ward Motor Vehicle Company, Mount Vernon, N. Y., has resigned to become chairman of the board of the Ward Baking Corporation and also of the Ward Baking Company. Mr. Ward has been identified with the electric vehicle industry for approximately 25 years, organizing in Pittsburgh the business which formed the nucleus for the present Ward Motor Vehicle Company. He studied engineering at Cornell University and early in his career became interested in transportation. In addition to his activities in the electrical field Mr. Ward devoted considerable time to the baking business, having been a member of the board of directors of the Ward Baking Company for a number of years. He has retained his position as a director of the Ward Motor Vehicle Company, but resigned as a director of the Society for Electrical Development after serving that organization for a number of years.

*C. A. Ward*

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**Willard F. Place** has been elected a director of the Rochester Gas & Electric Corporation, Rochester, N. Y.

**C. Y. Ferris**, of Stone, Webster & Blodget, Inc., has been elected a director of the Blackstone Valley Gas & Electric Company of Rhode Island. He becomes an additional director.

**Dr. John B. Whitehead**, professor of electrical engineering and dean of the school of engineering of Johns Hopkins University, has been engaged as a consultant for the engineering and research staffs of the General Cable Corporation. He is to act in a close advisory capacity on wire and cable insulations and structures and will give particular attention to new developments of high-tension paper cables. Professor Whitehead has, over a period of years, devoted considerable time to cable research and has accomplished results of material benefit to the National Electric Light Association, the Engineering Foundation and the industry as a whole. He has likewise been active in the work of the American Institute of Electrical Engineers and the National Research Council. Professor Whitehead expects to continue his interests and co-operation with such agencies and his university work, but his association with General Cable will be his chief extra-curricular activity.

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### *E. P. Peck Resigns*

Emerson P. Peck has resigned as vice-president of the Utica Gas & Electric Company, Utica, N. Y., effective May 15. Mr. Peck will join the engineering and development division of the New York Power & Light Corporation in Albany, N. Y. Mr. Peck affiliated himself with the Utica company in 1919 and is responsible for almost the complete reconstruction of the electrical engineering department.

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**Samuel Insull, Jr.**, president of the Midland Utilities Company, Chicago, and an officer of other utility properties in the Middle West, sailed for Europe April 18 aboard the Cunard liner *Aquitania* for a short sojourn abroad.

**Francis B. Flahive**, formerly assistant treasurer of the Columbia Gas & Electric Corporation, was elected treasurer of the Columbia system. For sixteen years he was associated with Stone & Webster in various financial and managerial capacities. Soon after his connection with the Columbia system in 1927 he was made assistant treasurer.

**George T. Ladd** has been elected vice-chairman of the board of directors of the Combustion Engineering Corporation, New York. Mr. Ladd is an authority on the design and manufacture of steam boilers and has achieved marked success in this field. He is president of the Ladd Water Tube Boiler Company and president of the Heine Boiler Company.

**Edward Reynolds, Jr.**, was recently elected a vice-president of the Columbia Gas & Electric Corporation. He will continue to act as secretary of the corporation and have jurisdiction over its fiscal affairs. Mr. Reynolds was graduated from Harvard University in 1915 and received his early public utility experience with Stone & Webster in Boston, resigning from that position at the outbreak of the World War to enter the U. S. Navy. For 3½ years after the close of the war he was connected with the bond department of the Guaranty Trust Company and in the fall of 1922 joined the Columbia System as treasurer of the Columbia Gas & Electric Corporation.

### *J. C. Boyers New President of Ward Vehicle Company*

J. C. Boyers, formerly vice-president in charge of sales of the Ward Motor Vehicle Company, Mount Vernon, N. Y., has been elected president of that organization to succeed Charles A. Ward, resigned. Mr. Boyers becomes active managing head of the company after an association with the electric vehicle industry which covers a period of fifteen years. Some years ago Mr. Ward chanced upon Mr. Boyers in the vicinity of New Rochelle and induced him to join the Ward Motor Vehicle Company. Mr. Boyers threw in his lot with Mr. Ward and it was not long before he was named vice-president. His activities have not been confined to the transportation field, for he is a director of the American National Bank of Mount Vernon, the Jefferson Title & Mortgage Company and a vice-president of the Community Trust Company.

*J. C. Boyers*

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**Hugh L. Forman** has been named vice-president in charge of sales of the Ward Motor Vehicle Company, to succeed J. C. Boyers, now president. Mr. Forman was identified with the Ward Motor Vehicle Company for five years prior to the war, but he severed this connection to enter military service. Subsequently he affiliated himself with the Franklin Automobile Company of Syracuse, N. Y.

**William C. Bell**, vice-president of the Rhode Island Public Service Company and general manager of the Narragansett Electric Lighting Company, Providence, has been appointed vice-president of the New England Power Association, with headquarters at Boston, Mass. Mr. Bell was educated at the University of California, and after service with the Pacific Gas & Electric Company and San Francisco Power Company he went to Richmond, Va., in 1911, later becoming general manager of the Virginia Electric & Power Company. About a year ago he was made general manager of the Narragansett company, and has already acquired a high reputation among the younger central station executives of New England.

### *C. A. Collier Heads Southeastern Division*

Charles A. Collier, vice-president of the Georgia Power Company, Atlanta, was elected president of the Southeastern Division of the National Electric Light Association at the convention held during the past week in Miami, Fla. Mr. Collier has been identified with the public utility industry in the Southeast since 1909, the year in which he was graduated from the Georgia School of Technology. Starting as inspector of wiring and motors with the Georgia Railway & Electric Company, he soon was promoted to the position of industrial power sales engineer, and one year later became power sales engineer for large industries. Subsequently, he was appointed assistant to the contract agent of the parent company, the Georgia Railway & Power Company, his special duties being investigation work on customers' power installations, especially on industrial plants.

*C. A. Collier*

After advancing from assistant to the sales manager, assistant to the operating and sales manager and assistant to the general sales manager to the position of general sales manager, he was elected last summer a vice-president of the Georgia Power Company, successor to the Georgia Railway & Power Company, in charge of commercial activities. For many years Mr. Collier has been prominently identified with the Southeastern Division and with local association work in Atlanta.

F. Harper Craddock and C. Maynard Turner, Olympia, have been appointed respectively to the positions of chief engineer and assistant chief engineer of the Department of Public Works of Washington. Mr. Craddock has been with the department for five years. He is a graduate civil engineer from Rensselaer Polytechnic Institute and has had fifteen years' experience on railroad, municipal works and building construction and appraisal work in various sections of the United States. Mr. Turner has had several years' experience in the distribution and operating departments of the largest private and municipal electric utilities in the Northwest and was, for two years, employed as sales engineer for the Westinghouse Electric & Manufacturing Company.

Victor H. Tousley of Chicago has been appointed to the position of electrical field secretary of the National Fire Protection Association, succeeding in this capacity W. J. Canada, who is now identified with the National Electrical Manufacturers' Association. Mr. Tousley will assume his new duties on May 1, 1928, and will temporarily have an office at the Underwriters' Laboratories, Chicago. He is widely known throughout the country in electrical circles. Mr. Tousley has been associated with the department of gas and electricity of the city of Chicago for the past 25 years and for the past fifteen years has been chief electrical inspector of that department. He was graduated from the American Institute of Technology, Chicago, as electrical engineer, is the author of a series of books on electrical construction and has been a frequent contributor to technical magazines. He has for many years been an active member of the Western Association of Electrical Inspectors, of which organization he was president from 1910 to 1912. He has been a member of the electrical committee (National Electrical Code) of the National Fire Protection Association for the past fifteen years. Mr. Tousley is past-president of the Electric Club of Chicago.

### *S. B. Swan General Manager in Providence*

Samuel B. Swan, formerly electrical engineer and more recently superintendent of distribution of the Narragansett Electric Company, Providence, R. I., has been appointed general manager of the company, succeeding W. C. Bell. Mr. Swan has been in the service of the company for eighteen years and is one of the best-known electrical engineers in the New England utility field. He has played an important part in the development of the Narragansett system from an urban property to an extended organization serving a large portion of the state and today forming a vital part of the New England Power Association system. Mr. Bell has assumed new duties in Boston.

*S. B. Swan*

## Obituary

William Robert Quinn, well-known designer of fuel-oil-burning equipment, died suddenly in his room at the Hotel Manger, New York, April 12. Mr. Quinn had been a resident of San Francisco for several years past, having gone there as the Pacific Coast representative of the Combustion Engineering Corporation. He was in New York on a business trip at the time of his death. Mr. Quinn was president of the Quinn Oil Burner & Torch Company until this company was purchased by the Combustion Engineering Corporation in 1922.

A. L. Broomall, manager of the renewal parts engineering department of the Westinghouse Electric & Manufacturing Company, died April 10 at his home in Wilkinsburg, Pa., from pneumonia. Mr. Broomall's first important work was on the installation of the first electric locomotives on the New York, New Haven & Hartford Railroad. From 1911 to 1915 he had charge of the design of electric vehicle motors and then he was appointed section head of the direct-current motor section. In 1922 he was transferred to the renewal parts engineering department as engineer in charge, later becoming manager of the department, which position he held when he died. He was a member of the A.I.E.E.

Charles E. Corrigan, for many years a prominent figure in the manufacturing branch of the electrical industry, died suddenly in Jacksonville, Fla., March 24 following an operation. Mr. Corrigan was formerly vice-president of the National Metal Molding Company, Pittsburgh, but he retired in 1926 from active work, removing to Sarasota, Fla., where he became interested in poultry culture. During his career Mr. Corrigan devoted considerable time to association work, being especially interested in the affairs of the Associated Manufacturers of Electrical Supplies. He was considered an authority on concentric wiring and for many years held the chairmanship of the conduit section of the Associated Manufacturers of Electrical Supplies as well as membership on many other committees of that organization and on the board of governors. Mr. Corrigan relinquished his association activities when he retired and established a residence in Florida.

# Financial and Statistical News

## *Decline in General Market Utility Stocks Strong*

WITH transactions on the Stock Exchange still running in the neighborhood of 4,000,000 shares daily, selling pressure made itself felt during the past week and the market moved downward. In spite of the trend of the general market the light and power stocks held firm and substantial gains were recorded by many. The index of common stocks of fifteen representative light and power companies advanced five points over the preceding week. Brooklyn Edison advanced eight points, Columbia Gas & Electric ten, Detroit Edison ten, Public Service Corporation of New Jersey ten and Pacific Gas & Electric six. The Electric Bond & Share group was conspicuously strong. Electric Bond & Share securities advanced 36 points during the week under review, from 90 to 126, and Electric Investors advanced eleven points, from 49 to 60. General Electric showed marked progress and A. T. & T. rose to the highest level in the history of the company on the New York Stock Exchange, reaching 190¼.

## Utility Stocks Popular with Investment Trusts

Pointing out that the effect of investment trust buying is very important in the present securities market, the Babson Statistical Organization, Babson Park, Mass., bulletin of April 10 tabulated the popularity of public utility common stocks and various industrial, railroad and oil stocks held by five or more in a group of 31 investment trusts which make public their holdings. The number of trusts holding utility stocks and the companies represented follow:

American Telephone & Telegraph, 15; Consolidated Gas of New York, 13; North American, 12; American Gas & Electric, 10; American Power & Light, 9; Brooklyn Edison, 9; Columbia Gas & Electric, 9; International Telephone & Telegraph, 9; Southern California Edison, 9; Western Union Telegraph, 9; Detroit Edison, 8; Public Service of New Jersey, 8; Standard Gas & Electric, 7; Commonwealth Power, 6; National Power & Light, 6, and United Gas Improvement, 6.

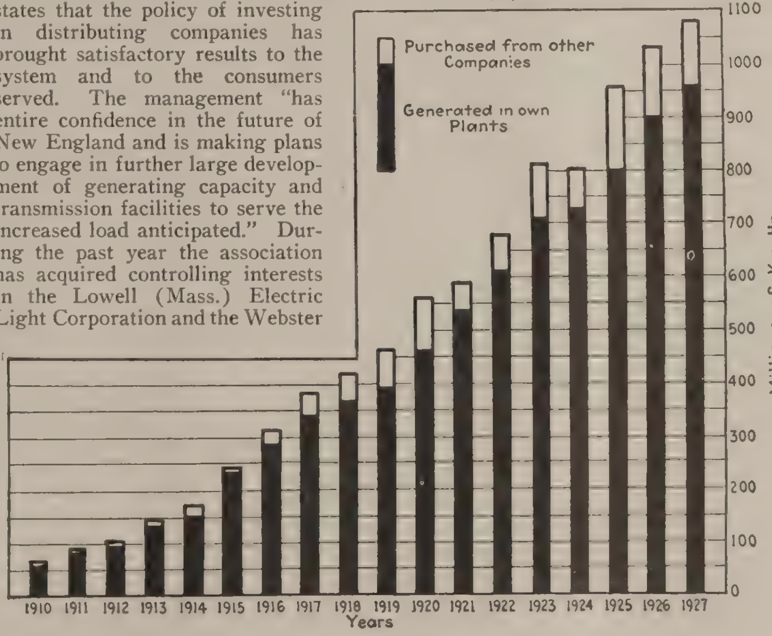
Six trusts hold 180,000 shares of American Gas & Electric, four trusts hold 450,000 shares of American Power & Light and three hold 539,000 shares of National Power & Light. Among industrials, seventeen investment trusts hold General Electric and ten Westinghouse stock. Commenting on the quality of the holdings, the report says:

> These trusts hold (in all classes) several billion dollars worth of stocks. . . . In a way the compilation represents the consensus of opinion as to the best stocks for permanent holding. While all of the investment trusts represented in this compilation are not necessarily the largest or the most conservative, nevertheless the combined results of this study should be fairly representative of all investment trust holdings. . . . The class of securities most held is very good indeed and the large volume of trust buying has undoubtedly been a big factor in pushing up the prices of these stocks to present high levels. On the other hand, when the next period of liquidation comes, these holdings by investment trusts will not prevent drastic declines in stock prices.

# New England Power Association Expands

MATERIAL progress in development of additional generating capacity, in improvement of transmission facilities and in enlargement of outlets for power featured the activities of the New England Power Association in 1927. In his annual report to stockholders Frank D. Comerford, president, states that the policy of investing in distributing companies has brought satisfactory results to the system and to the consumers served. The management "has entire confidence in the future of New England and is making plans to engage in further large development of generating capacity and transmission facilities to serve the increased load anticipated." During the past year the association has acquired controlling interests in the Lowell (Mass.) Electric Light Corporation and the Webster & Southbridge Gas & Electric Company. The most important construction work undertaken was the 60,000-hp. hydro-electric plant on the Connecticut River at Bellows Falls, Vt. Thanks to the thorough development and regulation of the Deerfield River by the New England Power Company the November flood did little damage in the immediate section of New England, and flood conditions did not materially affect other plants of the system. A large amount of line and substation construction was completed during the year and an important tie-in was made between the system and the United Electric Railways plant at Providence, R. I. Sales of power show a gain in output for the year, despite somewhat uneven industrial conditions.

The gross operating revenue, eliminating intercompany sales, was $27,378,



*Kilowatt-hour production of the New England Power Association*

*Growth of Companies Comprising New England Power Association*

| Year Ended Dec. 31 | Earnings | | Customers | | Kilowatt-Hours Generated (000 Omitted) | Kilowatt-Hours Purchased (000 Omitted) | Kilowatt-Hours Total (000 Omitted) | Total Gas Production M C F |
|---|---|---|---|---|---|---|---|---|
| | Gross | Net* | Electric | Gas | | | | |
| 1923 | 26,027,969 | 8,630,547 | 115,413 | 43,369 | 777,644 | 98,866 | 876,510 | 1,123,730 |
| 1924 | 26,079,499 | 9,000,990 | 134,603 | 44,729 | 779,784 | 86,668 | 866,452 | 1,089,169 |
| 1925 | 28,535,723 | 10,913,024 | 150,565 | 44,848 | 867,438 | 140,360 | 1,007,798 | 1,098,839 |
| 1926 | 29,076,789 | 11,949,741 | 167,805 | 45,367 | 941,675 | 129,747 | 1,071,422 | 1,120,644 |
| 1927 | 29,828,095 | 13,801,027 | 190,830 | 43,962 | 982,269 | 122,249 | 1,104,518 | 1,142,611 |

*Net before depreciation and federal income taxes.

251; other income, $1,400,409, and total income, $28,778,661. Expenses other than maintenance, depreciation and taxes were $10,827,403; maintenance, $2,782,269; depreciation, $2,687,083, and taxes, $2,523,271, leaving net earnings before interest and dividends, $9,958,633. Net consolidated earnings after interest and preferred and class A dividends of subsidiaries were $4,477,934. Preferred dividends of the association totaled $1,910,421, leaving $2,567,512 net earnings applicable to common shares, or $3.37 per share. Gross assets were $210,237,106, of which capital assets accounted for $181,310,871. The stabilizing effect of the diversification of the system's electrical load is indicated in the following percentage analysis of its revenue from sales of electricity for the year 1927: Public utilities, 17.1; industrials, 47.2; railways, 3; miscellaneous, 4.97 and residential and commercial lighting, etc., 27.8. The number of electric customers increased during the year from 167,805 to 190,830, and the total energy generated and purchased from 1,071,422,000 kw.-hr. to 1,104,518,000 kw.-hr. Over 250 communities having a population in excess of 2,500,000 are served by the system, either directly or through contracts with local distributing companies. The major portion of the energy sold by the system is in large blocks under long-term contracts to many prominent industrial concerns and local distributing companies. The table which appears on page 835 shows the growth of the properties now comprising the system.

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NEW NO-PAR PREFERRED ISSUE APPROVED FOR BUFFALO, NIAGARA & EASTERN.—The Buffalo, Niagara & Eastern Power Corporation has filed a certificate at Dover, Del., increasing the authorized capitalization by 500,000 shares of $5 cumulative dividend first preferred stock of no par value. According to present plans not more than 350,000 shares of this new stock will be issued to acquire by exchange or to provide funds for the redemption of preferred stock of the Niagara Falls Power Company, the Niagara, Lockport & Ontario Power Company and the Tonowanda Power Company.

## Macomber Heads N.E. Power Minority Interest

Arrangements have been consummated under which a group of Boston business interests, headed by John R. Macomber of Harris, Forbes & Company, will take over the minority holdings in the New England Power Association hitherto in the hands of F. L. Carlisle & Company, the Northeastern Power Corporation and Stone & Webster, Inc. These holdings compose about 40 per cent of the common stock of the association. The holdings of the International Paper Company in the association remain undisturbed. These represent about 45 per cent of the common stock. The new group is friendly to the present management of the association, as is the International Paper Company.

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PUBLIC SERVICE PRODUCTION ELECTS DIRECTORS.—At a meeting held April 17 the Public Service Production Company, Newark, N. J., elected the following directors: Dwight P. Robinson,

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 17 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 78 | 72 | 81 |
| Ala. Pwr., $7 cum. pf.—no par | k114½ | 114½ | 115½ |
| Allis Chalmers Mfg., 6% com. | 124¾ | 115⅛ | 127¾ |
| Aluminum Co. of Amer., com. | 143¾ | 120 | 150 |
| Aluminum Co. of Amer., 6% pf. | 109½ | 105½ | 109⅞ |
| **Amer. & Foreign Pwr., 7% pf.—no par** | 108 | 105⅞ | 109 |
| Amer. & Foreign Pwr., com.—no par | 31½ | 22⅞ | 27⅞ |
| Amer. Bosch Magneto, com.—no par | 25¾ | 15⅞ | 28¾ |
| Amer. Brown Boveri Elec.† | 14⅞ | 10⅞ | 18 |
| Amer. Brown Boveri Elec., pf. $7 | 52 | 46½ | 63 |
| Amer. Gas & Elec., 6% pf.—no par | k108 | 105 | 108¾ |
| Amer. Gas & Elec., com. †—no par | 139⅛ | 117½ | 145 |
| Amer. Lt. & Trac., 6% pf. | 116 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 220 | 170 | 220 |
| Amer. Pwr. & Lt., 6% pf. | 107¼ | 104 | 109⅞ |
| Amer. Pwr. & Lt., com. †—no par | 80⅛ | 62½ | 83 |
| Amer. Pub. Serv., 7% pf. | 98½ | 97½ | 101 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | a 96⅛ | 87½ | 96⅞ |
| Amer. Pub. Utilities, 7% pr. pf. | a100¼ | 95¾ | 101 |
| Amer. Pub. Utilities, com. | k 60 | 60 | 65 |
| Amer. States Sec., A | a 10⅛ | 4 | 9 |
| Amer. States Sec., B | a 12 | 4⅞ | 9⅞ |
| Amer. Superpwr., 6% 1st pf. | l 103 | .... | .... |
| Amer. Super pwr., Class A†—no par | 50⅞ | 37 | 46¾ |
| Amer. Super pwr., Class B†—no par | 53½ | 37¾ | 48 |
| Amer. Wtr. Wks. & Elec., 6% pf. | 105½ | 101½ | 105 |
| Amer. W.W. & E., com. new—no par | 61 | 52½ | 61 |
| Anaconda Copper cap. $3 | 68⅞ | 54⅞ | 72⅞ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr. & Lt., 7% pf. | 107½ | 108 | 109¼ |
| Assoc. Gas & Elec., $3.50—50 | 54½ | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 96 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 48¾ | 47 | 51⅞ |
| BABCOCK & WILCOX, 7% com. | 119 | 117½ | 124¾ |
| Binghamton L., H. & P., $6 pf. | 108½ | 102 | 108½ |
| Birmingham Elec., pf.—$7—no par | k109½ | 109½ | 111 |
| Blackstone Valley G. & E., 6% pf. | m106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k158 | 135 | 165 |
| Blaw-Knox, com.† | i102 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f240 | .... | .... |
| **Brazilian Trac., Lt. & Pwr., com., new** | f 60 | .... | .... |
| Broad River Pwr., 7% pf. | 105 | 105 | 108 |
| Brooklyn Edison, 8% com. | 258 | 206½ | 253 |
| **Buffalo, Niagara & East. Pwr., $1.60 pf. 25** | l 26⅞ | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20 no par | l 42 | .... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | 99 | 98 | 101 |
| **California Ry. & Pwr., 7% pf.** | 135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l111 | 109 | 110½ |
| Central & S. W. Util., $7 pf.—no par | a104 | 99½ | 105½ |
| **Central & S. W. Util., pr. ln. $7 pf.—no par** | a109 | 103½ | 108 |
| **Central Ark. Ry. & Lt., 7% pf.** | 104 | 105 | 107 |
| **Central Ill. Pub. Serv., $6 pf.** | a 98½ | 97⅞ | 100½ |
| Central Ind. Pwr., 7% pf. | a 99¾ | 95 | 99¾ |
| Central Maine Power, 6% pf. | 96 | 96 | 98 |
| Central Maine Power, 7% | 109 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 109 | 104½ | 105½ |
| Central States Elec., 7% pf. | 117⅞ | 104¼ | 114 |
| Century Elec., 6% com. | m135 | 135 | 145 |
| **Cincinnati Gas & Elec., 5% com.** | g100 | 97½ | 100 |
| Cities Service, $6 pf.—no par | l 99⅞ | 94½ | 100 |
| Cities Service, pf. B—no par | l 9⅞ | 8⅞ | 9½ |
| **Cities Service, pf. BB—no par** | k 93¾ | 88⅞ | 95 |
| **Cities Service, com.—20** | l 58 | 54 | 59⅞ |
| **Cities Service, Bks. Shrs.—10** | m28⅞ | 28⅞ | 28⅞ |
| **Cities Service Pwr. & Lt., 7% pf.** | k107⅞ | 106 | 109½ |
| **Cities Service Pwr. & Lt., 6% pf.** | k 99 | 95 | 100 |
| **Cleveland Elec. Illg., 6% pf.** | 112½ | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 400 | 350 | 410 |
| **Columbia Gas & Elec., 6% pf.** | 109⅞ | 107⅞ | 110⅞ |
| **Columbia G. & E. com. $5—no par** | 106⅞ | 89½ | 97⅞ |
| **Columbus Elec. & Pwr., $2 com.—no par** | k 77¾ | 66 | 79 |
| Columbus Elec. & Pwr., 7% | 112 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 108½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 108 | .... | .... |
| Columbus Ry., P. & Lt. com.—no par | k115 | .... | .... |
| **Commonwealth Edison, 8% com.** | a181½ | 165 | 189 |
| **Commonwealth Pwr., 6% pf.** | 103½ | 102⅞ | 104⅞ |
| Commonw'th Pwr., $2, com.—no par | 84½ | 62¼ | 84½ |
| **Conn. Lt. & Pwr., 8% pf.** | 122 | 120 | 125 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 118 | 121 |
| **Cons. Gas of N. Y., pf.** | 104 | 101⅞ | 105 |
| Cons. Gas of N. Y., com. $5—no par. | 155¾ | 119⅞ | 149⅞ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111½ | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | m111¼ | 110⅞ | 114½ |
| **Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf.** | e104½ | 100½ | 105½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 79½ | 67½ | 80 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | .. | .... |
| Consumers Pwr., 6% pf. | 104½ | 105½ | 106½ |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108 | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par | k230 | 240 | 265 |
| **Crocker Wheeler, com.†** | k 38 | 24 | 38 |
| Crocker Wheeler, 7% pf. | k 90 | 77 | 95 |
| DALLAS PWR. & LT., 7% pf. | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 108½ | 108½ | 109½ |
| Derby Gas & Elec., 7% pf. | 102 | 96 | 100½ |
| Detroit Edison, 8% com. | 190½ | 166½ | 194¾ |
| **Dubilier Condenser, com.—no par** | 5⅞ | 2½ | 5⅞ |
| **Duke Pwr., cap.** | k143 | 130 | 145 |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 111 | 112½ |
| Eastern States Pwr. B | 22 | 11¼ | 22 |
| Eastern States Pwr., pf. | k 98 | 98 | 99 |
| **East. Tex. Elec., 7% pf.** | 107½ | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d280 | 252 | 280 |
| **El Paso Elec. 7% pf.** | 113 | 110 | 112½ |
| **Elec. Bond & Share, 6% pf.** | l109¾ | 108⅞ | 111⅞ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l119½ | 76 | 126 |
| Electric Household Util.† | a 23 | 13¼ | 24 |
| Elec. Investors, 6% pf.—no par | 103 | 101 | 103½ |
| Elec. Investors, com †—no par | 60¾ | 40⅛ | 60¾ |
| Elec. Pwr. & Lt., ctfs. pf., ex div. | i109¾ | 106½ | 110⅞ |
| **Elec. Pwr. & Lt., ctfs., com.—no par ex.div.** | k 33⅞ | 28¾ | 40⅞ |
| Elec. Ry. Securities, com.—no par | 7 | ... | ... |
| Elec. St. Battery com. $5.25—no par | 81¾ | 69 | 83¼ |
| **Elmira Wtr., Lt. & R.R., 7% pf.** | 106½ | 104 | 107 |
| **Empire Pwr., ptc.†** | 32⅞ | 27½ | 35⅞ |
| **Engr. Pub. Serv. $7. pf.—no par** | 110½ | 107 | 110⅞ |
| Engr. Pub. Serv., com.—no par | 41½ | 33 | 42½ |
| Eureka Vacuum Cleaner, com. $4—no par | 76¾ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | 109½ | 104 | 110 |
| **F.-M., com.—$3—no par** | 47¾ | 32½ | 48⅞ |
| **Federal Lt. & Trac., com $1.40** | 54 | 42 | 56½ |
| Federal Lt. & Trac., $6 pf.—no par | 107⅞ | 98 | 107¾ |
| Florida Pwr. & Lt., 7% pf. | k108 | 105 | 108¼ |
| Ft. Worth Pwr. & Lt., 7% pf. | i114 | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf. | 82 | 75 | 85 |
| Galveston-Houston Elec., com. | 36 | 31 | 38 |
| **General Cable, Cl. A** | 75¼ | 56 | 84½ |
| Gen. Elec. $3 com.—no par | 173 | 124 | 174½ |
| Gen. Elec., special—6% | 11⅞ | 11¼ | 11⅞ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par | 44¾ | 35½ | 44¾ |
| Gen. G. & E. (Del.) pf. A $8—no par | 141 | 122¾ | 141 |
| **Gen. G. & E. (Del.) pf. A $7—no par.** | k120 | 108½ | 113½ |
| **Gen. G. & E. (Del.) pf. B $7** | k111 | 105½ | 111 |
| Gen. Pub. Serv., $7 cum. pf., no par. | k117 | 110 | 120 |
| **Gen. Pub. Serv., com., no par** | 21¾ | 16⅞ | 21¾ |
| **General Public Utilities, $7 pf.** | k 58 | 55 | 65 |
| **Ga. Lt., Pwr. & Rys., com** | k 58 | 55 | 65 |
| **Gt. Western Pwr., 7% pf** | h105 | .... | .... |
| IDAHO PWR., 7% pf | 110¾ | 109 | 110½ |
| **Ill. No. Utilities, 6% pf.** | a100¾ | 98½ | 100¾ |
| **Ill. Pwr. & Lt., 7% pf.** | 105 | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 105½ | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf. | 103 | 100 | 105 |
| **Ingersoll Rand com.** | 96½ | 90 | 94 |
| Int. Combus. Engr., com. $2—no par | 50½ | 45¼ | 55¾ |
| Int. Combustion Engr., 7% pf | 103¾ | 103 | 105½ |
| Int. Util., Class A—$3.50—no par | 46¾ | 44½ | 51¼ |
| **Int. Utilities, Class B—no par** | 9 | 6⅞ | 10½ |
| **Interstate Pwr., pf.—$7—no par** | 103 | 99 | 103½ |
| **Interstate Pub. Serv., 7% pf.** | 104½ | 103 | 106 |
| **Iowa Ry. & Lt., 7% pf.** | 101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 108 | 105 | 107 |
| Johns-Manville com †—no par | 124½ | 111½ | 133½ |
| **Johns-Manville, 7% pf.** | 122½ | 119½ | 121½ |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 14. lBid price Wednesday, April 18. mLatest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 17 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS GAS & ELEC. 7% pf. | *l*110½ | 107 | 110 |
| Kelvinator Corp. | 21½ | 11¼ | 21⅞ |
| Kentucky Hydro-Elec., 7% pf. | *m*104½ | 102 | 104¾ |
| Kentucky Sec., 6% pf. | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 103 | 100 | 103 |
| LACLEDE GAS LT., 10% com. | *k*200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 32¼ | 19¾ | 27¾ |
| Long Island Ltg., 7% pf. | *k*110½ | 110¼ | 110½ |
| Long Island Ltg., 6% pf. | *k*108 | 107 | 108¼ |
| Long Island Ltg., com.†—no par | *k*178 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | 111 | 105½ | 111½ |
| Louisville Gas & Elec., cl. A. $1.75 | 34 | 28 | 35 |
| MAN. ELEC. SUPPLY, cap. $5—no par | 55¼ | 50 | 61 |
| Maytag Mfg., com. 50—no par | 37 | 30 | 38¾ |
| Memphis P. & L., pf.—$7—no par | 111 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 108½ | 103 | 108½ |
| Metropolitan Ed., pf.—$7—no par | 109 | 109 | 111 |
| Metropolitan Ed., com. $5—no par | *k*160 | 125 | 155 |
| Middle West Utilities, 7% pf. | *a*121¾ | 116½ | 124½ |
| Middle West Util., 7% pr. lien | *a*126 | 125 | 129¾ |
| Middle West Util., com. $6—no par | *a*142½ | 123½ | 142½ |
| Midland Utilities, pr. ln. 6% pf. | *a* 95¼ | 94½ | 97 |
| Midland Utilities, 6% pf. A | *a* 91 | 89½ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | *k*104 | 100 | 103 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 102 | 98 | 101⅜ |
| Minn. Pwr. & Lt., 7% pf. | *l*108¾ | 107 | 109 |
| Miss. River Pwr., 6% pf. | 108 | 94 | 109½ |
| Miss. River Pwr., 3% com. | 110 | .... | .. |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | *k*107½ | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | *k*104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 35¼ | 29½ | 36¾ |
| Montana Pwr., 5% com. | 165 | 102¼ | 169½ |
| Montreal Pwr., 7½% com. | *f* 97½ | .... | .... |
| Mountain States Pwr., 7% pf. | 106¾ | 97 | 105 |
| Mountain States Pwr., com.† | 17½ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109 | 98 | 110½ |
| National Carbon, 8% pf. | *a*138½ | 138 | 139¾ |
| National Elec. Pwr., A† | *a* 31½ | 27½ | 32¾ |
| National Lt., Ht. & Pwr., com. | *h* 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 109½ | 108¼ | 111 |
| National Pwr. & Lt., com.†—no par. | 32⅛ | 21⅞ | 27⅛ |
| National Pub. Serv., 7% pf. | 101 | 99 | 103 |
| National Pub. Serv., 7% ptc., pf. | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 25⅞ | 22 | 27½ |
| National Pub. Serv., B com.—no par | *m* 28⅛ | 24⅛ | 30 |
| Nebraska Pwr., 7% pf. | *l*111 | 110 | 111½ |
| Nevada-Calif. Elec., com. | 35½ | 22 | 37 |
| New Brunswick Pwr., 4% pf. | 62 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 108 | 98½ | 109½ |
| New Eng. Pub. Serv., pf. $7 | 106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | 105 | 101 | 105¼ |
| New York Power & Light 7% pf. | 115½ |  | .. |
| NiagaraFalls Pwr., 7% pf.—25 | 27¾ | 27⅛ | 28⅛ |
| No. Amer., 6% pf.—50 | 54 | 53¼ | 55 |
| No. Amer., com.—10 | 67⅛ | 58⅞ | 67 |
| No. Amer. Edison, $6 pf.—no par | 104 | 102½ | 105⅛ |
| Northeastern Pwr., com. | 26½ | 19¾ | 26⅛ |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 26¾ | 18 | 27½ |
| Northern Ohio Pwr. & Lt., 6% pf. | 99 | 90 | 99 |
| No. Ont. St. & Pr. 6% pf. | *l*100 | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | *k* 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 109⅛ | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 147½ | 123 | 136⅞ |
| No. Texas Elec., 6% pf. | 54½ | 45 | 70 |
| No. Texas Elec., com. | 17 | .... | .... |
| OHIO BRASS, com. B $4—no par. | *k*106 | 90 | 107 |
| Ohio Brass, 6% pf. | *k*107 | 106 | 111 |
| Ohio Pwr., 6% pf. | 108⅛ | 104 | 107½ |
| Ohio Pub. Serv., $6 pf. | 105 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 113 | 107 | 112 |
| Ohio River Edison, 7% pf. | 108½ | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 115⅛ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | *k* 29½ | 26⅞ | 29¾ |
| Pacific Gas & Elec., 8% new com. | 48 | 43⅜ | 49⅞ |
| Pacific Pwr. & Lt., 7% pf. | *l*110½ | 106 | 110 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | *c* 80¼ | 79⅛ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 97 | 93½ | 99 |
| Penn-Ohio Edison, 7% pf. | *k*106½ | 97½ | 104 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 110 | 99 | 110 |
| Penn Pwr. & Lt.—$7—no par | *l*110 | 109 | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | *e* 76 | 68 | 76 |
| Phila. Co., 5% pf.-50 | *k* 45⅝ | 45½ | 48⅛ |
| Phila. Co., 6% pf.—50 | 56⅞ | 52 | 57 |
| Phila. Co., com.—50 | *k*165½ | 145 | 165½ |
| Phila. Elec., 8% com.—25 | *c* 66⅛ | 55½ | 66⅞ |
| Portland Elec. Pwr., 7% pf. | 102½ | 100 | 104¼ |
| Portland Elec. Pwr., 6% pf. | 94 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 85 | 55 | 88 |
| Portland Elec. Pwr., com. | 51 | 42¼ | 52 |
| Potomac Elec. Power, 6% pf. | *j*113 | .... | .... |
| Pwr. Sec., pf.—no par | *k* 65 | 50 | 68 |
| Pwr. Sec., com.—no par | 12 | 5 | 15 |
| Public Serv. of Colorado, 7% pf., | 105 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 109 | 103⅛ | 109½ |
| Pub. Serv. of N. J., 7% pf. | 125½ | 118 | 121⅝ |
| Pub. Serv. of N. J., $2 com.—no par | 52¾ | 41½ | 49⅞ |
| Pub. Serv. of No. Ill., 6% pf. | *a*113 | 110 | 115 |
| P. S. of No. Ill., com. $8—no par | *a*173 | 159½ | 180 |
| Pub. Serv. of No. Ill., $8 com. | *a*174½ | 159⅛ | 180 |
| Pub. Serv. of Okla., 7% pr. ln. | 106½ | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109¾ | 108 | 110⅛ |
| Puget Sound Pwr. & Lt., 7% pf. | 110½ | 109 | 113 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | *k*100 | 96½ | 99 |
| Puget Sound Pwr. & Lt., com. | 74⅛ | 34⅛ | 63½ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | *k* 56 | 54½ | 57⅛ |
| Radio Corp. of Amer., com.—no par. | 165½ | 85¼ | 196½ |
| Rochester Gas & Elec. 6% pf. D | 105½ | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105½ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 110 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | *k* 75 | 70 | 75 |
| Servel, Inc. | 9⅛ | 4¼ | 10½ |
| Sierra Pacific Elec., 2% com. | 35½ | 29 | 38¾ |
| Sioux City Gas & Elec., 7% pf. | 107¾ | 100 | 108¾ |
| Southeastern Pwr. & Lt., pf.—$7 no par | *l* 109 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | *l* 89 | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 53½ | 41¾ | 48½ |
| So. Calif. Edison, 8% pf. | 28 | 38¾ | 41 |
| So. Calif. Edison, 7% pf. | 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 27 | 25½ | 28 |
| So. Calif. Edison, 8% com. | 46⅛ | 43½ | 48⅞ |
| Southern Cities Utilities, 7% pf. | 80½ | 75 | 87 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 93 | 88 | 92½ |
| Southwestern Pwr. & Lt., 7% pf. | 114½ | 103 | 113 |
| Standard Gas & Elec., 8% pf. | 70½ | 65 | 70½ |
| Standard Gas & Elec., 7% pr. pf. | 114 | 110½ | 115 |
| Standard G. & E., com. $3.50 | 67⅛ | 57⅛ | 66⅞ |
| Standard Power & Light, com. | 44⅛ | 29¾ | 45 |
| Standard Pwr. & Lt., 7% pf. | *k*105 | 98 | 105 |
| Staten Island Edison, pf.—$6—no par | 102½ | 99 | 103¼ |
| Superheater, $6 com.—no par | *m*162 | 162 | 175 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | *k*117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | *k* 68⅞ | 62 | 69½ |
| Tenn. Elec. Pwr., 6% pf. | 103½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109 | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | *k* 10 | .... | .... |
| Terre Haute, Ind. & East. Trac., com. | *k* 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | *l*113½ | 113½ | 113½ |
| Tide Water Pwr., 8% pf. | 112 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 131 | 112⅛ | 134 |
| Toledo Edison, 7% pf. | 109½ | 108 | 111 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | *k*145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 93 | 102 |
| UNITED GAS & ELEC., 7% pf. | 95 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | *c*134¼ | 111½ | 134¾ |
| United Lt. & Pwr., pf.—$4—no par | *a* 57 | 53 | 57 |
| United Lt. & Pwr., pf.—$6.50—no par | *a*102 | 95 | 102 |
| United L. & P., com. A .48—no par | *a* 25⅞ | 14 | 25⅛ |
| United L. & P., com. B .48—no par | *a* 29½ | 19 | 30 |
| Utah Pwr. & Lt., 7% pf. | *l*112½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105½ | 105 | 106½ |
| Utica Gas & Elec., 8% com. | *k*200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101 | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | *m* 31¼ | 28½ | 34½ |
| Utilities Pwr. & Lt., com. B $1—no par | *k* 29⅞ | 18½ | 29¾ |
| VERMONT HYDRO-ELEC., 7% pf. | 100 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | *k*110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102½ | 97 | 103 |
| WAGNER ELEC., 7% pf. | *g*101½ | 96⅛ | 102 |
| Wagner Elec., com.—no par | *b* 62⅞ | 37 | 60 |
| Washington Ry. & Elec., 5% com. | *j*485 | .... | .... |
| Washington Ry. & Elec., 7% pf. | *j*102½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | 227 | 175 | 235 |
| West Penn Elec., 7% pf. | 114⅛ | 109½ | 114¾ |
| West Penn Elec., Cl. A $7 | 111⅛ | 106½ | 112 |
| West Penn Pwr., 7% pf. | 115⅛ | 114⅛ | 117 |
| West Penn Pwr., 6% pf. | 109⅛ | 108⅞ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf. | 104 | 103 | 104⅛ |
| Western States Gas & Elec., 7% pf. | 102 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 105½ | 88⅛ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | *k*33¼ | 30¾ | 34¼ |
| Weston Elec. Instrument, com.—no par | 16⅛ | 12½ | 17¾ |
| Wheeling Elec., 6% pf. | 106 | 95 | 104 |
| Worthington Pump, 7% pf. A | *k* 55 | 46½ | 55 |
| Worthington Pump, 6% B | 45½ | 41 | 49½ |
| Worthington Pump, com. | 31½ | 28 | 34½ |
| YALE & TOWNE com. $5—25, | 72½ | 68½ | 75 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 14. *l*Bid price Wednesday, April 18. *m*Latest quotations available. †Dividend rate variable

Samuel T. Bodine, Arthur W. Thompson, Paul Thompson, J. E. Zimmermann, Thomas N. McCarter and Percy S. Young. These men, all prominent in public utility circles, are on the directorate of the United Engineers & Constructors, Inc., organized early this year.

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CINCINNATI STOCKHOLDERS APPROVE CONSOLIDATION. — Stockholders of the Cincinnati Gas & Electric Company have approved the consolidation of their company and the Columbia Power Company into a new corporation named the Columbia Gas & Electric Corporation. They will exchange their $100 par stock on an even basis for 5 per cent preferred stock of the new corporation, as announced previously in the ELECTRICAL WORLD.

ALLIS-CHALMERS INCREASES CAPITAL. —The Allis-Chalmers Manufacutring Company is planning to increase its authorized capital stock to $50,000,000 from $26,000,000. A meeting of stockholders to vote on the proposed increase has been called for May 3. It is not contemplated that any portion of the proposed additional stock will be issued at this time, but directors deem it advisable to have such unissued stock available for possible requirements in connection with future expansion and development.

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AMERICAN ELECTRIC POWER INCREASES STOCK.—The American Electric Power Corporation has filed a certificate at Dover, Del., increasing its authorized capital stock (no-par value) from 415,000 shares to 515,000 shares.

CONNECTICUT COMPANY TO CHANGE SET-UP.—President Samuel Ferguson's recommendation to increase the capital stock of the Connecticut Power Company and reduce the par value of the stock was recently approved by the directors. A stockholders' meeting early in May is expected to provide for a capital increase of $3,000,000. New shares will then be issued in the ratio of one for five at par and the par value reduced from $100 to $25. At first it is planned to increase the capital from $5,800,000 to $7,000,000. This is an increase of $1,200,000, and the balance of the proposed $3,000,000 capital increase will be authorized for any future circumstances that may arise. This action is to provide for the acquisition of shares of the Union Light & Power Company, Unionville, Conn., and the

$25 par value will make a wider distribution of stock possible. It will also be in line with the reduction of par value made by the Hartford Electric Light Company, a closely allied company.

## Standard Gas to Change Set-Up

Stockholders of the Standard Gas & Electric Company will be asked to vote May 16 on a proposal to change the 500,000 shares of 7 per cent prior preference stock of $100 par value to 750,000 shares of no-par prior preference stock. A change in the authorized amount of 8 per cent cumulative preferred stock from 600,000 shares of $50 par value to 1,500,000 shares without par value will also be considered.

## New Capital Issues

The largest electric light and power issue of the year was offered by the Associated Gas & Electric Company in the form of convertible 4½ per cent gold debentures, a piece of financing involving a total of $63,000,000. Proceeds will be used to retire debentures outstanding and securities of subsidiaries, for the acquisition of property and for other corporate purposes.

A ten-million-dollar issue was offered by the Shawinigan Water & Power Company in the form of first mortgage and collateral trust sinking fund gold bonds, priced at 98½ and accrued interest, yielding about 4.60 per cent.

During the week ended April 19 the Central States Electric Corporation issued 6 per cent cumulative preferred stock to the amount of $10,000,000 at 101 a share and accrued dividend, to yield 5.94 per cent. Each certificate, representing preferred stock, will carry a stock purchase warrant (non-detachable prior to Nov. 1, 1928) entitling the holder, subject to the provisions of resolutions to be adopted by the directors authorizing the issue of such warrants, to purchase from the Central States Electric Corporation on or before May 1, 1933, one share (without par value) of common stock of the North American Company for each share of preferred stock.

ENGINEERS PUBLIC SERVICE INCREASES COMMON.—Stockholders of the Engineers Public Service Company, at a special meeting held April 12 at Wilmington, Del., voted to increase the authorized common stock from 1,500,000 to 3,000,000 shares, of no par value, and approved amendments to the charter permitting consummation of the $35,000,000 refinancing plan proposed by the directors. Under this plan all of the company's $7 dividend no par preferred stock will be called and replaced by an issue of $5 dividend convertible preferred stock. The directors, meeting at New York after the stockholders' action, voted to call the $7 dividend preferred stock on July 1 at 110 and accrued dividends. There are 310,468 preferred $7 dividend and 797,240 common shares now outstanding.

AMERICAN SUPERPOWER WILL PAY STOCK DIVIDEND.—The directors of the American Superpower Corporation declared a stock dividend to holders of class A and class B common shares of record April 23, consisting of one share of preference stock for each five shares of common stock held. This declaration of the directors followed authorization by the stockholders of the corporation of an issue of 400,000 shares of no-par $6 cumulative preference stock.

BALTIMORE STOCKHOLDERS APPROVE INCREASE IN CAPITAL STOCK.—Stockholders of the Consolidated Gas, Electric Light & Power Company of Baltimore approved the proposed increase in total capital stock to 1,500,000 shares from 1,450,000 shares, the additional 50,000 shares to be classified as 5 per cent series A preferred. They also authorized the directors to issue any number of shares of stock of one or more classes from time to time as the directors deem advisable.

## Cities Service Plans $50,000,000 Loan

With the purpose of refunding outstanding securities and enlarging the company's activities Cities Service Company is planning a fifty-million-dollar issue of 5 per cent debentures, one of the largest pieces of public utility financing of the year. Public offering of the issue is expected within a few days.

KANSAS CITY COMPANY INCREASES CAPITAL.—At the recent annual meeting of the stockholders of the Kansas City Power & Light Company the board of directors was authorized to increase the common stock of the company from 350,000 to 600,000 shares.

## Utilities Well Represented on New Legal Bond List

The securities listed below have qualified as legal investments for savings banks and trust funds in New York State, according to the tentative list issued by F. H. Warder, Superintendent of Banks.

ALABAMA POWER—1st mtge. lien & ref. 5s, 1951; 5s, 1956; 1st mtge. 5s, 1946; 1st & ref. 4½s, 1967.

BLACKSTONE VALLEY GAS & ELECTRIC—1st & gen. 5s, 1939.

BROOKLYN EDISON CO.—Edison Elec. Illum. 1st cons. 4s, 1939; Kings County Elec. Light & Pr. 1st 5s, 1937, and 6s, 1997; Brooklyn Edison A 5s, 1949, and B 6s, 1930.

BUFFALO GENERAL ELECTRIC—1st 5s, 1939; 1st ref. 5s, 1939; gen. & ref. 5s, 1956.

CENTRAL MAINE POWER—1st 5s, 1939; 1st & gen. 5½s, 1949; 5s, 1955, and 4½s, 1957.

CLEVELAND ELECTRIC ILLUMINATING—1st 5s, 1939; general 5s, 1954 and 1961.

CONNECTICUT POWER—1st and cons. 5s, 1963.

CONNECTICUT LIGHT & POWER—1st & ref. 7s, 1951; 5½s, 1954, and 4½s, 1956.

CONSOLIDATED GAS OF BALTIMORE—United Elec. Light & P. 1st 4½s, 1929; Cons. Gas of Balt. 1st 5s, 1939, and 1st 4½s, 1954; Cons. Gas, Elec. L. & P. gen. 4½s, 1935; 1st ref. 6s, 1949; 5s, 1965 and 5½s, 1952.

CONSUMERS POWER—Michigan Light 5s, 1946; Consumers 1st ref. 5s, 1936; 1st unif. 5s, 1952; 5½s, 1954.

DETROIT EDISON—1st 5s, 1933; Eastern Mich. 5s, 1931; Det. Edison 1st & ref. 5s, 1940; 6s, 1940; gen. & ref. 5s, 1949; 5s, 1955; 5s, 1962.

DUQUESNE LIGHT—1st 4½s, 1967.

ERIE COUNTY ELECTRIC—Cons. 6s, 1959; gen. & ref. 5½s, 1960.

HARRISBURG LIGHT & POWER—1st 5s, 1952.

INDIANA & MICHIGAN ELECTRIC—1st 5s, 1957; 1st and ref. 5s, 1955.

KANSAS CITY POWER & LIGHT—1st mortgage 5s, A, 1952, 4½s, B, 1957.

LOS ANGELES GAS & ELECTRIC—Gen. 5s, 1934; 1st & ref. 5s, 1939; gen. & ref. Series D-1, 5½-6s, 1942-49; 1st & gen. 5s, 1961.

METROPOLITAN EDISON CO.—York Haven Water & Power Co. 1st 5s, 1951; Metro. Edison 1st & ref. 5s, 1953; Metro. Edison 1st 4½s, 1968.

NEBRASKA POWER—1st 5s, 1949; 1st 6s, 1949.

NEW JERSEY POWER & LIGHT—1st 5s, 1956.

NEW YORK EDISON—New York Gas, Elec. Light, Heat & Power 1st 5s, 1948; purchase money 4s, 1949; Edison Elec. Illum. 5s, 1995; New York Edison 1st & ref. 6½s, 1941, and 5s, 1944.

NEW YORK & QUEENS ELECTRIC LIGHT & POWER—1st 5s, 1930.

NIAGARA FALLS POWER—Hydraulic Pwr. of N. F. 1st & ref. 5s, 1950; ref. & imp. 5s, 1951; Niagara Falls Pwr. 1st 5s, 1932; ref. & gen. 6s, 1932; 1st & cons. 6s, 1950.

NORTHERN INDIANA PUBLIC SERVICE—1st & ref. 5½s, 1960; 5s, 1966; Northern Indiana Gas & Electric 1st lien & ref. 6s, 1952, and 5s, 1929; Indiana Lighting 4s, 1958.

PACIFIC GAS & ELECTRIC—Divisional bonds, gen. & ref. 5s. 1942; 1st & ref. 4½s, 5s, 5½s and 6s, Series B-E.

PACIFIC POWER & LIGHT—1st & ref. 5s, 1930.

PHILADELPHIA ELECTRIC—1st s. f. 4s & 5s, 1966; 1st & ref. 5½s, 1947; 5½s, 1953; 5s, 1960; 4½s, 1967.

PHILADELPHIA SUBURBAN COUNTIES GAS & ELECTRIC—P. S. G. & El. 1st & ref. 5s, 1960; cons. 6s, 1943; 5½s, 1955; P. S. C. G. & El. 1st ref. 4½s, 1957.

PUBLIC SERVICE ELECTRIC AND GAS (N. J.)—United Electric 1st 4s, 1949; Public Service Electric and Gas 1st and ref. 5s, 1965 and 4½s, 1967.

PUBLIC SERVICE COMPANY OF N. H.—1st and ref. 5s, 1956.

QUEENS BOROUGH GAS AND ELECTRIC—Gen. 5s, 1952; ref. 6s, 1953; ref. 6s, 1955.

ROCHESTER GAS AND ELECTRIC—Municipal Gas and Elec., 1st 4½s, 1942; Rochester Ry. and Lt. 5s, 1954; Rochester Gas and Elec. gen. 7s, 1946; 5½s, 1948; 4½s, 1977.

SAN DIEGO CONSOLIDATED GAS AND ELECTRIC—1st 5s, 1939; 1st and ref. 6s, 1939; 5s, 1947; 6s, 1947.

SOUTHERN CALIFORNIA EDISON—Mt. Whitney Power and Elec. 6s, 1939; Pacific Light and Pwr. 1st 5s, 1942; 5s, 1951; Southern California Edison gen. 5s, 1939; gen. and ref. 5s, 1944; 5½s, 1944; ref. 5s, 1951; 5s, 1952.

SYRACUSE LIGHTING—Syracuse Gas 1st 5s, 1946; Lighting 1st 5s, 1951; 1st and ref. 5½s, 1954.

TOLEDO EDISON—Toledo Gas, Elec. and Heating 1st 5s, 1935; Toledo Edison 1st 5s, 1947.

TWIN STATE GAS AND ELECTRIC—1st and ref. 5s, 1953; 5½s, A, 1945.

UNION ELECTRIC LIGHT AND POWER (MO.)—1st 5s, 1932; ref. and ext. 5s, 1933; gen. A 5s, 1954; B 5s, 1967.

UNITED ILLUMINATING (CONN.)—1st 4s, 1940.

UTICA GAS AND ELECTRIC—Equitable Gas and Electric 5s, 1942; Utica Gas and Elec. ref. 5s, 1957; gen. 5½s, 1949; 5s, 1956.

WEST PENNSYLVANIA POWER—1st mortgage, Series A 5s, 1946; E 5s, 1963; F 5½s, 1953; G 5s, 1956.

WESTERN NEW YORK UTILITIES—1st 5s, 1946.

WHEELING ELECTRIC—1st 5s, 1941.

WISCONSIN GAS AND ELECTRIC—1st 5s, 1952.

# Business News and Market Conditions

## First Quarter Contracts Increase 25 per Cent

*Increases Reported from All Sections—Contracts 41 per Cent Greater than in February and 38 per Cent More than in March, 1927.*

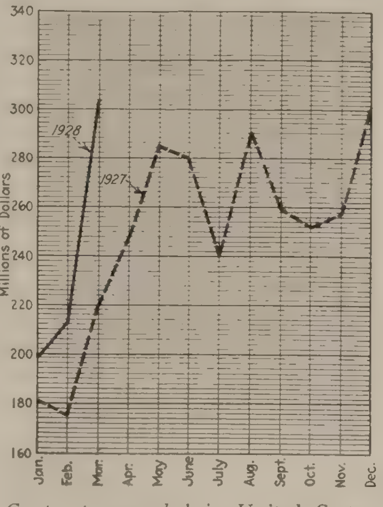
EVERY section of the country showed a gain in engineering construction contracts during March when compared with average weekly figures for February. Increases ranged from 97 per cent in New England to 11 per cent in the South. Compared with a year ago, March totals showed increases in all sections, except west of the Mississippi, where a 15 per cent decline was recorded. Contracts reported by the *Engineering News-Record* during the five weeks of March, 1928, totaled $379,521,000.

The outstanding feature in the awards let during March, 1928, was the large commercial building total for the Middle Atlantic states. This value, $113,428,000, constituted 30 per cent of the total awards. The average monthly commercial awards in that section during 1926 were $40,335,000, in 1927 $52,440,000 and thus far in 1928 $72,300,000. Several of the large March contracts were: In New York, office and store, $23,000,000; office and printing, $6,000,000; apartment hotel, $6,000,000; in Chicago, office and printing, $10,000,000; theater and office, $20,000,000; club, office and store, $4,000,000. There were 25 commercial building awards outside of New York City that exceeded $1,000,000, and these totaled $32,650,000. New York commercial awards totaled $81,451,000 and Illinois awards totaled $43,236,000.

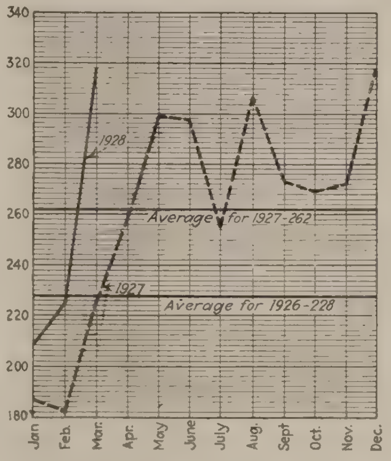
Total private awards for March, 1928, exceeded those of a year ago by 56 per cent, whereas only an 8 per cent increase is shown in public contracts. The summer months are peak months for public awards because of the large volume of street and road work, which thus far in 1928 constitutes 47.5 per cent of all public contracts. Public contracts in 1928 and 1927 to date respectively are $241,748,000 and $205,171,000.

The construction volume index number for March is 318. This compares with 228 for the whole of 1926, 262 for all of 1927 and 100 for 1913. This means that the actual volume of contract letting in March, 1928 (not the mere money value of the contracts let), is 218 per cent greater than the volume for 1913. The index number contains the increment of construction and indicates the rate at which contracts are let, as compared with 1913 awards.

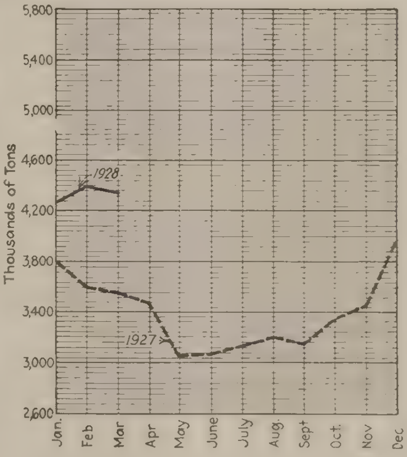
Unfilled orders of the United States Steel Corporation showed a decrease in March. The trend in 1927 and to April 1, 1928, is indicated in the accompanying curve. The decrease was smaller than anticipated and indicates increased buying late in March.



*Contracts awarded in United States*



*Construction volume as compared with an index of 100 for 1913*



*Unfilled tonnage as reported by the United States Steel Corporation*

In the chart at the left the actual volume of construction is compared and not the mere money value of contracts let. (*Engineering News-Record* statistics.)

*Value of Contracts Let in the United States and Canada During March, 1928*

Thousands of dollars (000 omitted)

| | New England | Middle Atlantic | South | Middle West | West of Mississippi | Far West | United States | Jan. 1 to Date, U. S. | Canada |
|---|---|---|---|---|---|---|---|---|---|
| Waterworks | .... | $567 | $148 | $623 | $899 | $466 | $2,703 | *$7,365* | $144 |
| Sewers | ..... | 1,208 | 201 | 3,999 | 996 | 1,765 | 8,169 | *13,120* | 253 |
| Bridges | $288 | 2,190 | 153 | 2,112 | 2,289 | 524 | 7,556 | *22,623* | 500 |
| Excavation, drainage, etc | 25 | 137 | 52 | 245 | 126 | 34 | 619 | *4,225* | 259 |
| Streets and roads | 222 | 8,163 | 6,155 | 15,103 | 17,300 | 5,023 | 51,966 | *114,993* | 10,488 |
| Industrial building | 6,616 | 8,635 | 10,860 | 7,288 | 4,510 | 2,642 | 40,551 | *79,914* | 640 |
| Commercial building | 14,899 | 113,428 | 7,491 | 59,392 | 15,265 | 21,756 | 232,231 | *462,296* | 3,610 |
| Federal government | ........ | 3,650 | 459 | 64 | 1,485 | 646 | 6,304 | *12,248* | ...... |
| Unclassified | 140 | 7,629 | 946 | 1,202 | 11,183 | 8,322 | 29,422 | *74,011* | 6,500 |
| March, 1928 | 22,190 | 145,607 | 26,465 | 90,028 | 54,053 | 41,178 | 379,521 | ........ | 22,394 |
| February, 1928 | 9,020 | 84,820 | 18,962 | 45,281 | 34,706 | 20,501 | 213,290 | ........ | 4,744 |
| March, 1927 | 21,984 | 84,256 | 16,769 | 56,944 | 63,304 | 30,181 | 273,438 | ........ | 5,309 |
| Year to date, 1928 | *48,550* | *303,231* | *64,504* | *175,589* | *120,440* | *78,481* | ........ | *790,795* | *39,713* |
| Year to date, 1927 | 50,446 | 178,076 | 50,493 | 142,880 | 117,868 | 90,685 | ........ | 630,448 | 13,931 |

NOTE.—Owing to five weeks of construction contracts being included in some months, as in March, the figure for the total contracts let, as shown in the table, does not agree with the figure as represented in the curve. In order to obtain comparable figures the curve is worked out on a four-week basis for each month.

# Market Conditions

IN NEW ENGLAND central-station companies are prominent buyers. Insulator sales in that district were reported at a peak last week. Small motor sales reached a total of over $50,000. Good central-station buying continues in the Eastern district. Prime movers are in demand. Sales include a 5,000-kw. unit, costing $55,000, for northern New York and a 70,000-kw. unit, costing $750,000, for a Middle West company. A metropolitan central-station company also bought $50,000 worth of transformers. Railway business is beginning to loom as an active factor in the market.

Large power equipment orders are anticipated in the Southeast. One company plans the immediate purchase of $1,000,000 worth of generating equipment. A steel mill in Alabama purchased $45,000 worth of motors and an iron mill in the same state ordered $20,000 worth of automatic substation equipment. In St. Louis manufacturers report the demand for motors and equipment above normal. A slight increase in business is noted in the Middle West, with industrial activity somewhat spotty. On the Pacific Coast power company buying is fair and street-lighting sales are active.

## *Central Stations Prominent in New England Buying*

Sales of electrical equipment in the New England district have continued with encouraging signs of activity. Central-station needs have added vigor to the market. Many small orders were reported. Bus supports, disconnecting switch orders, small switches, outside requirements, insulators, cable and wire were in good demand. A prominent manufacturer reports insulator sales at a peak during the past week. Orders for general replacement equipment included one for an eastern Massachusetts substation for $2,000 and another for a central-station company in Maine for $1,500. One of the largest manufacturers in the district records a steady gain in inquiries. Small motor sales reached a total of over $50,000. A few large motors were ordered during the week.

Heavy industrial equipment sales are quiet, but indications point to a number of interesting orders that will be placed shortly. The plans for the addition to the Edgar station include provisions for a 10,000-kw. turbo-generator unit as well as two high-pressure boilers rated 1,400 lb. per square inch. Construction projects are as follows:

The Public Service Company of New Hampshire, Manchester, plans to construct interconnecting lines, one of 66,000 volts connecting the Griggs Falls plant with Nashua and a 33,000-volt line connecting Henniker with Hillsborough. The Randolph and Holbrook Power & Electric Light Company, Randolph, Mass., is planning to build a substation in Holbrook, Mass. Springfield, Mass., has authorized $234,000 for an electric pumping plant for municipal water works.

## *Large Power Equipment Order Expected in Southeast*

No purchases out of the ordinary are reported for central-station companies in the Southeast. One company ordered fiber conduit amounting to $6,700, aluminum cable totaling $2,100 and creosoted pine poles valued at $4,300. An order approximating $30,000 for cotton gin motors for a Mississippi power company is in immediate prospect and will probably be placed this week. An Alabama power company has asked for bids on three waterwheels and generators, with a total capacity of 90,000 kva., and contracts will probably be let the early part of May.

Construction contracts have been let on the two new viaducts in Atlanta and the sub-contract on electrical work will undoubtedly be let within the very near future. The electrical materials required on this project will total about $35,000. Bids are in on school building construction amounting to about $1,000,000 in Atlanta and contracts are to be let this week.

A steel mill in Alabama that is revamping its plant ordered motors amounting to $45,000 and an iron mill in the same state ordered $20,000 worth of automatic substation equipment. A cotton mill in the Carolinas ordered motor equipment costing $2,500. Purchases by contractors are slow, such orders as are being received coming from the larger contracting firms. One contractor ordered $6,000 worth of wiring materials for one job in middle Georgia. Construction projects are as follows:

The Erwin Manufacturing Company, Huntsville, Ala., plans addition to textile mill, to cost $100,000. The Columbus Electric & Power Company, Columbus, Ga., is planning hydro-electric power plants on the Chattahoochee River, near Maple Creek and Harrison Island, respectively, to cost $1,000,000. The Lindsay-McMillan Company, Milwaukee, Wis., plans an oil refining plant near Savannah, Ga., to cost $150,000. Rolling Fork, Miss., will receive bids May 1 for equipment for municipal power plant. Columbia, N. C., is asking bids until May 7 for equipment for municipal lighting plant. Shelby County Commissioners, Memphis, Tenn., plan mechanical shops for the County Workhouse, to cost $400,000. Union City, Tenn., plans early installation of a 1,000-kw. turbo-generating unit. The American Creosoting Works, Inc., Norfolk, Va., plans a creosote distilling plant, to cost $150,000. The Gauley Power Company, Charleston, W. Va., plans a 60,000-hp. hydro-electric power plant on the Gauley River in Fayette County, to cost $900,000. Martinsburg, W. Va., plans a municipal power plant. Hazelhurst and Meridian, Miss., will install ornamental lighting systems.

## *Prices Continue Firm in Dull Metal Markets*

Absence of buying interest accompanied by unchanged or, in some cases, slightly higher prices, featured the non-ferrous metal markets during the week ended Wednesday. Lead has been quiet but steady at 6.10 cents, New York, and 6 cents, St. Louis; some activity is reported in tin at slightly better prices and the tone of the domestic zinc market is better as a consequence of some improvement in prices in London. Antimony quotations are fractionally higher.

NEW YORK METAL MARKET PRICES

| | Apr. 11, 1928 Cents per Pound | Apr. 18, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 13.9625 | 13.9875 |
| Lead, Am. S. & R. price | 6.10 | 6.10 |
| Antimony............ | 9.625 | 10.00 |
| Nickel, ingot.......... | 35 | 35.00 |
| Zinc spots............ | 6.075 | 6.10 |
| Tin, Straits........... | 51.875 | 52.50 |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price April 18, 1928, 16 cents.

## *Good Central-Station Buying in Eastern District*

Power company business is a feature of current business in the Eastern district, not only with regard to actual contracts but in connection with inquiries for early commitment. Prime movers are again in demand, with substation equipment and line materials close seconds in volume sales. The outlook for continuance of the present buying movement is decidedly encouraging. A central-station company in northern New York has placed an order for a 5,000-kw. turbo-generator, with accessories, totaling about $55,000 and a Middle West power company has contracted for a 70,000-kw. unit of like type with the same manufacturer, the order aggregating $750,000. An order for transformers has been given by a metropolitan central-station company to an amount which will be approximately $50,000.

A New York company has secured an order for the steam end of a municipal power station project in Missouri, covering boilers, stokers, forced draft equipment, etc., amounting to $30,000. The contract for the turbo-generator installation for the same plant in Missouri has been given to a Pittsburgh manufacturer at $41,000. Control apparatus for central-station service is in improved demand, following rather spotty conditions for several weeks past. A leading maker has secured a contract for equipment of this kind for a New York power station, costing approximately $60,000.

Railway business is beginning to loom as an active factor in the market. Actual buying is expected to mature within the next four to six weeks. It is anticipated that the New York Central Railroad Company will be in the market for equipment for the electrification of its west side lines in New York at an early date. The decision of the Pennsylvania Railroad Company to expend $20,000,000 for a new passenger terminal and line improvements at Newark, N. J., is another project of particular importance. Immediate construction activities in the Eastern district include the following:

The United Electric Light & Power Company, New York, plans for a distributing plant on 134th Street to cost $60,000. The LaClede Company, Buffalo, N. Y., will build an addition to its paper and card factory to cost about $100,000. The Signal Corps Laboratory, Fort H. G. Wright, N. Y., is asking bids until April 30 for 16,000 ft. of submarine cable (Circular 4). The Royle & Pilkington Company, Mount Holly, N. J., plans a new textile mill at Hazlewood, N. C., to cost $125,000. The Roller Bearing Company of America, Inc., Newark, N. J., has acquired the former plant of the Mercer Motor Car Company, Trenton, N. J., and will remove and expand its works at a cost of $350,000. The Bureau of Water, Philadelphia, Pa., is asking bids until April 26 for switchboards, electrical instruments, etc., for the Belmont pumping station (Contract No. 917); also, at same time for motor-driven pumping machinery (Contract No. 916).

The Baltimore & Ohio Railroad Company will make extensions in shops at New Castle, Pa., to cost $150,000. Washington and Jefferson College, Washington, Pa., plans a two-story chemistry building to cost $225,000. The Philadelphia Suburban-Counties Gas & Electric Company will install a power switching station at Bridgeport, Pa., in connection with service from the Conowingo hydro-electric power project. The Board of District Commissioners, Washington, D. C., is asking bids until April 25 for motors, starting equipment, etc., in connection with pumping machinery for the municipal sewage system. The General Purchasing Officer, Panama Canal, Washington, is asking bids until April 27 for dome refractors, electric refrigerators, etc. (Panama Schedule 1870.)

## *Street-Lighting Sales Active on Pacific Coast*

Recent power company orders on the Pacific Coast include one carload of 60,000-volt pin-type insulators for $8,000 and one carload of 11,000-volt units for $3,500, both for installation along the central area of the Coast range. A contract placed by Truckee for installation of a light, heat and power system amounted to $9,372. The power company load drive is reflected in a San Francisco jobber's purchase of 210 ranges, valued at $22,500, for stock.

Street-lighting business amounted to nearly $30,000. An order for 51 assorted motors, from 5 hp. to 150 hp. and valued at $15,000, has been placed for Hawaiian shipment. Prospective business includes complete electrical equipment for the Oakland Estuary subway, airway beacons and landing equipment for all the emergency fields on the airway routes between San Francisco and Blue Canyon and San Francisco and Redding, a $500,000 oil distributing plant in San Jose for a Doheny subsidiary, a $2,000,000 expenditure by San Francisco for new firehouses and high-pressure extensions, a 10-mile pole line job for Stanford University, a 45-mile farmers' telephone line for Raymond and a 15-mile similar line for Lemoore, a $2,000,000 factory and plant for Johns-Manville at Pittsburg, Calif., and a $1,000,000 hotel and bungalow colony near Indio on the edge of the California desert.

Sales of motors and pumps for orchards and irrigation districts in eastern Washington continue exceptionally brisk. Other motor business is quiet. Range sales reported average about 750 per month in Seattle alone and domestic appliances are in good demand. Specifications are reported out for approximately 50 motors, 25 hp. to 15 hp., for an Idaho lumber mill and for 30-in. butterfly valves, pumps and motors for a pumping plant for the U. S. Indian Irrigation Service at Wapato.

The city of Seattle is taking bids for 175,000 ft. of guy wire and 10,000 eight-pin cross-arms. The Mountain States Power Company, Tacoma, Wash., plans an expenditure in excess of $100,000 in improvements to light and power service in Coos Bay, Ore. The Northwestern Pulp & Paper Company is reported to have signed a contract with the Austin Company for a 100-ton pulp mill at Astoria, Ore. Construction projects are as follows:

The Willys-Overland Company, Toledo, Ohio, will build an assembling plant at Los Angeles, to cost $1,000,000. The Floco Motors Corporation, Los Angeles, Calif., recently organized, plans an automobile manufacturing plant to cost $150,000. The Continental Can Company, San Francisco, Calif., plans a new plant at Sacramento, to cost $1,000,000, and the California Co-operative Producers, Inc., Oakland, will build a canning plant on adjoining site, to cost $350,000. The Pacific Lumber Company, Scotia, Calif., plans a pulp and paper mill, to cost $500,000. The Pacific Power & Light Company, Portland, Ore., will extend transmission lines in the Lewiston-Clarkston and Idaho district, to cost $90,000. Santa Barbara, Salinas, Calif., and Santa Paula, Calif., plan ornamental lighting systems.

## *Power Company Buying Active in St. Louis District*

All manufacturers in the St. Louis district report the demand for small industrial motors and equipment above normal. One lot of $1,000 worth of motors was shipped to the lead district, another lot of 21 small motors was sold to a refining company for $2,000. A large power company is making extensive changes in its power plants at a cost estimated at over $1,250,000. Orders have already been placed for more than one-half of the needed equipment. Construction projects are as follows:

The Arkansas Portland Cement Company, operated by the Oklahoma Portland Cement Company, Ada, Okla., plans a new mill near Schaal, Ark., to cost $1,000,000. The Century Electric Company, St. Louis, Mo., plans a new plant unit to cost $200,000. The Benton County Utilities Corporation, Gentry, Ark., plans transmission lines at Springtown, Ark. The Southwestern Light & Power Company, Oklahoma City, Okla., plans a transmission line from Comanche to Addington, Okla. The Southwestern Light & Power Company, Oklahoma City, Okla., has acquired the municipal power plant at Eric, Okla. The West Texas Utilities Company, Abilene, Tex., plans a transmission line to Eden, Tex. The Texas Gulf Power Company has acquired the municipal power plant at Strawn, Tex.

## *Slight Increase Noted in Middle West*

There has been a slight increase in the volume of business transacted in the Middle West and the employment situation has improved a trifle. The steel, automobile and electrical industries apparently are operating with a substantial volume of business. Industrial activity is somewhat spotty. An interesting report made public this week of the location of the Wireless Dry Cells, Ltd., an Eastern dry cell manufacturer, in the Chicago clearing industrial district, states that this firm will give employment to 400 to 500 workers and is the 87th firm to locate in this district and the fifth firm this year.

The various utility companies are proceeding with spring construction work and a considerable amount of apparatus purchasing is reported. Among the interesting orders placed this week were one for a 40,000-kw. frequency changer, valued at $350,000, and two others for labor and material to construct a substation, at a cost of $145,000. Jobbers' sales continue to show improvement. Motor sales have increased somewhat and considerable building business is being obtained. Construction projects are as follows:

The Midwest Rubber Reclaiming Company, Monsanto, Ill., plans a one-story plant to cost $150,000. The Northwestern Light & Power Company, Cedar Rapids, Iowa, plans improvements in power plant at Peterson, Iowa, to cost $65,000. The General Motors Corporation, Detroit, plans a seven-story research laboratory to cost $250,000. The AC Spark Plug Company, Flint, Mich., will build a three-story addition, to cost $100,000. The Michigan School for the Blind, Lansing, Mich., plans a new power plant to cost $100,000. The Monroe Auto Equipment Company, Monroe, Mich., plans a factory addition to cost $150,000.

The Firestone Tire & Rubber Company, Akron, Ohio, plans a two-story factory branch plant at Columbus, Ohio, to cost $125,000. The Standard Electric Stove Company, Toledo, Ohio, plans a new plant, to cost $150,000. The Carnegie Steel Company plans an addition to its McDonald mill, Youngstown, Ohio, to cost $1,000,000. The Wisconsin Power & Light Company, Madison, Wis., plans rebuilding of power dam and hydro-electric power plant at Necedah, Wis. The Lake Superior District Power Company, Ironwood, Mich., has secured a franchise for a transmission line from Wakefield to Thomaston. The Dayton Power & Light Company, Dayton, Ohio, plans transmission lines in Piqua, Ohio, and Covington, Ky., districts, to cost more than $500,000; also plant improvements and extensions at Dayton. The Lake Superior District Power Company, Ashland, Wis., plans a transmission line from its White River plant to Mason and Benoit, Wis. Elgin, Ill., and Benton, Wis., plan ornamental lighting systems.

# Activities of the Trade

## Westinghouse Gets Large Power Equipment Order

The Duke Power Company, Charlotte, N. C., has awarded a contract to the Westinghouse Electric & Manufacturing Company for two 60,000-kw. steam turbo-generator units for the Riverbend power plant. The contract involves more than $1,250,000. The first unit of the equipment will be delivered April 1, 1929, and the second on May 1, 1929. The Riverbend steam plant of the Duke Power Company, preliminary work on which is already under way, is occupying a site on the Catawba River, 12 miles from Charlotte. A possible eventual installation of 450,000 kw. in this plant is announced.

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The Oliver Iron & Steel Company, Pittsburgh, announces that Bertram Quarrie has been elected president of the company to succeed Henry Oliver, who has resigned. Mr. Quarrie was formerly connected with the American Steel & Wire Company and the Otis Steel Company at Cleveland.

The C. O. Bartlett & Snow Company, Cleveland, manufacturer of material handling equipment, announces the appointment of W. H. Norrington as its representative in New York City and vicinity with headquarters at 30 Church Street.

The J. Leo Scanlon Company, Buffalo, N. Y., manufacturers' agent, announces that Vincent J. Brown is now associated with the company as a sales representative.

The Dampney Company of America, Hyde Park, Boston, announces that the sale of its "Apexior" protective coatings for power plant equipment will be handled in southern Minnesota by the Kent Engineering Company, 732 Builders Exchange, Minneapolis, Minn.

The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, announces a reduced price on its "Hotpoint" model R 6-lb. laundry iron. Price reductions also have been announced on other standard "Hotpoint" irons.

The Ideal Commutator Dresser Company, Sycamore, Ill., announces the appointment of the Syracuse Supply Company, 314 West Fayette Street, Syracuse, N. Y., as its sales representative for the sale of Ideal commutator resurfacers and other maintenance equipment in the Syracuse territory.

The Federal Gauge Company, 564 West Adams Street, Chicago, announces the organization of the Mercoid Corporation to become the operating unit of the company. The Federal company also controls the Mercoid Corporation and the Arcless Contact Company, a controlling interest in which has just been acquired. General offices will be maintained at and correspondence for any of these three companies should be addressed to 564 West Adams Street, Chicago.

Edwards & Company, Inc., 140th and Exterior Streets, New York City, manufacturer of electric signaling devices, announces several additions and changes to its line of electric signaling devices. The company also has appointed Walter I. Ferguson & Company as representative in Kansas City, 208 Baltimore Building, and in St. Louis, 1486 Arcade Building.

The National Flue Cleaner Company, Groveville, N. J., manufacturer of soot blowers for fire tube boilers, announces the appointment of the Naylor-Hickey Corporation, 643 Washington Boulevard, Chicago, as its Chicago representative and the Furnace Improvement Company, 511 Westminster Street, Providence, R. I., as its New England representative.

The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, has placed on the market a gymnasium fixture consisting of a heavy gage steel canopy and wire guard and RLM standard dome reflector, a ball fixture aligner and an intensifier, a supplementary lighting unit for special operations, where in addition to good general illumination it is desirable to concentrate an intense light on certain small areas.

The American Brown Boveri Electric Corporation, Camden, N. J., has received an order from Anderson, Ind., for a 10,000-kw. steam turbine for the municipal power plant.

The Belden Manufacturing Company, Chicago, manufacturer of insulated wires and cables, plans a second unit for its plant at Richmond, Ind.

The Simplex Wire & Cable Company, Cambridge, Mass., has awarded a contract to Stone & Webster, Inc., Boston, for a one-story addition to its plant on Franklin Street.

The Eureka Vacuum Cleaner Company, Detroit, announces a new model 11 Eureka combination home and automobile cleaner with detachable handle.

The Westinghouse Electric & Manufacturing Company has appointed the Times Appliance Company, Inc., 33 West 60th Street, New York City, and 166 Atlantic Avenue, Brooklyn, N. Y., as its agent jobber in the Metropolitan district exclusive of New Jersey. This company, of which E. B. Ingraham is general manager, has been for seven years a special jobber for the Westinghouse company. The officers are E. A. Allen, president; B. A. Allen, vice-president, and E. B. Ingraham, secretary and treasurer.

## General Electric Orders Increase 3 per Cent

Orders received by the General Electric Company for the first three months of this year amounted to $79,925,840, President Gerard Swope has announced. This compares with $77,550,581 for the corresponding quarter in 1927, an increase of 3 per cent, and with $86,433,658 for the first quarter of 1926.

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The Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., manufacturer of safety switches, etc., announces the opening of a new office in Boston in charge of Frank W. Garner, who has been connected with the New England sales force of the company.

The Rockbestos Products Corporation, New Haven, Conn., manufacturer of asbestos covered wires and cables, announces the appointment of C. Dent Slaughter as its Pacific Coast representative, with offices at 314 Twelfth Street, San Francisco; 324 North San Pedro Street, Los Angeles; 200 North Thirteenth Street, Portland, and 1108 Post Street, Seattle.

C. Wendel Muench & Company, 557 West Monroe Street, Chicago, has been organized to serve electrical manufacturers as advertising agents. The organization will specialize in electrical accounts, rendering merchandising direct-by-mail and general advertising service. C. W. Muench, for nine years director of the sales and advertising of George Richards & Company, manufacturers of "Hemco" products, is head of the new organization.

The W. N. Matthews Corporation, St. Louis, manufacturer of electrical specialties and mechanical painting equipment, has added the No. 6 "Xpandix" anchor to its line. This new unit is a two-way expanding type of malleable anchor recommended for 6,000 lb. maximum strain.

The Buffalo Foundry & Machine Company, Buffalo, N. Y., has acquired the assets, physical properties and patents of the Chemical & Vacuum Machinery Company and will supplement its "Buflovak" and Buflokast" lines of driers and evaporators with several new types. Charles O. Lavett, former general manager, and H. E. Neubauer, former chief engineer of the Chemical & Vacuum Machinery Company, are now associated with the Buffalo Foundry & Machine Company.

Copeland Products, Inc., Detroit, manufacturer of electric refrigerators, reports the largest first quarter's shipments in the company's history, with an increase of 45 per cent over the first quarter of 1927.

The R. Thomas & Sons Company, East Liverpool, Ohio, manufacturer of porcelain insulators, announces that after May 1 its executive offices will be located at Lisbon, Ohio.

# New Equipment Available

## Manual A.C. Starter

A manual across the line alternating-current motor starter, the CH-9115, is announced by the Cutler-Hammer Manufacturing Company, Milwaukee. Designed to meet the need for an inexpensive manual starter, it includes overload cutouts giving complete motor protection, cadmium plated, double break, roller type contacts and small size, safety, dustproof inclosing case. The roller type contacts are of the double break type, cadmium plated, and by breaking the arc in two places give several times the life of ordinary contacts. In addition, the contact rollers turn after each operation to present a new contact surface for the next operation.

Complete motor protection is obtained during both the starting and running periods. The thermal overload cutouts provide the necessary time interval to take care of starting inrushes without shutting down the motor. The starter is small and compact, the inclosing case is dustproof and the cover is in two parts. This permits opening the lower section only for replacing fusible links in the thermal overload cutouts. The cover can be opened only when the starter is in the "off" position and all current-carrying parts are dead. Installation can be made without removing the panel from the case. All parts are easily accessible for quick inspection.

## Portable Farm Motor

A line of farm "Handi-Motors" consisting of the Wagner air-jacketed (totally inclosed self-ventilated) motor mounted on a portable hand truck has been placed on the market by the Wagner Electric Corporation, St. Louis. Where the air-jacketed motor is not required the regular Wagner open type sleeve motor is supplied. Motors of 2, 3, 5 and 7½ hp., 1,725 r.p.m., 220 volts, single or polyphase are used. The same truck is used for any motor in the line.

Pedestal Type Traffic Signal.—A pedestal type traffic signal using lights in groups of three each on all four sides, and designed to stand in the center of street intersections, or for mounting on curbs is being marketed by the General Electric Company The new signal differs principally from previous types in the design of the base and the length of the overhead fitting. The new type incorporates a form for the concrete as part of its base, not only saving the time and labor of making a form but also making the signal and base an integral unit and therefore less liable to breakage. The signal may also be obtained in an adjustable form for use at street intersections where the angle of intersection is other than 90 deg. In the adjustable form the signal faces are so arranged that they can be moved to any position, either greater or less than a right angle.

## Power Supervisory System

The type E Strowger power supervisory system has been developed by the Electric Power Equipment Corporation, Philadelphia, to meet the needs of comparatively small power installations for a simple method of control and supervision from a distant point. It is said to be particularly suitable where continuous indication is not necessary and where high speed of operation is not important.

The equipment at the substation consists essentially of a switch of the standard Strowger type having a number of semi-circular rows of contacts arranged parallel with each other and in horizontal planes. Associated with each row of contacts is a finger attached to the switch shaft. The shaft and fingers are capable of being moved together, step by step, by means of a magnet, to any desired set of contacts, and may be released from any point by a release magnet which brings the shaft and fingers back to the "home" position. The contact fingers on the switch are of the short-circuiting type, avoiding the use of flexible cords. Each set of contacts is associated with a circuit breaker or other unit to be controlled. The selection of a particular unit by the switch is controlled by the circuit selector at the dispatcher's station.

*Dispatcher's control cabinet for power supervisory system*

At the substation there is a polarized relay which may be operated in one direction or the other by means of a control key. A number of resistances in the control circuit are so adjusted as to afford a different deflection of the dispatcher's voltmeter indicator. The dispatcher's control cabinet is shown in the illustration. A standard 45-volt dry battery unit supplies current for operating the voltmeter, a 24-volt storage battery is required for operating the switch and relays and a 110-volt alternating-current circuit is used for ringing the alarm. If a unit trips out automatically the alarm will ring. The dispatcher can then check to determine which unit or units have tripped out, when they may be reclosed in the usual manner by the operation of the control key.

## Motors for Gaseous Mines

Direct-current motors with starting switches, designed to meet the requirements of the U. S. Bureau of Mines for equipment permissible for use in gaseous mines, have been developed by the General Electric Company and are offered in 1, 3 and 5-hp. ratings. These equipments are for use on mine pumps, room conveyors and for similar applications where constant-speed, direct-current motors are suitable. These motors and starters, when included in an assembly of elements submitted for approval to the Bureau of Mines, will not themselves need to be tested in an explosive mixture, since they have already met the requirements of such test; but the approval plate can be applied only when the whole assembly has been approved, which is in accordance with the bureau's established practice. The new equipment has been give the General Electric designation "Class BM."

## Across-the-Line Motor

A line of squirrel cage motors from 1 hp. to 30 hp. for control by an automatic push-button system has been developed by the Triumph Electric Corporation, Cincinnati. These motors are designed to develop at least 150 per cent of the full-load torque at starting, when connected directly across the line. There is no compensator or resistance type starter used, and the current taken is below the limits set by the N.E.L.A. regulations. The motors are fitted with Timken roller bearings, but can be supplied with either ball or sleeve bearings if desired.

Primary Cutouts.—A new line of inclosed expulsion type cutouts has been designed by the General Electric Company. The new cutouts are said to have very high dielectric strength, both for 60-cycle and impulse voltages. Current ratings and interrupting capacity ratings have been increased over those of previous designs. The line comprises four cutouts, rated as follows: 60 amp., 2,500/4,000Y volts; 60 amp., 7,500 volts; 150 amp., 5,000 volts, and 150 amp., 7,500/12,500Y volts. The company states that the 60-amp. cutout can economically replace plug type cutouts generally used on 2,300/4,000Y volt systems. The wet-process porcelain housings used are of a new design. The doors are of "Textolite," a molded insulating compound, with handles of the same material, and they may be opened by a pull of a standard switch hook. The fuse holder is supported by the door and is removed from the circuit when the door is opened.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued April 3, 1928)

Reissue 16,920. Burglar-Proof Induction Coil; H. J. Murray, New York, N. Y. App. filed Oct. 11, 1921.

1,664,403. Circuit-Continuing Device; H. A. Douglas, Bronson, Mich. App. filed April 17, 1922. For a headlighting or other reflecting lamp.

1,664,408. Attachment Plug; F. F. Frakes, Columbia, Tenn. App. filed May 31, 1927. Having a fuse of the removable type in circuit with the plug, and secured therein.

1,664,429. Electric Paint Remover; W. Multhaup, Winona, Minn. App. filed March 29, 1927.

1,664,457. Electrical Hair or Massage Brush; A. Lloyd, London, England. App. filed April 10, 1926.

1,664,519. Automatic Regulation in Electric-Lighting Systems; F. C. Lyne, Westminster, London, and J. Etchells, Aston, Birmingham, England. App. filed April 25, 1927. As train lighting systems.

1,664,534. Circuit Controller; F. D. Zimmerman and E. M. Pyle, Jerome, Pa. App. filed May 26, 1926. Manually operable electric motor starters and controllers.

1,664,540. Dynamo Frame; W. A. Chryst, Dayton, Ohio. App. filed Aug. 27, 1925. For small machines as are used on automobiles.

1,664,561. Short-Circuiting Mechanism; J. J. Janca, St. Louis, Mo. App. filed Dec. 24, 1925. For single phase motors.

1,664,584. Electric Cooking and Heating Apparatus; J. H. Williams, Toronto, Ont., Can. App. filed April 6, 1925. For use in apartments or rooms where the usual cooking and heating facilities are not readily available; fireless cooker type.

1,664,586. Switching Apparatus; L. T. Barnes, Hempstead, N. Y. App. filed Dec. 5, 1925. Applicable to flashing lamps or the like.

1,664,624. Electric-Fixture Mount; M. Heichen, Brooklyn, N. Y. App. filed July 24, 1926. Combined switch and mounting for side wall fixtures.

1,664,672, 1,664,673. Induction Electricity Meter. A. L. Emens, Lafayette, Ind. Apps. filed March 12 and Dec. 24, 1926. Having a protecting outer case.

1,664,686. Junction Fitting for Metallic Armored Electrical Conductors; J. H. Hunter, Detroit, Mich. App. filed April 13, 1925.

1,664,692. Coupling for Battery Terminals; F. W. Leuthesser, Oak Park, Ill. App. filed March 7, 1925.

1,664,708. Brush for Generators, Etc.; A. A. Schupp, Saginaw, Mich. App. filed April 2, 1924. Made of a cast metal alloy consisting of metallic lead and metallic copper in substantially equal proportions.

1,664,720. Thermo Electric Generator; C. W. Woodruff, Columbus, Ohio. App. filed Dec. 7, 1925. Thermo-electric cell of the type employing hot and cold junctions of dissimilar metals for supplying filament and plate currents in vacuum tube circuits.

1,664,750. Process for the Production of Galvanic Metal Coatings; F. Kirschner, Vienna, Austria. App. filed Oct. 12, 1923.

1,664,758. Electrically Heated Sadiron Stand; R. O. Reynolds, Auburn, Me. App. filed Nov. 26, 1926.

1,664,759. Electric Fitting and the Like; A. B. Rypinski, Brooklyn, N. Y. App. filed May 13, 1921. Mountings of sockets on a base of porcelain or non-conducting material.

1,664,778. Thermostat; L. P. Hynes, Albany, N. Y. App. filed March 24, 1923. As used on railway cars to control the heating.

1,664,781. Dynamo-Electric Machine; G. H. Leland, Dayton, Ohio. App. filed Nov. 22, 1920. Single-phase alternating current motors of the repulsion-starting and induction-running type.

1,664,800. Electrochemical Method of and Means for Protecting Buried Pipe Lines Against Corrosion; R. Van A. Mills, Sandy Spring, Md. App. filed Dec. 5, 1924.

1,664,845. Switching Device; A. P. Ball, Detroit, Mich. App. filed Nov. 23, 1921. Having means which insure that the movable switch contacts will be completely engaged with the stationary contacts upon a closing movement of a switch operating handle or analagous device.

1,664,857. Cigarette Lighter; M. J. Harkless, Homewood, Ill. App. filed Sept. 13, 1926.

1,664,882. Metal-Casting Machine; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Sept. 6, 1921. Heaters for metal molding machines, such as those used for casting type.

1,664,947. Traffic Regulator; M. E. Rusch, St. Paul, Minn. App. filed Nov. 13, 1925.

1,664,952. Signaling Apparatus; N. H. Suren, Needham, Mass. App. filed Sept. 6, 1924. Non-interference signal transmitter for use in signaling systems which are normally conditioned for metallic circuit operation and have provision for operation through a normally open ground return in the event of a broken metallic circuit.

1,664,986. Plug Connecter; B. P. McKinley, Flushing, N. Y. App. filed Dec. 8, 1923. Twin type.

1,664,992. Electrotherapeutical Apparatus; S. Pongo, New York, N. Y. App. filed July 26, 1927. Electric bath-cabinet.

1,665,014. Thermostatic Current Control; O. Q. Beckworth, Los Angeles, Calif. App. filed July 9, 1925.

1,665,018. Electric Swivel Socket; P. S. Black, Fort Worth, Tex. App. filed April 25, 1927.

1,665,021. Automatic Electric Switch for Cable-Carrying Drums; J. H. Cohen, Bridgeport, Conn. App. filed Nov. 3, 1923.

1,665,038. Electric Welding Machine; J. W. Meadowcroft, Philadelphia, Pa. App. filed Dec. 7, 1925. Spot welder with work-handling mechanism adapted for use where the parts or assemblies to be welded are relatively large and cumbersome, such as the door and body sills in the building of sheet steel automobile bodies.

1,665,048. Battery Terminal; A. W. Weimer and J. F. Smith, Geneseo, Ill. App. filed Jan. 3, 1927.

1,665,060. Automatic Control Means for Electromagnetic Operating Devices; H. K. Hitchcock, Pittsburgh, Pa. App. filed Feb. 5, 1927.

1,665,062. Mold for Making Metal Patterns by Electrodeposition; A K. Laukel, Detroit, Mich. App. filed Oct. 15, 1926.

1,665,066, 1,665,067. Electric Welding Machine; J. W. Meadowcroft, Philadelphia, Pa. Apps. filed Nov. 24, 1925 and March 7, 1927. For spot welding.

1,665,095. Eectrical Plug Lock; J. B. Henry, Connersville, Ind. App. filed Jan. 5, 1927.

1,665,113. Circuit Breaker; F. W. Roller, East Orange, N. J. App. filed Sept. 24, 1924. Automatic air circuit breaker.

1,665,122. Tractor-Lighting Device; W. H. White, Copeland, Kan. App. filed June 25, 1927. Means for attaching a magneto to tractor so that it will be driven from the pulley shaft of the tractor to furnish current for a lighting system placed on the tractor.

1,665,126. Safety Switchboard; J. F. Burns, Philadelphia, Pa. App. filed June 23, 1922.

1,665,166. Electrical Connecter; J. E. Graham, London, England. App. filed Oct. 21, 1925.

1,665,169. Holder for Electric Fuses; O. E. Holtsclaw, Elwood, Ind. App. filed April 21, 1925. To hold a fuse perfectly tight without the aid of springs.

1,665,191. High-Tension Cable to Prevent a Breaking Down of the Insulation; E. G. Sievert and H. Svenson, Sundbyberg, near Stockholm, Sweden. App. filed Nov. 9, 1925.

# New Trade Literature

ASBESTOS INSULATED WIRES AND CABLES.—The Rockbestos Products Corporation, New Haven, Conn., has issued two bulletins covering the Rockbestos "A.V.C." (asbestos and varnished cambric) cables. The bulletins give complete construction specification tables for this insulation, which is intended for the utmost in severe conditions of heat, moisture, acid fumes, oil, flame and gas. Another bulletin issued by the company contains the standard specification of all Rockbestos insulated wires and cables as to the quality of the copper, the asbestos and the method of impregnating, testing and inspecting. A new asbestos and varnished cambric insulated switchboard wire is described in the bulletin covering switchboard wires and cables.

TRANSFORMERS.—The Packard Electric Company, Warren, Ohio, has issued pamphlets Nos. 529, 521 and 517 describing and illustrating its type LD dry-type current transformers, type BK1, BK2 and BK3 indoor dry-type current transformers and its type PW outdoor potential transformers.

TRANSMISSION AND DISTRIBUTION MATERIAL.—Porter & Ross, Inc., 30 Church Street, New York City, has issued a 240-page illustrated catalog as a source of pole line material buying information. The catalog contains a good deal of material covering poles and includes specifications, information for storing and painting poles, and a table of sizes and carloadings. A chapter is devoted to outdoor substation equipment covering a line of disconnecting switches, bus supports, straight connectors, etc. A line of construction tools are also described and illustrated.

ELECTRICAL AIR HEATERS.—A catalog issued by the Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, describes the "Hotpoint" electric air heaters for the home. The catalog is well illustrated and a chapter is devoted to the essentials of correct room heating. The "Calrod" heating unit used in "Hotpoint" heaters is illustrated and described. The catalog contains information as to how to determine heater sizes, how to estimate heating costs, and other miscellaneous data on heating.

AIR PREHEATER.—Catalog AH-3 issued by the Combustion Engineering Corporation, 200 Madison Avenue, New York City, describes and illustrates the "C-E" air preheater. It contains charts showing typical performances of the air preheater and drawings show the applications of the air preheater to different installations.

MOTOR-GENERATOR SETS.—Bulletin No. 450 issued by Roth Brothers & Company, 1400 West Adams Street, Chicago, describes and illustrates its motor-generator sets, including the new two-bearing motor-generator sets recently developed by the company. General specifications covering the line are included. Tables give a complete listing of the various sizes in the different lines.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Rosario, Argentina (No. 30,667), for storage and radio batteries.

Purchase is desired in Temuco, Chile (No. 30,665), of batteries and flash lights.

Purchase is desired in Baghdad, Iraq (No. 30,696), of electric automobile bulbs.

Purchase is desired in Durango, Mexico (Nos. 30,674 and 30,675), of electric corn poppers and electric ice cream freezing machines.

An agency is desired in Manila, P. I. (No. 30,669), for electrical goods.

An agency is desired in Rome, Italy (No. 30,668), for household electrical machines, especially refrigerators and washing machines.

An agency is desired in Warsaw, Poland (No. 30,666), for farm lighting plants.

An agency is desired in Paris, France (No. 30,643), for air compressors.

Purchase is desired in Naples, Italy (No. 30,641), of hand-operated floor-scraping (parquet) machines.

Remarkable building progress has been made in the principal South African municipalities and many projects are contemplated.

A power company has filed plans with the Canadian Department of Public Works at Ottawa for a hydro-electric development on the Ottawa River, to cost $2,500,000. The property now held by the company is in virtue of a water lease from the Province of Quebec. (Canada No. 274,191.)

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## The Assistant Tax Collector

OF EVERY dollar paid by the public for electric light and power, 10 cents is used for taxes. The electric service company is one of the assistant tax collectors, and a big one, for our various political subdivisions.

The percentage of the public's dollar which it has to pass on differs among the several states, ranging, among the states for which information is available, from 6.7 per cent in Alabama to 13.5 per cent in South Carolina. The average rate is about 9.7 per cent.

On the basis of data taken from public utility commission reports or obtained at commission offices it has been possible to analyze the operations in twenty states and the District of Columbia. Although this is fewer than half the number, the operations account for $1,026,163,241 of the operating revenue for 1926, constituting about 62 per cent of the national total. The taxes paid by the companies earning this revenue amounted to almost $100,000,000, or, to be precise, $99,303,840. Assuming that the same ratio holds in the remaining states, the electric light and power companies of the United States paid, in 1926, about $160,000,000 in taxes.

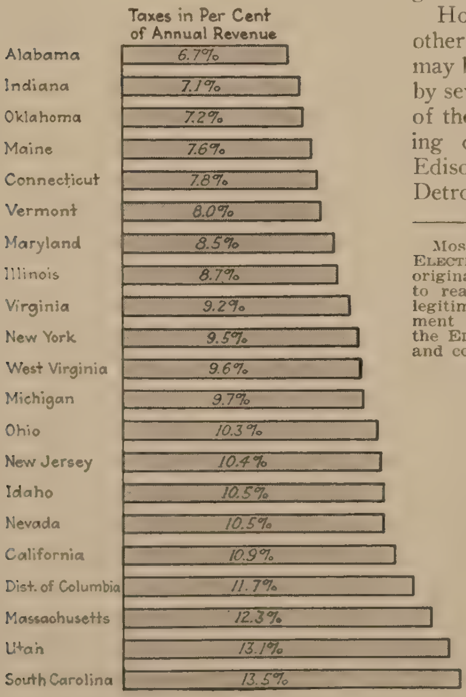
Data were also obtained for one additional state, Kansas, but they unfortunately did not include operations of companies serving only one city or town each. To what extent that omission may affect the ratios is not known, but it is not believed to be great. The state figures as reported indicate a tax ratio of about 5 per cent, which is lower than that for Alabama and is, in fact, the lowest figure received. If this truly represents the situation it is then proper to include the Kansas figures with the others; the effect is to change the general average to 9.6 per cent. The effect on the estimated national total of $160,000,000 for taxes is negligible.

How this sum compares with the other expenditures of the industry may be judged from figures published by several individual companies. Two of them are shown in the accompanying diagram: The Commonwealth Edison Company for 1925 and the Detroit Edison Company for 1926. Their proportion for taxes corresponds fairly well with the national average, and the allocation of costs may be regarded as typical. It will be seen that the taxes are roughly equal to the interest charges on the funded debt; they are from half to two-thirds as great as the cost of fuel; they are about half as large as the biggest item, that for labor.

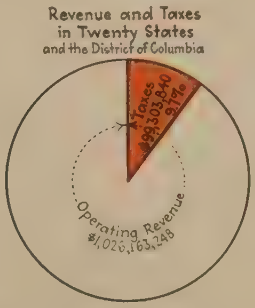
Attempts to draw deductions regarding localities or types of plant associated with high or low tax ratios lead to inconclusive results. Alabama and South Carolina are both Southern states. One is at the top of the column, the other at the bottom. In New England Maine, Connecticut and Vermont are near one end of the list and Massachusetts near the other. Waterpower states like Alabama, Maine and California are not distinguishable, by position in the table, from predominantly fuel-using states like Indiana, Oklahoma, New Jersey or Massachusetts.

The circumstance that taxation is usually based primarily on property values rather than on revenue is of especial significance to electric power companies, where, in round numbers, an investment of five dollars is required to bring in a dollar of revenue. The effect is to make the ratio of taxes to earnings much higher than in industries or other business activities having a more rapid turn-over.

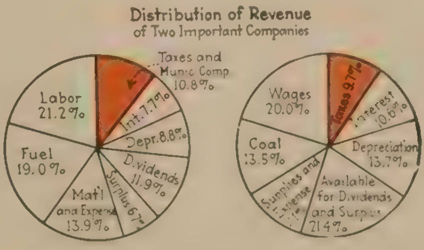
Electric service carries a very sizable indirect tax. This expense becomes part of the production cost. It cannot be taken out of any of the other items.



*One dollar in seven for taxes*



*Taxes absorbed 9.7 per cent*



*Taxes equal half the labor cost*

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Most of the data for statistics in the Electrical World are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the Electrical World, help it in obtaining and compiling further basic information.

# West Reports Increased Activity During First Quarter

THAT the manufacturing plants of the Western States witnessed slightly increased productivity during the first quarter over that reported for the same period in 1927 is indicated by reports received on monthly electrical energy consumption by some 400 large manufacturing plants operating in this section. The increased average rate of productivity during the quarter was 2.2 per cent over the first quarter of last year. The year opened with the rate of activity slightly under that of January last year, but both February and March witnessed a rate of activity over that of the same months last year, the March activity being about 10.4 per cent over March of 1927, but slightly below March of 1926. Past history indicated that a drop in the rate of activity in manufacturing plants was normally to be expected in March, and the current March followed this general trend by reporting a drop of 5.3 per cent under February. This was slightly under the drop witnessed by general industry in the nation as a whole.

Every industrial group operating in the Western States reported a rate of operations during March under that of February, after correction is made for the number of working days. On the other hand, every industrial group, except the metal industries group and the shipbuilding industry, reported March operations over those of March last year. Three of the industrial group—chemicals and allied products, metal industries group and shipbuilding—reported an average rate of operations during the first quarter of the current year under that of the same period last year.

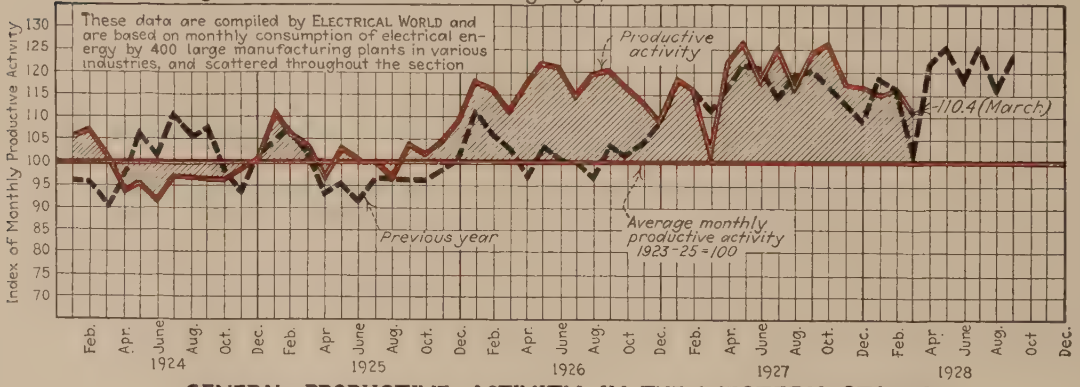
*Indexes of Productive Activity in the Western States*

All Figures Adjusted for Number of Working Days

| | March, 1928 | February, 1928 | March, 1927 | Average for First Quarter 1928 | Average for First Quarter 1927 |
|---|---|---|---|---|---|
| All industry | 110.4 | 116.7 | 100.1 | 114.0 | 111.6 |
| Chemicals and allied products | 104.6 | 106.9 | 85.8 | 104.8 | 109.5 |
| Food and kindred products | 101.8 | 104.8 | 83.8 | 106.8 | 92.5 |
| Lumber and its products | 122.0 | 124.2 | 91.1 | 121.8 | 105.3 |
| Metal industries group | 113.3 | 123.0 | 130.7 | 123.4 | 136.8 |
| Paper and pulp | 131.2 | 139.7 | 118.7 | 135.7 | 129.5 |
| Rubber | 153.6 | 159.8 | ..... | 151.2 | ..... |
| Shipbuilding | 84.7 | 100.5 | 117.7 | 93.8 | 123.5 |
| Stone, clay and glass | 139.4 | 170.8 | ..... | 153.4 | ..... |

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*

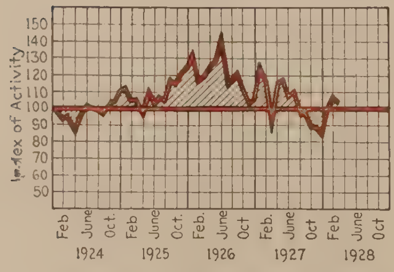
Adjusted for Number of Working Days, but not for Seasonal Variation



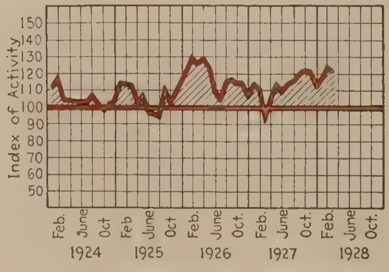
*States in the* WESTERN GROUP

Montana, Idaho, Wyoming, Colorado, New Mexico, Utah, Nevada, Washington, Oregon, California.

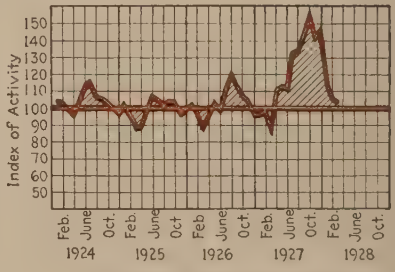
GENERAL PRODUCTIVE ACTIVITY IN THE WESTERN STATES



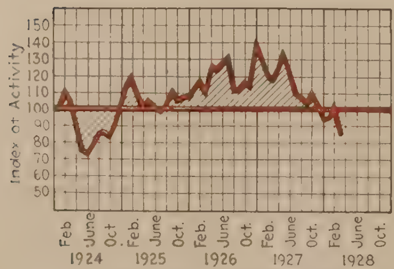
Chemical and Allied Products



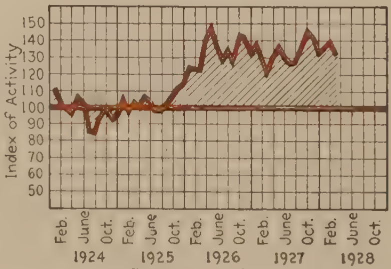
Lumber and Its Products



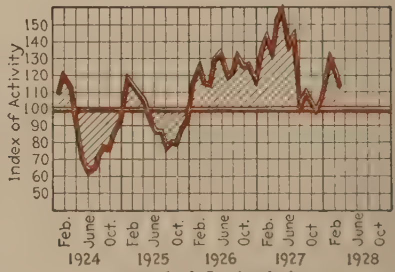
Food and Kindred Products



Automotive and Shipbuilding



Paper and Pulp



Metal Industries

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES

# Electrical World

*McGraw-Hill Publishing Company, Inc.*
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## *Politics and Engineering*

THE big tasks before Congress remain unfinished while the politicians spar for position in the presidential primary ring. Boulder Dam, Mississippi flood control and Muscle Shoals afford opportunities for the introduction of bills whose contents are designed to appeal to public sentiment. These projects are the excuses for congressional orations in which the orator defends the public from predatory interests with many mighty words. This is a typical presidential year.

Engineering and economic considerations should dictate legislation on Boulder Dam, flood control and Muscle Shoals. Engineering and economic facts should be established before money is spent or policies determined. The American Engineering Council has stated that Boulder Dam and flood control should be subjected to more thorough engineering investigation before legislation is enacted. A very able committee of the council reported only last week that the Boulder Dam project is not based on sufficient engineering data to establish its cost or its feasibility. Despite engineers and their reports, however, Congress is only too likely to discuss these projects with an eye to popular appeal and to enact legislation upon them which reflects political ambitions and not engineering data.

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## *A Good Investment in Managerial Time*

NOT a few public utility managers regard attendance upon rate hearings as an unwarranted burden upon their normal activities. Such executives apparently believe in shifting the load to the shoulders of legal counsel whenever possible and confine their own participation to directing the preparation of cases. Granted that more than half the time spent in a hearing room is extremely irksome to an alert and energetic manager and that reliance upon the legal profession is essential to proper procedure, the fact remains that appearance before a public regulating body almost always carries within itself potential opportunities of the greatest value from the standpoint of public relations.

Press representatives at hearings listen closely to the utterances of executives, and the words of a straightforward, businesslike official daily concerned with the operation of a utility bear weight with commissioners and often reach front-page display space in local news sheets. Seldom indeed does a rate case terminate without an opportunity for a qualified executive to tell the story of the utility's aims and achievements to the people via the hearing room, and while constant attendance on protracted hearings is not essential unless the situation is critical, "absent treatment" is a risky proceeding. It should never be forgotten that the public is virtually always in favor of hearings, regardless of the subject matter, and to fail to capitalize these opportunities is to fall short of demonstrating the truth that the company has nothing to conceal but instead everything to reveal.

* * * *

## *Diversity Stabilizes Utility Investments*

FROM the smallest central station serving a few score of customers in an isolated area to the investment group with far-flung properties half a continent or more apart, diversity underlies the operations and prosperity of all. The use of energy by customers supplied by a single-phase feeder illustrates the value of non-coincident demands on a little system serving a thinly settled rural region many miles away from another which provides power in blocks for densely grouped industries over cable trunk lines forming an interconnected set-up of great economic importance. Diversity is common to both. Go back to the immigrant's "lean-to" equipped with but two lamps and carry the element of diversified usage up the line to a completely electrified steel mill or railroad zone entering a metropolitan area. Non-coincident use of service is at the bottom of the capital outlay required to meet the needs of these customers without excessive cost. Upon the ability of the engineer to gage the relation between demand and plant investment required to render such service depends no small part of the success of the enterprise.

If the investor could trace the part which diversity plays in stabilizing the light and power business, he would be both amazed and brain-weary. The complex variations in usage of energy which are finally integrated into the plant or system load curve exhibit extraordinary differences in time and magnitude when analyzed even superficially with the aid of technical imagination. The transformation of these usage differentials into a total output burden which is finally equated into revenue from a system or group of systems marks a process of almost impregnable economic strength. The universality of electric service does not restrict its success in systems serving many customers of the same type unless expansion has run wild from the standpoint of capital outlays. Witness the high diversity factor of the electric range load in a single large apartment house. It is true that volume business must accompany diversity for economic success, and suitable rates are likewise basic. But those who market securities of light and power companies and those who buy them do well to reflect from time to time upon what diversity of demand and usage produces in the way of stability of earning power. Given sound management—and by this is meant not brilliance of administration but good, thoroughgoing, competent direction of loyal and intelligent employee service—diversity will do its stabilizing work in the face of practically every obstacle except political interference; and with right public relations it is hardly too much to say that nothing but a cataclysm of nature can jeopardize success—and even then but temporarily.

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## *Why Does a Billion-Dollar Load Go Begging?*

PROFESSEDLY, utility executives are keenly desirous of building industrial load on their lines. The enormous sums of money that have been invested in power plants and systems must show earnings. New loads and more intensive development of present applications for electric service must be sought. But with these conditions existing a potential industrial heating load amounting to millions of kilowatts and more than a billion dollars in annual revenue is virtually going begging so far as effective selling effort on the part of the majority of power companies is concerned. Some few electric utilities have taken definite and effective steps to set up in their sales departments a competent sales engineering staff to develop the heating load. For the most part, however, the central-station companies in their attempts at organizing an industrial heating department have "sent a boy to do a man's job."

Why does this condition exist? The manufacturers of industrial electric heating equipment want and need the sales assistance of the power companies. It is no fault of the utility power sales departments. They are doing the best they can with the equipment and personnel at their command. The real difficulty is executive failure to sense the possibilities of this class of business in load and revenue. The heating load properly developed means a large increase in revenue to the central-station industry. It is revenue not only for one year but for many years to come. Central-station executives would surely, therefore, find it profitable to map out and approve a plan to promote this business which could be followed through by their sales departments. Some electric utilities have already done this. Is it not time for many others to organize to do their share in the actual selling of this class of load?

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## *Carrier-Current Performance*

THE use of carrier-current telephone systems is accepted; but the degree of acceptance is a variable depending on the kind of experience that has been had. Some operating men feel that the reliability of carrier communication has not been fully demonstrated. Some will state flatly that its complete lack of reliability has been proved to them. Others will admit that it has its deficiencies, but maintain that these deficiencies can be minimized to a point comparable to, or even below, the defects of wire communication and that carrier-current systems are perfectly workable and practicable.

There is a large interconnected system in the South that has grown very rapidly in the past few years. It covers such a large area that a private-wire telephone system would be very costly. A carrier installation was made at a much lower cost and has been used for load dispatching for about four years with perfect satisfaction. As a matter of fact, the assertion is made that the carrier communication is quieter during storms than the long-distance telephone. The experience of this company indicates that carrier communication cannot be satisfactorily maintained over open switches or through transformations. It has been learned that proper maintenance is necessary for satisfactory operation of the system. If the impossible is not expected of it and if it receives reasonable attention, carrier-current communication may be included in the scheme of operating procedure with every anticipation that it will perform acceptably.

Carrier systems are secondary lines of communication in most cases, and more and more it becomes apparent that the Bell system telephone lines should be relied upon for primary communication facilities. It is to be expected that the Bell engineers will develop their facilities to meet power-company requirements and that Bell executives will realize the value of the business available from light and power systems.

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## *What Is in the Atom?*

SCIENTISTS are trying to unravel the inner structure of matter. They are using mathematics, physical analogies, chemical reactions, spectra and even lightning in order to find out what matter is made of. They have not found the answer to this problem, but they have found enough facts to cause them to throw about all the past laws and theories into the discard.

Among the first assumptions to be discarded were the old periodic system and the theory of immutability of the elements. Radioactivity did for these, because it gave absolute evidence that one element could transform itself into another. Once it was known that elements were destructible, it became necessary to attack individual atom structures, and now science is in the midst of trying to explain atoms and molecules so that it may have another and correct periodic system and another theory of matter that also is correct. Some progress has been made through the researches of Niels, Bohr, Stoner, Millikan and others, but there is a long, rough road still ahead.

Of interest to electrical engineers is the fact that the attack on the atom is premised on the atom consisting of positive and negative electric charges, and that experimental work consists of attempts to ionize atoms by electrical or chemical means. It is thought that the positive electric charges are bonded to the residual mass of the atom which we call matter, and on this assumption Rutherford developed the modern nucleus theory of matter. Then Van der Broeck, Moseley, Bohr and others readopted the century-old hypothesis of Prout according to which all elements are more or less complex aggregates of the element hydrogen because the hydrogen ion is the unit positive charge. So a new periodic table was set up based on the number of positive charges and negative charges in the atoms, and in this table the negative charges were added to make atomic weights equal atomic numbers. Then planetary laws were applied to the internal structure of the atom, definite mechanical arrangements of internal charges were assumed, and the two emission assumptions necessary to the axioms of the quantum theory of energy were added to give modern atomistics. But a system of mechanics valid for such a system of atom charges is still unknown and the structure of all atoms is still unknown. We know only the structure of the atomic nucleus.

The whole mechanics of atomic theory is now undergoing a crisis, and the elaborate planetary structure and theory of Bohr is challenged. It is questionable whether a mechanical explanation of atomic and interatomic processes is needed, and recent work with the spectra and radioactive forces has developed data that require such a mass of corrective hypotheses to support the theory of mechanics that the whole principle is challenged.

Atomic structure is so bonded to the quantum theory of energy that a simultaneous solution of both must be had. We cannot yet devise an experiment to investigate the changes taking place within the atom. Our experimental tools themselves are atomic structures, and interatomic actions occur which prohibit conclusive experimental results. But the scientists are still undiscouraged, for the goal is very enticing. They should be encouraged in their work, for in it lie infinite possibilities for future engineering applications of value to civilization.

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## *The Answer to the Jobber's Problem*

RECENT announcement by the executive committee of the Electrical Supply Jobbers' Association that the managing director appointed last November had withdrawn impresses once more upon electrical men the fact that distribution in this industry is sick and worried. It had been hoped that following a study of the jobber's problem by a fresh mind would come some plan to lead the wholesalers of electrical supplies and equipment out of the embarrassing morass and point the way to prosperity. But it is hardly to be expected that help will come from without nor yet from any effort to restore the good old times. The cure will have to come from within. The plan will have to be fashioned for the future—no matter what the past has been.

Fundamentally the value of the jobber of this industry—to any industry—depends upon the effectiveness of his warehouse and his delivery service. He is not cast in the plot as a creative builder of markets. His function is to collect goods from many sources into a local stock and deliver them in such assortment as the buyer desires. True, household appliances and radio both have been actively promoted by jobbers, but both these lines most fortunately became available in times of stress and were seized upon to save the situation. There will be many jobbers also who will continue to specialize in specialties, but, by and large, the jobber functions best as a distributor of staple lines, and that is where his best success has been made.

The answer to the jobber's problem will in the end be found in three directions probably—through a more accurate knowledge of his markets, through a more expert and economical operation of his warehouse and delivery service, and through more highly organized industry policies. Or it can be put in other words thus: By an intelligent use of complete industry statistics he will eliminate much present waste in buying, selling and in turnover. By a closer analysis of methods he will learn to reduce both his stock inertia and his territory and provide a more economic service. And by stronger industry co-ordination he will overcome some of the weaknesses of his present relations both with the manufacturer and with the power industry, for he will be able then to prove his worth.

No Moses can be expected to come from over the hills to lead the jobbers to a land of plenty. The function of distribution in the electrical industry waits for prosperity upon action by the jobbers themselves individually and as a group.

* * * *

## *Tremendous Trifles*

THE importance of the small and relatively trifling thing has been told and retold—the shoe, the horse, the rider and the kingdom lost for the want of a horseshoe nail. Men, it has been said, stumble not over mountains but over molehills. The big job of the electric light and power industry is well recognized. Continuity of supply, steady voltage and service are symbols of the business. The less tangible matters are in a measure recognized under the title of public relations. Too often this is assumed to be a closed book when a director has been appointed and certain rules have been formulated. Commercial men, presumably, are those who come in contact with the customers most often and have been well trained; but meter readers, testers and inspectors, linemen and truck drivers are in continual association with consumers and the public. How can they aid in the job of fostering good relations with those they meet? How can they strengthen the tremendous trifles?

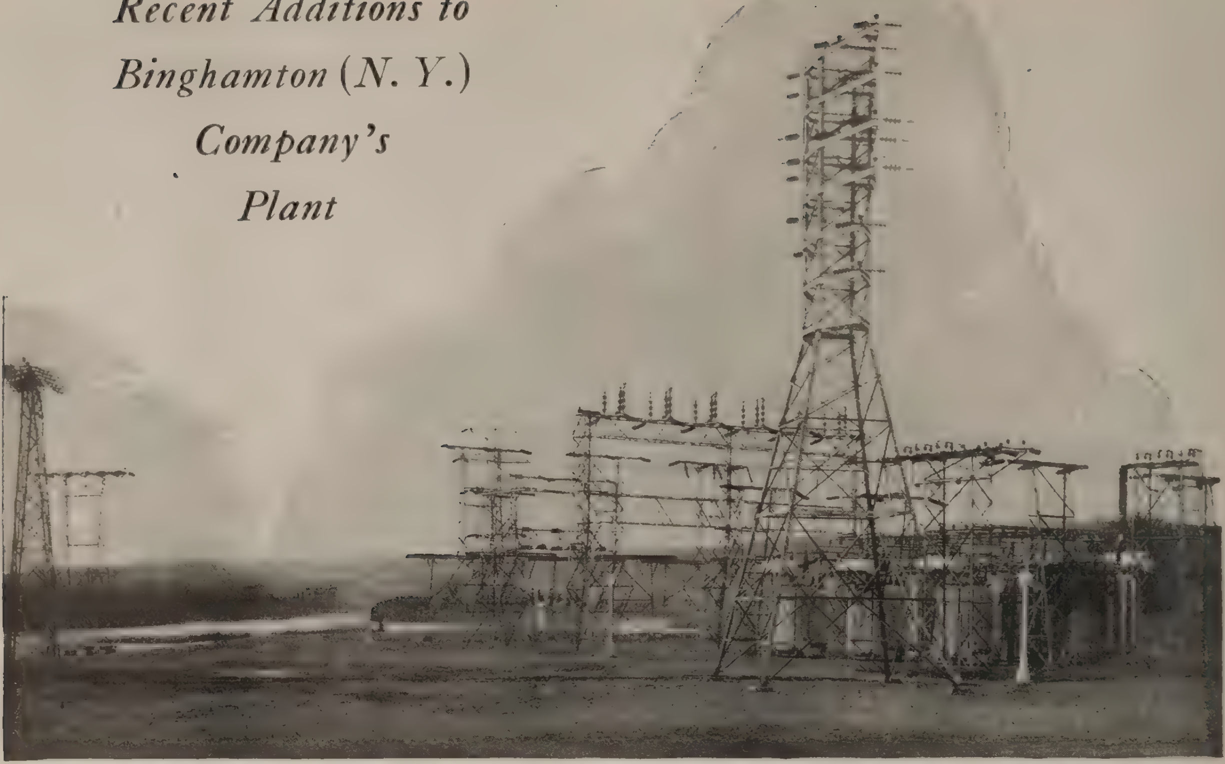
Electric utility men can learn a lesson from department stores, taxicab companies, railroads, up-to-date gasoline filling stations and hotels. Every meterman, every lineman and every employee engaged in similar work might well have a uniform. It should be trim and neat in appearance. It should be adapted to the occupational duties of the wearer and it should be kept in repair and clean condition. A uniform means business. It has an amazing reaction upon the psychology of the employee. If you doubt it, compare rides in taxicabs with uniformed and ununiformed drivers. Apparel often proclaims the—service.

* * * *

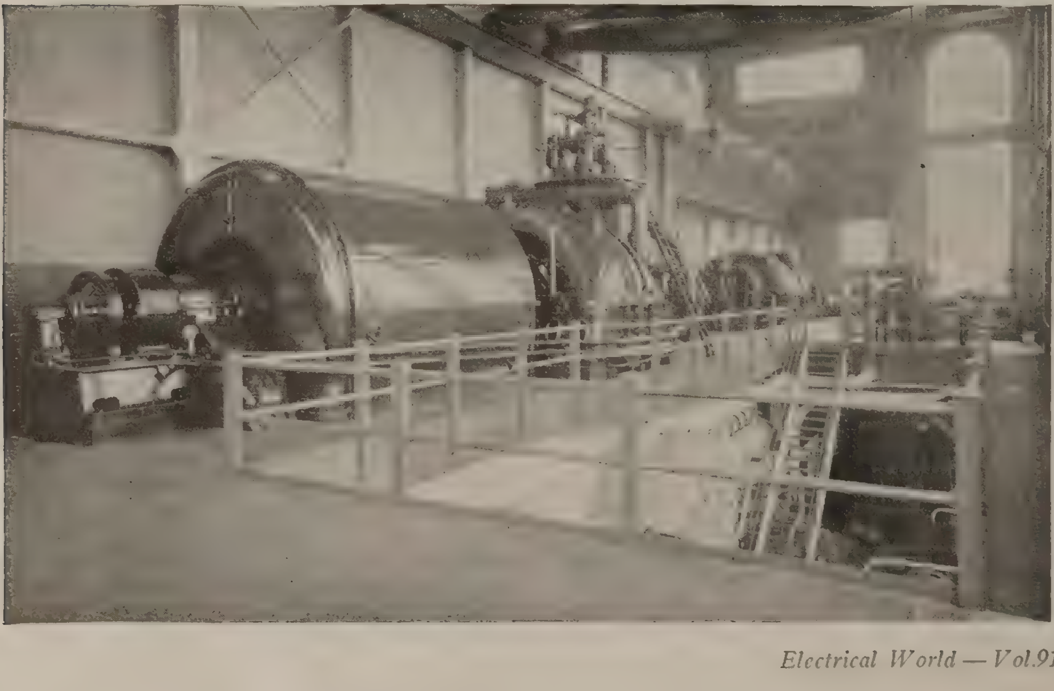
## *When Statistics Would Have Saved the Day*

WHEN sales decline within a short time after a new manufacturer has entered the field the logical conclusion of the older manufactures, if they lack statistics on this situation, is that the new competitor is getting an unusually large share of the business. Often the result is that the older manufacturers reduce prices to meet the situation. An actual case last year resulted in a price reduction amounting to nearly one-third. The price cut in no way helped the situation. Had statistics been available, the manufacturers involved would have calmly awaited the facts and acted in accordance with the proper dictates. No one would have rushed to the false conclusion that somebody else was getting all the business and slashed his own price in a wild grasp for orders. The price standard of this product would not then have been demoralized. Therefore every manufacturer should heartily subscribe to the accumulation and publication of statistics on their products as an anchor of basic facts to tie to in times of trouble.

# *Recent Additions to Binghamton (N. Y.) Company's Plant*



APPROXIMATELY $3,000,000 was spent last year by the Binghamton (N. Y.) Light, Heat & Power Company for additions to property and equipment. Installation of a 30,000-kw. turbo-generator at the main station in Johnson City, a 110,000-volt line to Elmira and two 110/33-kv. substations constituted the major additions. The new turbine and the step-down substation at the main station are shown. To provide for the new unit 82.5 ft. was added to the end of the turbine room and 115.5 ft. to boiler room. Four boilers burning powdered fuel were also installed.



# Distribution "Revamp" Pays Dividend

West Penn Power Company makes changes, renewals and betterments that not only permit better service and provide for growth of load but bring directly or indirectly monetary benefits

By Merrill De Merit
*Distribution Manager West Penn Power Company, Pittsburgh, Pa.*

GROWTH of load, depreciation of old equipment and demands by customers for better service periodically require changes, renewals and extensions of a distribution system. To delay such revamping usually results in an increased cost of rehabilitation when it is finally performed at the risk of impaired service and operating economy during the meantime.

Since July, 1923, the West Penn Power Company has approved work orders for revamping its distribution systems to an extent of $810,181, and it is estimated that similar work for 1928 will require $150,000, making the five-year total $960,181. Evaluations of the direct and indirect benefits of this work have fully justified the expenditure. Among the major benefits derived, which will be evaluated later, are reduced distribution operating expense, decreased energy losses, increased energy consumption and revenue due to higher voltage, lowered pole cost due to joint construction, improved service and reduction of accidents. Benefits to which a cash value cannot be so readily assigned include elimination of unsightly facilities, which hasten demands for underground service; improvement of customer's service, reduction of operating troubles and facility with which cause of trouble can be remedied, reduction in lost revenue due to interruptions and the minimization of accidents, with the resultant human suffering.

The computed annual saving due to the distribution revamp for the work done so far totals $264,619, distributed as follows: Decreased operating expense, $95,913; reduced energy losses, $30,705; increased revenue due to higher voltage, $87,514; decreased maintenance due to joint construction, $28,457; change to four-wire, 4,000-volt primary distribution, $22,030. Including the savings contemplated by the 1928 plans, the total annual savings will be $301,619.

To determine reductions in operating expenses, division managers who have operated distribution systems both before and after rebuilding were asked to estimate the savings in the sections revamped. Operating expenses are not subdivided by districts, so that direct comparisons of actual charges are impossible. However, by covering many towns and by discounting estimates liberally conservative figures have been compiled which indicate that annual reductions and operating expenses have averaged about 10 per cent of the debit revamp work orders, which figure has been used, subject, of course, to check in each instance.

One of the division managers who was called upon to enable a fair estimate made the following comment: "Previous to the revamp five and sometimes six men were employed continually, in addition to the short line crew. These men worked in ........ and ........ on maintenance and operation and did some construction. Previous to revamping one of the towns (by far the larger) these men were unable to do any construction work because they were so busy on maintenance and operation. One truck was required for these men. The saving would be about four men and one-half the cost of the truck."

*New trussed-steel poles shown to left of wood-pole line*

The comment from another division manager reads: "Previous to the revamping six men and one truck were engaged continually for maintenance and operation of these districts in addition to the short line crew. These men did some construction work, but more overtime was spent on maintenance and operation than the entire time spent on construction."

In still another division the manager reported: "Eight men and one truck were continually engaged on maintenance and operation of these three districts in addition to the men who are now engaged on this work."

Each division manager advised that not only were these savings being made but that the service is better from the standpoint of interruption, and that additional interest is shown in safety work.

Evaluating these savings, they can be expressed as a percentage of the debit work order, averaged and applied to a large number of other revamp debit work orders made in exactly the same manner and under the same conditions. This method of calculating was used because operating and maintenance expenses are controlled more or less to follow the revenue, consequently direct comparison of charges before and after the revamp would not show the savings in expenses.

*Ramshackle hillside substation gives way to elevated-platform transformers*

Decreases in energy losses were calculated from current and voltage tests and copper wire and transformer constants. Annual savings were thus evaluated with fair accuracy, considering such energy to be worth 1 cent per kilowatt-hour.

Increases in revenue due to raise in secondary voltages were estimated in two ways: First, by taking actual kilowatt-hour consumption increases in the districts revamped and attempting by graphical methods to eliminate changes due to other causes, such as addition of new customers, sales of appliances, changes in rate, etc.; second, by determining weighted average service voltage before and after revamping, calculating the average voltage increase and corresponding consumption and revenue increase. The two methods check quite closely and furnish a fair measure of the added annual revenue due to revamping.

Considering the first method, predictions were made for five districts, which were revamped, as to the consumption which would have obtained in 1926 if the districts had not been revamped. From this prediction and the actual consumption of these districts the actual increase in kilowatt-hour consumption due to revamping was determined. This consumption was evaluated at $0.035 per kilowatt-hour as the increased revenue due to revamping. By using averages a percentage has been determined which can be applied to future revamps. From this can be determined the increased revenue which is accruing due to the revamping which has been done and which will follow.

### 3,983 Pole Locations Eliminated by Joint Use

Yearly savings due to joint construction are considered equal to one-half the annual charges on poles jointly used. Assuming the average joint pole to be worth $35 installed and conceding annual charges of 15 per cent, the savings were calculated for joint construction. It may be pointed out that up to 1928 during this rehabilitation period 12,207 poles were converted to joint use and 3,983 pole locations were entirely eliminated through improved layouts and planning.

In fourteen towns where the primary distribution was changed from three-wire, 2,300-volt to four-wire, 4,000-volt a total annual saving of $22,030 was made by eliminating 2,300-volt circuits, involving 161 wires valued at $151,347, and by saving pole space valued at $48,680. The net saving in capital expenditure was $200,027, giving the annual saving mentioned before of $22,030. In addition to the saving in distribution equipment, substation savings resulted because of reduced circuit positions, switches, regulators, etc. Saving in investment for these causes is estimated at $186,000 and result in annual savings at 11 per cent of about $20,000. (Not included in totals which are for distribution only.)

The changes which brought about these benefits involved the redesign of the distribution system to meet modified standards as to primary circuits, transformer layouts, secondary circuits, pole plants, joint construction, elimination of hazards and corrections to meet present specifications. The relative importance of these factors varied on different parts of the system and the total money available determined the degree of perfection of physical and operating conditions aimed at by the

## *Effect of Revamp on Future Work*

By the time all West Penn distribution systems have been revamped new conditions will prevail in two major respects: First, the system of continuous design will have simplified and smoothed out the process and quality of revamping necessary. Second, completed maps and records will have reduced the field work and expense necessary to determine accurately the conditions of distribution systems and need for improvement. Consequently, revamping will eventually become a continuous rather than a periodic process to which a schedule can be applied that was impractical heretofore.

For example: (1) Bad conditions will be eliminated and changes made in accordance with future plans, so that operating hazards and expenses will be reduced at the same time that capital expenditures for future additions are made; (2) increases in revenue due to revamping will accrue to the company continually instead of in jumps at times of general revamping; (3) more effective testing will enable more exact and better designs and the cost of testing will be reduced, because only one-third of the system need be tested each year; (4) revamping of construction will produce an improved load factor in construction; (5) with the aid of map records, revamping work can be accurately budgeted and expenditures anticipated; (6) the engineering work can also be budgeted and provided for in a better manner and at less expense for corresponding improvements; (7) additions made at any point in the system will fit in more closely with general plans than at present; (8) joint planning and joint construction work can progress to the best advantage and can be co-ordinated.

design. To date rehabilitation has attempted to correct undesirable conditions in the order in which they would render the greatest return for the money expended upon such improvements.

Selection of the primary voltage was based on existing voltage, tree conditions, distance from substations to load centers, availability of other voltages, rate of growth and cost of changes. With the voltage determined, the next decision was whether to use the "main feed and branch," "segregated territory" or "feeder and network" primary system. Distribution of the present and prospective loads and location of the existing primaries determined considerations at this stage.

Large savings in transformer capacity were made possible by taking advantage of the fact that it is both safe and economical to carry loads up to 160 per cent of the nameplate rating.

### FOUR-WIRE, 4,000-VOLT PRIMARIES

In nearly all West Penn towns the primary distribution circuits before revamping were operating at 2,300 volts. In many of the larger towns it has been found economical to change to three-phase, four-wire, 4,000-volt systems. In general, the advantages of this system accrue from the fact that the effective distribution voltage is really 4,000 volts, although 2,300-volt transformers and other equipment may still be used. In addition, the 4,000-volt system requires only about 44 per cent of the copper necessary in a 2,300-volt system for the same power transmitted and the same percentage of losses. Actually, one neutral conductor is used for two or three circuits and the saving is greater. Consequently, the number of circuits after substituting the 4,000-volt system is only one-third of that required for 2,300-volt operation. Consideration was also given to the disadvantages of the 4,000-volt system, such as the higher voltage and the grounded neutral. During stormy weather bad tree conditions and other weak points in insulation cause grounds and consequently short circuits. However, when such weak points have once been cleared operation is found to be as reliable as that secured with lines operating at the lower voltage.

*Single straight poles replace duplicate and leaning structures*

In many of the districts larger amounts of money than were authorized would have been required to bring the distribution to its ultimate standard immediately. However, a system of progressive or continuous rehabilitation has been incorporated so that a general revamp would not again be required. Essentially, this plan enables caring for future business by making additions rather than replacements. This procedure is particularly advantageous in selecting transformer capacities and locations because of the high rate at which domestic and commercial load densities are increasing. Since lighting loads are at a maximum for only a few hours each day, the possibility of carrying the peak at much greater than the continuous rated capacity of the transformer without exceeding prescribed temperature rises was recognized.

*Alley construction cleared up*

### SECONDARIES FOLLOW PRIMARIES

Tests and analyses developed several guiding principles for the design of secondary distribution circuits. These include proper use of two-wire and three-wire secondaries and economical location of transformers along the secondaries. In general, the line type of distribution is used with primaries following secondaries. Transformer locations were planned about every 500 ft. on No. 6 wire and every 700 ft. on No. 4 secondaries. Poles of sufficient height were installed at such locations where new poles were found necessary.

Continuous or progressive design is particularly valuable for secondary circuits. Replacement of secondaries is costly, so new loads should be cared for, first, by placing intermediate transformers on existing secondaries, and, second, if required, by replacing transformers with units of double capacity. The secondaries will then be carrying double the original load, but for only half the initial distances, and it would still be adequate although the total load served is 400 per cent of the initial load on these distribution facilities.

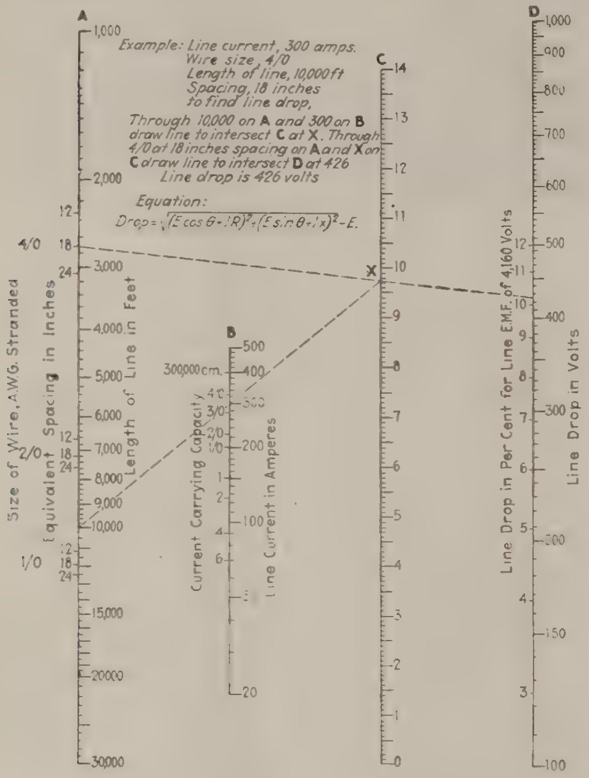
Expenditures for pole changes came under two general classifications: Those providing for joint construction of the utilities and those necessary because of depreciation and changes in pole sizes. Joint construction has been provided in most places except on main leads away from substations or where voltage or peculiar local conditions made independent pole lines preferable.

Dangerous conditions resulting from either depreciated equipment or inadequate clearances have been eliminated as discovered. Much unsightly plant has been replaced, particularly the offensive cases, but these changes were justified by other causes alone.

# Feeder Layout Chart

By R. W. Jickling and T. A. Robinson
*Assistant Electrical Engineers*
*City of Winnipeg Hydro-Electric System*

IN LAYING out residential feeders it was found that the same calculation had to be repeated a great many times in varying forms. The volts drop or regulation is required at peak-load conditions. This peak load may be assumed as at least 95 per cent power factor for lighting feeders. The variables to be chosen from are wire size, current, voltage drop, length of line and per cent capacity of regulator required to give good voltage at the base of distribution. To increase the usefulness of the chart the volt drop is given direct instead of in per cent of a certain line voltage. This means that the chart may be used for a 2,400-volt or 4,160-volt feeder equally well. The per cent drop for 4,160 volts is, however, shown in addition.



*Enables estimating voltage drop in three-phase lines at 95 per cent power factor and balanced load*

Starting with any one of the quantities, it is extremely easy to get the others without any intermediate calculations, as is necessary with most charts of this type.

The chart is based upon the following conditions:

Three-phase lines, at 95 per cent power factor, balanced load.
Spacing, 12, 18 and 24 in., being the equivalent spacing, or spacing of three wires in a delta arrangement.
Wire sizes, 1/0 to 4/0 stranded.
Current, 50 to 500 amp.
Distances, 1,000 to 30,000 ft.

The resistance of wire is taken at 20 deg. C. and for 97 per cent conductivity copper, as given in the N.E.L.A. overhead systems reference book.

Reactance for 60 cycles is as given in the N.E.L.A. systems reference book.

The allowable carrying capacities shown are the National Electrical Code standard for weatherproof wires.

Equation of drop = $(E\cos O - IR)^2 - (E\sin O - IX)^2 - E$

The chart, if carefully used, is accurate to within 2 per cent. If one considers how much the quantities themselves are likely to vary, this is quite sufficient for most ordinary purposes.

# Supervisory Equipment Inspections

By O. M. Ward
*Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.*

THE IMPORTANT functions performed by supervisory equipment requires that this kind of apparatus be kept always tuned to perfect operation. The only way that this end can be attained is by frequent and sedulous attention. The report form reproduced here testifies to the detail of the inspections of supervisory equipment which are made at intervals of one week on the system of the Milwaukee Electric Railway & Light Company. A copy of this report for each inspection is kept in the substation so that previous conditions of the apparatus are known at every inspection.

INSPECTION REPORT OF SUPERVISORY EQUIPMENT

Station ................................Date ................
Reg. & Drive Panel. Mech. Oper.....Elect. Oper.....Contacts....
Connections..... Fuses..... Condenser..... Resistances.....
Remarks ..................................................
Oper. Control Panel. Mech. Oper....Elect. Oper....Contacts....
Connections.......... Fuses.......... Resistances...........
Remarks ..................................................
Control Panel No. 1, Points No. 1 to 10. Mech. Oper.........
Elect. Oper. .............Point selecting relays ............
Individual A, B, C, relays....Contacts....Step over relays....
Connections .........Fuses .........Toggle switches .......
Test breaker and reset.....Test breaker relays J, S, L, A......
Remarks ..................................................
Control Panel No. 2, Points No. 11 to 20. Mech. Oper.........
Elect. Oper. ............ Point selecting relays ............
Individual A, B. C, relays....Contacts....Step over relays....
Connections ........ Fuses ........ Toggle switches ........
Remarks ..................................................
Control Panel No. 3, Points No. 21 to 30. Mech. Oper.........
Elect. Oper. .............Point selecting relays ............
Individual A, B, C, relays....Contacts....Step over relays....
Connections ........ Fuses ........ Toggle switches ........
Remarks ..................................................
Control Panel No. 4, Points No. 31 to 40. Mech. Oper. .........
Elect. Oper. ............ Point selecting relays ............
Individual A, B, C, relays....Contacts....Step over relays....
Connections ........ Fuses ........ Toggle switches ........
Remarks ..................................................
Insulation Test Between Iron Frame and Cabinet...........
Remarks ..................................................
Current Transmitter, Ammeter. Contacts......Connections......
Motor ................ D'Arsonval element ...............
Kelvin balance element ............ Rheostat ............
Remarks ..................................................
Current Transmitter, Voltmeter. Contacts......Connections.....
Motor ................ D'Arsonval element ...............
Kelvin balance element ............ Rheostat ............
Remarks ..................................................
M.C. Relays. Transformer.....Main Bus.....Auxiliary Bus.....
M.S. Relays. Line No. 3411...Line No. 3422...Line No. 3433...
Line No. 3444...Line No. 3455...Line No. 3466...
Transformer ..............................................
Motor Generator, 125 Volts. Motor Generator, 48 Volts.
Bearings .....Brushes ..... Bearings ......Brushes ......
Mech. Oper....Elect. Oper.... Mech. Oper.....Elect. Oper....
Relays & Contactors ........ Relays & Contactors .........
Contacts .................. Contacts ....................
Remarks ..........................................
Protective Equipment .........................................
Dispatcher's Control Panel. White and black alarm lamps.......
White stop lamps.......Red lamps.......Green lamps.......
Control Keys, Twist Type. Stop key.........Start key.........
Reset key.....Master control key.....Alarm release key.....
Alarm buzzer......Ammeter check......Voltmeter check......
Synchronous Clock. Time setting....Contacts....Connections....
Insulating Test Between Steel Panel and Ground................
Remarks ..................................................
Condition of Building and Property. Roof........Yard.. .....
Fire Extinguisher ................ Cabinets ................
High Tension equipment..........Leaky insulators...........
Air Break Switch .........................................
Remarks ..................................................
..........................................................
Inspector..................

## *What Is the Matter with*

# Industrial Electric Heat?

A billion-dollar load goes begging in the electrical industry. Study of existing conditions shows how the power companies can cash in on enormous new-business possibilities

By T. P. Kindig

*Western Editor* Electrical World

THAT the power industry should be vitally interested in building up the industrial electric heating load there can be no question. Every kilowatt of this class of business means additional load and revenue for the central-station company. There are at least 50,000,000 kw. of this type of load which should be connected to the central-station company's lines. This load would consume, in round numbers, 100,000,000,000 kw.-hr. per year and return about $1,250,000,000 gross annual revenue.

Yet with these possibilities staring it in the face, the power industry—in fact, the entire electrical industry—seemingly regards the heating load with lackadaisical indifference. The efforts put forth to get this business are puerile and infinitesimal in proportion to what it means not only in the sale of kilowatt-hours but also the sale of electrical equipment to supply and control the use of energy for heating purposes. Why does such a condition exist? What is the matter with industrial heating? Why doesn't it go ahead faster? Whose fault is it?

A review of the present status of industrial electric heating from the standpoint of the manufacturers of heating equipment reveals some most interesting and rather startling conditions in the attitude of power companies toward this class of business. The heating-equipment manufacturers believe that the central-station companies are of great potential value in developing the use of industrial electric-heating apparatus. In fact, they believe the power companies should be the ones most concerned in seeing these installations multiply, because they will receive the revenue from energy consumption year after year, while the equipment manufacturer must realize his profit from the direct sale and orders for additional apparatus. However, the manufacturers of industrial heating equipment have found that there is still much to be desired in the attitude and degree of assistance that should be expected from the local central-station company in the sale and installation of this type of apparatus. In many cities the manufacturer, while desiring its co-operation, is reluctant to have the local power company participate in the negotiations with the customer.

That such a condition should exist is difficult for many power company executives and heads of commercial departments to believe. But facts cannot be denied. The experiences and opinions set forth in the following paragraphs have been placed before a number of utility executives and power sales engineers who have admitted that many of the conditions were true in their own companies. Also, in their opinion the utilities as a whole are putting very little effort back of industrial heating and much of this effort is ineffective and sometimes detrimental.

An examination of the facts shows that despite the enormous load and revenue which would accrue directly to the central-station companies, these very companies are themselves chiefly to blame for the relatively slow rate of growth of the heating load. In a large number of cases installations of industrial electric heating equipment have been made almost in spite of rather than because of any practical assistance from the power companies. That this is true would appear to contradict the fact that the utility sales departments have long recognized the value of the heating load and are striving with what available tools they have to get the business. But the fault does not rest with the utilities' power sales departments.

### Sending a Boy to Do a Man's Job

Failure to develop the heating load must be laid on the doorstep of the utility executive. In more ways than one the man upstairs in the front office has hindered rather than helped the installation of electric heating apparatus in the manufacturing plants of his customers. More than that, in most instances where the utility executive has finally consented to the addition of a special "heating man" to the sales force he has in effect "sent a boy to do a man's job." As a matter of fact, the power companies which have anything even approaching an adequate industrial heating sales force can be counted on the fingers of one hand. Here is a class of business which when properly developed will total two or three times the present motor load. However, the sales engineering support which a utility company will give to industrial electric heating is usually in inverse ratio to the potential volume. The power company has, say, five power sales engineers, and if it is well equipped, as utilities go, it may have one man who devotes his time to industrial heating.

Power companies are anxious and eager, wherever possible, to add to their motor load, but when the question of a heating load comes up there develops a surprising and unexplainable indifference on the part of the utility executive. This leads to the question, Are hot kilowatts less desirable to the power company than cold ones? Does it mean that the dollars received for energy used in an electric furnace are less profitable than those that go through an electric motor? It doesn't require a lengthy analysis to show the value of the heating load. Its high power factor and high load factor characteristics, together with frequent possibilities for off-peak operation, make it undeniably a desirable class of business.

Perhaps it is the sale of energy in large single blocks that has appalled some utility executives. A fair-sized electric furnace has a large demand and in twenty-four hours will consume a surprisingly large number of kilowatt-hours. Quite often individual installations of electric furnaces run into thousands of kilowatts. Recently the installation of a single heat-treating furnace called for a demand of 3,000 kw. This furnace is being operated 24 hours a day and is connected to the lines of one of the few power companies that is intelligently encouraging and building the heating load. In developing the installation of this furnace the manufacturer worked very closely with the local power company and its customer and the resultant operation of the furnace is highly satisfactory from every standpoint. However, contrast the attitude of this power company with that of the utility in another city where the same furnace builder tried to work with the local central-station company in the sale of heating equipment.

He first went to the power company to obtain its schedule of rates. He met with a cold reception and was told that the prospective customer could not have a primary power rate. Why? Because, the utility vice-president said, "an electric furnace load could not earn the rate." It took the furnace manufacturer half a day finally to convince this executive that the furnace which he proposed to install on the customer's premises not only was entitled to such a rate but that it would give the power company a more desirable load than many power loads which it already was serving under the same rate.

### *Some Questions for Utility Executives to Answer*

What have you done to develop the industrial electric heating load in your territory?

Are you sending a boy to do a man's job?

Are hot kilowatts less desirable than cold ones? And why?

Don't the power companies understand big business?

Do you know how much potential heating load there is in your territory?

Do you know how much gross annual revenue the heating load would add to your company's income?

Why, when the ratio of potential heating load to available power load is three to one, is the ratio of heating sales to power sales engineers one to three?

Why does the heating equipment manufacturer want and at the same time fear the sales assistance of many electric utilities?

What are the central-station companies going to do to right this situation and help get this business on their lines?

But that was not all. After the question of rate had been settled the manufacturer visited the power sales department, thinking that here he would be able to obtain the necessary information concerning power and service conditions in the customer's plant and that at least the power sales department would be glad to know of this prospective heating load. This is the reception he received at the hands of the power sales department. He was told that the power company did not want any furnace manufacturer "messing around" with its customers. Any negotiations to be carried on with this customer must be through the power company. In other words, this furnace manufacturer could not try to sell an electric furnace in that town.

It is no wonder that this electric furnace manufacturer says of the power company, "If you want to lose a sale or have it go gas or oil try to work through the power company. To sell an electric furnace in that town, get in, sell it, get out, install the furnace and when ready for service then tell the power company."

### Special Rate Not Wanted

There is an idea on the part of some power company executives that the manufacturers of electric heating equipment desire that special low rates should be set up for energy used for heating purposes. This is not true. What the electric furnace manufacturers do want is that the electric heating load shall be served at the standard power rate which will give the customer the benefit of high load factor and high power factor operation. Certainly a load which operates at very nearly unity power factor and has a yearly load power factor of 40 to 50 per cent should be more desirable to the utility company than a load whose power factor is under 75 per cent and whose annual load factor is less than 25 per cent.

Frequently the sale of an electric furnace is lost to some type of fuel-fired furnace. This happens not always because of the severe competition from the fuel-fired furnace manufacturers but because the power company has not wholeheartedly backed up the recommendations for electrical equipment. Again, the power company in endeavoring to get the customer the best proposition in the price of the furnace has called in several manufacturers. Different types of design and varying prices have been presented, and in the end a gas or oil furnace manufacturer walks off with the order. The power companies should provide themselves with industrial heating men who are sufficiently well equipped with a knowledge of the customers' needs and the electrical equipment available in the market so that they can recommend to the customer one or two manufacturers best fitted to supply the particular requirements. It is well for the central-station company to realize that a furnace manufacturer who builds both electric and fuel-fired equipment prefers to recommend electrical equipment. The profit is just as great and the manufacturer is more certain that the electric furnace will meet and hold up to specifications.

### Training of Salesmen Inadequate

In a number of instances where the power companies have delegated one or more men to handle the industrial heating business in the territory the training and experience of these men has been totally inadequate. It is true that competent and experienced heating men are scarce and the facilities for training men for such highly specialized work as the sale of industrial heating equipment could be greatly improved. Much credit must be given to the industrial heating committee of the National Electric Light Association, which has co-operated with the electrical manufacturers in holding a two weeks' training course each year where utility power sales engineers could study the theory and practice of industrial heating application. It could not be expected, however, that these courses would provide the power salesman with a complete working knowledge of the intricacies of industrial heating application. Some further practical experience is necessary, for, verily, a little knowledge is a dangerous thing in the hands of a novice. The man who is going to sell industrial electric-heating equipment needs to have, more than anything else, a very practical knowledge of the manufacturing processes in the industrial plant where the furnace is to be installed. The successful installation of an electric furnace does not depend upon a theoretical knowledge of either electrical or thermal formulas but, rather, a very practical knowledge of the production problems of an industry.

Development of electric heat-treating processes to their present state of practical and economical application has been possible largely through the persistent efforts of furnace builders working with the industrial plant operators to design equipment which would fit into production schedules and improve manufacturing processes. Credit for this development work must go mainly to the heating equipment manufacturers and to the industrial plants which have been willing to accept such a revolutionary change in heat-treating methods as the adoption of electrical equipment. Outstanding in electric heating development by central-station companies has been the work of the Milwaukee Electric Railway & Light Company and the Detroit Edison Company. What these two companies have done serves to illustrate what can be accomplished by an electric utility to promote the use of industrial electric heating in its territory.

### Constructive Suggestions Made

The need for broader training of industrial heating sales engineers and the responsibility for the extent of development to date are cited to show where it is possible for the central-station company to take a more active and profitable part in the promotion of this class of business.

Still another direction in which the electrical industry has been negligent in the development of the heating load has been its failure to lay out a comprehensive publicity program to promote this load. There has been no provision for promoting industrial electric heating through publicity, as has been done by the gas industry for the promotion of industrial gas.

Central-station executives should see to it that a careful survey is made of all industrial plants in their territory in order to evaluate the extent of the potential industrial heating load. They should determine what this amounts to in additional kilowatts and gross revenue and then set up a force of industrial heating specialists in proportion to the volume of business.

Sales engineers who are to specialize on this class of business should not only receive the instruction and training available through the N.E.L.A. industrial heating courses but some provision should be made whereby these men could receive practical experience both in the plants of the electric-heating equipment manufacturers and in the operation of these furnaces in industrial plants. Such training and experience would necessarily mean considerably more than mere inspection trips and should provide the men with actual working knowledge of the equipment.

Power companies should be careful to see, in recommending rates for the industrial heating load, that the rate schedules provide some reward to the user when warranted by high load factor and high power factor operation.

The power company and the manufacturers of electric-heating equipment should get together on a basis of closer co-operation not only in the sale of heating equipment but also in a well-thought-out educational and publicity program, some of this education and publicity to be directed toward the power companies themselves.

### What the Load Means

Every kilowatt of industrial electric heating load put on the lines of the central-station company means an added revenue of $30 to $40 per year, which will continue for many years. For every kilowatt of industrial heating equipment installed there must be provided from $100 to $200 worth of other electrical equipment, including generating, transmission, distribution, metering, wiring, control and other apparatus. Or, putting it another way, every dollar spent for industrial heating apparatus means that about $5 additional must be spent for electrical equipment to supply and control its operation.

## *What Utilities Can Do to Develop Industrial Electric Heating*

Get a true conception of the extent of this load in kilowatts and its value in dollars of gross revenue.

Give the utility sales department ample sales engineering personnel to handle potential business.

Encourage sales engineers to specialize in practical knowledge of industrial heat applications and where they fit into industrial processes.

See that rate structures are so drawn as to reward high load and high power factor when earned by heating load.

Stand back of furnace manufacturers' recommendations to customers.

Don't open the way for a fuel-fired installation by asking too many electric furnace manufacturers to specify and bid on the same job.

Don't try to recommend standardized equipment where special design and engineering are required.

Get together with the electric furnace and equipment manufacturers on a joint advertising and publicity program to develop the heating load.

Remember that the central station company is the greatest single influence for developing the electric business in its territory and act accordingly.

A picture of the industrial heating business looks about like this: There is a 50,000,000-kw. load which would earn at least $1,250,000,000 for the power companies. There is $2,000,000,000 of electric heat-treating equipment to be sold by the manufacturers of this type of apparatus. There will be $10,000,000,000 of generating, transmission, control and miscellaneous apparatus necessary to supply energy to this load. Both the central station and manufacturing branches of the electrical industry can ill afford to overlook this business much longer. They should stop hunting elephants with popguns and quit sending boys to do a man's job.

# Regulator Protects Penstock on Fluctuating Loads

### Feeder regulator mechanism actuates water rheostat to maintain minimum water velocity in long penstock of small hydro plant

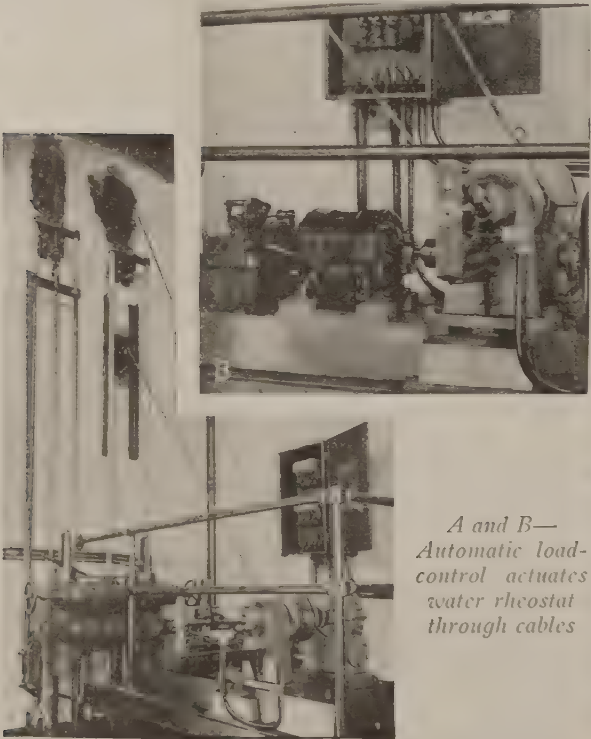
By S. C. Lindsay
*Assistant Electrical Engineer*
*Puget Sound Power & Light Company,* Seattle, Wash.*

PRIOR to the electrification of the Great Northern Railway between Skykomish, Wash., and the old Cascade Tunnel the Tumwater hydro-electric plant of the railway company was used to supply energy for hauling trains through a tunnel approximately 2 miles in length. The load varied from about 800 to 4,000 kw., with somewhat rapid increases in demand when accelerating trains and sudden decreases when the trains were through the tunnel.

The turbines in the generating plant are supplied through one wood-stave pipe line 8 ft. 6 in. in diameter and 11,832 ft. in length. The original design of the plant included a hydraulic governor mechanism, combined with an induction motor sensitive to frequency variations, which operated a water rheostat automatically to maintain a minimum load on the generators when trains were not in operation. This loading device was for the purpose of maintaining a minimum velocity of water in the pipe line to prevent it from collapsing upon sudden load demands. The plant is also equipped with a surge tank of limited capacity which assists in performing the same function.

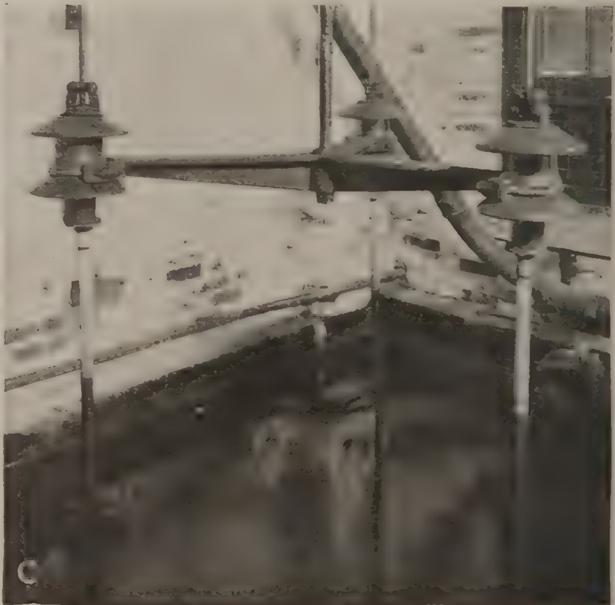
The operation of the plant was fairly satisfactory, but when the Washington Electric Company agent took over its operation in connection with increased power supply for the railroad the old emergency loading system, which functioned through frequency and water pressure, was no longer adequate. The increased demands of the railroad required that the Tumwater plant be paralleled with the Puget Sound Power & Light Company's 60-cycle system through frequency changers which gave practically a fixed frequency. Under these conditions, the problem was to find a regulating mechanism that would operate automatically to maintain a minimum load on the generators as a function of trail-load kilowatt demand. Operating experience had shown that a minimum load of 1,800 to 2,000 kw. on the plant would permit rapid acceleration of trains without excessive demands on the pipe line.

The device consists of a single-phase voltage regulator which through intermediary of a motor-driven cable drum raises and lowers the electrodes of a water rheostat. In the feeder regulator equipment a contact-making wattmeter was substituted for the contact-making voltmeter. The wattmeter is a polyphase curve-drawing instrument having special contacts to which the control circuit of the regulator mechanism is connected. A dead point exists in the scale between the 2,000- and 2,500-kw. load points, which prevents the electrodes of the water rheostat from continually traveling from one position to the other.



*A and B—Automatic load-control actuates water rheostat through cables*

*C—Automatically actuated 6,600-volt water rheostat prevents pipe line rupture during fluctuating load*



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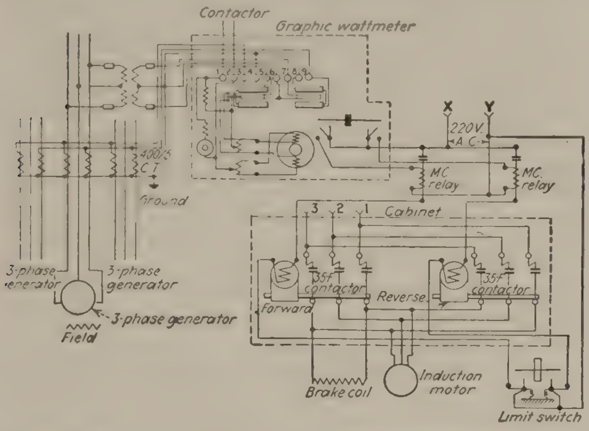
*Under executive management of Stone & Webster, Inc.

When the load is more than 2,500 kw. the device does no regulating and the electrodes are out of the water. When the load drops below 2,000 kw. the electrodes are lowered to a depth that will hold the load to approximately that value. For total generator loads of 2,000 kw. the division of load between the railroad and the loading rheostat may be anything from 100 kw. on the rheostat to 1,900 kw. on the railroad, or 100 kw. on the railroad to 1,900 kw. on the rheostat. The device will regulate for load changes of 50 kw. and can be set to regulate more closely, if desired.



*Connections of special curve-drawing wattmeter which actuates feeder regulator controlling water rheostat*

A motor drives a shaft carrying an 8-in. drum on which is wound the cable for raising and lowering the electrodes. An extension of the shaft carrying the drum is threaded and carries a nut which operates the limit switches. A 3-hp. motor is so geared that the rate of travel of the electrodes is approximately 1 ft. per second. An electrode speed of 1½ ft. per second, first tried, proved too fast, as the device did the governing for the plant, instead of the waterwheel governors, at loads less than 2,000 kw.

The rheostat tank is concrete, 8 ft. x 9 ft. by approximately 10 ft. deep. The electrodes are 1¼-in. iron pipe spaced on an approximately 3-ft. equilateral triangle and directly connected to the 6,600-volt generator bus through an oil circuit breaker. A small quantity of water from the penstock is kept flowing continuously through the tank to keep the temperature down. The resistant is maintained low enough to carry a load of 2,000 kw. when the electrodes are fully immersed by a salt solution, admitted to the rheostat tank as required by the station operator.

The water supply for the plant is in excess of load requirements for several years to come, which led to the adoption of this scheme. The installation was made at a cost not exceeding $1,500, as compared with estimated costs of from $10,000 to $12,000 for other schemes considered. The device has been in operation since Feb. 1, 1927, and its performance has been highly satisfactory.

This special adaptation of apparatus was made by the Seattle shops of the Westinghouse Electric & Manufacturing Company under specifications furnished by the writer.

# Service Testing of Meter Transformers

## How the meter department of the Southern Power Company tests instrument transformers in the field

By B. J. Brown
*Superintendent Meter Department, Dubre Power Company, Charlotte, N. C.*

Testing watt-hour meters in service has been reduced to a fine art and work in the field can be done with practically as high an accuracy as in the test room. The great majority of meters will remain accurate for months, even years, but where large blocks of power are measured it is customary to test every few months to find the occasional time that one is not correct and also to satisfy the management that the power is being accurately measured. The testing of instrument transformers in service has not been developed to the same high plane of proficiency. While instrument transform-

*Special truck used by Duke Power Company for field test work*

The following apparatus is carried on the truck:
Three insulated sticks with heavy insulated leads for connecting the potential transformers to the high side of the circuit.
Two 2,600-volt, 20:1 standard potential transformers.
Two 600-volt, 6:1 standard potential transformers.
Two 500-, 1,000-, 1,200-amp. standard current transformers.
Two 2,500-3,000-amp. standard current transformers.
Secondary lead with snap switches.
One rotating standard.
One indicating voltmeter.
One indicating ammeter.
Rubber gloves.
Slide rule and test block.
Four sections ladder.

*Accuracy of Metering Equipment Where Instrument Transformers Are Used*

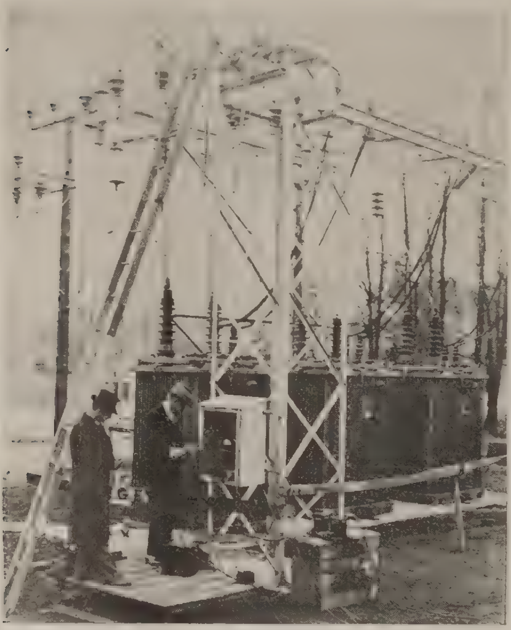
| | 1924 | | | | 1925 | | | | 1926 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Accuracy | Meter and Transformers | Per Cent | Transformer | Per Cent | Meter and Transformers | Per Cent | Transformer | Per Cent | Meter and Transformers | Per Cent | Transformer | Per Cent |
| 0 to 1 | 184 | 78.0 | 207 | 87.7 | 205 | 77.4 | 210 | 79.3 | 208 | 76.0 | 241 | 87.9 |
| 1 to 2 | 39 | 16.5 | 20 | 8.5 | 50 | 18.8 | 48 | 18.1 | 50 | 18.2 | 30 | 11.0 |
| 2 to 3 | 11 | 4.7 | 8 | 3.4 | 6 | 2.3 | 3 | 1.1 | 12 | 4.3 | 1 | 0.4 |
| 3 to 5 | 1 | 0.4 | 0 | 0.0 | 0 | 0.0 | 1 | 0.4 | 3 | 1.1 | 2 | 0.7 |
| Over 5 | 1 | 0.4 | 1 | 0.4 | 4 | 1.5 | 3* | 1.1 | 1† | 0.4 | 0 | 0.0 |
| Totals | 236 | 100.0 | 236 | 100.0 | 265 | 100.0 | 265 | 100.0 | 274 | 100.0 | 274 | 100.0 |

*These three cases were: (1) One current transformer secondary grounded due to heavy short circuit, 7 per cent slow. (2) Partial ground in secondary cable, 14.1 per cent slow. (3) Partial ground in current transformer secondary, 17.1 per cent slow.

†A550-volt self-contained meter was found 40 per cent fast due to lightning injuring coils.

ers have a high degree of initial accuracy and the majority of them hold it over a considerable length of time, they are exposed to lightning, short circuits and grounds, the heavy artillery of trouble, making it advisable to test frequently under service conditions.

A number of years ago several different sized portable standard current and potential transformers using an indicating polyphase wattmeter were tried out by this company in an endeavor to test and establish corrective constants on complete meter and instrument transformer installations. It was soon found, however, that these tests would not agree under varying conditions and the work was consequently abandoned. It is now realized that the so-called portable standards were built light and had even worse calibration curves than the commercial types upon the lines.



*Instrument transformers are tested in the field by the Duke Power Company*

Shortly afterward some German precision type current transformers with hinged joints, designed for slipping over busbars, were obtained. These were checked by the Bureau of Standards for accuracy after opening and closing and subsequently used on special tests over a number of years. Recently the transformers were rechecked by the bureau and found O.K., showing that good hinged type transformers can be built to hold up.

Later, the practice was initiated of removing the transformers and testing them in the meter laboratory. This required a large supply of extra transformers, nearly all of the changes had to be made on Sundays and the installations were so scattered that only a few installations could be changed. With only a limited number of Sundays in a year, this method of testing was far from satisfactory and efforts were directed toward developing a means of testing that could be used to check the transformers while in service any day of the week.

Considering safety and freedom from interruption of prime importance, as many of the customers' circuits were of heavy current rating, and remembering the reliability and accuracy of the German instrument transformers, it was decided to try to secure current transformers that could be slipped over the supply lines. These German transformers were rather heavy and cumbersome and could not be obtained in sizes smaller than 3,000 amp., so the matter was taken up with American manufacturers and very satisfactory units secured which, while possessing rather large ratios and phase angle curves, did not vary nor appear affected by the opening and closing of the gap. The following sizes were tried: 200 amp., 500 amp., 1,000 amp. and 1,200 amp. While the 200-amp. transformer did not prove satisfactory, except for high power factors and when well loaded, the other transformers have been used for several years and tests that have been made on the same meter installations by different individuals check very closely.

The actual metering of customers' circuits is done on the load side of the power transformers. The instrument transformers are usually of the indoor type, mounted in galvanized boxes, and installed on the steelwork of the customer's substation. Conduit is run from the metering transformers to the meter box, located at a convenient spot at the base of the steelwork of the substation or, if of the pole type structure, placed upon one of the poles. The meter is sealed and the box is also locked. A window enables the meter to be read.

The arrangement of the testing apparatus used in checking the accuracy of these installations is shown in the accompanying illustrations. This apparatus consists of the following: Two standard potential and two standard current transformers, voltmeter, ammeter (it is more accurate to calculate power factor) and a polyphase standard integrating watt-hour meter.

The meter is tested first by connecting the polyphase integrating watt-hour meter in series with it on the secondary side of the transformers. This determines the error of the meter under service conditions. Next, a check is made with the standard meter connected. The difference between these two tests gives the combined inaccuracy of current and potential transformers. Then the potentials of the standard meter are changed to the secondary of the service transformers on the test block. The difference between this and the previous check gives the inaccuracy of potential transformers and the difference between this and the first test on the meter gives the inaccuracy of current transformers.

When these instrument transformers show a variation of 1½ per cent from correct they are changed and then retested in the laboratory to determine the trouble. Tests made during the last three years are given in the accompanying table.

A special truck equipped with all the apparatus that is required for any kind of a test has been used in this meter testing work.

In regard to the time and expense of this testing work, costs differ so much throughout the country, due to local conditions, that it is difficult to compare them. On the Duke Power Company system the customers are scattered over a wide area, averaging from 60 to 75 miles from the laboratory, located in Charlotte. On a number of tests reviewed the cost of time and expense per installation averaged $4.50, while the estimated cost of installing tested transformers and taking the replaced transformers back to laboratory and testing was $16.50 per installation.

# Ground Resistance Testing

New method of investigation described. Instruments and test procedure outlined. Results of tests and analysis of operation indicated

By W. B. CRAIGMILE
*James G. Biddle Company, Philadelphia, Pa.*

TESTS of the resistance of ground rods or plates and of grounded structures to earth have been made for many years. All methods of measurement employed in the past have disadvantages, which lack of space here prevents discussing, but which are fairly well understood. However, one objection common to all of these methods is that some calculation is necessary to obtain the result.

Tests by the new method are made with the recently developed "megger" ground resistance tester and require the use of two auxiliary grounds. The resistance of the ground under test is given by the deflection of the pointer on the scale of the instrument in one operation, directly and without any computation. The principle of operation is shown in Fig. 1.

Current is supplied by a self-contained direct-current hand-generator, and after passing through the current coil of the ohmmeter is changed into alternating current for the test by means of a commutator or current reverser. The potential drop across the ground under test is picked up at $P_1$ and $P_2$ and converted into direct current for actuating the potential coil of the ohmmeter. Thus the result is shown at once by the direct-current ohmmeter, having all the advantages of sensitiveness and accuracy of this type.

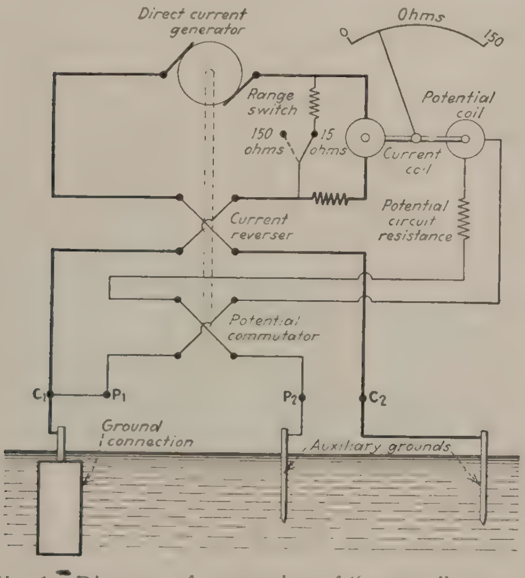


*Fig. 1—Diagram of connection of "megger" ground resistance tester*

The two coils of the ohmmeter are mounted on the same shaft and work in opposition in a permanent magnet field. Thus the instrument is a true ohmmeter and indicates $R$ as a ratio of $\frac{E}{I}$, unaffected by the exact voltage generated in the armature, or strength of the magnetic field. The current reverser and potential commutator are on the same shaft as the armature of the generator and so run in synchronism, whatever the speed.

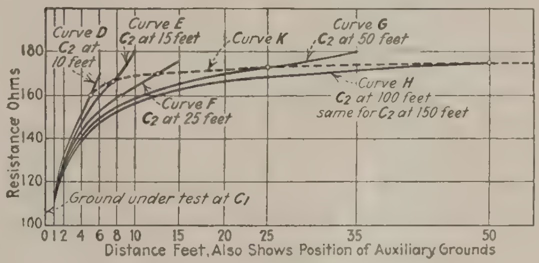


*Fig. 2—Results of ground tests*

Variation of resistance with spacing $C_1 — C_2$. Ground under test at zero feet. Current return ground at 10, 15, 25, 50, 100 and 150 feet. Resistance measured at several points between $C_1 — C_2$.

As the current in the ground circuit is alternating, errors due to stray currents—either direct or alternating—in the earth are avoided. At normal speed of turning the handcrank the frequency of the test current is 50 cycles per second. Should there be stray current in the earth of the same frequency as the test current the pointer becomes unsteady. The remedy is very simple—turn the crank slower or faster so as to make the frequencies of the test current and stray current differ from each other.

The resistance to earth of the auxiliary current ground $C_2$ does not at all affect the accuracy of the test; it can make no difference except in the sensitiveness of the ohmmeter. Tests show that even if the resistance at $C_2$ is several times the range of the instrument the ohmmeter remains amply sensitive.

The potential circuit of the ohmmeter is of high resistance so as to minimize the effect of the resistance to earth of the auxiliary potential ground $P_2$. In all but the lowest range of the instrument the potential circuit has a resistance of a least 10,000 ohms; thus a wide variation in the resistance of the auxiliary potential ground is permissible without causing any serious error in the indications. The instrument is compact and of convenient form and weight to be carried easily from place to place.

In most cases the resistance of a water pipe to earth will be found to be small. Where considerable resistance exists it is usually due to joints made with some poor-conducting material. The resistance of a ground connection referred to a water pipe can be measured directly by the "megger" ground resistance tester. It is necessary only to join $C_1$ $P_1$ (Fig. 1) to the ground under test and $C_2$ $P_2$ to the water pipe. If the resistance of the water pipe to earth is suspected to be more than a few tenths of an ohm it can be tested in the usual manner, joining $C_1$ $P_1$ to the pipe and using auxiliary grounds for $C_2$ and $P_2$.

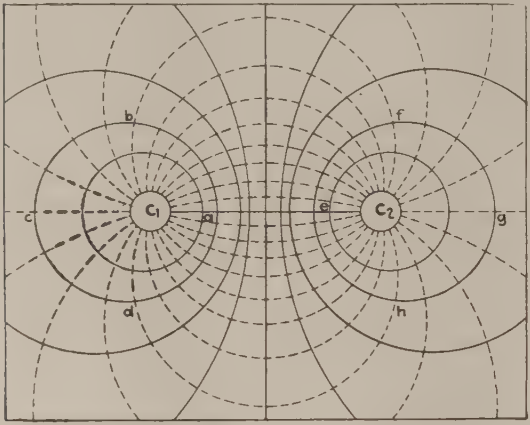


*Fig. 3—Current and equipotential lines between two electrodes near the surface of the ground*

Results of a test are plotted in Fig. 2. In this test a series of stakes made of $\frac{3}{4}$-in. galvanized iron pipe were driven 3 ft. into moist, sandy loam. Stakes were driven at 0, 1, 2, 4, 6, 8, 10, 15, 20, 25, 35, 50, 65, 100 and 150 ft. The resistance to earth of the stake at 0 ft. ($C_1$ of Fig. 1) was determined to be 175 ohms. Repeated measurements of this resistance and the distribution of resistance were made for spacings $C_1 — C_2$ of 10, 15, 25, 50, 100 and 150 ft. respectively.

The curve for a spacing of 150 ft. $C_1 — C_2$ is coincident with curve $H$ for 100-ft. spacing within the probable limits of observation. Curve $K$, shown dotted, is drawn through the mid-point values of the other curves.

It will be noticed that for spacings of $C_1 — C_2$ of 10, 15 and 25 ft. the midpoint readings are correct within an error not exceeding 10 per cent. However, the slope of the curves at their mid-points is quite steep, so that a slight misplacement of the potential stake may result in a considerable change in the reading. Also for close spacing we must bear in mind that if the resistances to earth at $C_1$ and $C_2$ are not nearly equal in value the curves will be distorted and the reading at the mid-point may not give a true idea of the actual resistance of the ground under test.

From curve $G$ for a spacing of $C_1 — C_2$ of 50 ft. the difficulties mentioned can be seen to be much reduced, and for spacing of 100 and 150 ft. $C_1 — C_2$, curve $H$ shows that the difficulty appears practically not at all. Therefore, it seems safe to say that the auxiliary ground for current return, $C_2$, should be at least 100 ft. from the ground under test, $C_1$, and the auxiliary potential ground approximately 50 ft. from the ground under test. For commercial accuracy the distances may be reduced to 50 ft. and 25 ft. respectively. The curves shown are typical of many obtained and will serve as examples.

Let $C_1$ and $C_2$ of Fig. 3 be two electrodes near the surface and carrying into and out of the earth. If the electrodes are not large compared to the distance between them, and the surrounding earth is of uniform quality, the current distribution and equipotential lines at the surface of the earth will have the general form shown in the figure. The dotted lines represent current flow and the solid lines represent equal potentials, although no attempt has been made to draw them to scale.

The curves, Fig. 2, show that for proper spacing of $C_1 — C_2$ to measure ground resistance the electrodes will usually be relatively small and relatively near the surface of the earth; therefore we need consider only the distribution as in Fig. 3, at the surface of the earth. If we measure the flow of current into the earth and the potential from $C_1$ to point $a$ we can obtain a value of resistance. A measurement to any point on the line $a$, $b$, $c$, $d$ will give the same value. Therefore the equipotential lines become lines of equal resistance.

Suppose that $C_1$ and $C_2$ are far enough apart so that a measurement of resistance on the line joining them and taken anywhere between $a$ and $e$ gives a resulting value of a sufficient degree of accuracy. (See Fig. 2, curve $H$.) Then a measurement on any equipotential line passing between $a$ and $e$ will give an equally good result.

Heretofore we have assumed that in measuring resistance by the single-test "megger" method (or the a.c. fall of potential method) points $C_1$, $C_2$ and $P_2$ should be in a straight line. We now see this is not necessary; $P_2$ can be placed anywhere except within two relatively small restricted areas, *abcd* and *efgh*. Thus $P_2$ may be placed far to one side of the line joining $C_1$ and $C_2$ or back of $C_1$ or $C_2$.

In conclusion, it is important to note that all that has been said regarding the spacing of auxiliary ground connections applies to any of the various methods in common use for measuring ground resistance.

## Simplified Bus Design at Siegfried

THE bus structure at the new Siegfried (Pa.) substation of the Pennsylvania Power & Light Company is constructed of 5-in. steel tubing welded together. The portion indicated in the accompanying illustration is that serving to connect the circuit breakers to the 220,000-volt line. The unusual design of bus supports presents an illusive impression of the real proportions. Note workman at right. Siegfried will serve as a tie-station in the 220,000-volt, 200-mile transmission ring connecting the systems of the Philadelphia Electric Company, the Pennsylvania Power & Light Company and the Public Service Electric & Gas Company.

# Carrier-Current Control
## *for Street Lighting*

San Francisco has one of first installations. System eliminates substation street lighting feeders and control apparatus. Transformers installed near load center

By R. Roy Cowles

*Assistant Engineer Department of Engineering*
*Pacific Gas & Electric Company, San Francisco, Cal.*

Vacuum tubes and the principles of radio communication which are being utilized by power companies for communication over transmission lines and for remote signaling and relaying are now entering the field of street-lighting control. Although the remote control of street-lighting circuits by carrier current has been under development for more than four years and has been watched with interest by utility engineers, one of the first commercial installations ever made has just been completed in San Francisco by the Pacific Gas & Electric Company.

The system consists essentially of a transmitting set in the substation and a receiving set centrally located with respect to the circuits to be controlled. The carrier-current equipment operates over one phase of a three-phase, 4,000-volt feeder through capacitor couplers in the substation and out on the line. In the substation there is a control transmitter connected to a line tuning unit, the latter being connected to the phase wires through fuses and capacitors on the line side of the feeder voltage regulators. The receiving set is located on a pole approximately 5,000 ft. from the substation and consists of a control receiver connected to the same two-phase wires through fuses and capacitors. A 600-watt, 2,300/115-volt transformer on the same pole supplies 115 volts for the operation of the receiving control circuit. Three single-pole, 2,300-volt oil switches are mounted on a pole one span away to avoid congestion. These energize the street-lighting transformers from the 4,000-volt feeder. Two No. 6 wires are run between the control receiver and the oil switches for operation of the latter.

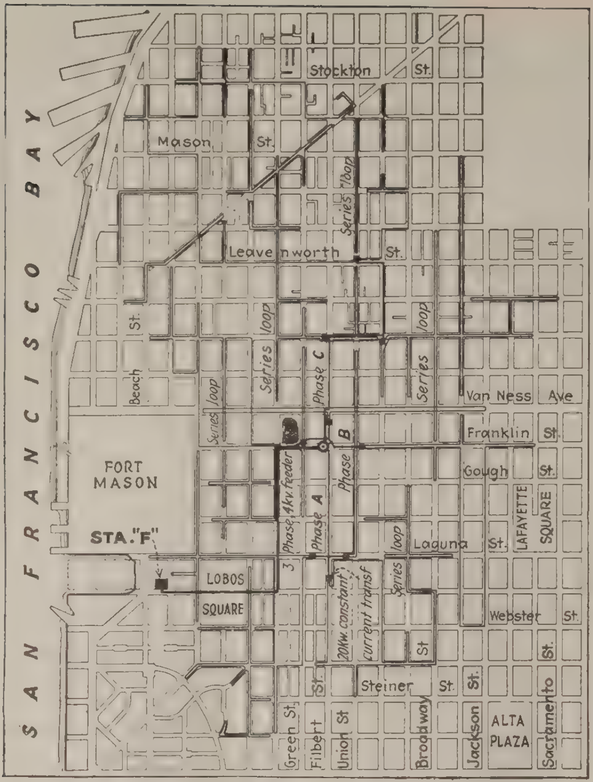
The oil switches are connected through inclosed type cutouts to the individual phase wires of the feeder. Three separate phases are run from the oil switches in different directions to supply the various constant-current regulating transformers located in the vicinity. There are at present nine 20-kw. transformers operating from the control. Connections for the apparatus involved in carrier-current street-lighting control are shown schematically in the accompanying diagram.

The transmitting circuit used is a Colpitts oscillating circuit using the full wave self-rectifying principle. The transmitter is rated at 100 watts, using two 50-watt tubes, one operating on each half of the supply voltage cycle. It delivers 2.5-amp. radio frequency into the 4,000-volt feeder. Filament and plate voltages are supplied from a power transformer. During one-half of the supply voltage cycle the voltage impressed on one of the tubes is positive and on the other negative. The tube using the positive voltage oscillates, while the other tube stays idle due to the negative voltage impressed upon it. Across the oscillating circuit is the primary of the output transformer, the secondary being coupled to the outgoing feeder by means of the line tuning unit and coupling capacitors.

*Three 2,300-volt, pole-mounted oil switches operated by control receiver in weatherproof box on pole at right*

In the view at the left fused cutouts are on the opposite side of the pole. In the illustration at right the 4,000-volt feeder is shown on the top cross-arm, below which are the fuses and line connecting capacitors.

The transmitter is adjustable to three frequencies, 35, 40 or 45 kilocycles. This is far below the broadcast frequency band of 550 to 1,500 kilocycles and has caused no interference with radio broadcast reception. The transmitter is adjusted to 35 kilocycles, which was found by test to be the most efficient frequency for the particular



*Territory included in carrier-current street-lighting control*

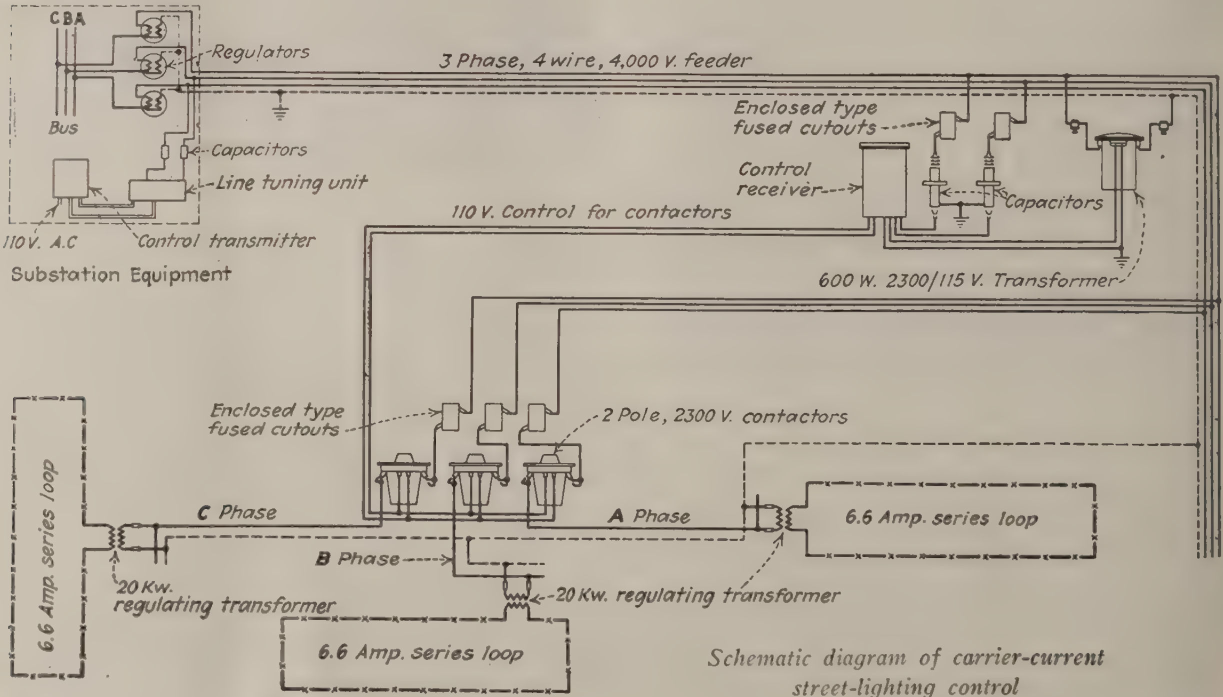
feeder circuit used. By long or short time intervals during which the transmitter operates the same frequency is made to serve for both turning the lights on and off. The time interval for closing is four seconds and for opening fourteen seconds.

The receiver is a simple biased detector circuit using one UX-210 tube. Filament and plate voltages are obtained from a small transformer. The tube is always energized, but the grid is so biased with alternating current that no current flows in the plate circuit until a voltage is impressed on the receiver input. The plate current output of the tube is 3.5 milliamp. although the polarized relay which it actuates will operate on as low as 0.8 milliamp. The plate current energizes a polarized relay, which in turn energizes a time selector relay operating at 120 volts a.c. This relay closes after an interval of four seconds and opens after an interval of seven seconds and operates the control contactor, which in turn controls the oil circuit breakers on the street-lighting circuits. Push-button control is provided so that the time selector relay may be closed manually if desired.

Before turning the equipment over for operation, tests were made by the engineering department to determine certain features. It was found that: (1) Street lights can be turned off immediately after being turned on, but cannot be turned on again until the selector relay in the receiving set has reset itself, its time interval being 45 seconds. (2) When street lights are on loss of voltage will cut lights out, but they will come on again when voltage is restored. No adjustments need be made at the transmitter.

### Flexibility of System

This control system as now installed at Station F can be expanded considerably with the addition of minor equipment only. At present one transmitting set operates one receiving set controlling approximately 3 square miles of street-lighting area operating on the same time schedule. The transmitter panel is equipped for three control circuits, making it possible to provide control for two more 4,000-volt feeders by simply adding a line tuning unit and two capacitors to each feeder controlled and by installing the necessary control receivers and capacitors at convenient points out on the line. With


CBA
Regulators
Bus
Capacitors
Line tuning unit
110 V. A.C
Control transmitter
Substation Equipment
3 Phase, 4 wire, 4,000 V. feeder
Enclosed type fused cutouts
Control receiver
Capacitors
110 V. Control for contactors
600 W. 2300/115 V. Transformer
Enclosed type fused cutouts
2 Pole, 2300 V. contactors
6.6 Amp. series loop
C Phase
A Phase
6.6 Amp. series loop
B Phase
20 Kw. regulating transformer
20 Kw. regulating transformer
6.6 Amp. series loop

*Schematic diagram of carrier-current street-lighting control* the present installation the oil circuit breakers can handle three times the present street-lighting load, or the phase wires can be extended to provide for new areas.

The center of load for the street lighting in the present control area is approximately 5,000 ft. from the substation, but the range of the equipment is greatly in excess of this distance. The polarized relay of the receiver will operate on 0.8 milliamp., as previously mentioned, although it is now receiving 3.4 milliamp. Thus the receiver would still operate successfully if it were moved to a point several miles distant from the substation. Since a receiver draws virtually no radio-frequency current from the feeder it is possible to connect a large number of receivers to a feeder without reducing the control radius of the station transmitter. In addition to this fact the number of feeders to which one transmitter can be connected is limited only by the number of feeders radiating from a single substation. Hence the area that can be controlled by one transmitter is dependent upon the distribution feeder system rather than any limitations of the carrier-control system.

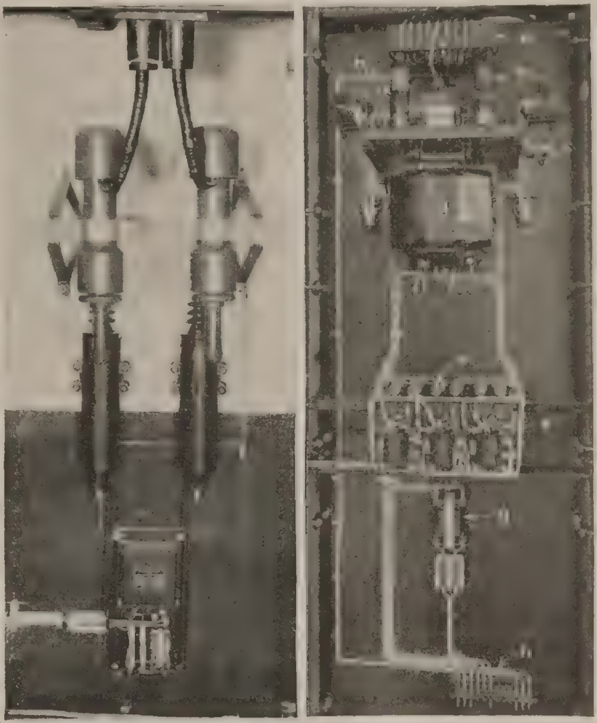
### ADVANTAGES OF SYSTEM

Carrier-current control makes possible the use of the multiple-feeder system of street lighting, which is more reliable and subject to less trouble than straight series systems fed from the substation. Elimination of the constant-current transformers from substations has made possible economy of space and reduced cost and avoids the excessively long series loops, with consequent high voltage, which have been a source of trouble and frequent interruption in the past.

The disadvantage of the multiple-feeder system is its cost and the resulting congestion of poles and underground conduits in the vicinity of the substations. Carrier-current control makes possible the elimination of that portion of the feeders from the substation to the point of control, also substation switching equipment, etc. This represents a large percentage of the cost of the street-lighting system. Carrier-current control of street lighting fed from commercial feeders permits taking advantage of the diversity between commercial load and street-lighting load, thus utilizing feeder copper and substation facilities at greater efficiency.

Pilot wire or some similar form of wired control might in certain favorable cases be used instead of carrier current to accomplish the same purpose. The congestion of poles and underground conduits in the vicinity of the substation as well as the cost would, however, in most cases eliminate such systems from consideration. Moreover, pilot wire control must of necessity be limited to very short distances, while carrier-current control has no such limitation.

A brief historical review of the street-lighting practice of the Pacific Gas & Electric Company and the considerations leading up to the use of carrier-current control may be of interest. A large percentage of street lighting on the system of this utility had been supplied from constant-current transformers installed in the substations. As cities grew and demand for street lighting increased, series circuits were expanded by adding more wire, increasing the number of lamps per circuit and including more territory in a single loop. In many cases it was necessary to take new series circuits out of the substations as the constant-current transformers were becoming overloaded. Many of the constant-current transformers were of 70-kw. capacity, operating at 7.5 amp., which made the normal voltage approximately 10,000 volts. In case of an open circuit, the voltage would rise considerably above this value. As these series circuits grew they eventually reached extreme lengths, one circuit in Oakland being more than 60 miles long. As a result of the extreme lengths of these series circuits and the consequent high voltage they were subject to considerable trouble.



*Line tuning unit and rear of carrier control panel*

Tuning unit is connected to 4,000-volt feeder in substation through tetrachloride fuses and capacitators.

The control panel is equipped for the control of three separate feeders. Flexibility of carrier current street-lighting control permits the operation of midnight lights or other schedules if desired.

(*a*) Output transformer. (*b*1, *b*2) Two vacuum tubes. (*c*) Test key. (*d*) Power transformer. (*e*) Red and green lights indicating "on" and "off." (*f*) Position relay—suitable for three-circuit controls. (*g*) Line switch—110-volt a.c. from supply circuit. (*h*) Terminal block for connections.

It was therefore apparent that changes must be made in the street-lighting system to reduce the number of interruptions and consequently improve the service. Analysis has shown that for the territory involved a series incandescent lamp system was more economical than a multiple system. It was readily apparent that if series street lighting was to be used the number of miles in each circuit must be materially reduced, and similarly the voltage and the number of lamps per circuit. The space occupied by the constant-current transformers in the substations was also of considerable importance, and as the substations became crowded, or as new substations were built, this space became increasingly valuable. Two considerations, therefore, became of great importance, the removal of constant-current transformers from substations and reduction in length and voltage of series circuits. These considerations led to the adoption of the following street-lighting principle, which was put into effect about five years ago:

Constant-current transformers, all of 6.6 amp. secondary, to be installed on the pole or in the manhole at the most convenient locations.

Size of constant-current transformers to depend upon the average size of lamps. Since the average number of lamps per circuit is 60, it works out that the most economical size for San Francisco division is 20 kw. and for the other divisions 10 kw. This arrangement keeps the voltage on the series circuit down to 3,000 in San Francisco and 1,500 in the other divisions.

The constant-current transformers are fed by 4,000-volt, three-phase, four-wire multiple feeders, which are switched at the substation and treated exactly as any other distribution feeder with the exception that there are no feeder regulators. Where lights are required to be switched on different schedules, such as all night and midnight, one of the phases is used for that schedule, whereas the other phase may be used for other time schedules. Where all of the street lighting is on the same schedule, the three phases are run out as single-phase feeders to supply different areas. In a few cases the principle of "cascading" is followed, whereby a series circuit will operate the series coil of a 2,300-volt oil switch, which in turn provides excitation for another series circuit through a constant-current transformer.

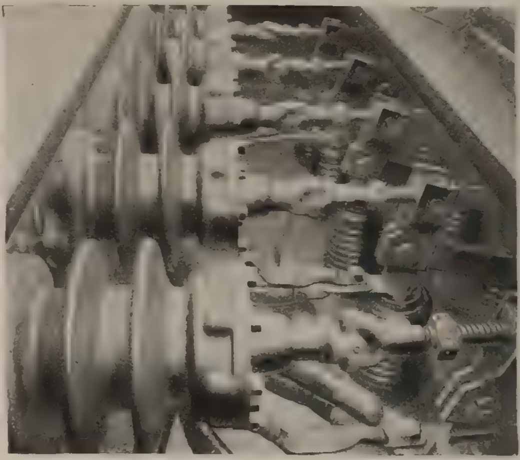
Experience with multiple electrolier circuits supplied by 4,000-volt, three-phase feeders had already shown that the same degree of reliability which had been obtained from distribution feeders of the same type and voltage could be expected from such street-lighting feeders. By shortening the length of the series loops and reducing the voltage it has been possible to reduce greatly the number of interruptions and improve the service, and by removing the constant-current transformers from the substations much valuable space has been saved and capital investment reduced.

At the time the above general plan was adopted engineers of the company were considering other types of control whereby distribution feeders could be utilized in their existing form and constant-current transformers installed on poles or in manholes. At that time consideration was being given to oil switches operated by some type of pilot wire, or carrier-current control over the 4,000-volt distribution feeders. The latter method was favored, but it was not until early in 1927 that the company felt that carrier-current control had progressed to the point where it could be regarded as reliable. One complete control unit was installed during the summer of 1927, and has functioned successfully since that time.

# Transformer Disconnecting Switches in Oil-Filled Potheads

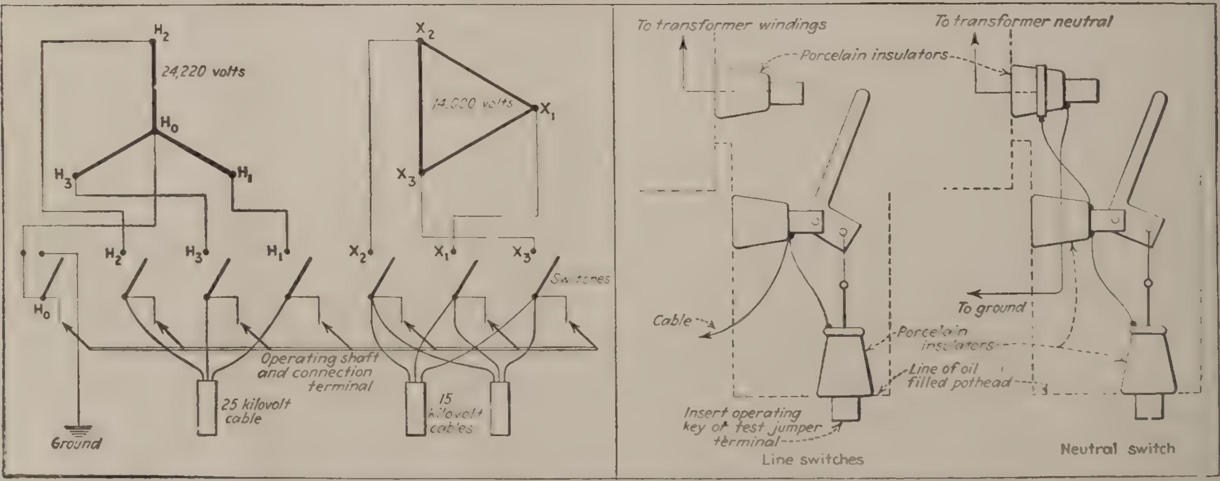
By Wellen H. Colburn
*Edison Electric Illuminating Company of Boston*

REFERENCE was made by the writer in a recent article (Electrical World, Oct. 22, 1927, pages 845 to 847) to special disconnecting facilities installed in oil-filled potheads on transformers of the Boston Edison Company. The accompanying illustrations show the scheme in more detail than was presented in the original article.



*Interior of oil-filled pothead showing bushings and switch-operating shafts*

The above illustration of one of these potheads shows the arrangement of insulating bushings and switch-operating mechanism in a field installation. The four bushings and associated operating shafts at the top of the illustration are on the 24-kv. connections of the transformer and the two at the bottom, with a third which cannot be seen, are on the 15-kv. connections.



*Connections between transformer windings and pothead switches. Details of cable ground and jumper terminals shown at right*

Switching is effected by an insulated operating key, not shown in the accompanying halftone. The handle permits external operation.

The bushings at the left are hollow and contain the "bayonet" end of the switch-operating mechanism, into which the key fits and to which the jumper connections are made as shown in the connection diagrams. All the porcelain will withstand over 100 kv. as installed to allow kenotron tests to be applied to the cables. The arrangement shown for the neutral switch permits the disconnection of the transformer neutral from the ground and the application of a "high-potential or other test to the transformer windings, should advance in the company's testing program or the experience of the industry justify it." Testing of transmission cables is accomplished by opening the switches and connecting the high-potential test jumpers to the bayonets.

## *Electrolytic Production of Oxygen Proves Economical*

General Electric Company

| Comparative Data for 1,000-Cu.Ft.-per-Hour Oxygen Plant | Liquefaction Process | Electrolytic Process |
|---|---|---|
| Oxygen produced per kilowatt-hour (theoretical) | 25 cu.ft. | 5.29 cu.ft. |
| Oxygen produced per kilowatt-hour (actual) | 24 cu.ft. | 4.00 cu.ft. |
| Initial cost for producing equipment | $25,000 | $50,000 |
| Non-productive time required to get plant into full production | 2 to 8 hours | Almost instantly† |
| Number of hours per day plant must run to be most economical | 24 | Depends on type of cell |
| Rate of depreciation, per cent | 10 | 10 |
| Byproducts produced (theoretical) | 100 cu.ft. $N_2$ | 10.58 cu.ft. $H_2$ |
| Byproducts produced (actual) | 88 cu.ft. $N_2$ | 8.00 cu.ft. $H_2$ |
| Equipment area required, including aisles, etc. | 800 sq.ft. | 2,500 sq.ft.‡ |
| Ratio of labor cost per 1,000 cu.ft., per cent | 100 | 100 |
| Relative incidental material costs per 1,000 cu.ft., per cent | 100 | 90 |
| Relative maintenance costs per 1,000 cu.ft., per cent | 100 | 90 |
| Purity of oxygen, per cent | 99.0 | 99.5 |
| Purity of byproduct, per cent | 99.0 $N_2$ | 99.5 $H_2$ |
| Connected load for production only | 55 hp. approx. | 330 hp. approx. |
| Ratio of other costs per 1,000 cu.ft., per cent | 100 | 100 |

† A short time, together with an increased power consumption, is necessary to bring the electrolyte to normal operating temperature.

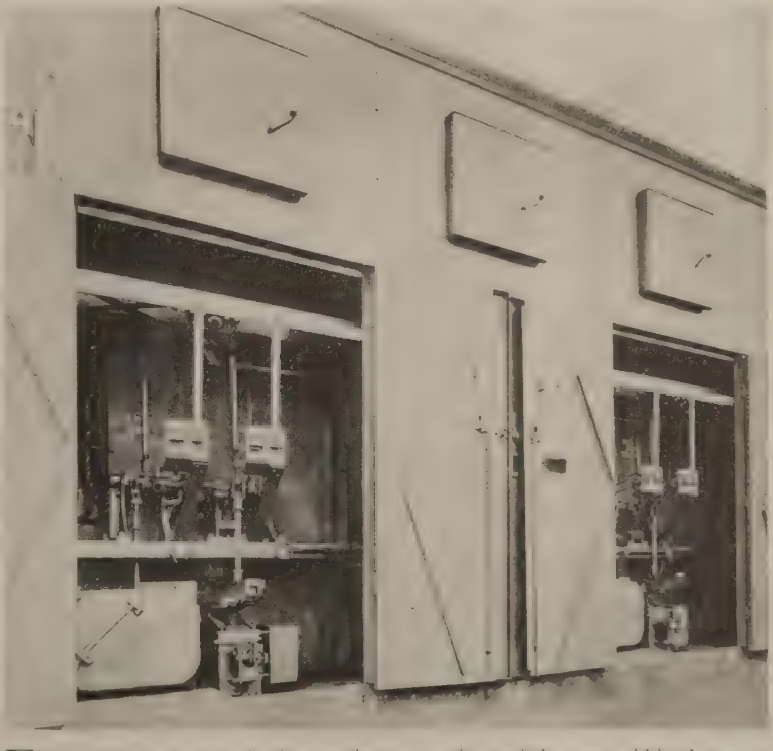
‡ Includes area for motor-generator sets. This varies with the type of cell, but a sacrifice in operating efficiency results if floor space is favored at the expense of other design features of the cell.

## Attracting New Industries by Utility Company Aid

VIGOROUS activity is under way in New England utility circles in the field of industrial development through central station co-operation with the New England Council, chambers of commerce and other organizations. The co-operating power committee of the electric service companies, headed by C. L. Edgar, has appointed a committee on industrial development under the chairmanship of Julius Daniels, assistant superintendent sales department, Boston Edison Company, which is rapidly becoming a factor in territorial industrial surveys and movements toward increasing such development. The other members of this committee are R. D. Morrison, industrial engineer Central Maine Power Company; A. R. Schiller, vice-president Public Service Company of New Hampshire; E. C. Hathaway, Twin State Gas & Electric Company, Boston (representing Vermont); P. J. Wilson, sales manager Narragansett Electric Company, Providence, R. I., and A. V. S. Lindsley, sales manager Connecticut Light & Power Company, Waterbury, Conn.

A number of New England power companies have established industrial development bureaus in their organizations and outlines for making industrial inventories have been sent to each company. Survey work is proceeding, contacts with chambers of commerce, co-operation with real estate agencies and railroads are being made, local business organizations are in many cases being advised of all bids sought by the United States government, air mail letters are being sent to prospective industrial concerns and advertising is being carried in trade papers emphasizing the power facilities of the territory. This work is in many cases being tied in with that of the power sales departments of the utilities, and at a recent meeting of the New England Association of Central Station Power Sales Engineers at Boston Chairman Daniels described the above industrial promotion work in considerable detail. The outline of an industrial survey sent to territorial operating companies includes eleven pages of form sheets.

## Outdoor Cabinets Used for Station Extension



EXISTING indoor switching equipment was amplified by outdoor additions at the Northwest station of the Commonwealth Edison Company, Chicago, Ill. The 12,000-volt buses and disconnecting switches are within the upper doors. Wheel-mounted circuit breakers and their operating mechanism are mounted below. Phase segregations on 50-ft. spacings are used.

# Exporter Reviews South American Market

### Large field calls for same selling methods as used in domestic market. American capital needed in South America's public utilities

By McKew Parr
*President Parr Electric Export Corporation*

VIRTUALLY all American electrical appliances may be sold in the South American market provided the same intelligence, patience and courage are displayed as are exercised in selling the same material in the domestic market. The greatest handicap to the development of the American electrical export business is the lack of familiarity and personal interest in these export markets by the directing heads of the smaller electrical companies. When the executives of the American electrical manufacturing companies show the same personal interest in foreign markets that is displayed by the German manufacturers, then, indeed, the future for the American electric export business will be very bright.

The standard practice of the lighting companies in South America is modeled after the practice of their home countries, most of their purchases being made in the country where the control of the stock is held and from which most of their engineers come. It is for this reason that all American electrical manufacturers are observing with sympathy and interest the activity of one of the large holding companies in the United States which has acquired a number of central-station properties in the smaller cities of South America, particularly in Brazil. When an American holding company secures an interest in a South American public utility company it means that American engineers and American wiring standards are introduced, the benefit of which accrues to all the manufacturers in general.

### Competition Is Chiefly National

In South America the competition very largely is along national lines, and consequently there should be no jealousy between American manufacturers in the foreign field, as the success of any one manufacturer in introducing American wiring practices results in a better opportunity for all other American manufacturers. No matter what the rivalry may be between companies in the United States, every American electrical man abroad is pleased and grateful to see another American electrical manufacturer secure business and advance American wiring practices.

A great source of help to the American electrical manufacturer visiting the South American market is found in the offices of the commercial attachés of the Department of Commerce, who are extremely accommodating and helpful to the salesmen of American manufacturers, their advice and information being of great practical value. Inasmuch as the steamship companies and cable companies of other nationalities all very properly do what they can to help the manufacturers of their own countries, American manufacturers should support similar services that have been built up by American capital.

It is very gratifying to observe the high estimate placed in South America upon the quality and dependability of American electrical material. The prices of American electrical materials are considerably higher than those of European manufacture, but it is my observation that in all cases it was felt that American electrical materials and practices were of the very best and, despite the much higher price, it appears to be the general opinion that the American product was worth the increased charge. It is my opinion that, despite the price handicap, our goods may be sold in all markets in very large volume by applying to their sale the same methods of missionary work and advertising that have been developed in marketing similar products in this country.

It is essential, in order to reap the greatest benefit from the possibilities that are open to American manufacturers in South America, that this country invest more freely in the securities of South America's public utilities. A study of the returns to stockholders in the United States who have invested in South American utilities proves that the field offers a very attractive return on the investment, with a high rate of security provided the management is trustworthy. By applying the experience and efficiency that we have gained in the operation of central-station business in this country we cannot help but meet with considerable success in South America.

### Recommends U. S. Investment in South America

It was the unanimous opinion of all Americans in South America with whom this subject was discussed that it would be very much more beneficial for the future of the United States to invest its capital in the utilities in Brazil and the Argentine Republic, Chile and Peru, instead of lending its capital, as at present, to the European financial agencies that support the manufacture and exportation of European electrical material to South America. It was the opinion of those consulted that the United States is simply lending its own gold to its competitors to use against us in this market.

The German electrical manufacturers have shown a great deal of interest in the South American market and have many branches, carrying large stocks, in all the important centers. In general, the German products are considered to be decidedly inferior to the American goods, although they are usable and workable. There are very few British electrical lines of wiring supplies to be found in South America with the possible exception of power cables. There is one Belgian manufacturer of motors, control apparatus and wire that has a very good business in Brazil. An Italian manufacturer of motors and of fans and another Italian maker of wires have branches throughout the various countries and do an excellent business. An Italian manufacturer of electric-heating appliances has a small sale in Brazil. The Italian interest in the electrical industry is very active throughout South America, many of the leading jobbers and contractors being Italian and several important central stations are of Italian ownership. A well-known Dutch manufacturer of lamps has an extremely large business, a Dutch manufacturer of wire has a fair business, and a French manufacturer of wire has a small business, mostly of annunciator and office wire. Electrical fixtures are manufactured both in Brazil and in the Argentine Republic by local firms which do a considerable business. There are two wire manufacturers in Brazil, both appearing to be prosperous.

In these countries there is a great lack of capital and an appreciation on the part of the educated classes of the necessity for development of the public utilities by

American or European capital. In Brazil the legal rate of interest is 12 per cent per annum, but the average merchant and business man have to pay considerably more. One can secure on time deposits in Brazil from the leading banks an interest rate of 9 per cent per annum, so it will be seen that the country offers a most excellent field for investment.

## Merchandising Methods of Berlin Electrical Company

PROGRESSIVE merchandising methods are not confined to the United States. In Berlin the Berliner Städtische Elektricitäts Werke Aktien Gesellschaft makes use of elaborate display rooms, newspaper advertising, illuminated dwelling houses, illuminated signs and catchy poster effects on the monthly bills. The influence of the latter was measurable by the large number of inquiries that came each month for the particular appliance then advertised. These appliances included sewing machine motors and sewing lamps, hot water accumulators, washing machines and vacuum cleaners. The same method was used for special publicity on the deferred-payment plan. In addition, a model of the company's new 300,000-kva. power plant was displayed at three exhibits held by various outside organizations during the past year.

To facilitate the wiring of homes and the purchase of appliances, the company made arrangements with a large number of contractors and dealers for financing the customers' orders.

For this purpose a separate organization was established. The customer pays a certain percentage down and signs an agreement with the company to pay the balance at the same time he pays his lighting bill. To cover overhead and interest a charge of 5 per cent is made for payments in five monthly installments or 10 per cent for ten months. Meanwhile, the company advances to the contractor or dealer the unpaid balance. The customer, of course, has the use of his purchase during the period of payment. With the traditions prevailing in Germany this is a radical innovation.

The company states that the plan is meeting with increasing favor and has found particular application for Christmas purchases. To assure the purchase only of articles coming up to accepted standards, the company maintains a testing laboratory. This is apparently in lieu of a nationally functioning organization for approving equipment and installations. The company also exercises supervision over the contractors, through a system of approvals which can be and in a number of cases have been withdrawn for cause. At the end of 1926 there were 2,850 approved contractors or contracting firms.

The company's progressive policy evidently pays. During 1926 the number of low-tension customers (presumably residential, commercial lighting and small power) increased from 368,706 to 442,044, a gain of almost 20 per cent. During the same period the corresponding connected load increased from 516,915 kw. to 555,698 kw. and the total connected load from 741,417 kw. to 801,203 kw.

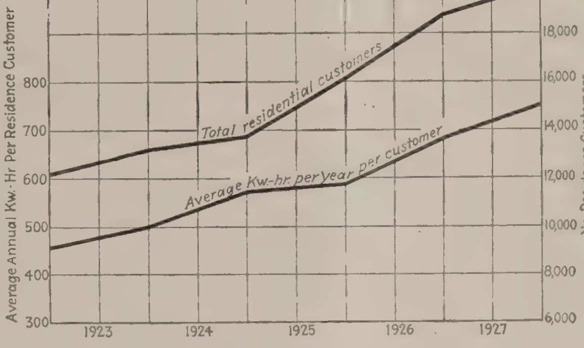
*Readily accessible appliance display stand and customers' lounge room also having equipment on display*

## Residential Customers Use 753 Kw.-Hr. per Year

By D. F. McCurrach

*Rate Engineer Northwestern Electric Company, Portland, Ore.*

EXCLUSIVE of electric water heating, residential customers on the system of the Northwestern Electric Company, Portland, Ore., used an average of 753 kw.-hr. each during 1927. If water heating is included the consumption was 946 kw.-hr. per customer. The number of residential customers and the average annual consumption per customer for the past five years are shown by the accompanying curves. This system embraces a considerable rural territory in southwestern Washington, which has a tendency to lower the average. The effect of adding a large number of rural customers



*Range sales contribute to increasing domestic consumption*

PRIMARY RATE FOR RESIDENCE LIGHTING COVERING FIRST 100 HOURS USE OF DEMAND

75 per cent of customers pay for first 20 kw.-hr. at primary rate and balance at secondary rate.

| | Cents Per Kw.-Hr. |
|---|---|
| First 9 kw.-hr. per month | 8 |
| Next 70 kw.-hr. per month | 7 |
| Next 100 kw.-hr. per month | 6 |
| Excess over 179 kw.-hr. per month | 5 |
| Secondary rate: | |
| First 50 kw.-hr. per month | 3 |
| All excess per month | 2 |

A discount of 5 per cent allowed for prompt payment.

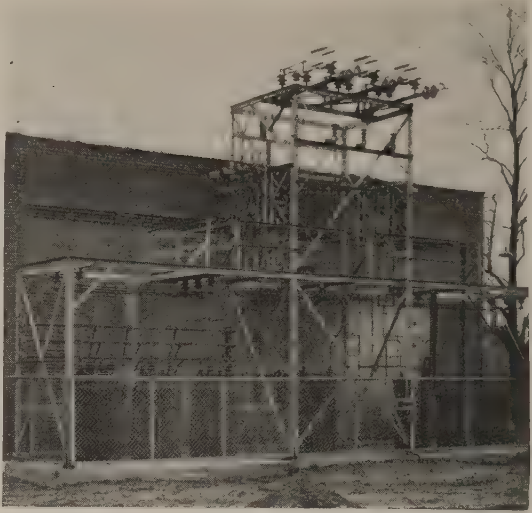
Minimum charge for lighting service only $1 per month.

Minimum charge for lighting service in combination with heating, cooking and small domestic power loads in excess of 2 kw. connected, $2 per month.

in 1925 is clearly shown by a rise in the customer curve and a drop in the consumption curve.

The gratifying increase shown in domestic consumption over the past five-year period is of particular interest in view of the fact that during this time the rates have not been changed and the showing made would seem to be an indication of their reasonableness, as the customer has seen fit to utilize this service in increasing quantities. Obviously, this would not have been the case if the cost of service had been found burdensome in any way, or had it represented a large percentage of the expense of maintaining his home. The principal element contributing to this increase is undoubtedly ranges, the saturation of which has increased from around 5 per cent in 1923 to approximately 20 per cent at the present time. Radio, home-lighting campaigns and appliance sales efforts also have contributed in a large measure to this upbuilding.

## A Multi-Voltage Industrial Substation



THIS industrial substation, through which the Fort Wayne, Ind., works of the Western Gas Construction Company, a subsidiary of the Koppers Company, is served by the Indiana Service Corporation, may be taken as a good example of modern construction and design. The incoming power is at 13,800 volts and serves secondary demands of 225 kva. at 4,000 volts, 450 kva. at 460 volts and 100-kva., single-phase for lighting at 115-230 volts. Provision is made in the design for primary metering equipment which has not yet been installed.

# *Electrical Industry Objects Only to Power Feature of Boulder Dam Bill*

*An Interview With*

R. H. BALLARD

*President Southern California Edison Company*

"NO PROPOSED legislation in recent years has attracted more attention or has been more involved in politics that the Swing-Johnson bill to provide governmental flood control and power development on the Colorado River. Failure of the bill to pass has been laid partly at the door of the privately operated utilities of the nation and partly to opposition of the basin states, notably Arizona. It is the proposal to put the government into the power business and the unjust accusation made against the light and power utilities of blocking the bill that concern me and upon which I feel strongly," declared R. H. Ballard, president of the Southern California Edison Company to a representative of the ELECTRICAL WORLD recently.

"One point should be made clear to the ardent supporters of the Boulder Dam bill, and that is that the electrical industry and business interests of the nation oppose on principle all schemes which would put the government into business and do object most emphatically to the provision still retained in the bill authorizing the government to build and operate power plants at Boulder Dam in violation of the policy laid down in the federal water-power act passed by Congress in 1920, after more than ten years of deliberation.

"If the bill should be amended to remove this objection it would still provide the benefits sought for and permit repayment of the cost of the dam to the government. It could also provide that the government construct the dam and that the power development be made under the provisions of the national law and be subject to regulation by the Federal Power Commission. Any agency — municipal or corporate—desiring to develop power at the dam could then apply to the Federal Power Commission for a license to do so. Moreover, the bill in its amended form would no doubt prove less objectionable to Arizona and Nevada, which have insisted that they receive revenue from power equivalent to the taxes they would otherwise receive if power development was carried out by private capital."

# Fixed Par Versus No-Par Stock

### Practice is divided between two systems of issuing stock. Massachusetts considers legalizing the issue of shares without par

HAS the issue of no-par stock become an established institution in public utility finance? The question is again brought forward by the introduction of a bill in the Massachusetts Legislature providing for the legalization of the practice. Massachusetts early introduced legislation prohibiting the use of no-par stocks and has been more or less a leader among those states where no-par stock is prohibited.

Practice in respect to par is divided. Its use in the United States was recommended in 1911 in a report to Congress by the Railroad Securities Commission, generally called the Hadley Commission. It was first introduced in New York State in 1912. No-par stock is now permitted, in so far as common shares are concerned, in about three-fourths of the states, and preferred shares without par value may be issued in approximately half of the states. In some of the states there are further restrictions upon such issue in the case of public utilities. Last year power and light financing in the United States involved a total of about $150,000,000 in the form of common stock, and the bulk of this was issued in shares without par value. Furthermore, a large proportion of preferred stock has recently been issued in no-par shares. Legislative changes have been instituted in several of the states to facilitate the issuance of stock without par value.

That there are two sides to the question is emphasized by the recent attack of a leading economist upon the issue of no-par stock. In "Wall Street and Main Street" Prof. W. Z. Ripley referred to the issue of no-par stock as "an egregious malversation of the rights of shareholders and of the public generally." He states, further, that no-par stock "widens the opportunity for resort to setting up a so-called initial surplus upon the creation of a corporation, and that it distinctly tends to enhance the danger of misrepresentation of expected dividends." Elsewhere he adds: "Is it not obvious that the absolute and uncontrolled power afforded to those new charters to fix the price of each new issue of shares independently of all others reduces the whole matter to the merest gamble on the integrity and judgment of the corporate officers and directors? Most of all, is it not feared that this no-par device is utterly unsuited to all public service companies wherein by all the principles of sound regulation the issue of securities ought not to exceed the actual amount of the investment? Inasmuch as the issuance of no-par shares cuts the ground from under any attempt to correlate closely the amount of the investment and to save its par value for the securities, it is clear that regulation and non-par shares are utterly incompatible one with another."

> Professor Ripley: *The issue of no-par stock is an egregious malversation of the rights of shareholders and of the public generally.*
>
> Hadley Commission: *We do not believe that the retention of the hundred-dollar mark, or any other dollar mark, on the face of the share of stock is of essential importance. We are ready to recommend that the law should encourage the creation of companies whose shares have no par value, and permit existing companies to change their stock into shares without par value.*

### Specific Objections to No-Par Stock

Apart from the statements just quoted with respect to no-par stocks, any opposition or criticism which exists appears to be based on technical or practical phases of the question. Certain accounting complications arise in connection with no-par stock, especially with respect to the balance sheet, and a uniform solution is still lacking.

It was brought out in the Hadley Railroad Securities Commission's report in 1911 that no-par stock permits inflation by making it easy to create an excessive number of shares. The same report raises the point that no-par stock divides companies into two classes, those having par value shares and those having no-par value shares, and that this creates confusion. In some states the authorities have refused licenses to form corporations because the non-par feature involves the compilation of fees which have been fixed by statute on the basis of the par value. It was stated that transfer fees, stock taxes, fees for operation in foreign states, etc., may be based upon arbitrary figures in excess of the fair value of the stock. The argument also has been advanced that relieving the stockholders from discount creates an unfair liability to creditors.

After considering the matter from every angle, however, the commission decided: "We do not believe that the retention of the hundred-dollar mark, or any other dollar mark, on the face of the share of stock is of essential importance. We are ready to recommend that the law should encourage the creation of companies whose shares have no par value and permit existing companies to change their stock into shares without par value whenever their convenience requires it. After such conversion, any new shares could be sold at such price as was deemed desirable by the board of directors with the requirement of publicity as to the proceeds of the sale of such shares and as to the disposition thereof, giving to the old shareholders, except in some cases of reorganization or consolidation, prior rights to subscribe pro rata, if they so desired, in proportion to the amount of their holdings."

The commission, moreover, goes on to point out that there are outstanding advantages in the issue of no-par stock where two companies whose shares have different market values consolidate. "It has been the custom to equalize the difference by the issue of extra shares of the consolidated company to the owners of the higher priced stock. This practice has always tended to produce increase of capital issues and may readily cause the new stock to be issued for a consideration less than its par value. The only alternative was to scale down some of the old stocks, and this often involved serious difficulties, both of business policy and of law. By the simple expedient of omitting the dollar mark from the new shares, the number can be adjusted to the demands of financial convenience without danger of misrepresentation or suspicion of unfairness to any one."

In the case of reorganizations the advantage of shares without par value is even more obvious. Says the commission's report: "It is here that the necessity and justice of getting money from stockholders is greatest. It is here that the impossibility of getting them to pay par for new shares is most conspicuous. We believe that in such cases the public interest would be subserved and the speedy rehabilitation of the roads promoted, by requiring the conversion of common stock and encouraging the conversion of the preferred stock into shares without par value, the certificates simply indicating the proportionate or preferential claims of the holders upon assets and upon such profits as might from time to time be earned." While the discussion is dealing with the railroads rather than the power and light situation, it is obvious that the principles apply equally in the latter case.

### Advantages of No-Par Stock

Advocates of no-par value shares maintain that their cardinal merit is accuracy. Par value printed on a share of stock, it is urged, is not necessarily a true indication of its real value. Its value obviously depends on the corporation's net earnings and assets both past and future, rather than on the figures printed on the certificate. Basically, a stock certificate is nothing more or less than a statement of ownership of a proportionate share of the assets of some business or organization. It is probable, say its advocates, that the statement of an artificial par value of such share is capable of producing much more misunderstanding than the share without par value. Naturally, shares of stock find their natural level, as with any other species of property, in an open market, and the purchaser or holder is not deceived by any false or fictitious face value of his certificate. It would not be difficult to obtain innumerable examples of shares in mining and similar ventures with a nominal value of $100, but which actually are worthless or nearly so. Par value printed on a certificate makes it easy for promoters to extract money through the irresistible attractiveness of offering a $100 share of stock for $50.

Possibly the strongest argument put forth by advocates of no-par stock is that already mentioned by the Hadley Commission, that the method simplifies consolidation and reorganization. When the par value of a stock is not fixed the number of shares can be readily adjusted to the demands of financial convenience, thus affording relief from an undue inflexibility of financial set-up. This is a matter of decided importance in view of the large number of capital reorganizations in the power and light industry at the moment.

Another argument put forth by advocates of no-par stock is that the incentive for the over-valuation of assets in order to balance the books at the time of reorganization is reduced. Properties can be placed on books at a fair value and capital stock can be credited at the same value. In this way promoters are deprived of the advantage of inflated capitalization and the attention of the investing public is focused upon the real value of the shares. This discourages the carrying of fictitious values in balance sheets of good will, patents and the like, and in an effective way, without delaying or embarrassing legitimate enterprises, carries out the purposes of the so-called blue sky laws. Again, if there is no par there can be no discount, so the stockholder is relieved of the liability for discount resulting from purchase of stock at less than par.

The opposition to no-par stock in Massachusetts is rather a long story and one based on financial principles which have been adopted in New England for many decades. In arguing for the passage of the bill, counsel for the Electric and Gas Association stated that "If the gas and electric companies had no-par value stock, the half-truths which have brought so much ill will to utilities in Massachusetts would be forestalled. The habit of the general public in quoting utilities as obtaining large dividends should be quoted on the par value plus the premium actually paid in by the shareholder."

## Oil Well Pumping with Electricity

IN SPEAKING to the convention of the Oklahoma Utilities Association, O. A. Jennings of the Oklahoma Gas & Electric Company presented twelve specific reasons why beam pumping of oil wells is better performed with electricity than with other forms of power. Since his company took on about 36,000 kw. of oil field load in 1927 it seems that Mr. Jennings should speak with adequate authority. The twelve reasons, all of them contributing to lowered cost and increased production, are:

1. Power shutdowns for repairs to prime movers.
2. Easier on belts and rig, which results in less time down for breakage and repairs.
3. Actual experience shows rods unscrew less often and break less often because of the more even and steady motion of the beam.
4. Regular, even motion and exact number of pumping strokes per minute of pumping time means more oil lifted.
5. Fewer rod jobs and lost motion due to shutdown time.
6. Even motion of beam means less "whipping" or "spring" of rods in deep holes.
7. Less time for complete pulling job. No sticking on center, no stalling of back-firing, no clutch troubles. Not necessary for one of the well gang to be making frequent trips to engine house to kick off engine. All men on "derrick floor"; that is, "on the job all the time."
8. Not affected by freezing of water lines, water in gas lines, low steam pressure, poor mixture in cold weather or too rich mixture in hot weather.
9. Ring oil bearings do away with the necessity of daily oiling and the attendant danger from neglect of this duty.
10. Fire risk loss—insurance, both fire and compensation, lower in electrically equipped plants.
11. Impossible for motor to run away, no exploding flywheels, no torn-up rigs.
12. Salvage value of equipment higher than any other oil field power equipment.

The electrical equipment for beam well pumping consists of a double-rated motor in capacities of 10/25-15/30 and 30/65 hp., the lower rating used for pumping, the higher rating for pulling out the rods and tubing when the wells sand up or other troubles occur. This equipment is carried in stock by manufacturers and many oil companies keep extra motors in their warehouses.

# Portable Lamps Increase Revenue

By M. Luckiesh
*Director Lighting Research Laboratory, National Lamp Works, Cleveland, Ohio*

THE present rate at which portable lamps are being bought is approximately 0.3 unit per home per year, representing an average expenditure of about $3.60 per customer per year. Six additional portable lamps can readily be justified in the average home. The lighting equipment for a "conservative ideal" home, based on the minimum requirements for utilitarian and convenient lighting, includes an average of 8.5 portable lamps. Bedrooms account for 2.5 portables. The remaining six are distributed elsewhere. However, extensive surveys indicate that there is an average of only 2.8 portable lamps per home. Considering the present wired homes, therefore, six additional portables would make a potential market for more than 100,000,000 portables, or sixteen times as many as were sold last year.

The portable lamps in use in the home account for at least 49,000,000 sockets. The existing potential market, however, would require a possible addition of at least 100,000,000 sockets, an equivalent of 5,000,000 new residential customers. Five million new residential customers is greater than the number added to central-station lines in the past three years and is nearly one-third of the total number of residential customers in this country.

A 200-watt, direct-indirect, portable operating one hour per day (average socket) increases the average annual gross revenue $5.08. Five small portables containing 50 watts each, burning one hour per day, would increase the average annual gross revenue $6.36. The addition of these six portables, one direct-indirect and five small portables, would alone increase the average annual gross revenue per residential customer from $27.89 to $39.33, or 41 per cent. As long as rates remain unchanged much of this increase in gross revenue is really increase in net revenue.

Portable lamps may provide proper and convenient lighting and add much to the cheerfulness of the home. The portable also earns its keep when not lighted because of its decorative value. Furthermore, it is one piece of lighting equipment which is quite often lighted purely for the charm or decorative note which it introduces in the home.

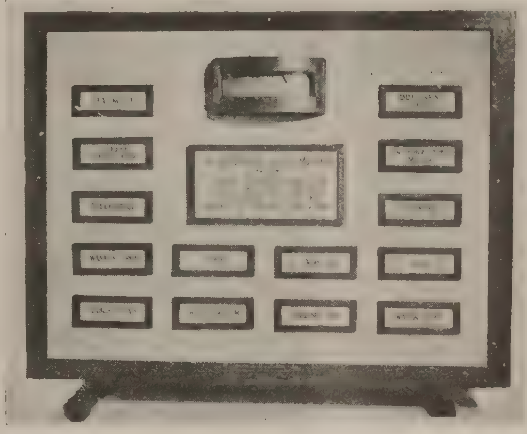
# Selling Electric Refrigeration

THE electric refrigeration committee of the National Electric Light Association has recently issued a booklet constituting a general outline of suggested year-round sales and merchandising activities. "Selling the 'Idea' of Electric Refrigeration" is offered as an aid for a more intensive and more effective marketing of electric refrigeration. The activity proposes a co-operative market development effort, bringing together the local electric refrigeration interests, the electric light and power companies, the electric dealers and contractor-dealers, department, hardware, housefurnishing, dry goods, general stores and other distribution channels.

By way of practical illustration the mailing pieces and advertisements now being used by an electric light and power company that is said to have made marked progress in the building of an electric refrigeration load are shown. These items are personalized in each case with the name of the individual electric customer. It is especially pointed out that in this or in any other direct mail campaign a list of prospects should be very carefully selected and prepared. It is stated further that this or any other advertising activity cannot be expected to produce sales unless the utility and other refrigeration dealers carefully plan ahead and follow through with a well-organized personal solicitation. This co-operative plan is not offered as a substitute for the activity of manufacturers, but is designed to pave the way by selling the idea of refrigeration without any reference to particular makes or types.

# Appliance-Use Cost Meter

THE cost of energy consumed by various appliances and devices is a matter of moment to all electric service users and it is particularly of interest to those customers, present and prospective, on rural and farm lines. The obvious reason for this interest among rural users is that it is necessary for this class to make large use of energy for other than lighting alone in order to benefit fully from the service and to make the supply of that service at least not unprofitable to the utility. The engineering department of Iowa State College devised a display arrangement which shows in cents the costs of using various appliances and equipments at a rate of 10 cents per kilowatt-hour. This display was set up under the direction of Prof. Frank D. Paine of the department, who is also director of the Iowa rural electrification project.



*Meter at top of board successively shows cost of operating each device indicated in panels*

The operation of the display is simple. It consists essentially, as shown in the illustration, of a board on which is mounted an indicating wattmeter calibrated in cents per hour and a number of plates which are illuminated in turn to identify the appliances as they are turned on and off by a flasher.

The display was made up originally to serve as the exhibit of the rural electrification project at the convention of the Iowa Farm Bureau Federation. At this convention the display was seen by more than 3,000 farmers and farmers' wives of the state, in whom it excited much interest. Following the convention the exhibit has been in continuous use by utility companies throughout the state on loan from the college.

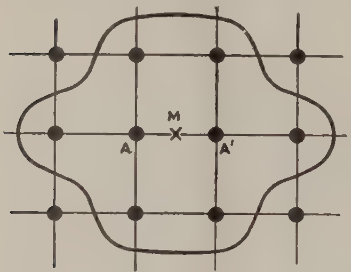
# Letters from Our Readers

## *Motor Starting Current Vs. Lighting Flicker*

*To the Editor of the* Electrical World:

In a study of the effect of motor starting currents on the voltage of a combined light and power underground alternating-current network it is essential, as in all engineering studies, that careful consideration be given to the factors from which mathematical conclusions are drawn. H. L. Wallau, in his article "Motor Starting Current Vs. Lighting Flicker," in the Electrical World of Jan. 28, 1928, has set up certain derived formulas from which he would determine the allowable ratings of motors to be installed on a network. Let us examine some of the factors used in deriving the formulas:

(a) One-Way Feed.—This is rather unusual but it is assumed that Mr. Wallau refers to a motor installation somewhat isolated from the network proper. It is hardly conceivable, however, that it would be so isolated as to have only one transformer bank as a source of current. One bank may be considerably closer to the motor installation than several others, but this does not justify the assumption that all the other banks may be neglected in calculations of current fed to the motor. This is especially true when the network transformers have high inherent impedances, as is generally the case.



*Motor starting current on underground a.c. network comes from more than two banks of transformers*

(b) Two-Way Feed.—The same reasoning applies here as was noted above for a one-way feed. Transformers located at distances further than one-half block from the motor must also be taken into account. This may be shown by the case indicated by the accompanying sketch, in which we have a networked section with 100-kva. transformers uniformly spaced and with 400-ft. blocks and a three-phase motor installation at *M*. The motor location which will result in the greatest voltage disturbance in its immediate vicinity is evidently in the center of the block, as shown. The motor current will be split up among the surrounding banks. However, since the average network system may not be as "stiff" as this one, only the transformer banks within 1½ blocks from the motor, as the boundary line on the sketch indicates, are included in the computations.

The combined cable and transformer impedances from all the included transformer banks to the motor *M* will be 0.0076 ohm (resistance 0.00303 ohm, reactance 0.00696 ohm), assuming 10 per cent transformer impedance and three 500-circ.mil single-conductor cables in one duct. The circuit impedance from the banks *A* and $A^1$ to *M*, which alone is considered by Mr. Wallau, will be 0.0116 ohm, about 50 per cent higher than that obtained by considering the six other banks. If banks farther away were also taken into account the discrepancy would be larger. It is apparent that the motor size as determined by Mr. Wallau's formulas would be smaller than would be actually allowable.

Mr. Wallau has given a value of 15 per cent as the average power factor or the starting current of induction motors. It is believed that he was referring only to squirrel-cage induction motors when he gave this figure, if such is correct. The wound-rotor, slip-ring type of motor using a resistance starter will have a much better starting power factor.

The ratio of resistance to reactance for the circuit will determine the influence of the motor power factor in the regulation of the circuit. It so happens that in the example noted above this ratio is such that motor power factor does not bear an important part. Thus the allowable motor starting current increment for two volts regulation is 270 amp. for 15 per cent power factor, 260 amp. for 50 per cent power factor, and 300 amp. for 80 per cent power factor.

No attempt should be made to calculate an allowable motor starting current without taking fully into account the actual physical layout of the network system, the type of motor and the motor starter. After a value has been determined it is not necessarily the maximum allowable starting current for the motor. It represents an instantaneous value and must be used on a rate basis. For instance, if 200 amp. will produce a two-volt drop, a motor might have a maximum starting current value of 600 amp. and still not produce an objectionable light flicker provided the 600 amp. are obtained at a definite time rate and not instantly. That is, if a change in voltage at the rate of two volts per second is not objectionable, then the allowable motor starting current can be any amount so long as the rate of increase is not greater than this value.

F. E. Johnson,
Distribution Engineering Department.
New Orleans Public Service, Inc.
New Orleans, La.

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## *Time Lag of Spark Gaps*

*To the Editor of the* Electrical World:

I have just read one of the editorials in the March 17 issue of the Electrical World, entitled "Time Lag of Spark Gaps," commenting on the work done by J. J. Torok of the Westinghouse company. I feel that the last part of paragraph three of this editorial may be misconstrued and the impression may be conveyed that the sphere gap is not satisfactory as a measuring instrument for high voltages. The actual facts are that this work of Mr. Torok's has demonstrated that while the sphere gap has a time lag which depends upon the steepness of wave front of the surges impressed on it, this time lag is so small that even with the very steepest wave fronts that can be obtained in the laboratory the impulse ratio will probably not be more than 10 per cent and with the steepest wave fronts that have been observed due to lightning the impulse ratio will not be more than 5 per cent.

In fact, Mr. Torok's work indicates that the sphere gap may be considered quite reliable for all practical purposes, though it could hardly be classed as a precision instrument. However, one advantage that we shall gain as a result of Mr. Torok's work will be a better insight into the behavior of the sphere gap during the breakdown period, and as a result we shall no doubt be able to make better use of it as a measuring instrument than we have done in the past.

Charles Fortescue,
Consulting Transmission Engineer.
Westinghouse Electric & Manufacturing Company.

# Digest of Electrical Literature

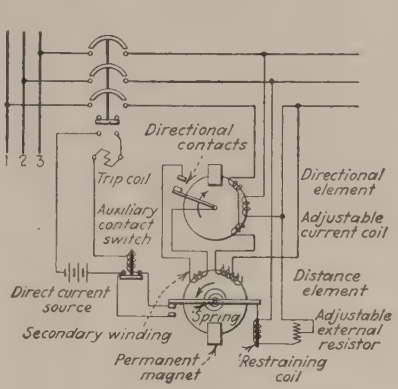
## *Hydro-Electric Development and Steam Equipment*

*Binary Mixtures in Steam Engineering.*—When mixtures of two substances, particularly those having different boiling temperatures, are subjected to the action of temperature and pressure, their behavior is contrary to that encountered with simple substances, such as water. Ebullition and condensation temperatures vary under constant pressure and new heat cycles and characteristic curves descriptive of them are involved. This discussion includes references to a number of articles appearing in foreign publications and referring to the theoretical and practical considerations of binary mixtures under thermodynamic and border-line conditions. It is stated that cyclic processes involving binary mixtures are of great economic significance when applied to steam engines. The effort to produce higher efficiency leads to an increase in the boiler pressure, but even at the highest technically permissible pressures the evaporation temperature is still far below the limit permissible by the strength of the materials employed. This leads to the employment of binary vapor engines wherein, for example, mercury is used in the upper temperature range and water in the lower. It is contended that the same end may be attained by using a solution as a working medium. The heat is supplied to the evaporator at the highest permissible temperature, while the heat in the mixer is liberated at a temperature which is suitable for the upper range in the heat cycle of the conventional steam engine. The steam generated in the evaporator then performs work in a steam engine against the mixer pressure and is afterward exhausted to the mixer.—*Mechanical Engineering*, April, 1928.

## *Units, Measurements and Instruments*

*The Testing of Audio-frequency Transformers by Means of the Cathode Ray Oscillograph.*—M. Kobayashi.—The cathode-ray oscillograph may, in the opinion of the author, be applied to the determination of the characteristics of apparatus used within a wide range of frequency. The application to the testing of audio-frequency transformers is described and the impedance-frequency characteristics and voltage-frequency characteristics are obtained vectorially from the elliptical figure produced by the cathode-ray oscillograph. The author has made several observations in connection with such test work, including: The impedance and voltage ratios are not constant for all frequencies and, in general, separate resonant frequencies exist for impedance and voltage ratios; if a suitable non-inductive resistance is connected to the secondary of the transformer the impedance and voltage ratio are stabilized against frequency variation; it is desirable in the design of the transformer-coupled amplifier that the secondary be shunted by a certain non-inductive resistance, and the transformer coupling should not be applied to the amplifiers for which phase distortions are undesirable.—*Journal of the Institute of Electrical Engineers of Japan*, February, 1928.

*The Impedance Relay.*—H. A. McLaughlin and E. O. Erickson.—The developments made in the impedance relay since its introduction in 1923 are reviewed by the author. The features of construction and operation, with special emphasis on the methods of obtaining proper potential for the restraining elements without the use of high-voltage potential transformers, are also noted. The use of potential form condenser type bushings is discussed, and the methods of compensating for the voltage drop through power transformers and for the shifting of the secondary neutral point have been developed in connection with the use of low voltage potential. The authors state that the impedance relay, while relatively new in the field of protective devices, is already being used extensively both in this country and abroad. Because of the impossibility of obtaining satisfactory results with over-current and directional relays in some cases, and the objectional time delays involved even when selectivity can be obtained, the impedance relay is receiving more and more consideration. This is stated to be a step in the right direction, since the impedance principle involves a relay independent of system conditions and dependent on direction of current flow for its operation and on distance from the fault for its time. Many improvements and developments have been made as the result of operating experience which has resulted in a better understanding of the operation of this device.—*Journal of the American Institute of Electrical Engineers*, April, 1928.



*Directional-control impedance relay*

## *Transmission, Substations and Distribution*

*A General Solution for Short Transmission Lines.*—C. M. Longbottom.—The author has endeavored to describe a general solution by which voltage regulation may be ascertained quickly and with reasonable accuracy. The basis of this method is the circle diagram and formulas and charts are given to illustrate the contention and aid in the solution of problems. The effect of the length of line, the line-phase angle, the load power factor, the regulation of a short line, and regulated and unregulated line values are given. A tabulated card index for certain standard conductor sizes is offered and suggested for ready reference in correlating the values of the several factors involved.—*Electrical Engineer (Australia)*, Feb. 16, 1928.

*Safety Interlock for High-Voltage Apparatus.* — M. Jumier. — It is customary to provide inclosing doors for cells in high-voltage indoor power installations, to prevent access to live parts. An arrangement is described in this article by which all such doors may be closed by locks operated by a master key. The latter may be kept in a small metal box, located near the main oil switch. This box has a hinged cover, which cannot be opened until the oil switch has been tripped. Only then is it possible to obtain the key and unlock the doors to the various cells, which are now dead. On the other hand, the oil switch cannot be closed until every cell door has been closed again, the key has been returned into the box and the lid of the box has been shut. In addition, red and green signal lamps are connected to all doors and the contact in the box, to show the attendant optically the position of doors and the main switch. This is claimed to be the most foolproof safety interlock known.—*Revue Générale de l'Electricité*, March 3, 1928.

*Three-Winding Transformer Banks.*—G. D. Floyd.—Operating features of three-winding transformer banks have been considered by the author. A theoretical study of simple cases of parallel operation of typical transformer banks is included, showing the effect of various methods of operation on the maximum load that can be carried on the windings and the consequent reduction in transformer bank capacity. Some generalized conclusions are drawn from a study of load unbalancing and parallel operation; a three-winding transformer where load is taken from both secondary and tertiary including parallel operation of secondary and tertiary windings is essential for equal division of loads among the transformers; the utilization of available capacity becomes greater as the number of banks increases, other things being equal; it is desirable, from a utilization standpoint, to be able to divide the 110-kv. bus into sub-systems; if one or more tertiary groups of feeders are lightly loaded and the others relatively heavily loaded, better utilization of available capacity can be made by supplying the lightly loaded group over the reactor bus, and opening the tertiary supply from its transformer bank, and the voltages on the tertiary group of feeders are not materially different for considerable unbalance in tertiary loads. —*Electrical News (Toronto)*, April 1, 1928.

## *Illumination*

*Lighting Spray Booths.*—A. H. Nuckolls.—As a result of an investigation to determine the most desirable method of safeguarding the electric lighting arrangements for spray booths several practices have been developed. It is stated that in such work there are two distinct phases of fire hazard to consider, the volatile liquid solvents, the vapors in admixture with the air being flammable, and the non-volatile solids or residue, which are flammable and easily ignited under moderate heat. The residue and vapors when present in the air as a mist or cloud may, under certain conditions where there is a source of ignition, offer a flash fire or explosion hazard. In order to obtain information regarding the dangers involved, a series of measurements were obtained of maximum temperature of various parts of vapor-proof and mercury vapor lamps, fixtures and auxiliaries by means of accurately calibrated thermocouples. A series of tests to determine the surface temperatures likely to cause ignition of spray residues such as are commonly used was also made. A series of spray tests in which the spray was applied directly to the lighted lamps, fixtures and auxiliaries while in operation was carried out. The result as indicated in temperature readings at various points on standard fixtures is offered in condensed form.—*Laboratories' Data (National Board of Fire Underwriters)*, March, 1928.

## *Motors and Control*

*The Three-Phase Compensated Induction Motor.*—Toshio Sugie.—The various advantages and relative merits of the several types of induction motors and of a compensated machine of this type are compared by the author. The theory of the compensated induction motor is described and the best results with respect to the load characteristics with various brush positions and the effect of voltage variations and of frequency variations, as obtained with a test machine, are considered. It is stated that though the motor has a limitation of maximum possible capacity so far as design considerations are concerned, there is no obstacle due to this limitation with the motor capacities ordinarily used for industrial purposes. This device is said to possess speed characteristics and starting characteristics comparable to those of a wound-rotor induction motor and to incorporate a series compensation comparable in dependability to that obtained with parallel compensation. The primary windings are arranged in the stator and the construction is stated as being simplified. The power factor approximates 90 per cent.—*Journal Institute of Electrical Engineers of Japan*, February, 1928.

## *Heat Applications and Material Handling*

*Railroad Bridge Made by Arc Welding.*—A. G. Bissell. What is said to be the first all-welded bridge to carry rail traffic has recently been completed in Pennsylvania. The details of design and the fabrication procedure have been outlined by the author and the data for material and labor requirements are included. A series of tests were conducted upon this structure to determine deflection and vibration by running a locomotive across the bridge at various speeds.—*Iron Age*, April 12, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*The Effect of Impurities and Moisture upon the Breakdown Voltage of Transformer Oil.*—Y. Toriyama.—The voltage-current curves of various transformer oils have been derived by the author from the breakdown value when using sphere and plate electrodes. It is stated that the results indicate that the curves are influenced not only by the form of the electrode but by the existence of dust and moisture in the oil. The combined effect of fibrous dust and moisture upon the breakdown voltage under uniform stress is given particular consideration, with particular reference to the former impurity. It is stated that in well-filtered oil this fibrous dust is very thin, and it has been assumed to be of ellipsoidal shape. On the basis of this assumption, the breakdown voltage of the transformer oil has been calculated, and the results are said to correspond closely to theoretical considerations.—*Journal Institute of Electrical Engineers of Japan*, January, 1928.

*Extreme Ultra-Violet Spectra Excited by Controlled Electron Impacts.*—K. T. Compton and J. C. Boyce.—This investigation is the outgrowth of an unsuccessful attempt to photograph, by ordinary spectroscopic methods, the spectrum of soft X-rays excited in solid targets by the impacts of electrons whose energies are of the order of 100 volts. Numerous experimenters have detected such radiation by photo-electric means, and the desirability of securing a direct spectroscopic check on the interpretation of the breaks found in their curves of photo-electric current versus bombarding voltage was evident. A modification of the original apparatus designed for use in the study of gases under somewhat different conditions from those hitherto employed permitted the desired determination. In this instance gas molecules have been substituted for the solid target previously used and conditions so adjusted that all radiation from them arises from single impacts by electrons of known and controlled velocity. It is stated that the gases have also been handled in such a manner as to insure such a high degree of purity that there is little room for doubt regarding the origin of the lines appearing in the spectrum. The apparatus used in this determination and the spectrograph light source and the method of handling the gases are given in detail. Data regarding the spectra of helium and neon and argon are included.—*Journal of the Franklin Institute*, April, 1928.

## *Miscellaneous*

*A New Method of Separating the Hydraulic Losses in a Centrifugal Pump.*—Michael D. Aisenstein.—Particulars of a method by means of which the friction and shock losses of a given pump may be determined separately from its head-capacity curve. The author has concluded his mathematical discussion and derivation of formulas with the analysis of a specific problem in design. A consideration has been offered of the apparently inconsistent expression for hydraulic efficiency which often amounts to less than the actual pump efficiency. The latter includes, besides hydraulic losses, mechanical losses such as disk friction, friction in stuffing boxes, etc. The reason for this inconsistency is said to repose in the fact that the theoretical head in feet for an impeller with an infinite number of vanes is never produced by the impeller and is an imaginary quantity because the average actual angle between the relative velocity and peripheral velocity is always less than the casting angle of the vane, so that the drop between the theoretical head in feet for an impeller with an infinite number of vanes and the theoretical head in feet for an impeller with a finite number of vanes does not consume any power and is not a loss.—*Transactions of the American Society of Mechanical Engineers*, January-April, 1928.

*Physical Properties of Lead Cable Sheaths.*—P. Dunsheath.—The author has discussed some of the troubles that may arise from the practical use of lead cable sheaths owing to physical weaknesses in the materials utilized and has indicated how these weaknesses are connected with the inherent grain structure in the metal and the streamline structure due to the extrusion process. Existing metallurgical knowledge is reviewed and illustrations are given from the author's investigation into the crystal structure of cable sheaths. Various factors involved in the much-discussed disintegration by vibration theory are examined and the improvement of pure lead by the employment of alloying metals is treated both theoretically and practically. Special apparatus for the vibration tests is described and a consideration of the "weld" and a description of a new type of cable press which produces a cable sheath that is weldless are also noted.—*Journal of the Institution of Electrical Engineers (England)*, March, 1928.

# News of the Industry

## Flood-Control Bill Appropriates $352,500,000

The Jones-Reid flood-control bill, carrying provisions which critics of the measure assert involve a total expenditure far beyond a billion dollars, was passed by the House of Representatives this week by a vote of 254 to 91. It had previously passed the Senate by 70 to 0. A possible presidential veto confronts it.

The bill authorizes appropriation of $325,000,000 for flood control works on the Mississippi, provides $17,500,000 in addition for flood control on the Sacramento River in California, and also makes available the unexpended balance of $10,000,000 previously authorized for survey of reservoirs on tributaries of the Mississippi. A planning board to be made up of the chief of the army Corps of Engineers, the head of the Mississippi River Commission and a civilian engineer is charged with the duty of reporting to the Executive before any definite plan of control is carried forward. The federal government is protected against damages to public utilities, which leaves them at liberty to sue for loss in accordance with their constitutional rights.

## Bay State Speaker Against Hasty Action

Speaker John C. Hull of the Massachusetts House of Representatives, at a hearing Wednesday before the joint rules committee, opposed action looking toward further public utility legislation in the Bay State pending a decision by the courts in the Worcester rate case. The committee was considering the resolve for an investigation of ways and means for further regulation of gas and electric utilities in the state. The Mayors of Cambridge, Somerville, Brockton, Lowell, Marlboro, Revere and Lawrence favored the resolve. Senator Gaspar G. Bacon, chairman of the committee on power and light, also declared that the proposed investigation should wait on the Worcester case.

## Lackawanna Road Has 76-Mile Electrification Plans

Coming electrification in New Jersey by the Delaware, Lackawanna & Western Railroad will, according to an announcement made by President J. M. Davis this week, include the Morris & Essex line from Hoboken to Dover, the Passaic & Delaware to Gladstone and the Montclair branch—a total of 76 miles of road or 173 miles of track, at an expenditure of approximately $14,000,000. Mr. Davis added:

"Officials of the company are carefully weighing the advantages and relative cost of purchasing electric power from outside companies as compared with the construction of a generating plant and manufacturing its own power. The construction and equipment of the proper power plant and accessories would cost about $4,250,000 and would raise the total cost of this electrification work to the neighborhood of $18,000,000. Construction work will be started just as soon as the Lackawanna engineers can prepare plans, and it is estimated that it will be completed within two years."

Jackson & Moreland of Boston have been appointed engineers to carry out the railroad company's plans, and it is probable that orders for all equipment will be placed within sixty days.

## Trade Commission Looks Into Propaganda

### Expenditures of Joint Committee of National Utility Associations Subject of Inquiry—Income of N.E.L.A. Also Put on Federal Body's Record

PAYMENT of substantial counsel fees to former Senator Irvine L. Lenroot of Wisconsin and Richard Washburn Child, former Ambassador to Italy, by the Joint Committee of National Utility Associations was revealed on Tuesday, April 24, at the Federal Trade Commission's investigation into public utilities.

Particulars of these payments were contained in the testimony of Ira L. Grimshaw of New York, assistant director of the joint committee. He said that Mr. Lenroot received $20,000 to oppose the Walsh resolution proposing the inquiry before the Senate interstate commerce committee, and that $7,500 was paid to Mr. Child for writing a book for the joint committee about the Boulder Dam project. • •

Producing an account book taken by the investigators from the files of the joint committee, Robert E. Healy, chief counsel for the commission, asked Mr. Grimshaw to identify payments noted in it. Mr. Grimshaw testified that $5,000 had been paid as an initial fee to Ernest Greenwood, a former newspaper man, for writing a book, "Aladdin U. S. A.," brought out by Harper's, and that J. Bart Campbell, a Washington newspaper man, was receiving $150 a month from the committee in payment for utility news gathered by him and sold to the joint committee. He did not act as a publicity agent.

George H. Francis of New York, auditor for the joint committee and the National Electric Light Association, testified that besides its yearly income of more than $1,000,000, the N.E.L.A. has handled a special fund for educational and research work to which the larger power companies contribute in addition to taking care of the deficiencies incurred by the association.

Mr. Grimshaw presented a table of total contributions of $1,000 or more by groups of utility companies to the Joint Committee of National Utility Associations. These numbered 26 in all, the ten largest contributors being: Insull companies, $61,750; Electric Bond & Share companies, $60,994; Byllesby companies, $36,992; Brady companies, $32,000; North American companies, $28,000; United Gas Improvement companies, $20,000; Columbia Gas & Electric, $20,000; Public Service Electric & Gas, $20,000; Doherty companies, $16,000; Stone & Webster companies, $16,000.

## Debate on Boulder Dam Bill Begins in Senate

Discussion of the Swing-Johnson Boulder Dam bill was beginning in the United States Senate on Thursday as the ELECTRICAL WORLD closed its forms. Prediction from Washington is that the measure will be before the Upper House for at least a week.

The House rules committee at a session on April 24 reached no decision in the matter of granting priority in the consideration of the Boulder Dam bill. Representative Smith of Idaho, chairman of the committee having jurisdiction, is requesting a rule to allow six hours of general debate to be divided equally between those favoring and those opposing the bill. In requesting priority ruling for the measure, Mr. Smith stated that, after considering the matter for six years, Congress should settle the controversy by enacting legislation authorizing construction, subject to ratification by six of the seven states involved. Chairman Snell of the rules committee pointed out that it ought to be possible to provide for flood control without going into power development.

Representative Taylor of Colorado stated the case for the upper basin states, bringing out that their chief concern is in preserving their water rights. "There are three ways of settling the question of allocation of water," he said—"first, for the states to come to an agreement among themselves; second, for the Supreme Court to decide the question as it did in a dispute between Colorado and Kansas over division of the water of the

Arkansas River, and, third, for Congress to adopt legislation making the allocation. Since the states will not agree nor accept a ruling from the Supreme Court, the only remaining way is to let Congress decide."

## Los Angeles "Times" Is for Flood Control First

Harry Chandler, publisher of the Los Angeles *Times*, speaking at a dinner tendered to him and other newspaper men in New York on Wednesday evening, told of the difficulties in the way of agreement on the Boulder Dam project on the Colorado for irrigation and power and predicted that some parts of the plan would have to be abandoned, at least temporarily, and agreement reached on a flood-control dam. Politics and mistaken opinions so surrounded the project contemplated in the Hoover compact that the seven states involved could not unite, he said; but all elements admitted the necessity of a dam to eliminate the always present threat of inundation in the Imperial Valley. If the dam were built with a wide enough base, developments for power might come later.

## Tacoma May Ask Bids for Second Cushman Unit

The city of Tacoma, Wash., contemplates letting contracts for construction of the second unit at its Cushman plant before the end of the year. The major contracts will be for a dam and a tunnel 2½ miles long to carry the water to where it will be dropped down through steel penstocks to the second power house.

In the first unit of the new Lake Cushman plant, completed early in 1926, the city is developing 50,000 hp., and at the sixteen-year-old La Grande plant on the Nisqually River it is developing 32,000 hp. In the second unit of the Cushman plant, the engineering survey for which is now under way, there will be developed 140,000 hp., according to the present plans of the city engineering department. It will also pave the way for the installation of 25,000 additional horsepower at the first Cushman power house, giving the city altogether a future total of 247,000 hp.

## Rural Electrification Project on National Scale

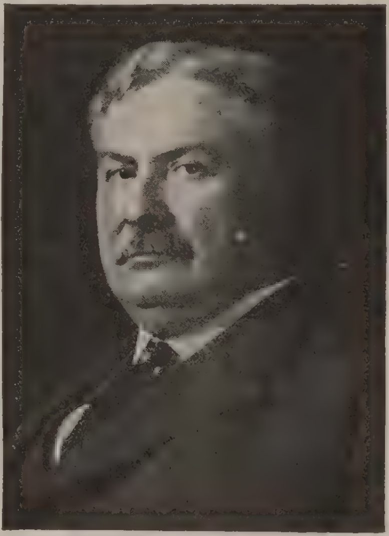
Under the auspices of the Committee on the Relation of Electricity to Agriculture, operating in conjunction with a Maryland state committee, a new experimental enterprise, to be known as the "national rural electric project," is soon to be established. It will be within easy driving distance of the national capital, probably adjacent to the highway between Washington and Baltimore. One of the first steps will be the erection on the grounds of the Agricultural College of the University of Maryland at College Park, on this national highway, of an exhibition building in which will be housed displays illustrative of the experiments being carried out on the national project and also on the various state experimental lines.

In some community not far from College Park six or eight farms, in a cluster if possible, will be selected as a base for the experiment. Dr. R. A. Pearson, president University of Maryland, heads the Maryland committee.

It is expected that it will take five years to obtain all the information desired. The National Electric Light Association, represented by Charles F. Stuart, chairman of its rural electric service committee, is participating.

## Death of James J. Wood

*Consulting Engineer at General Electric Company's Fort Wayne Works Since 1890—His Prominence in the Early Days of Arc Lighting*



JAMES J. WOOD, consulting engineer of the Fort Wayne works of the General Electric Company and one of the pioneers of electric lighting by arc lamps in America, died suddenly on April 19 at Asheville, N. C. He had just passed his seventy-second birthday and had gone to Asheville in an endeavor to recuperate from illness.

Mr. Wood was born at Kinsale, Ireland, being brought to America at the age of eight. The family lived in Connecticut for more than ten years. At the age of 18 he was graduated from the Brooklyn evening high school and in 1878 from the Brooklyn Polytechnic Institute. At that time the Brady Manufacturing Company, for which young Wood worked while pursuing his studies, was making castings and parts for electric dynamo machines invented by James B. Fuller of the Fuller Electric Company and by Hiram S. Maxim, then chief engineer of the United States Electric Lighting Company. As machine-shop foreman young Wood directed the construction of these machines and soon became interested in the electric lighting idea himself.

In 1879, after much private study and experimenting, he designed and built an arc-light dynamo of his own. This dynamo was so efficient that it caused the Fuller Electric Company to substitute Wood's machine for Fuller's and change the company name to the Fuller-Wood Company. After about ten years' service as electrical inventor for this and other companies in New York, Mr. Wood went to Fort Wayne in 1890, as the result of a commercial agreement with the old Thomson-Houston company, which then had a large interest in the contemporary Fort Wayne Electric Works. He had remained there ever since as the outstanding electrical engineer of the Fort Wayne plant.

When Mr. Wood went to Fort Wayne his dynamo and arc lamp were already in use extensively under the name of the "Wood arc-lighting system." He added accessory equipment to the system while at Fort Wayne, inventing types of meters and switch devices, as well as alternating-current dynamos and some of the earliest electric fans to be placed on the market. Before this he had been concerned in the manufacture of the Brayton oil engine installed in the first Holland submarine, and he built the first lamps for Hiram S. Maxim and the machines for constructing the main cables used on the original Brooklyn Bridge. His patents, numbering 240, included one for a dynamo for flood-lighting which was first used on the Statue of Liberty.

Mr. Wood was a fellow of the American Institute of Electrical Engineers and a member of the Quarter Century Club of the General Electric Company.

## Tokyo Congress Plans

*Many American Engineers Will Journey to Japan in October, 1929, to Take Part in World-Wide Conference of Technical Men*

A CABLEGRAM was received last Saturday by Maurice Holland, executive secretary of the American committee of the World Congress of Engineers to be held in Tokyo next year, from Baron C. Shiba, vice-president of the congress, outlining the plans and program. The meeting, Baron Shiba states, will convene in Tokyo on Oct. 30, 1929. The official languages of the congress will be English and Japanese. The first week will be devoted to technical papers and social meetings, the second week to inspection trips in Tokyo and vicinity, and the next fortnight to trips throughout Japan especially arranged to give the delegates an opportunity to visit the great industrial and engineering centers of the country.

The World Congress, which will be attended by engineers and scientists from all parts of the world, is designed to promote international co-operation in the study of engineering science and problems, and international authorities on engineering are being requested to prepare papers on subjects of interest and moment to engineers. Many notable technical men from America will attend the congress, eighty of the nation's foremost engineers and scientists having, as already reported, accepted membership on the American committee under the honorary chairmanship of Secretary Hoover and the active chairmanship of Dr. Elmer A. Sperry.

Dr. Sperry has made public the names of members of the various American committees charged with carrying out the plans for the undertaking. The chairmen are: Finance, John W. Lieb; technical program, Dugald C. Jackson; transportation, Frank B. Jewett; entertainment, O. C. Merrill; publicity, J. H. McGraw; promotion and attendance, George W. Fuller. These chairmen, with Gano Dunn, Maurice Holland, Charles F. Scott, Elmer A. Sperry, W. E. Wickenden and Calvin W. Rice, will make up an American executive committee under the chairmanship of Mr. Lieb.

## Purchases and Mergers

*Scattered Transactions of Comparatively Small Importance Compose the Week's Record — Tendency to Consolidate Subsidiaries Continues Manifest*

THE eleven companies which, as reported last week, are to be taken over by the Metropolitan Edison Company as part of the General Gas & Electric's plan to simplify the corporate structure of its subsidiaries are the Ortanna Electric Light & Power Company, the Boyertown Electric Company, the Annville & Palmyra Electric Light Company, the Bernville Light, Heat & Power Company, the Berks-Lehigh Power Company, the Birdsboro Electric Company, the Hamburg Gas & Electric Company, the Topton Electric Light & Power Company, the Weisenberg Township Electric Light & Power Company, the French Creek Electric Company and the Blue Mountain Electric Company.

The Harlem Valley Electric Corporation has filed a petition with the Public Service Commission of New York to acquire the franchises and plant of the Eastern New York Electric & Gas Company, which has its principal office in Mechanicville and distributes electricity in the villages of Brewster, Chatham, Pauling and Philmont and in many towns in Rensselaer, Columbia, Dutchess and Putnam Counties. Both companies are controlled by the Associated Gas & Electric Company.

Sale of the Rock River Valley Light & Power Company, a distribution system serving Barstow, Joslin and Hillsdale, Ill., to the People's Power Company of Moline awaits only approval of the Illinois Commerce Commission. The price was $30,000.

Sale of the electrical distribution system of the city of De Soto, Kan., to the Bonner Springs division of the Kansas Electric Power Company, Lawrence, has been agreed upon by the City Council. De Soto has heretofore purchased power wholesale from the Kansas Electric Power.

The municipal light, ice and water plants of Donalsonville, Ga., have been sold to the Georgia Power Company for $50,000.

The municipal electric plant at Vidalia, La., has been acquired by the Southwestern Gas & Electric Company.

Twenty per cent reduction in rates for Quincy (Calif.) electric consumers will result from the purchase of the Quincy Electric Light & Power Company by the Great Western Power Company of California.

Stockholders of the American Power & Light Company, meeting in Augusta, Me., on Tuesday, ratified the plan to exchange preferred stock for the common stock of the Montana Power Company. This makes the merger of the companies effective, as John D. Ryan and associates, who held control of Montana Power, have agreed to the two-to-one plan of exchange.

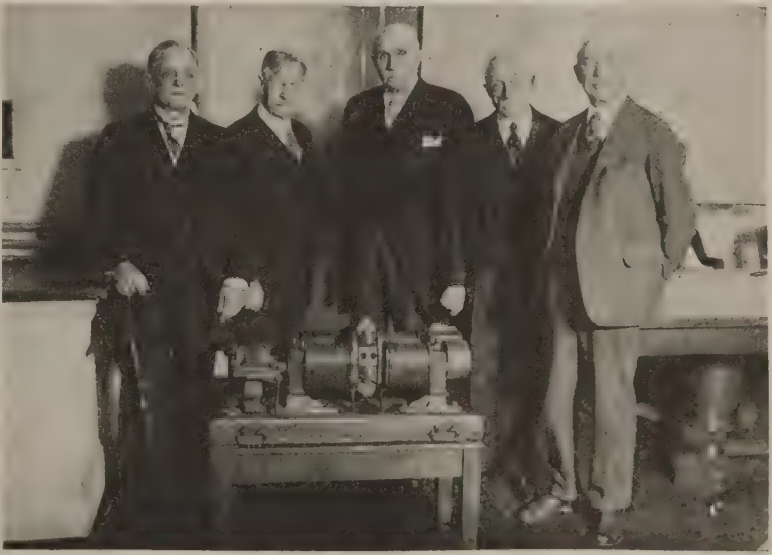
Reports from Chicago tell of a geographic readjustment of Insull-controlled companies by which the Middle West Utilities Company will have a majority interest in the National Electric Power Company and the Inland Power & Light Corporation, acquired last year from the Albert Emanuel and the A. E. Fitkin interests respectively. As a result of this transaction the New England Public Service Company, a Middle West Utilities subsidiary, has been transferred to the National Electric Power Company, which will be the holding company for all the properties of the system operating in the East, while the Kansas Electric Power Company, the Southwest Power Company and the Northwestern Public Service Company, former National Electric Power subsidiaries, have been transferred to direct control of the Middle West Utilities Company. The Inland Power & Light Corporation subsidiaries, operating in Kansas, Missouri, Arkansas, Texas and Michigan, are expected to be combined with the other Middle West Utilities properties on a geographic basis.

## I. W. Day Elected President of New England N.E.L.A.

Irvin W. Day, vice-president of the Connecticut Light & Power Company, Waterbury, Conn., was elected president of the New England Division of the National Electric Light Association at the annual meeting on Tuesday of this week at Boston. Other officers chosen were: Vice-president, C. H. Hodskinson, Boston Edison company; treasurer, F. L. Ball, Charles H. Tenney & Company, Boston; executive committee, George S. Williams of Maine, W. A. Buttrick of New Hampshire, W. C. Bell of Vermont, H. E. Duren of Massachusetts, David Daly of Rhode Island, A. D. Colvin of Connecticut and F. D. Gordon, ex officio. Section chairmen elected were: Accounting, J. W. Lester, Boston Edison company; Commercial, A. S. Moore, Brockton Edison company; Public Relations, Haller D. Seavey, Western Massachusetts Companies; Engineering, Frank R. Fowles, Portland, Me.

Following the election, Philip Cabot, professor of public utility management, Harvard Graduate School of Business Administration, gave an address upon the use of electricity in the home, predicting that this class of central-station business will ultimately become the most profitable of all. He predicted that within fifteen years comparatively little appliance business will be done by central stations in view of the progressive developments of other outlets.

## Five Electrical Pioneers Meet at Franklin Institute



*Thomson Sprague Brush Sperry Rice*

WORTHY of note was an assemblage at the Franklin Institute, Philadelphia, last week, when five men who have played distinguished parts in electrical history stood grouped around an ancient dynamo. They were Charles F. Brush, Elihu Thomson, Frank J. Sprague, Elmer A. Sperry and Edwin W. Rice, Jr. Dr. Brush, now 79, who made the dynamo, and Dr. Thomson, now 75, were the developers of rival arc-lighting systems in their early days, and each of the three younger men is old enough to have been an engineer of note when the art was in its infancy. Dr. Brush and Dr. Thomson were speakers at a meeting which followed the reunion.

## M. J. Insull Explains Situation on Colorado of Texas

Following an inspection of the properties of the Middle West Utilities Company in west Texas, Martin J. Insull of Chicago, head of the company and its several subsidiaries, made the statement at Abilene, Tex., last week that he may abandon the project of constructing a series of six dams and hydro-electric projects on the Colorado River, which would have involved an expenditure of approximately $25,000,000. The failure of the Brownwood Irrigation District to give the Insull interests an assurance that it will recognize priority rights of the Middle West Utilities Company on the 580,000 acre-feet of water of that stream which it proposed to use in the development of power was given as the reason for this possible change of plans.

"Unless we are given this assurance, we will not proceed with our project," Mr. Insull said. "I did not want to get mixed up in any dispute between any sections of the state, neither did I want to get into the hydro-electric power business in this state. I do not believe that it is a particularly profitable business. I would much rather buy the power from some one else at the dam than to build the dams. Lignite and oil will produce power today cheaper than water power on the Colorado River. When the Syndicate Power Company presented its plan for power on the Colorado River, we did not think that it was a particularly good business deal. We thought it was a good thing for Texas and that anything that was good for Texas was good for us. When our proposition failed to meet with approval of the West Texas Chamber of Commerce and when that body turned down our offer at Dallas, we got out of the Syndicate Power Company."

## Another Grandiose Scheme Proposed for Canada

Another ambitious plan for navigation and power has been put before the Canadian Parliament. Last year it was the Georgian Bay canal scheme, sponsored by the Sifton interests, which occupied the attention of the House through fourteen sittings. This year it is a bill to detail certain powers to the Great Lakes & Atlantic Canal & Power Company, which was incorporated 24 years ago, with general powers subject to the approval of the government. This company's proposal is to construct a 35-ft. waterway from tidewater to the Great Lakes at an outlay of approximately $200,000,000. In the process 2,800,000 hp. of electrical energy would be developed in the Province of Quebec, the promoters say.

Sponsors of the proposal think that it meets all the objections voiced in connection with St. Lawrence development. They declare that it will provide, without cost to the Dominion or provinces, an all-Canadian waterway, thereby relieving the country of financing and at the same time providing a route which Canada could control. The bill provides for a canal system from either Cornwall or Prescott to Lake St. Francis, and thence to Beauharnois and back to the St. Lawrence River in the neighborhood of Montreal.

The Great Lakes & Atlantic has notified the government of its willingness to complete the navigation works and turn them over to the government to operate without compensation, the power rights being sufficient inducement to proceed with the work.

# How Germany Solves Electric Problems

### Bin and Unit Pulverizers Both in Use in Central-Station Plants —High-Pressure Steam in Favor—Agricultural and Railroad Electrification—Statistics for 1927

By Dr. Gerhard Dehne*

Berlin, April 1, 1928.

A COMPLETE cessation of the building of power plants in Germany followed the war, but at the same time there arose a demand for electricity which made enlargements of existing installations imperative, and these had sometimes to be made hastily without waiting for the proper development of engineering ideas. Journeys to America were made by German engineers to study the new developments there, and some of these have now been applied to German plants with modifications and sometimes innovations that German conditions call for.

Most American plants burning pulverized coal use a central coal mill—the "bin system," as it is called in America—and some of the largest German plants—for example, the Klingenberg plant in Berlin—have adopted this method. Many private plants, however, have installed unit pulverizers, simplifying construction. This method was followed in the new plant of the communal Elektrizitätswerk Mark in Westphalia with such good results that it is likely to grow in use. Electrical filters to eliminate gas fumes have been employed by the Leunawerke with success.

In America boilers have long operated at a pressure of 84 to 100 atmospheres. In Germany the Grosskraftwerk Mannheim operates with a pressure of 100 atmospheres. In the Siemens-Schuckert cable works there was installed last year a Benson boiler at 230 atmospheres, which burns 30 tons of pulverized coal an hour, and boilers burning from 30 to 40 tons were installed in 1927 in many power houses without causing any difficulty.

The largest two-pole turbo-generator in Germany produces 40,000 kva. at 80 per cent power factor. The largest units with four poles (two-shaft machines)—those in the Klingenberg plant—have a capacity of 80,000 kw. each. The largest machines running at 3,000 r.p.m.—which are considerably cheaper than 1,500-r.p.m. machines—work very successfully in the Hamburg station, producing 37,500 kva., and preparations have been made to raise their rating to 50,000 kva. An experimental 44,000-kva. generator is already operating.

Some figures regarding the application of electricity to German agriculture were brought out in "Agricultural Week" in the Berlin exhibition halls recently. Use of electrical power increased from 1907 to 1925 by 3,000,000 hp., electric motors with a total rating of 3,334,051 hp. being in use in the last-named year. However, only 12.6 per cent of the farms are operated by electricity.

The electrification of the Breslau-Königszelt railroad in Silesia, completed in January, draws attention to a market for electrical energy which is becoming more important every year, that furnished by the German state railroads. Electrification began on a small scale before the war. Most of the work, however, has been accomplished in the last few years. Omitting the suburban districts of Berlin and Hamburg, there are three separate railroad systems—in central Germany (Leipzig-Magdeburg), in Bavaria around Munich and in Silesia (Breslau-Görlitz). In Bavaria the railway plants are operated by the water powers of the Alps, in Silesia by the less valuable pit coal and in central Germany by brown (soft) coal, which is coming into extensive employment. The whole length of the state lines, which include nine-tenths of all German railroads, was 33,306 miles in January, 1928. Of this, 760 miles were electrified, geographically divided as follows: Bavaria, 381; Silesia, 160; central Germany, 117; Berlin, 49; Baden, 30; Hamburg, 23. In 1928 the electrification of the Berlin urban and suburban railways, with a length of about 310 miles, will be finished.

According to reports by the "chambers of industry and commerce" and statements made by Dr. Carl Friedrich von Siemens at the annual meeting of the Siemens & Halske company, 1927 was in most branches of the German electrical industry a very satisfactory year. Seventy-five per cent of the electrical energy used in Germany is produced in plants owned or controlled by the nation, the states or the communes. These public utility undertakings have recently placed contracts for electrical equipment and supplies of various kinds.

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*Dr. Dehne's first Berlin article appeared as a letter to the editor on March 24 (page 619).

# Electrical Engineers at Conowingo

*Inspection of Plant Follows Full Discussion of Its Features at Closing Sessions of Baltimore Regional Institute Meeting*

A TRIP to Conowingo participated in by 128 of the delegates to the regional meeting of the Middle Eastern District of the American Institute of Electrical Engineers, held in Baltimore, brought it to a successful close on Friday, April 20. The earlier sessions were reported in the ELECTRICAL WORLD last week. Those of Thursday were devoted to the design, transmission, communication and operating stability features of the Conowingo development. Following a general review of the economic factors which led to the erection of the power plant at this site, Alexander Wilson, 3d, outlined the construction methods utilized and the design of the hydraulic equipment.

The electrical features of the Conowingo plant and of the receiving stations in Philadelphia were reviewed by R. A. Hentz. These include a 220,000-volt substation built on the roof of the power plant, a 30,000-kva. synchronous condenser installed for stability purposes at Plymouth Meeting, and three-winding 220/69/13.3-kv. self-cooled transformer banks arranged for tap changing under load.

The 220-kv. transmission line between Conowingo and Plymouth Meeting was described by P. H. Chase. Two single-circuit tower lines, each with double-ground wire protection, are used. Conductors are of 795,000-circ. mil steel-reinforced aluminum. Slip clamps are used to decrease unbalanced longitudinal stresses on the towers in the event of conductor breakage.

In the discussion following the presentation of these papers F. G. Baum welcomed the introduction of 220-kv. lines in Eastern practice and mentioned the satisfactory service yielded by such construction for many years in West Coast work. R. L. Thomas called attention to the agreement with the Holtwood plant, further upstream, under which water is purchased with a net gain of from 84,000,000 kw.-hr. to 100,000,000 kw.-hr. yearly. P. L. Alger commented upon the use of rotors built up on the job, with heavy plates and riveted construction, and installed, consequently, without factory-shop tests.

The communication system for use in the plant in connection with the transmission line and in load dispatching was outlined in a paper by W. B. Beals and E. B. Tuttle. The value of co-operative consideration of such problems by utility and telephone company engineers was suggested as desirable at an early stage in the planning of the project.

A quantitative mechanical analysis of power-system transient disturbances as applied to the problems arising in the several interconnections involved in this three-company tie-in was detailed by R. C. Bergvall and P. H. Robinson in a paper read by the former. Records were obtained by taking motion pictures of an equivalent mechanical system.

The superexcitation of synchronous condensers for the Conowingo system, with particular attention to the design limits of the excitation equipment and the possible emergency condenser output, was treated by D. M. Jones.

In the ensuing discussion F. G. Baum pointed out the value of synchronous condensers in increasing the capacity of the line by taking care of the line-charging capacity, which at one time presented a difficult transmission-line problem. A. E. Bauhan said that with the three-company tie introduced by the present interconnection he anticipated an increased number of voltage dips and relatively unimportant disturbances, but that these would not, he felt, be of a serious nature in general. A. F. Bang questioned the desirability of mounting an outdoor switching structure on the roof of the generating station, as limiting future expansion and introducing oil-fire hazards, and expressed disapproval of the plan of placing reactances on the high-voltage side of transformers in transmission work while using them on the low-voltage side in cable distribution practice.

# Symposium at New Haven on Surge Measurements

In addition to the papers covering electric power on street railways and the electrification of steam railroads which, as listed in the ELECTRICAL WORLD for April 7 (page 726), will be presented when the regional meeting of the American Institute of Electrical Engineers meets at New Haven next month, there will be a symposium on surge measurements and protective devices. This will be held on the opening morning, Wednesday, May 9, and will include the following papers:

"Application of Relays for Protection of Power-System Interconnections," L. N. Crichton and H. C. Graves, Westinghouse Electric & Manufacturing Company.

"Application of Wound-Type Current Transformers to High-Voltage Circuit Breakers," J. C. Rea, Pacific Electric Manufacturing Company.

"Relation Between Transmission-Line and Transformer Insulation," W. W. Lewis, General Electric Company.

"Rationalization of Transmission-System Insulation Strength," Philip Sporn, American Gas & Electric Company.

"Hall High-Speed Recorder," C. I. Hall, General Electric Company.

"Pages from the Hall High-Speed Recorder," E. M. Tingley, Commonwealth Edison Company.

"Oscillograph Recording of Transmission-Line Disturbances," J. W. Legg, Westinghouse Electric & Manufacturing Company.

"High-Speed Graphic Voltmeter," A. F. Hamdi and H. D. Braley, New York Edison Company.

In the afternoon of Wednesday these papers are to be presented:

"Selection of Railway Motor Equipment by Principles of Similar Speed-Time Curves," B. A. Widell, General Electric Company.

"Shunting of Track Circuit in Polyphase Continuous Inductive Train Control," C. F. Estwick, General Railway Signal Company.

"The Diverter-Pole Generator," E. D. Smith, Jr., Rochester Electric Products Corporation.

"Electric Reduction in Hard Rubber, Pyrex, Glass, Fused and Crystalline Quartz," H. H. Race, Cornell University.

Another paper not previously noted will be given on Friday afternoon by L. A. Sheldon of the General Electric Company on the mercury boiler and turbine.

# Competition for Los Angeles Ornamental Lighting

The Affiliated Improvement Associations of Los Angeles, representing 130 organizations, are urging the City Council to authorize competitive bidding for furnishing energy and maintenance for the ornamental lighting systems in the city. This service is paid for by annual direct assessments on property owners on the streets on which there are ornamental lighting posts. The assessments total more than $1,000,000 a year and are increasing as additional systems are installed.

A practical monopoly on this business is held by the Municipal Bureau of Power and Light through its political connections with the Board of Public Works. The Power Bureau charges 4 cents a kilowatt-hour. The Los Angeles Gas & Electric Corporation has offered the same service for 3 cents a kilowatt-hour.

# Ferguson Against Federal Regulation of Utilities

Speaking on the utility question in its relation to politics, Samuel Ferguson, president of the Hartford (Conn.) Electric Light Company, declared Monday in an address before the national convention of the League of Women Voters at Chicago:

"I can raise no possible objection to being regulated by a fair-minded body, whether state or federal, provided that body could devote itself exclusively to regulating me according to local needs. But if in a rapidly changing industry rules and regulations necessary for my locality must also conform to the rules required by the vastly different conditions in California, Illinois or Maine, and be consistent all over the country, you can readily see that we shall be enmeshed in a hopeless snarl of red tape."

Congress can, by a very simple enactment, delegate its authority to the joint jurisdiction of the state utility commissions interested in particular interstate transactions, he said.

"One rather appealing fallacy," Mr. Ferguson observed in the course of his remarks, "has been indorsed by ex-Governor Pinchot and others, namely, that a fair return is one which will keep the company's securities at par, on the theory that this would be sufficient to make possible the obtaining of new capital when necessary for extensions. This is a policy of stagnation and high prices. If progress is to be rapid, capital must be anxious to be obtained and to be employed. To employ the maximum capital, growth must be as rapid as possible, and the only way to stimulate the maximum of growth is by a policy of minimum prices for the product sold."

Pointing out the fallacy of stressing fuel rather than distribution costs, indulged in by advocates of government operation at Muscle Shoals and Boulder Dam, Mr. Ferguson said that this undue prominence given to the smallest item of electrical costs distorted the picture.

## Stevenson Creek Arch Dam Undergoes Severe Tests

Although no additional engineering tests have been made so far this year upon the experimental concrete arch dam on Stevenson Creek, in the mountains near Fresno, Cal., the Bureau of Standards, which has co-operated with the Engineering Foundation's committee of investigation in this enterprise, reports that the dam has undergone severe tests occasioned by floods. A flood which destroyed all the observation platforms and caused the choking of the undersluice filled the reservoir with rock, sand and silt to an average depth of about 40 ft. at the upstream face of the dam. With this débris against the dam the water filled the reservoir and at times rose to a height of about 3 ft. above the crest. During the winter just past the reservoir has been full, and a small amount of water has been running over the top of the dam. The only observed effects produced by unexpected pressure of débris and water have been a slight extension of the cracks near the bottom of the dam which occurred during a previous load test, the formation of an additional crack near the bottom and a small increase in the deflection of the dam.

The test has yielded results which give direct information on the temperatures in the concrete and on strains, stresses and deflections in the dam. The results also afford a basis for comparison with the stresses and deflections as computed by current methods of design. There was reasonably good agreement with the computed stress at approximately the mid-height of the dam, but at the top the agreement was poor. Results of tests of a celluloid model of the dam at Princeton University agree so well with the results from the actual structure that added confidence is felt in the use of models in designing arch dams. The Bureau of Reclamation is building at the University of Colorado, Boulder, a concrete model of the Stevenson Creek Dam, which will be tested for comparison with the Stevenson Creek Dam; also a model of the Gibson Dam, which is to be built in Montana and which will be about 900 ft. long and 165 ft. high.

The Stevenson Creek Dam is now 60 ft. in height. The Engineering Foundation plans to carry it higher.

# Briefer News

Duke Power Company Builds Lines Into Marion, N. C.—The Duke Power Company has a large force of men working on a 100,000-volt power line that is being brought from its Bridgewater plant at Lake James into Marion, N. C., to furnish power for textile plants. Five acres of land just outside the city will be used for a substation, which is to be erected soon.

Wisconsin Utilities Association Elects Officers.—The annual election of officers for the Wisconsin Utilities Association, which is conducted by mail ballot, was held last week and resulted as follows: President, C. R. Phenicie, Green Bay, vice-president Wisconsin Public Service Corporation; vice-president, D. E. Callender, Racine; treasurer, Ewald Haase, Milwaukee; publicity director, M. H. Frank, Fond du Lac; assistant publicity director, E. J. Steinberg, Milwaukee.

Oregon Commission to Evaluate Portland Companies.—An order has been entered by the Oregon Public Service Commission for a rate-fixing valuation of all properties belonging to the Portland Electric Power Company and the Northwestern Electric Company, whose consolidation was forbidden at a recent special election. The commission thinks it probable that the present rates of the two companies are inconsistent with the rate base determined by the commission in 1916.

Kansas City Chamber of Commerce Starts Courses in Public Utility Economics.—Under the auspices of the Kansas City Chamber of Commerce an evening course in public utility economics is being given at the Kansas City School of Commerce. It began on April 16 and will last for eight weeks, under the direction of Charles H. English. Special lectures on various phases of public utility administration will be given by experienced utility men, engineers and others, among them L. A. Pettit, Missouri Power & Light Company; C. C. Smith, A. E. Bettis, H. H. Kuhn and F. S. Dewey, Kansas City Power & Light Company, and S. B. Irelan, Henry L. Doherty & Company.

Southwestern Public Service Association Meets in Dallas Next Week.—Increasing the domestic load, refrigeration, organizing for service to large power customers, safety methods, rural electrification and the selection and training of personnel are the topics selected for discussion at the Electric Section of the Southwestern Public Service Association, which will hold its thirty-third annual convention at Dallas from Wednesday to Saturday of next week. The Electric Section and the other sections will meet in the afternoons. The general sessions, in the mornings, will be addressed by executive heads of the national utility associations and other well-known men.

Decatur Rate Reduction Contingent on Increase in Number of Customers.—The Illinois Power & Light Corporation has submitted to the Decatur City Council a proposal to establish an 8-cent, 6-cent and 3-cent rate to supplant the present charge of 9, 7 and 4 cents upon condition that the company obtains 17,000 patrons in the city with an average householder consumption of 400 kw.-hr. annually. The new tariff will be effective July 1 if this condition is met.

Montreal's 66,000-Volt Underground Cables.—Before the Montreal branch of the Engineering Institute of Canada on April 20 H. Milliken, chief engineer of the Montreal Light, Heat & Power Consolidated, described the city's new 66,000-volt underground cables and the new 4,000-volt distribution substation in the heart of the city. The cables, which extend about 4,000 ft. from the company's Vallée station to a double overhead 66,000-volt ring around the city, are, as so far installed, six in number, single-conductor, comprising two three-phase circuits. A third circuit will be installed soon, and eventually the present cable system will be duplicated and joined to the second ovehead ring.

Gering Farm Project in Nebraska Still in Litigation. — The district court at Gering, Neb., has upheld the legality of the recent act of the Legislature permitting rural communities to form districts for the purpose of purchasing electricity from municipalities and has dismissed the injunction that held up a recently called election. Nonresident landowners who asked for the injunction gave notice of appeal to the Supreme Court, which may tie the matter up for a year.

Erie Lighting Company's New Turbine.—A report just printed on the new 15,000-kw. turbine of the Erie (Pa.) Lighting Company, which went into operation about the beginning of the year, says that it exceeds efficiency specifications. This turbine, of General Electric manufacture, is the first fourteen-stage unit of its capacity to be designed and built by that company. It has doubled the previous capacity of the Erie plant, which is now one of the largest and most important base-load stations in the Pennsylvania division of the Associated Gas & Electric System. An 11,000-volt transmission line connects this plant with the Piney hydro-electric development on the Clarion River, which in turn is connected to the Seward steam station near Johnstown and the Deep Creek hydro plant in western Maryland.

Virginia Electric & Power Company's Budget.—Line extensions and connections, substations, improvements to distribution system and miscellaneous electrical items scheduled for completion in 1928 will cost the Virginia Electric & Power Company $2,500,000 or more.

Among these coming improvements are a 4,750-kw. substation at Norfolk, ornamental street lighting for Portsmouth, new equipment in various stations and substations, and an extension of transmission lines in northeastern North Carolina, $629,000 being appropriated for the last-named purpose.

SOUTHEASTERN WATER AND LIGHT ASSOCIATION MEETS AT ATLANTA.—The eighth annual meeting of the Southeastern Water and Light Association was held at Atlanta last week, representatives of municipal lighting plants and water departments predominating among the attendants as usual. New officers were elected as follows: President, R. B. Sims, Spartanburg, S. C.; vice-presidents, H. A. Lily, Badin, N. C.; W. W. Hunter, Augusta, Ga.; J. B. Farmer, Murfreesboro, Tenn., and J. F. Pearson, Orangeburg, S. C.; secretary, F. W. Chapman, Camden, S. C.

MODEL ELECTRICAL FARM WILL ADJOIN CHICAGO.—A model electrical farm of 80 acres is being developed by the Public Service Company of Northern Illinois a few miles out of Chicago. All of the buildings, including the farm home, will be built to specifications which include provision for all modern electrical applications. The house and barn will be wired according to "red seal" specifications. The farm will be operated by a practical farmer on a business basis in addition to being open for inspection and study. It is expected that it will be in complete operation early in the summer.

SAN FRANCISCO TO VOTE ON PUBLIC UTILITY COMMISSION ISSUE. — The Board of Supervisors of San Francisco has voted to place on the ballot at the primary election Aug. 28 a measure to permit voters of the city to decide whether they wish to create a public utility commission to administer and direct the water, light, power, heat and transportation utilities of the city. The measure was to have gone on the ballot at the next November general election. An attempt to change the provision fixing the commission at three members, and increasing it to a greater number, was decisively defeated at the board meeting.

FACT-FINDING POWER INVESTIGATION FOR MAINE.—The Maine section of the New England Council has appointed a fact-finding commission to investigate all phases of the power question as it affects that state. The commission is composed of William T. Cobb of Rockland, Philip Dana of Westbrook, James C. Boyd and Benjamin F. Cleaves of Portland, William I. Cummings of South Berwick, Leslie E. McIntire of Waterford and Robert J. Peabody of Lubec. The commission will not make recommendations, but the results of its inquiry will, it is expected, throw light on whether or not electrical energy should be sold for use outside the state.

WORK ON SLAVE FALLS PLANT ON WINNIPEG RIVER TO BEGIN SOON.—Preliminary development of the Slave Falls power site, on the Winnipeg River, in the Province of Manitoba, by the Winnipeg public hydro system will be begun soon, a year in advance of schedule, owing to the increased demand for electrical power from the city-owned utility. It is expected that development will be completed by 1931, at an estimated expenditure of $7,000,000. The Slave Falls site is 90 miles northeast of Winnipeg and 5 miles from the Pointe du Bois plant of the city hydro system. This is the last undeveloped power site on the Winnipeg River available to the public hydro enterprise. It will more than double the city's production of electrical energy and round out a twenty-five-million-dollar investment. There is available at the Slave Falls site a total of 36,480 continuous horsepower under conditions of ordinary minimum flow and more than 60,000 continuous horsepower at ordinary six-month flow. The head at this site is 26 ft.

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]**

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

American Institute of Electrical Engineers—New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

Indiana Electric Light Association (jointly with Indiana Public Utilities Association) — Columbia Club, Indianapolis, May 22-24. William Stokes, 1548 Consolidated Bldg., Indianapolis.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

SAN DIEGO COMPANY MAKES RATE REDUCTIONS TOTALING $400,000 A YEAR.—Customers of the San Diego Consolidated Gas & Electric Company will benefit immediately to the extent of more than $400,000 a year as the result of reductions in electric and steam rates that went into effect on April 20. These new rates are based on an inquiry by the California Railroad Commission and the report of its engineering department that the company earning in 1927 was substantially $400,000 in excess of a net return of 7½ per cent on its investment, with which the company expressed itself content. The speedy conclusion of the case, with its substantial saving to the consumers, is believed to establish a record in the matter of quick handling of a formal rate matter of such importance. Reductions for the various classes of business are approximately as follows: Lighting, 11.4 per cent; general power, 11.1; agricultural power, 15.2; street lighting, 6.3; electric railway, 7.5; steam heating, 8.6.

OPTIONAL TARIFF FOR UPSTATE NEW YORK CUSTOMERS.—Optional rates for domestic consumers, offering a sliding-scale reduction with a minimum monthly rate of $3.50, are announced by the New York Central Electric Corporation, serving Perry, Auburn, Geneva, Hornell and many other communities in western New York. Under the optional schedule clients pay 10 cents per kilowatt-hour for the first 25 kw.-hr. a month, 8 cents for the second 25 kw.-hr., 6 cents for the third, 4 cents for the fourth and 3 cents for the remainder. The regular rate is 11 cents per kilowatt-hour for the first 50 kw.-hr., with corresponding reductions for quantity consumption. The minimum monthly rate is $1. The optional schedule is designed to encourage average consumers to use electrical household devices.

INTERCONNECTION GOES ON APACE IN TEXAS.—The installation of the new generating unit in the power plant of the Comal Power Company, at New Braunfels, Tex., to bring its capacity to 60,000 kw., will take about fourteen months and cost $2,000,000. Completion of the new installation will give the San Antonio Public Service Company a combined total of 100,000 kw. at New Braunfels and San Antonio. The San Antonio Public Service Company is interconnected with the Central Power & Light Company south of New Braunfels and with the Texas Power & Light Company, serving communities north of New Braunfels, and it is now constructing a line from New Braunfels to Luling to meet the Texas Power & Light system on the east. The Texas Power & Light Company is understood to plan the immediate construction of another 132,000-kw. line from its Trinidad station to a proposed new substation at

Milano Junction and a 60,000-kw. line from Milano Junction to Cameron. This will give that company a double transmission circuit into Temple. A 60,000-kw. line will run from Luling to Taylor and connect with the Insull lines by way of Seguin.

**Oswego (N. Y.) Hydro Plant Starts Next Week.**—The hydro-electric plant at Oswego, N. Y., at Dam No. 6 on the Oswego River will be started on May 1. The plant has been constructed at a cost of approximately $1,000,000 by the Carlisle interests, which will operate it on a 25-year lease made a year ago, paying the city of Oswego in rent $50,000 a year. The plant will have a capacity of 7,500 hp., to be produced by three 2,500-hp. generators, with additional wheel pits for two more wheels, should the city at some future time obtain the right to develop the other one-half flow of the river, for which application has been made to the authorities at Albany.

**Salt Lake Has Successful Electrical Gathering.**—The seventh annual convention and "get-together" of the representatives of the various branches of the electrical industry in Salt Lake City and adjacent territory was held on March 28, at the Newhouse Hotel, under the auspices of the Electrical League of Utah, and proved the most successful yet held. R. M. Bleak, president of the league; B. E. Rowley, former president; R. R. Reid, president of the local contractors and dealers' association; W. M. Scott, superintendent of lines and service of the Utah Power & Light Company's Salt Lake division; City Attorney William H. Folland of Salt Lake City, who discussed city ordinances; L. B. Gowan, of the Lighting Service Bureau; Clyde L. Chamblin, president of the Association of Electragists International, and Adam S. Bennion of the Utah Power & Light Company were speakers. About three hundred guests attended the dinner, at which George R. Randall was toastmaster.

**Ireland Plans Distribution of Shannon Energy.**—In a report just issued by the Electricity Supply Board of the Irish Free State plans are outlined for the distribution of energy from the River Shannon, which will become available next year. A start will be made in Dublin, where the existing network will be used. The municipal undertaking will connect its transformer station with that which is being built by the Shannon board, and the work of switching over will present no difficulty. Cork and Limerick will be tackled almost immediately, while the board is negotiating for the acquisition of the authorized undertakings in Dundalk, Wexford and Clonmel. In the opinion of the board the interest of the country will be served best by the acquisition of all existing undertakings by the state. The board has mapped out an ambitious program for the electrification of 130 towns and villages in the Free State.

# Recent Court Decisions

**To Recover for Personal Injuries on Specific Allegation of Negligence There Must Be Proof.**—The Supreme Court of Iowa sustained a directed verdict for the defendant in Rauch vs. Des Moines Electric Company, a damage suit brought because the plaintiff, who had climbed upon one of the company's lighting poles to view a parade, was injured by the falling of a globe upon his head. He sued for compensation, claiming that the dislodgment of the globe was due to its being insecurely attached to its bracket; but the courts found the contention unproved and pointed out that a specific allegation of this nature does not come under the doctrine of *res ipsa loquitur* ("the thing speaks for itself.") (218 N. W. 340.)*

**Children Cannot Climb Company's Poles at the Company's Risk.**—If parents permit their children to climb a public utility company's poles, they do so at their own risk, according to a decision of the Superior Court at Los Angeles. The ruling was made in connection with a damage suit for $75,000 brought by Harry K. Brown against the Southern California Edison Company because of the death of Brown's son, a boy of twelve, who climbed one of the defendant's poles and was killed. The court ruled: "With the development of electrical power and high-tension transmission lines it would be a dangerous precedent to relieve parents of responsibility and hold electrical distributing companies responsible for lack of knowledge or carelessness of a child of twelve which leads him to climb a pole which he ought to know was not put there for that purpose. To hold the companies liable would mean that they would be punished for the negligence of others."

**Complaint of Interference with Stream by Upper Riparian Owner Must Allege Unreasonable Use of Water as Matter of Law.**—The New York Supreme Court, Special Term, has dismissed the complaint in Maylender vs. Fulton County Gas & Electric Company, in which the company, as the upper riparian owner on Peck Creek, was charged with an unjustifiable interference with stream flow. Failure to allege that the company's works were not built in conformity with the fall of land, or were not adapted to the character of the stream, or were improperly operated, or that diversion of waters caused stream to overflow on plaintiff's land, or that plaintiff had ever used the waters of the stream or ever intended to do so, led, the court said, to the assumption that the dam was properly constructed and therefore that the lower riparian owner had no cause of action. (227 N. Y. S. 209.)

**When Is Contributory Negligence a Matter of Law?**—Affirming a judgment for the plaintiff in Beman vs. Iowa Electric Company, a damage suit brought because of the death of plaintiff's husband from electric shock, the Supreme Court of Iowa said that the alleged contributory negligence was for the jury to pass on and that contributory negligence becomes a question of law, for the judge, only when it is so flagrant as to be evident to any reasonable person. In this case the man was one of a bridge crew working near a 13,200-volt transmission line belonging to the company. The company had been asked to move its line and had done so, but apparently not far enough, since, although fellow workmen gave evidence that they had tested the operation of the boom which the victim was guiding and found an 18-inch clearance between it and the electric wire, it was proved that death resulted as stated above. Proof that there had been no contact between the boom or cable of the derrick and the wire and testimony that electricity transmitted at 13,200 volts will not arc or jump over a gap from an unbroken continuous wire were not held by the court to substantiate the company's defense, the "thing speaking for itself." (218 N. W. 343.)

# Commission Rulings

**Commission Insists that 95 per Cent of Consumers in Small Community Shall Have Metered Service.**—Meters are the best gage for determining what an electric consumer should pay for the service he receives, the North Dakota Board of Railroad Commissioners has held in the case of a complaint by citizens of Litchville against J. M. Haarsager, the operator of the electric light plant at that place. The petitioners asked for increased hours of electric service and reduction in the rate. The commission learned that some of the consumers had meters which they owned themselves while others received service at a flat rate. The company was directed to take over all meters within the next year and to put other consumers on a metered basis within 90 days, so that not more than 5 per cent of the consumers would remain on a flat-rate basis.

**Condemns Delay in Applying for Certificate Until Competition Is Threatened.**—In granting a certificate of public convenience and necessity to the Pacific Gas & Electric Company to operate a gas-distributing system in Irvington and contiguous territory and denying the application of the Alameda County Gas Company for a similar certificate, the California Railroad Commission reaffirmed its disapproval of a public utility waiting until threatened competition develops before making application to serve new territory. "A utility owes a duty to that portion of the public which seeks to obtain service as well as to that portion of the public which is already being served," the commission said. "In the case before us there is no question that the Pacific Gas & Electric Company made its offer of service only to forestall competition and filed its application for a certificate of public convenience and necessity only when forced to do so. For that reason it cannot urge a superior right to serve a territory which it has heretofore shown no disposition to enter. Much as the commission might look with favor upon the efforts of a new utility to develop an unserved territory, we are compelled in this instance, on account of the great disparity in rates and certain elements of financial ability, to grant the application of the Pacific Gas & Electric Company."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *N. A. Carle Resigns*

Nathaniel A. Carle, vice-president in charge of operations of the Public Service Production Company, Newark, N. J., has resigned. He is planning to make a trip to Leland Stanford University in California, of which institution he is a trustee, returning East in three months. For a number of years Mr. Carle has been an outstanding figure in the electrical industry, not only as an executive of one of the largest electric utilities in the country but also as a leader in the work of the national engineering organizations. He became identified with the Newark properties in 1912 as chief engineer of the Public Service Electric Company, in this capacity reorganizing and enlarging the engineering staff with noteworthy results along both technical and economic lines. In 1922, when the Public Service Production Company was organized, be became vice-president and general manager and two years later he was named vice-president in charge of operations.

*N. A. Carle*

Mr. Carle was born in Portland, Ore., and was graduated from Leland Stanford University. His early engineering activities carried him to Alaska, Canada, New England, Colorado and New York. Mr. Carle has given unstintingly of his time and energy to association affairs, having been an indefatigable worker as chairman and member of numerous committees. He is past-chairman of the Technical National Section of the National Electric Light Association, a fellow and a past-vice-president of the American Institute of Electrical Engineers and is active in the American Society of Mechanical Engineers, the Association of Edison Electric Illuminating Companies, the Institute of Radio Engineers and the American Electric Railway Association.

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O. W. MATTISON, formerly manager of the Missouri Power & Light Company in the Mexico district, is now in charge of the Dakota properties of the United Public Service Company with headquarters in Bismarck, N. D. PAUL C. EKERN of Brookfield will succeed Mr. Mattison in Mexico and J. F. DUNCAN of Edina will succeed Mr. Ekern in Brookfield.

HUEY P. LONG, a member of the Public Service Commission of Louisiana, has been elected Governor of that state on the Democratic ticket. Mr. Long was elected a member of the Railroad Commission of Louisiana in 1918, serving on that body until the Louisiana Public Service Commission was created in 1921, when he became a member of that commission. Three years later he was elected to a six-year term.

BANCROFT GHERARDI, chief engineer of the American Telephone & Telegraph Company and president of the American Institute of Electrical Engineers, and Jacob F. Schoellkopf, chairman of the board of directors of the Buffalo, Niagara & Eastern Power Corporation, Buffalo, N. Y., have been nominated to fill two vacancies on the board of trustees of Cornell University. The vacancies will occur in June, when the terms of John L. Senior of Chicago and Judge Cuthbert W. Pound of Lockport, N. Y., will have expired.

ROBERT L. FITZGERALD, manager of the light and power department of the Indiana Service Corporation, Fort Wayne, Ind., since 1924, has resigned his position with that company, effective April 30. Mr. Fitzgerald plans to enter business with B. O. Fink and Jack Fulton in the Auburn Stoker Corporation, Auburn, Ind., manufacturing and marketing automatic smokeless coal burners for heating and industrial boilers. He was formerly associated with the Gary (Ind.) Heat, Light & Water Company, the engineering staff of the Wisconsin Railroad and Tax Commission and with R. M. Feustel, consulting engineer.

ELMER A. SPERRY, inventor and engineer, has been awarded the Holley medal by the American Society of Mechanical Engineers for his achievements in the invention of the gyroscope. Frequent recognition has been given Mr. Sperry for his engineering accomplishments in the form of honorary degrees, medals and membership in scientific societies. In the course of his distinguished career he has been the recipient of the John Scott legacy medal and premium, the John Fritz medal, the Franklin medal and the American Museum of Safety medal. Mr. Sperry was decorated by Czar Nicholas II. of Russia for navigational equipment and he received the Order of the Rising Sun from the Emperor of Japan in 1922. Presentation of the Holley medal will be made May 16 at a dinner which is to be held during the spring meeting of the American Society of Mechanical Engineers in Pittsburgh.

## *Theodore Beran Retires*

Theodore Beran, commercial vice-president of the General Electric Company in charge of the New York district, has asked to be relieved of the responsibilities of his office May 1, having voluntarily decided to retire from active business life. In commenting on Mr. Beran's retirement J. G. Barry, vice-president of the company, said: "During his long and valuable service, extending over a period of more than 39 years, he has devoted himself wholeheartedly to the company's interests in building up its business in the important territory of which he was the principal commercial executive."

Mr. Beran was born in Springfield, Mass., and was educated in the public schools of New York City, later receiving an A.B. degree from the College of the City of New York. He joined the Sprague Electric Railway & Motor Company in New York in 1889 and when that company consolidated with the Edison interests in 1890 he continued with the Edison General Electric Company and with the General Electric when it was formed in 1892 from the consolidation of the Edison and Thomson-Houston interests. In 1904 he removed to Rugby, England, where he organized the commercial department of the British Thomson-Houston Company. In the fall of 1903 he was made acting manager of the New York district for the General Electric Company, a year later being designated district manager. It was in 1926 that he was named commercial vice-president. Mr. Beran is an associate member of the American Institute of Electrical Engineers, vice-president of the Electrical Board of Trade and a past-president of the New York Electrical Society.

*Theodore Beran*

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L. J. EDMONSTON, representing the Missouri Power & Light Company at Plattsburg, Mo., has been appointed manager of the Edina office.

### *S. E. Wolff Removes to Oklahoma*

Samuel E. Wolff, consulting engineer, of New York, has disposed of his utility interests in the East to become president of the Oklahoma Power & Water Company, organized by the Colvin interests, with headquarters in Sand Springs. Mr. Wolff has had many years experience in public utility operation in the East and in the Middle West, particularly in Michigan, where he was born and where he was identified with the properties now new constituent units of the Consumers Power Company. After serving in various departments he resigned as general manager of the Jackson (Mich.) Gas Company to take a similar position in charge of the gas, electric and railway utilities in Saginaw and Bay City, Mich. In 1908 he joined the New York executive staff of Hodenpyl, Hardy & Company, managers of the Michigan properties, and continued in the discharge of various functions for them until the end of 1921, when he engaged in some industrial work for a group of New York bankers. Recently he has operated properties in the East and has done financial and consulting work with offices in New York City. Mr. Wolff is a past-president of the Michigan Gas Association, a member of the American Gas Association and of the National Electric Light Association, the insurance committee of which he organized several years ago.

*S. E. Wolff*

**Herman Hill**, for many years consulting electrical and mechanical engineer, is now identified with the Perfection Appliance Company, a subsidiary of the Splitdorf-Bethlehem Electrical Company. Mr. Hill is a practical inventor, his patents totaling more than one thousand.

**Frank J. Doyle**, chief engineer of the Northern States Power Company at St. Cloud, Minn., for 3½ years, has been transferred to Sioux Falls, S. D., to manage the plant there operated by the Northern States company. He was assistant chief at Sioux Falls for 6½ years before removing to St. Cloud. Succeeding Mr. Doyle at St. Cloud as chief engineer will be L. H. Lawrence of Sioux Falls.

**T. F. Bowdern** is now head of the public relations department of the Arkansas-Missouri Power Company, the East Missouri Power Company and the Missouri Public Service Company, all controlled by the Inland Power & Light Company.

### *Moloney and Mullen of St. Louis Resign*

T. O. Moloney and James J. Mullen have resigned as president and vice-president of the Moloney Electric Company, St. Louis, Mo., effective June 30, to devote more time to their personal affairs. During the 30 years in which they have been connected with the company it has grown to be one of the largest transformer manufacturers in the United States with unusually well-equipped factories, having recently completed a large plant in the industrial district of St. Louis. Mr. Moloney and Mr. Mullen will continue as members of the board of directors and in an advisory capacity. F. H. Barrington will be in active charge of the management of the company, assisted by W. M. Cory, both of whom are identified with the company at the present time.

Mr. Moloney's activity in the electrical industry dates back to 1890, when he became connected with the electrical department of the Laclede Gas Light Company of St. Louis. The existing type of transformer engaged his special attention and through these studies he quickly obtained the experience which enabled him to contribute substantially to the evolution of the modern, well-balanced transformer. From these beginnings resulted the Moloney Electric Company, organized in 1897 with Mr. Moloney as president.

### *H. D. Savage Heads Combustion Engineering*

H. D. Savage, for many years vice-president of the Combustion Engineering Corporation, New York, has been elected president to succeed Joseph V. Santry, resigned. Mr. Savage brings to his new office a long and varied experience in the manufacture and sale of power plant equipment. He has been identified with the development of pulverized fuel-burning equipment since its very inception and is recognized as an authority on this subject. When the Combustion Engineering Corporation purchased the Lopulco Pulverized Fuel Systems, in 1920, Mr. Savage became associated with this organization as the directing head of the pulverized fuel division. In addition to the presidency of the Combustion Engineering Corporation Mr. Savage holds executive positions in a number of the subsidiary companies of the corporation. He is a member of the American Society of Mechanical Engineers, American Society of Mining and Metallurgical Engineers and of the Franklin Institute.

*H. D. Savage*

## Obituary

**Howard F. Thurber**, formerly president of the New York Telephone Company, died at his home in New York April 21 of pneumonia. Mr. Thurber was made chief executive of the telephone company in 1919 after spending practically his entire business life in the service of Eastern telephone companies. He occupied the office of president for five years and subsequently became chairman of the board of directors. Mr. Thurber was a native of Brooklyn, N. Y., and received his technical training at the Brooklyn Polytechnic Institute and at Cornell University. He was a member of the A.I.E.E.

**Elias E. Ries**, engineer-inventor, died of pneumonia at his home in New York April 20 after an illness of one week. Mr. Ries was prominently identified with the very beginnings and with the development of electrified railroads and rapid transit in New York and other cities. He was also a pioneer in the electric light industry in New York, from 1880 to 1884, having been affiliated with S. Bergmann & Company, the Edison company, the U. S. Electric Illuminating Company and with the Fuller Manufacturing Company.

**Alexander D. Lunt**, manager of the patent department of the General Electric Company since 1922, died in Atlantic City, N. J., April 25. He had been ill since December. A native of Biddeford, Me., Mr. Lunt received his technical education at Worcester Polytechnic Institute and at Cornell University. Previous to joining the General Electric patent department in 1898 he was connected with the United States Patent Office at Washington.

# Financial and Statistical News

## *Common Stocks Rise Steadily Refunding Program Large*

THE investor who has had sufficient foresight to add a sprinkling of utility common stocks to his holdings during the past few months has been amply repaid, assuming, of course, a reasonable degree of diversification. It would be difficult to pick a group of power and light stocks in which a handsome appreciation has not taken place, even since the beginning of the current year. A representative group of fifteen leading stocks averages 142 at present, against 122 at the first of the year. The same group averaged 95 at the beginning of last year. Among the individual members of the group gains of as much as 45 points were made since the beginning of this year. The market continues exceedingly strong.

Refunding and retiring of high-priced issues continues on a large scale. More than $116,000,000 of power and light company bonds were called in April. A large number of these were 6s and 7s. According to predictions, bond redemptions for May will be unusually heavy in the power and light industry. Several large issues will be replaced with money costing anywhere from ½ per cent to 2 per cent less and annual charges will thus be materially reduced.

## America Financing Big British Electricity Trust

Will the supply of electricity for lighting and power purposes in southern England (excluding London) eventually come under the control of one great trust supported and financed by American capital? This question is becoming one of great interest in British electrical circles at the present time. As straws indicate the direction of the wind, so it is thought do the many facts available indicate the trend of events.

The keynote of the situation is declared to be the Greater London and Counties Trust, Ltd., which is said to have behind it practically unlimited American capital. Already this trust has a controlling interest in the East Anglian Electricity Company, the Oxford Electric Company and Edmundsons' Electricity Corporation, Ltd. It will also control the Bedfordshire, Cambridgeshire and Huntingdonshire Company, which is not yet operating, but owns bulk supply powers within the area embraced by its title, and the Wessex Electricity Company. This, again, is not yet operating, but holds bulk supply powers within the counties of Oxford, Buckinghamshire, Berkshire, Wiltshire and Gloucestershire. It is also promoting a bill in Parliament to increase its area by including, *inter alia*, Devon and Cornwall.

How much farther the operations of the trust will extend cannot be stated at present. All that is known is that during recent months there has been a persistent purchasing of the shares of bulk supply and distributing companies in southern England at prices which have little regard for present dividends.

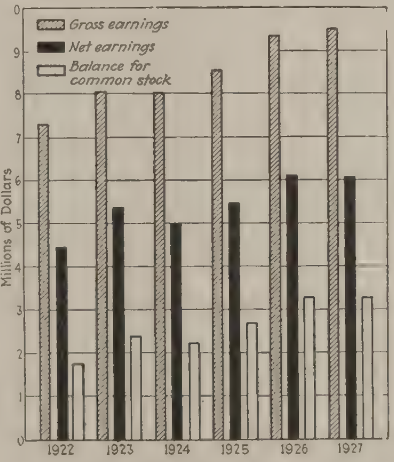
The latest development is the notification of the Sevenoaks Electricity Company of an offer to purchase its entire issued capital. No indication is given as to the identity of the potential purchaser, but shareholders have been advised not to part with their holdings. It is worth noting that the area in which the company operates is within the bulk supply area of one of the associated companies of the County of London Electric Supply Company.

## Virginia Electric Plans New Issues

To care for possible future financial requirements the directors of the Virginia Electric & Power Company have been authorized to issue, in their discretion, $8,000,000 in first and refunding mortgage gold bonds of the company, which will increase the aggregate to $20,000,000. This action was taken at the annual meeting of the stockholders. The directors also were authorized to petition the State Corporation Commission to permit amendment of the company's charter so as to provide for an increase of $5,000,000 in 6 per cent cumulative authorized preferred stock. Possibly $3,000,000 in 6 per cent preferred will be issued this year.

## Montana Power Gross Earnings Advance Slightly Over 1926

AS A result of curtailment of copper production last year the Montana Power Company, showed an increase of only 2 per cent in gross and an actual decline in net earnings as well as in surplus over charges. Completion of an electrolytic zinc plant by the Anaconda Copper Mining Company, however, is expected to add $750,000 to income yearly. Furthermore, important economies are expected to result from merger with the American Power & Light Company, on which plan the shareholders are asked to pass this week.



*Earnings of Montana Power Company covering six-year period*

| | 1926 | 1927 |
|---|---|---|
| Gross earnings | $9,339,189 | $9,518,728 |
| Operating expense | 3,208,551 | 3,437,638 |
| Net earnings | $6,130,638 | $6,081,090 |
| Interest | 1,826,610 | 2,168,387 |
| Surplus | $4,304,028 | $3,912,703 |
| Depreciation | 350,000 | 300,000 |
| Balance | $3,954,028 | $3,612,703 |
| Preferred dividend | 684,922 | 342,461 |
| For common | $3,269,106 | $3,270,242 |

The generating capacity of the Montana Power system now stands at 245,000 kw., 18,000 kw. having been added during the year. The year's output totaled 1,366,997,834 kw.-hr., which is approximately the same as the 1926 figure. The yearly load factor was 81.5 per cent and the company served 49,844 customers, an increase of 2,220.

Earning figures of the company for the past two years were as shown in the accompanying table.

## Utility Financing Active

During the week ended April 26 new offerings by the electric light and power companies of the country totaled approximately $58,000,000. One of the largest issues of that type brought out during the year was offered by Cities Service Company in the form of 5 per cent gold debentures, a piece of financing involving a total of $50,000,000. These securities were priced at 98 and interest to yield 5.13 per cent.

The Railway & Light Securities Company offered 4½ per cent collateral trust gold bonds to the amount of $3,000,000, the price being 94½ and interest, to yield about 4.90 per cent. These bonds, due May 1, 1953, are a direct obligation of the company, which was organized for the purpose of holding for income or sale the securities of public utility enterprises.

Six per cent cumulative preferred stock of the Iowa Power & Light Company was issued to the amount of $1,000,000 at $100 per share and accrued dividend.

The American European Securities

Company made two new offerings, one in the form of collateral trust 30-year sinking fund 5 per cent gold bonds, amounting to $2,000,000, and the other in the form of common stock of no par value, totaling 30,000 shares. The company was organized in 1925, under the laws of the State of Delaware, to take over the assets and business of the Investment Company for Electrical Enterprises in the United States, a Swiss corporation established in 1910.

Worthington Pump Elects New Directors.—E. T. Fishick and W. C. Stettenius have been elected members of the board of directors of the Worthington Pump & Machinery Corporation.

National Power & Light Increases Common Dividend. — The National Power & Light Company declared a quarterly dividend of 25 cents on the common, placing the stock on a dollar annual basis, against 80 cents previously. Initial quarterly dividend of $1.50 was also declared on the $6 preferred. The common dividend is payable June 1 to stock of record May 15 and the preferred May 1 to stock of record April 24.

## General Electric Sales Billed Down Slightly for Quarter

Sales billed by the General Electric Company for the first quarter of 1928 were $71,640,790, against $72,474,474 for the first quarter of 1927. Profit available for dividends on common, however, was $11,261,842, against $11,028,143. The comparative statement for the first quarter of the two years is given in the following table:

| | 1928 | 1927 |
|---|---|---|
| Net sales billed.......... | $71,640,790 | $72,474,474 |
| Less costs............... | 63,404,807 | 63,641,300 |
| Net income from sales.... | $8,235,982 | $8,833,173 |
| Other income, less interest paid and sundry charges | 3,669,504 | 2,838,557 |
| Profit available for dividends ............... | $11,905,487 | $11,671,731 |
| Less: Cash dividends on special stock.......... | 643,644 | 643,587 |
| Profit available for dividends on common stock | $11,261,842 | $11,028,143 |

## Utility Bonds Called in April Total $116,846,830

Among the electric light and power securities called for payment in April in advance of maturity are the following:

| Issue | Due | Amount |
|---|---|---|
| Public Service Elec. & Gas, 5½s... | 1959 | $25,379,000 |
| National Public Service, 6½s..... | 1955 | 15,635,000 |
| Continental Gas & Electric, 6½s.. | 1964 | 11,700,000 |
| Cincinnati Gas & Electric, 5s.... | 1956 | 8,224,000 |
| Cincinnati Gas & Electric, 5½s... | 1961 | 5,810,000 |
| Birmingham Electric, 6s......... | 1954 | 8,000,000 |
| Pennsylvania Edison, 5s......... | 1946 | 6,355,600 |
| Shawinigan Water & Power, 5s... | 1955 | 5,957,000 |
| Shawinigan Water & Power, 5½s.. | 1954 | 1,500,000 |
| Pennsylvania C. L. & P. 5½s.... | 1975 | 5,500,000 |
| Pennsylvania C. L. & P. 5s..... | 1950 | 2,191,000 |
| Utah Power & Light, 6s......... | 1944 | 5,500,000 |
| Indiana Service, 6s............ | 2020 | 4,795,530 |
| York Haven Water & Power, 5s.. | 1957 | 2,390,000 |
| Metropolitan Edison, 5s........ | 1939 | 2,348,000 |
| Memphis Power & Light, 6s..... | 1948 | 2,000,000 |
| Electrical Securities, 5s......... | 1955 | 1,000,000 |
| United Electric Securities, 5s.... | 1956 | 1,000,000 |
| Central Illinois Utilities, 6s...... | 1932 | 766,000 |
| Kingsport Utilities, Inc., 6s...... | 1937 | 456,000 |
| Kingsport Utilities, Inc., 7s...... | 1937 | 150,000 |
| Erie County Electric, 5½s*...... | 1960 | 137,000 |
| Potomac Electric Power, 6s*.... | 1953 | 52,700 |

* Not entire issues.

German Utility to Redeem Bonds. —The Westphalia United Electric Power Corporation will redeem at par and

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 24 | Low 1928 | High 1928 |
|---|---|---|---|
| **ABITIBI PWR. & PAPER, com., new — no par** ................ | 78 | 72 | 81 |
| Ala. Pwr., $7 cum. pf.—no par. | 115 | 114 | 116 |
| Allis Chalmers Mfg.,6% com.,ex.div. | 121½ | 115⅛ | 127⅝ |
| Aluminum Co. of Amer., com....... | 145 | 120 | 150⅛ |
| Aluminum Co. of Amer., 6% pf..... | 109½ | 105½ | 109⅜ |
| **Amer & Foreign Pwr., 7% pf.—no par** | 109 | 105¼ | 109½ |
| Amer. & Foreign Pwr., com.—no par | 30 | 22⅜ | 32 |
| Amer. Bosch Magneto, com.—no par | 24⅝ | 15⅞ | 28¾ |
| Amer. Brown Boveri Elec.†........ | 13¼ | 10⅞ | 18 |
| Amer. Brown Boveri Elec., pf. $7.... | 50 | 46½ | 63 |
| Amer. Gas & Elec., 6% pf.—no par.. | 109⅝ | 106¾ | 109⅝ |
| Amer. Gas & Elec., com. †—no par.. | 144⅞ | 117½ | 154 |
| Amer. Lt. & Trac., 6% pf.......... | 118 | 116 | 120 |
| Amer. Lt. & Trac., new com........ | 211 | 170 | 220 |
| Amer. Pwr. & Lt., 6% pf........... | 107⅞ | 104 | 109⅞ |
| Amer. Pwr. & Lt., com. †—no par... | 81 | 62½ | 85¾ |
| Amer. Pub. Serv., 7% pf........... | 99 | 99 | 100 |
| Amer. Pub. Serv., com. †.......... | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf..... | a 97 | 87½ | 96⅞ |
| Amer. Pub. Utilities, 7% pr. pf..... | a101 | 95¾ | 101½ |
| Amer. Pub. Utilities, com.......... | k 60 | 60 | 65 |
| Amer. States Sec., A.............. | a 11½ | 4 | 12¼ |
| Amer. States Sec., B .............. | a 15¼ | 4⅞ | 16½ |
| Amer. Superpwr., 6% 1st pf........ | l 103 | .... | .... |
| Amer.Super pwr., Class A†—no par.. | 50½ | 37 | 51¾ |
| Amer Super pwr., Class B†—no par.. | 53⅛ | 37¾ | 53⅞ |
| Amer. Wtr. Wks. & Elec., 6% pf.... | 105¼ | 101⅛ | 106 |
| Amer. W.W. & E., com. new—no par | 60½ | 52¼ | 64⅞ |
| Anaconda Copper cap. $3.......... | 67⅛ | 53¾ | 72⅞ |
| Appalachian Electric Pwr., 7% pf... | 108 | 108½ | 110 |
| Arkansas Pwr., & Lt. 7% pf........ | 107⅛ | 108 | 109¼ |
| Assoc. Gas & Elec., $3.50—50....... | 54⅛ | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 96 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 48⅜ | 47 | 51½ |
| **BABCOCK & WILCOX, 7% com..** | 118 | 117½ | 124¾ |
| Binghamton L., H. & P., $6 pf...... | 108 | 102 | 108½ |
| Birmingham Elec., pf.—$6—no par. | 106 | 104 | 105½ |
| Blackstone Valley G. & E., 6% pf... | k106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50.................... | k165 | 135 | 170 |
| Blaw-Knox, com.†................ | i101 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com.. | f234 | .... | .... |
| **Brazilian Trac., Lt. & Pwr.,com.,new** | f 58⅛ | .... | .... |
| Broad River Pwr., 7% pf.......... | 105 | 105 | 108 |
| Brooklyn Edison, 8% com.......... | 249⅛ | 206⅞ | 268½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf. 25 .................... | i 26¼ | .... | .. |
| Buffalo, Niagara & East. Pwr. com. $1 20—no par.................. | i 41½ | .... | .... |
| **CALIFORNIA ELEC. GENERATING, 6% pf**................. | 99⅛ | 98 | 101 |
| California Ry. & Pwr., 7% pf...... | 135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l111 | 109 | 110½ |
| Central & S. W. Util., $7 pf.—no par | a104⅛ | 99⅞ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par.................... | a110 | 103¼ | 110 |
| Central Ark. Ry. & Lt., 7% pf...... | 105½ | 105 | 107 |
| Central Ill. Pub. Serv., $6 pf........ | a 99⅞ | 97⅞ | 100⅛ |
| Central Ind. Pwr., 7% pf........... | a100 | 95 | 100 |
| Central Maine Power, 6% pf....... | 98 | 96 | 98 |
| Central Maine Power, 7%.......... | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf......... | 109 | 104½ | 105½ |
| Central States Elec., 7% pf........ | 117¼ | 104¼ | 119¾ |
| Century Elec., 6% com............ | m135 | 135 | 145 |
| Cincinnati Gas & Elec., 5% com.... | g 99¾ | 97½ | 100¼ |
| Cities Service, $6 pf.—no par........ | l 102⅞ | 94½ | 100 |
| Cities Service, pf. B—no par........ | l 9½ | 8⅞ | 9½ |
| Cities Service, pf. BB—no par....... | l 95 | 88½ | 95 |
| Cities Service com.—20............ | l 59¼ | 54 | 59⅞ |
| Cities Service, Bks. Shrs.—10....... | l29¼ | 26⅞ | 29⅞ |
| Cities Service Pwr. & Lt., 7% pf.... | 109 | 105¼ | 109 |
| Cities Service Pwr. & Lt., 6% pf.... | 100½ | 95⅜ | 101⅜ |
| Cleveland Elec. Illg., 6% pf........ | 113 | 113 | 115⅜ |
| Cleveland Elec. Illg., 10% com...... | 410 | 350 | 410 |
| Columbia Gas & Elec., 6% pf....... | 108½ | 107⅛ | 110⅛ |
| Columbia G. & E. com. $5—no par.. | 101¾ | 89½ | 106½ |
| Columbus Elec. & Pwr., $2 com.—no par.......................... | k 77¾ | 66 | 79 |
| Columbus Elec. & Pwr., 7%......... | 112 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7%..... | 110 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7%pf. B | 110 | .... | .... |
| Columbus Ry., P.& Lt. com.—no par | 120 | .... | .... |
| Commonwealth Edison, 8% com.... | a182 | 165 | 189 |
| Commonwealth Pwr., 6% pf....... | 103¼ | 102⅛ | 104⅞ |
| Commonw'th Pwr., $2, com.—no par | 79⅞ | 62¼ | 86⅜ |
| Conn. Lt. & Pwr., 8% pf........... | 121 | 120 | 125 |
| Conn. Lt. & Pwr., 7% pf........... | 117 | 118 | 121 |
| Cons. Gas of N. Y., pf............. | 104 | 101⅛ | 105 |
| Cons. Gas of N. Y., com. $5—no par. | 150 | 119⅞ | 156¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.......................... | e111½ | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf........................ | m111¼ | 110⅛ | 114¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf.......................... | e104⅞ | 100½ | 105½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par.............. | e 81⅛ | 67¼ | 82 |
| Consolidated Pwr. & Lt., 7% pf.... | 105 | ... | .... |
| Consumers Pwr., 6% pf............ | 104¼ | 105½ | 106½ |
| Consumers Pwr., 6.6% pf.......... | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf.. | 108 | 106½ | 108½ |
| Conti. G. & E. com. $4.40—no par.. | k230 | 240 | 265 |
| Crocker Wheeler, com.†........... | 40 | 23 | 46 |
| Crocker Wheeler, 7% pf........... | 90 | 77 | 95 |
| **DALLAS PWR. & LT., 7% pf.....** | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf......... | 108½ | 108½ | 109½ |
| Derby Gas & Elec., 7% pf.......... | 102 | 96 | 100½ |
| Detroit Edison, 8% com........... | 188 | 166½ | 194¾ |
| Dubilier Condenser, com.—no par... | 4⅛ | 2¼ | 5⅜ |
| Duke Pwr., cap.................... | k143 | 130 | 145 |
| **EASTERN NEW YORK UTIL., $7 pf**............................ | k110½ | 111 | 112½ |
| Eastern States Pwr. B............. | k 21 | 12 | 22 |
| Eastern States Pwr., pf........... | k 99 | 98 | 100½ |
| East. Tex. Elec., 7% pf........... | 107⅛ | 106 | 109 |
| Edison Elec of Boston, $12 com...... | d276 | 252 | 284½ |
| El Paso Elec. 7% pf............... | 110 | 110 | 112½ |
| Elec. Bond & Share, 6% pf......... | l110¼ | 108⅞ | 111⅜ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l119 | 76 | 127½ |
| Electric Household Util.†......... | a 21¾ | 13¼ | 24 |
| Elec. Investors, 6% pf.—no par..... | 104 | 101 | 103½ |
| Elec. Investors, com.†—no par...... | 58 | 40⅛ | 60½ |
| Elec. Pwr. & Lt., ctfs. pf........... | 109½ | 106½ | 110⅛ |
| Elec. Pwr. & Lt., ctfs., 40% pd..... | 127 | 120⅜ | 129⅜ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 41⅞ | 28¾ | 44½ |
| Elec. Ry. Securities, com.—no par... | 7 | ... | ... |
| Elec. St. Battery com. $5.25—no par | 79⅞ | 69 | 83⅜ |
| Elmira Wtr., Lt. & R.R., 7% pf.... | 106½ | 104 | 107 |
| Empire Pwr., ptc.†................ | 34½ | 27⅛ | 35⅞ |
| **Engr. Pub. Serv. $7, pf.—no par...** | 110⅝ | 107 | 110¼ |
| Engr. Pub. Serv., com.—no par .... | 40 | 33 | 42½ |
| Eureka Vacuum Cleaner, com. $4—no par........................... | 75 | 69 | 79 |
| **FAIRBANKS MORSE, 7% pf....** | k109½ | 104 | 110 |
| F.-M., com.—$3—no par........... | 51⅛ | 32½ | 54 |
| Federal Lt. & Trac.,com $1.40....... | 53¾ | 42 | 56⅛ |
| Federal Lt. & Trac., $6 pf.—no par.. | k108⅛ | 98 | 109 |
| Florida Pwr. & Lt., 7% pf......... | k108 | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf....... | i114 | 113 | 114½ |
| **GALVESTON-HOUSTON ELEC. 6% pf**.......................... | 82 | 75 | 85 |
| Galveston-Houston Elec., com...... | 34 | 31⅝ | 38 |
| General Cable, Cl.A.............. | 73⅞ | 56 | 84¼ |
| Gen. Elec. $3 com.—no par......... | 164 | 124 | 174½ |
| Gen. Elec., special—6%........... | 11⅛ | 11¼ | 11⅜ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par.................... | 41 | 35¼ | 44¼ |
| Gen. G. & E. (Del.) pf. A $8—no par | k142 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par | 124 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 ..... | 115 | 104 | 117 |
| Gen. Pub. Serv., $7 cum. pf., no par. | 117 | 110 | 120 |
| Gen. Pub. Serv., com., no par....... | 21⅞ | 16⅞ | 22¾ |
| General Public Utilities, $7 pf. .... | k 58 | 55 | 65 |
| Ga. Lt., Pwr. & Rys., com.......... | k 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf........... | h105 | .... | .... |
| **IDAHO PWR., 7% pf**............. | 110½ | 109 | 110½ |
| Ill. No. Utilities, 6% pf............ | a100 | ... | ... |
| Ill. Pwr. & Lt., 7% pf.............. | 105⅛ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf..... | k105½ | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf....... | k103 | 100 | 105 |
| Ingersoll Rand com. .............. | 98 | 90 | 98 |
| Int. Combus. Engr., com. $2—no par | 50 | 45½ | 55⅛ |
| Int. Combustion Engr.,7% pf....... | 104 | 103 | 106½ |
| Int. Util., Class A—$3.50—no par.. | 49 | 44¼ | 51 |
| Int. Utilities, Class B—no par...... | 11½ | 6⅛ | 11⅛ |
| Interstate Pwr., pf.—$7—no par.... | 103 | 99 | 103½ |
| Interstate Pub. Serv., 7% pf....... | 104 | 103 | 106⅛ |
| Iowa Ry. & Lt., 7% pf............. | 101 | 102 | 103 |
| **JERSEY CENTRAL PWR. & LT. CO., 7% pf**...................... | 107½ | 105 | 107 |
| Johns-Manville, com.†—no par. | 124⅞ | 111½ | 133½ |
| Johns-Manville, 7% pf............ | m122½ | 119½ | 121½ |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 21. lBid price Wednesday, April 25. mLatest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday April 24 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS GAS & ELEC. 7% pf. | *l*110 | 107 | 110 |
| Kelvinator Corp | 21⅜ | 11¼ | 22¼ |
| Kentucky Hydro-Elec., 7% pf. | *m*104½ | 102 | 104½ |
| Kentucky Sec., 6% pf. | 92 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 104½ | 100 | 105 |
| LACLEDE GAS LT., 10% com. | *k*200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par. | 29 | 19⅜ | 32¾ |
| Long Island Ltg., 7% pf. | *k*110½ | 110½ | 112 |
| Long Island Ltg., 6% pf. | *k*108½ | 107 | 109 |
| Long Island Ltg., com.†—no par. | *k*177 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | *k*111½ | 105 | 112 |
| Louisville Gas & Elec., cl. A. $1.75. | 36 | 28 | 36 |
| MAN. ELEC. SUPPLY, cap. $5—no par. | 53 | 50 | 61 |
| Maytag Co., com. 50—no par. | 38¼ | 30 | 39⅜ |
| Memphis P. & L., pf.—$7—no par. | 111 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par. | 109 | 103 | 109½ |
| Metropolitan Ed., pf.—$7—no par. | 109½ | 109 | 111 |
| Metropolitan Ed., com. $5—no par. | *k*160 | 125 | 155 |
| Middle West Utilities, 6% pf. | *a* 99 | 93½ | 100 |
| Middle West Util., 6% pr. lien. | *a*107 | 99 | 107 |
| Middle West Util., com. $6—no par | *a*141½ | 123½ | 143 |
| Midland Utilities, pr. ln. 6% pf. | *a* 95½ | 94½ | 97 |
| Midland Utilities, 6% pf. A | *a* 90¾ | 89⅛ | 92½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 105 | 98 | 107 |
| Minn. Pwr. & Lt., 7% pf. | *l*108½ | 107 | 109 |
| Miss. River Pwr., 6% pf. | *k*108 | 94 | 109½ |
| Miss. River Pwr., 3% com. | 110 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par. | *k*106 | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | *k*104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 39 | 29½ | 40 |
| Montana Pwr., 5% com. | 165 | 102½ | 169½ |
| Montreal Pwr., 7½% com. | *f* 97½ | .... | .... |
| Mountain States Pwr., 7% pf. | *k*104 | 97 | 105 |
| Mountain States Pwr., com.† | 17½ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110 | 98 | 110½ |
| National Carbon, 8% pf. | *a*138½ | 138 | 139¾ |
| National Elec. Pwr., A† | *a* 31½ | 27½ | 32¾ |
| National Lt., Ht. & Pwr., com. | *k* 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$7—no par | 109 | .... | .... |
| National Pwr. & Lt., com.†—no par. | 31 | 21⅜ | 33 |
| National Pub. Serv., 7% pf. | 102 | 99 | 103 |
| National Pub. Serv., 7% ptc., pf. | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par. | 25⅜ | 22 | 27½ |
| National Pub. Serv., B com.—no par | *k* 28½ | 24⅜ | 30 |
| Nebraska Pwr., 7% pf. | *l*111 | 110 | 111½ |
| Nevada-Calif. Elec., com. | 35½ | 33⅜ | 42 |
| New Brunswick Pwr., 4% pf. | 62 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7. | 105 | 105 | 109½ |
| New Eng. Pub. Serv., pf. $7 | 107 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf | 105 | 101 | 105½ |
| New York Power & Light 7% pf. | 115½ | .... | .... |
| Niagara Falls Pwr., 7% pf.—25. | *k* 27¾ | 27½ | 28¾ |
| No. Amer., 6% pf.—50. | 55 | 53¾ | 55 |
| No. Amer., com.—10. | 67¾ | 58⅜ | 68⅜ |
| No. Amer. Edison, $6 pf.—no par. | 104 | 102½ | 105⅜ |
| Northeastern Pwr., com. | 27½ | 19¾ | 30 |
| No. N. Y. Utilities, 7% pf. | 109 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 26⅜ | 18 | 28 |
| Northern Ohio Pwr. & Lt., 6% pf. | 99 | 90 | 99 |
| No. Ont. Lt. & Pr. 6% pf. | *k*100 | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | *k* 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 109 | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 146½ | 123 | 149 |
| No. Texas Elec., 6% pf. | 54½ | 45 | 70 |
| No. Texas Elec., com. | 17 | .... | .... |
| OHIO BRASS, com. B $4—no par. | *k* 96 | 90 | 107 |
| Ohio Brass, 6% pf. | *k*105 | 106 | 111 |
| Ohio Pwr., 6% pf. | 108½ | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | 105 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 113 | 107 | 112 |
| Ohio River Edison, 7% pf. | 109 | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 114½ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 29⅛ | 26¾ | 29¾ |
| Pacific Gas & Elec., 8% new com. | 48 | 43½ | 49⅞ |
| Pacific Pwr. & Lt., 7% pf. | *l*110 | 106 | 110 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par. | *c* 81¼ | 79⅞ | 82 |
| Penn-Ohio Edison, 6% pf. no par. | 98⅝ | 93⅜ | 99 |
| Penn-Ohio Edison, 7% pf | 108 | 97½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 110 | .... | .... |
| Penn Pwr. & Lt.—$7—no par. | *l*110 | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | *e* 78 | 68 | 78 |
| Phila. Co., 5% pf.—50. | 46 | 45½ | 48⅜ |
| Phila. Co., 6% pf.—50. | *k* 56⅛ | 52 | 57 |
| Phila. Co., com.—50. | *k*165½ | 145 | 166 |
| Phila. Elec., 8% com.—25. | *n* 66⅛ | 55½ | 66⅛ |
| Portland Elec. Pwr., 7% pf. | 103 | 100 | 104½ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 85 | 55 | 88 |
| Portland Elec. Pwr., com. | 45 | 42½ | 52 |
| Potomac Elec. Power, 6% pf. | *j*112¾ | .... | .... |
| Pwr. Sec., pf.—no par. | 65 | 50 | 68 |
| Pwr. Sec., com.—no par | 12 | 11 | 13⅜ |
| Public Serv. of Colorado, 7% pf. | 105 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 111 | 103⅜ | 111 |
| Pub. Serv. of N. J., 7% pf. | 125 | 118 | 125½ |
| Pub. Serv. of N. J., $2 com.—no par | 54¼ | 41½ | 56 |
| Pub. Serv. of No. Ill., 6% pf. | *a*111 | .... | .... |
| P. S. of No. Ill., com. $8—no par. | *a*173 | 159½ | 180 |
| Pub. Serv. of No. Ill., $8 com. | *a*174 | 159⅜ | 180 |
| Pub. Serv. of Okla., 7% pr. ln. | 106½ | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | *k*110½ | 108 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | *k*109½ | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par. | 105 | 92 | 105¾ |
| Puget Sound Pwr. & Lt., com. | *k* 81⅛ | 34⅜ | 84⅜ |
| RADIO CORP. OF AMER., $3.50 pf.—50. | 56½ | 54½ | 57¼ |
| Radio Corp. of Amer., com.—no par. | 179 | 85½ | 196½ |
| Rochester Gas & Elec. 6% pf. D | 105½ | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B. | 107 | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C. | 105¾ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf | 110 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | *k* 75 | 70 | 75 |
| Servel, Inc. | 10 | 4¼ | 10½ |
| Sierra Pacific Elec., 2% com. | 35⅜ | 29 | 38¾ |
| Sioux City Gas & Elec., 7% pf. | 107½ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | *l* 109 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | *l* 89½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par. | 51⅜ | 40⅞ | 53⅜ |
| So. Calif. Edison, 8% pf. | *k* 47 | 38½ | 41 |
| So. Calif. Edison, 7% pf. | 29 | 27½ | 29 |
| So. Calif. Edison, 6% pf. | 27⅛ | 25¾ | 27⅛ |
| So. Calif. Edison, 8% com. | 46 | 43½ | 48⅛ |
| Southern Cities Utilities, 7% pf. | 83 | 75 | 87 |
| Southwestern Lt. & Pwr., A $3. | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B. | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 95 | 88 | 96½ |
| Southwestern Pwr. & Lt., 7% pf | *k*113½ | 103 | 115 |
| Standard Gas & Elec., 8% pf. | 70 | 65 | 71 |
| Standard Gas & Elec., 7% pr. pf. | 114 | 108 | 115 |
| Standard G. & E., com. $3.50. | 67 | 57⅛ | 70 |
| Standard Power & Light, com. | 43⅛ | 29⅜ | 45 |
| Standard Pwr. & Lt., 7% pf. | *k*105½ | 98 | 106 |
| Staten Island Edison, pf.—$6—no par. | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par. | 160 | .... | .... |
| Syracuse Lighting, 7% pf. | 110 | 103 | 111 |
| Syracuse Lighting, 8% pf. | *k*117½ | 114 | 119 |
| TAMPA ELEC., com. $2. | *m* 68⅜ | 62 | 69½ |
| Tenn. Elec. Pwr., 6% pf. | 103½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109 | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf | *k* 10 | .... | .... |
| Terre Haute, Ind. & East. Trac., com. | *k* 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | *l*113 | 113½ | 115 |
| Tide Water Pwr., 8% pf. | 112 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par. | 127 | 112⅜ | 134 |
| Toledo Edison, 7% pf. | 109½ | 108 | 111 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | *k*145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | *k* 88 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 96 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50. | *c*130¾ | 111½ | 135¾ |
| United Lt. & Pwr., pf.—$4—no par. | *k* 55 | 49 | 56½ |
| United Lt. & Pwr., pf.—$6.50—no par. | *a*102½ | 95 | 102½ |
| United L. & P., com. A .48—no par. | *a* 24 | 14 | 25¾ |
| United L. & P., com. B .48—no par. | *k* 29½ | 20 | 29½ |
| Utah Pwr. & Lt., 7% pf. | *l*112½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105½ | 105 | 106 |
| Utica Gas & Elec., 8% com. | *k*200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101 | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2. | 32⅜ | 28½ | 34½ |
| Utilities Pwr. & Lt., com. B $1—no par. | 28 | 18½ | 30½ |
| VERMONT HYDRO-ELEC., 7% pf. | 100 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf | *k*110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102½ | 97 | 103½ |
| WAGNER ELEC., 7% pf. | *b*102 | 96½ | 102 |
| Wagner Elec., com.—no par. | *b* 71 | 37 | 60 |
| Washington Ry. & Elec., 5% com. | *j*485 | .... | .... |
| Washington Ry. & Elec., 7% pf. | *j*102½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | 227 | 175 | 235 |
| West Penn Elec., 7% pf. | 114½ | 109½ | 115 |
| West Penn Elec., Cl. A $7. | 110½ | 106½ | 115 |
| West Penn Pwr., 7% pf. | 115½ | 114⅜ | 117 |
| West Penn Pwr., 6% pf. | 109 | 108¾ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf. | 104 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | *k*102 | 100 | 106 |
| Western States Gas & Elec., com. | *m* 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50. | 101 | 88⅜ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par. | *i* 33 | 30⅜ | 34 |
| Weston Elec. Instrument, com.—no par. | 18⅜ | 12⅜ | 18⅜ |
| Wheeling Elec., 6% pf | 106 | 95 | 109 |
| Worthington Pump, 7% pf. A. | *k* 57 | 46½ | 57 |
| Worthington Pump, 6% B. | 45 | 41 | 49½ |
| Worthington Pump, com. | 31½ | 28 | 34½ |
| YALE & TOWNE com. $5—25. | 80 | 68½ | 80 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 21. *l*Bid price Wednesday, April 25. *m*Latest quotations available. †Dividend rate variable.

accrued interest on June 1, 1928, all its first mortgage sinking fund gold bonds, 6½ per cent series, due 1950, issued and outstanding.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of 5 per cent cumulative first preferred stock of the Duquesne Light Company to the amount of $20,000,000 and additional shares of common stock of the Engineers Public Service Company—no par value— numbering 100,000. There has also been authorized the listing of not exceeding $64,530 common stock of the Federal Light & Traction Company on official notice of issuance as a stock dividend, making the total amount applied for $6,517,965 common stock. The listing has also been authorized of 115,403 additional shares of common stock without par value of the North American Company, on official notice of issuance as a stock dividend, making the total number of shares applied for to date 4,742,861 shares. The New York Stock Exchange has authorized the listing of 14,000 additional shares of class A stock of the Utilities Power and Light Corporation without par value, on official notice of issuance and payment in full, making the total amount applied for 584,000 shares of class A stock.

ILLINOIS STOCKHOLDERS AUTHORIZE NEW PREFERRED ISSUE.—At a special meeting held April 23 stockholders of the Illinois Power & Light Corporation approved the new set-up outlined in the March 24 issue of the ELECTRICAL WORLD. The plan calls for the issuance of 600,000 shares of no-par value preferred stock, proceeds from the sale of which will be used to refund the 7 per cent cumulative preferred stock now outstanding. The new stock will be callable at 110.

CALIFORNIA UTILITY INCREASES CAPITAL STOCK.—The San Diego Consolidated Gas & Electric Company, San Diego, Cal., has recently increased its capital stock from $20,000,000 to $30,000,000.

NEW YORK STATE ELECTRIC INCREASES SHARES.—The New York State Electric Corporation has filed a certificate in the office of the Secretary of State increasing the number of shares from 100,000 (no par value) to 150,000 shares (no par value).

## Cities Service Adds 50,000 New Stockholders

More than 50,000 new names have been added to the security holders' list of the Cities Service Company during the past year, according to a recent announcement made by the company. The list now totals 350,000.

## Electric Bond & Share to Issue Stock

The board of directors of the Electric Bond & Share Securities Corporation has voted to offer pro rata to the common stockholders of that corporation of record April 30 the privilege of subscribing at $80 per share for one share of its common stock for each three shares of common stock held by them, respectively. This will call for the issuance of 600,957 shares of its authorized common stock.

## Twenty per Cent in Utilities

The Metropolitan Life Insurance Company, one of the nation's largest investors, has 20 per cent of its entire bond holdings in public utility bonds. Out of a total of $990,996,000 invested in bonds, both domestic and foreign, $200,004,300 are the bonds of public utilities and almost $60,000,000 of this was added during 1927.

**MOHAWK-HUDSON CORPORATION INCREASES PREFERRED STOCK.**—At the annual meeting of the stockholders of the Mohawk-Hudson Power Corporation it was voted to increase the authorized shares of preferred stock to 500,000 from 400,000 and the authorized shares of second preferred stock from 250,000 to 500,000. One new director was elected, Frederick J. Fuller, vice-president of the Central Union Trust Company, to succeed the lates James C. Brady. Other directors were re-elected.

**ANNUAL REPORT OF G. E. EMPLOYEES' SECURITIES CORPORATION.** — The fifth annual report of the G. E. Employees' Securities Corporation shows a total of 27,147 bondholders, an increase of 1,660 over a year ago, with an average holding of approximately $1,000. In addition there are 5,000 employees of the General Electric Company who are paying for bonds on installment subscriptions. The total amount paid bondholders as interest during 1927 amounted to $1,647,500. This brings the total of all payments to bondholders, including the extra 2 per cent paid by the General Electric Company since organization of the corporation, to $6,227,975. Total assets of the corporation amount to approximately $45,000,000, more than $9,000,000 in excess of 1926. Net income from operations amounted to $1,046,845, an increase of $315,465 compared with 1926.

## Company Reports

| Name of Company | Gross Earnings Twelve Months Ended March 31 1928 | 1927 |
|---|---|---|
| Bangor Hydro Electric... | $1,884,474 | $1,774,715 |
| Central Illinois Light..... | 4,491,111 | 4,261,654 |
| Cities Service............ | 32,941,878 | 28,106,804 |
| Commonwealth Power... | 54,507,811 | 50,205,325 |
| Consumers Power........ | 27,578,019 | 24,732,676 |
| Detroit Edison.......... | *13,895,895 | *12,775,321 |
| Illinois Northern Util..... | 3,360,049 | 3,140,684 |
| Illinois Power........... | 2,662,594 | 2,594,906 |
| Kansas City Pwr. & Lt.... | 13,014,063 | 11,086,228 |
| New York Power & Light | 19,286,360 | 18,019,479 |
| Ohio Edison............. | 1,967,630 | 1,844,638 |
| Portland Electric Power.. | 12,224,228 | 11,943,438 |
| So. Indiana Gas & Elec.... | 3,066,103 | 2,937,885 |
| Tennessee Electric Power | 12,760,388 | 11,998,918 |

# More than 80,000,000,000 Kw.-Hr. Generated in 1927

AN OUTPUT of 80,205,474,000 kw.-hr. was produced by public utility power plants in the United States in 1927, according to a recent compilation of the United States Geological Survey. Of this total the output from water power amounted to 29,875,008,000 kw.-hr., or 37.2 per cent, the balance, 50,330,466,000 kw.-hr., being produced from fuel. The fuel consumption consisted of 41,888,000 tons of coal, 6,782,000 bbl. of fuel oil and 62,919,000,000 cu.ft. of natural gas. This is equivalent to 45,910,000 net tons of coal, from which there was generated 49,995,000,000 kw.-hr. at an average fuel consumption of 1.84 lb. of coal per kilowatt-hour; for the small remainder wood fuel was used, more than two-thirds of it in Oregon.

In 1919 the average consumption of coal was 3.2 lb. per kilowatt-hour, in 1926 it was 1.95. The improvement in efficiency has been steady throughout this entire period.

The leading division in the use of water power is the Pacific, where it constituted 90.1 per cent of the total; the next is the Mountain, with 86.2 per cent. The imports from Canada during the year came to 1,632,609,000 kw.-hr. and the corresponding exports to Canada were 4,868,000 kw.-hr.

The generator capacity, 25,398,385 kw. in 3,805 plants in 1927, increased to 27,690,891 kw. in 3,740 plants in January, 1928. Only plants of 100 kw. or larger are here included and only establishments generating energy are counted. The data should therefore not be confused with other compilations which also comprise smaller companies, or those engaged exclusively in resale of purchased energy.

These figures apply to all public utility power plants, including electric light and power, railways, Bureau of Reclamation and certain manufacturing plants selling energy for public utility purposes. Regional data are given in the accompanying tables. The compilation as published by the survey includes detailed data for the individual states.

*Table I—Public Utility Power Companies* in the United States and Capacity of Generators, Jan. 1, 1927-1928*

| Division and State | 1927 Operating Companies | 1927 Plants | 1927 Capacity of Generators (Kilowatts) | 1928 Operating Companies | 1928 Plants | 1928 Capacity of Generators (Kilowatts) |
|---|---|---|---|---|---|---|
| United States............... | 2,058 | 3,805 | 25,398,385 | 1,820 | 3,740 | 27,690,891 |
| New England............. | 185 | 338 | 2,358,939 | 168 | 330 | 2,466,705 |
| Middle Atlantic............ | 256 | 468 | 6,646,142 | 214 | 436 | 7,113,361 |
| East North Central......... | 414 | 786 | 5,925,149 | 361 | 735 | 6,311,870 |
| West North Central........ | 422 | 706 | 1,886,186 | 387 | 682 | 2,008,224 |
| South Atlantic............. | 253 | 412 | 2,835,074 | 223 | 429 | 3,475,795 |
| East South Central......... | 110 | 196 | 1,221,372 | 104 | 200 | 1,330,756 |
| West South Central......... | 176 | 339 | 910,056 | 142 | 385 | 1,079,940 |
| Mountain................. | 151 | 277 | 877,911 | 139 | 274 | 975,419 |
| Pacific.................... | 91 | 281 | 2,737,556 | 82 | 269 | 2,928,821 |

*Includes only plants of 100 kw. or larger.

*Table II—Production of Electric Power by Public Utility Power Plants in the United States in 1927*

Compiled by Division of Power Resources, United States Geological Survey

| Division and State | Total Power Kilowatt-Hours | Total Power Per Cent of U. S. Total | Water Power Kilowatt-Hours | Water Power Per Cent of Total Power | Water Power Per Cent of U. S. Water Power | Fuel Power Kilowatt-Hours | Fuel Power Per Cent of Total Power | Fuel Power Per Cent of U. S. Fuel Power |
|---|---|---|---|---|---|---|---|---|
| United States...................... | 80,205,474,000 | 100.00 | 29,875,008,000 | 37.2 | 100.00 | 50,330,466,000 | 62.8 | 100.00 |
| New England..................... | 5,470,556,000 | 6.82 | 1,989,386,000 | 36.4 | 6.66 | 3,481,170,000 | 63.6 | 6.92 |
| Middle Atlantic.................. | 21,716,770,000 | 27.08 | 6,216,326,000 | 28.6 | 20.81 | 15,500,444,000 | 71.4 | 30.80 |
| East North Central............... | 18,843,349,000 | 23.49 | 2,409,740,000 | 12.8 | 8.07 | 16,433,609,000 | 87.2 | 32.65 |
| West North Central............... | 4,841,453,000 | 6.04 | 1,650,173,000 | 34.1 | 5.52 | 3,191,280,000 | 65.9 | 6.34 |
| South Atlantic.......... | 8,768,076,000 | 10.93 | 2,998,728,000 | 34.2 | 10.04 | 5,769,348,000 | 65.8 | 11.46 |
| East South Central............... | 3,407,700,000 | 4.25 | 2,211,600,000 | 64.9 | 7.40 | 1,196,100,000 | 35.1 | 2.38 |
| West South Central............... | 3,315,382,000 | 4.13 | 66,737,000 | 2.0 | 0.22 | 3,248,645,000 | 98.0 | 6.46 |
| Mountain......................... | 3,520,047,000 | 4.39 | 3,033,688,000 | 86.2 | 10.16 | 486,359,000 | 13.8 | 0.97 |
| Pacific............... | 10,322,141,000 | 12.87 | 9,298,630,000 | 90.1 | 31.12 | 1,023,511,000 | 9.9 | 2.03 |

# Business News and Market Conditions

## Committee Appointed to Study Sub-Standard Material

At a meeting held at the auditorium of the Consolidated Gas Company's building, New York City, on March 29 Charles L. Eidlitz, chairman of the board of governors of the Electrical Board of Trade of New York, Inc., was instructed to appoint a committee to try to crystallize the thoughts and intentions of the industry along lines which may result in controlling the manufacture, sale and use of sub-standard and hazardous materials and appliances. A report of this meeting appeared in the April 7, 1928, issue of the ELECTRICAL WORLD on page 737.

The following committee has been appointed by Mr. Eidlitz: J. C. Forsyth, chairman, New York Board of Fire Underwriters; Nicholas J. Kelly, New York City department of water supply, gas and electricity; H. R. Sargent, General Electric Company; Louis Freund, contractor; Edward C. Brown, contractor; Harry Kirkland, Society for Electrical Development; L. E. Moffatt, *Electrical Merchandising;* Frank Pattison, consulting engineer, and T. H. Joseph, contractor.

## Electrical Committee to Hold Special Meeting

A special meeting of the electrical committee of the National Fire Protection Association will be held at Atlantic City on May 3, 4 and 5, 1928, in the Chalfonte Hotel. A meeting of the correlating committee also has been called for the early morning of May 3. The annual meeting of the N.F.P.A. will begin on Monday, May 7.

The first meeting of the correlating committee was held on March 22, 23 and 24 last in accordance with the ac-

### *Value and Destination of Electrical Exports for January, 1928, Compared With Corresponding Month in 1927*

(Issued by Bureau of Foreign and Domestic Commerce)

| Articles | January | |
|---|---|---|
| | 1927 | 1928 |
| Direct current: | | |
| Under 500 kw. | $106,999 | $110,965 |
| 500 kw. and over | 54,700 | 29,059 |
| Alternating current: | | |
| Under 2,000 kva. | 13,135 | 18,606 |
| 2,000 kva. and over | 77,018 | 119,588 |
| Steam turbo-generator sets | 52,411 | 51,945 |
| Accessories and parts for generators | 100,243 | 79,606 |
| Self-contained lighting outfits | 64,280 | 83,051 |
| Batteries: | | |
| Flashlight batteries | 157,815 | 240,821 |
| Other dry and wet cell primary batteries | 156,162 | 180,616 |
| Storage batteries | 346,520 | 246 502 |
| Transforming or converting apparatus: | | |
| Power transformers | 132,905 | ........† |
| Power transformers, 500 kva. and over | ........* | 43,752 |
| Distribution transformers, less than 500 kva. | ........* | 46,454 |
| Other transformers | 78,983 | ........† |
| Instrument transformers | ........* | 8,582 |
| Other transformers, not elsewhere specified | ........* | 74,253 |
| Battery chargers under 15 amp. | ........* | 9,205 |
| Rectifiers, double current and motor-generators, dynamotors, synchronous and other converters | 130,679 | 100,020 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephone | 84,643 | 106,242 |
| Switches and circuit breakers over 10 amp. | 173,653 | 134,646 |
| Fuses and fuse blocks | 34,188 | 31,841 |
| Watt-hour and other measuring meters | 42,574 | 57,948 |
| Volt, watt and ampere meters and other recording, indicating and testing apparatus | 161,234 | ........† |
| Electrical indicating instruments | ........* | 27,525 |
| Electrical recording instruments | ........* | 17,232 |
| Other electrical testing apparatus | ........* | 102,158 |
| Lightning arresters, choke coils, reactors, and other protective devices | 68,111 | 57,021 |
| Motors, starters, and controllers: | | |
| Motors under 1 hp. | 169,458 | ........† |
| Motors ½ hp. and under | ........* | 110,476 |
| Motors over ½ hp. and under 1 hp. | ........* | 76,934 |
| Stationary motors: | | |
| 1 to 200 hp. | 207,288 | 184,335 |
| Over 200 hp. | 14,629 | 84,333 |
| Railway motors | 105,192 | 51,459 |
| Electric locomotives: | | |
| Railway | .......... | 74,780 |
| Mining and industrial | 17,344 | 298,621 |
| Station and warehouse electric motor trucks | 21,141 | 11,884 |
| Starting and controlling equipment: | | |
| For industrial motors | 87,158 | 149,479 |
| For electric railway and vehicle motors | 32,708 | 12,312 |
| Portable electric tools | 80,173 | 84,537 |
| Accessories and parts for motors | 164,457 | 177,950 |
| Electric appliances: | | |
| Electric fans | 87,580 | 24,908 |
| Electric lamps: | | |
| Metal filament | 183,296 | 95,596 |
| Other electric lamps | 32,641 | 33,257 |
| Flashlights | 162,068 | 195,988 |
| Searchlights and projectors | 130,841 | 40,061 |
| Motor-driven household devices | 165,518 | ........† |
| Electric vacuum cleaners | ........* | 70,339 |
| Other motor-driven devices, except tools | ........* | 71,053 |
| Electric flatirons | ........* | 16,366 |
| Domestic heating and cooking devices | 107,548 | ........† |
| Electric cooking ranges | ........* | 41,701 |
| Other domestic heating and cooking devices | ........* | 59,771 |
| Industrial electric furnaces and ovens | 18,782 | 38,925 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc. | 156,598 | 124,419 |
| Signal and communication devices: | | |
| Radio apparatus: | | |
| Transmitting sets and parts | 11,311 | 126,154 |
| Receiving sets | 202,095 | 209,323 |
| Tubes | 55,102 | 87,396 |
| Receiving-set components | 177,465 | 240,897 |
| Receiving-set accessories | 165,687 | 109,125 |
| Telegraph apparatus | 149,106 | 41,324 |
| Telephone apparatus: | | |
| Telephone instruments | 36,263 | 11,207 |
| Telephone switchboards | 4,451 | 13,919 |
| Other telephone equipment | 231,940 | 246,252 |
| Railway signals, switches, and attachments | 33,871 | 46,967 |
| Bells, buzzers, annunciators, and alarms | 20,233 | 20,315 |
| Other electric apparatus: | | |
| Spark plugs, magnetos, and other ignition apparatus | 211,115 | ........† |
| Spark plugs | ........* | 28,837 |
| Other starting, lighting, and ignition equipment | ........* | 135,247 |
| Insulating material | 129,049 | 103,502 |
| Metal conduit, outlet, and switch boxes | 54,390 | 69,938 |
| Sockets, receptacles, and lighting switches | 164,927 | 119,234 |
| Electric lighting fixtures, interior and street | 159,956 | ........† |
| Electric interior lighting fixtures | ........* | 143,311 |
| Electric street lighting fixtures | ........* | 57,607 |
| Other wiring supplies and line materials | 104,825 | 73,980 |
| Other electrical apparatus, not elsewhere specified | 729,211 | 579,515 |
| Rubber and friction tape | 32,372 | 28,239 |
| Globes and shades for lighting fixtures | 52,005 | 41,205 |
| Electrical glassware except for lighting | 24,212 | 29,051 |
| Electrical porcelain: | | |
| For less than 6,600 volts | 54,958 | 44,382 |
| For 6,600 volts and over | 50,472 | 51,227 |
| Carbons, carbon brushes and electrodes: | | |
| Electrodes for electric furnaces | 176,484 | 173,811 |
| Other carbon products | 179,221 | 44,188 |
| Insulated wire and cable (iron or steel) | 19,420 | 25,069 |
| Copper, bare wire | 143,645 | 191,293 |
| Copper, insulated wire and cable | 365,301 | 323,174 |
| Refrigeration sets up to 1 ton capacity | 172,917 | 294,844 |
| Domestic washing machines | 80,784 | 82,427 |
| Totals | $7,973,461 | $7,981,082 |

*Not collected in 1927. †Data for 1928 collected in more detail as given.

DESTINATION OF ELECTRICAL EXPORTS

| Country of Destination | January, 1928 |
|---|---|
| EUROPE: | $1,642,922 |
| Belgium | 59,021 |
| France | 113,473 |
| Germany | 129,000 |
| Italy | 174,604 |
| Netherlands | 72,707 |
| Spain | 234,301 |
| Sweden | 61,643 |
| United Kingdom | 492,188 |
| Other countries | 305,985 |
| WESTERN HEMISPHERE: | $4,366,498 |
| Canada | 1,571,730 |
| Mexico | 287,329 |
| Cuba | 250,714 |
| Argentina | 636,357 |
| Brazil | 691,688 |
| Chile | 184,026 |
| Colombia | 161,995 |
| Peru | 46,577 |
| Venezuela | 102,580 |
| Other countries | 433,502 |
| ASIA, AFRICA, AND OCEANIA: | $1,971,662 |
| British India | 290,529 |
| China | 104,588 |
| Japan | 305,157 |
| Philippine Islands | 174,647 |
| Australia | 514,872 |
| New Zealand | 84,921 |
| Union of South Africa | 187,311 |
| Other countries | 309,637 |

tion taken at the February, 1928, meeting of the electrical committee. The program followed by the correlating committee and which was suggested by Chairman V. H. Tousley was as follows:

1. That an editorial committee of three be appointed to prepare, and report to the meeting, wordings for requirements agreed upon in principle.

2. That any single item not agreed upon within ten minutes of discussion should be laid upon the table for discussion at the end of the meeting.

3. That only those items adopted by a two-thirds majority should be included in the correlating committee's report to the electrical committee with the recommendation that they be adopted at the special May meeting.

4. That items not so agreed upon should be referred to the electrical committee with the recommendation that they be treated as a special order of business at the February, 1929, meeting of the electrical committee.

## Productive Activity for Quarter 1 per Cent Over 1927

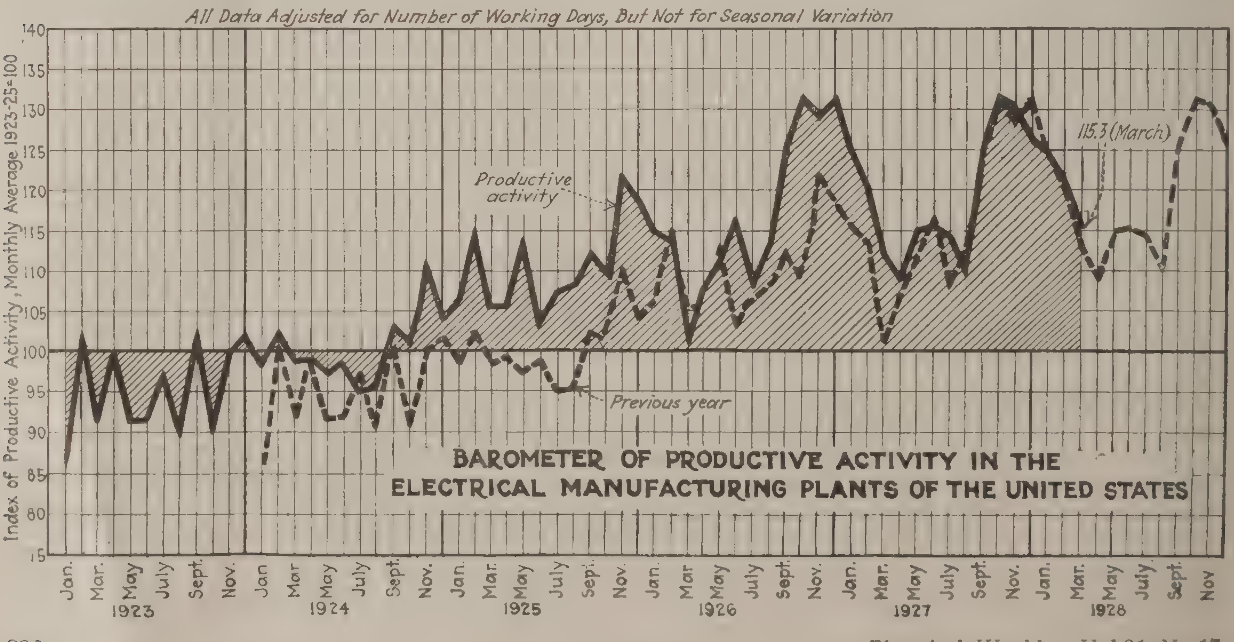
### Electrical Manufacturing Industry Following 1927 Trend, But on Slightly Higher Plane—March Rate of Operations 2.3 per Cent Over 1927

THAT the electrical manufacturing plants of the nation are operating at a slightly higher rate than the same time last year is indicated from reports on March consumption of electrical energy received by the ELECTRICAL WORLD from a large proportion of these plants. The average rate of productive operations during the first quarter of 1928 was about 1 per cent over that for the same period in 1927, but the March activity was 2.3 per cent over March last year. It would appear, therefore, that the operations of the electrical manufacturing plants during the present year are following very closely the trend witnessed during 1927, but on a slightly higher plane. The March rate of activity was 5.4 per cent below February and 12.3 per cent under October, the peak month for the past season. This reduction in activity, however, is perfectly normal in this industry. Past history would indicate that an upward turn will probably take place in April, although last year April activity was 3.4 per cent under March.

The index of activity in the electrical manufacturing industry based on consumption of electrical energy stands at 115.3 for March, as compared with 121.8 in February and 124.7 in January. Comparative indexes of productive activity referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days are as follows:

| | |
|---|---|
| March, 1928 | 115.3 |
| February, 1928 | 121.8 |
| October, 1927 (peak month) | 131.3 |
| March, 1927 | 112.7 |
| Average first quarter 1928 | 120.6 |
| Average first quarter 1927 | 119.3 |

The operations of the larger electrical manufacturing companies showed a much larger drop in activities from February to March than was reported by the smaller companies. Both groups, however, are now operating at about the same rate as compared with the average rate of activity during 1923-25.



# Market Conditions

CENTRAL-STATION buying continues to be quiet with conditions better than they were earlier in the year. Industrial plants are purchasing in fair volume although the activity is not as great as it was last year. It is anticipated that the Lackawanna Railroad will place orders within the next 60 days for electrical equipment in connection with the electrification of its suburban system in northern New Jersey at a cost of about $14,000,000.

In New England industrial plant buying was outstanding. Two orders for motors and control totaled over $150,000. Power companies are active in the Eastern district, and industrial business continues at a fair rate. In the Southeast power companies are buying conservatively though a few large orders are reported. Business is quiet in St. Louis but inquiries are good. In the Middle West conditions are gradually improving. On the Pacific Coast orders have been disappointing but prospective business is excellent. An order for $250,000 worth of equipment was placed by the Washington Pulp & Paper Company.

### *Copper and Zinc Markets Stiffen*

A moderate volume of business with a firmer tendency in prices for copper and zinc is the feature of the week in the non-ferrous metal markets. More sales of copper are reported than for three weeks and since Monday there has been decidedly less tendency to shade the price of $14\frac{1}{4}$ cents asked by the primary producers. The sellers of zinc have not pressed metal on the market and were

NEW YORK METAL MARKET PRICES

| | Apr. 18, 1928 Cents per Pound | Apr. 25, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic...... | 13.9875 | 14.00 |
| Lead, Am. S. & R. price | 6.10 | 6.10 |
| Antimony............... | 10.00 | 10.00 |
| Nickel, ingot............ | 35.00 | 35.00 |
| Zinc spots.............. | 6.10 | 6.15 |
| Tin, Straits............ | 52.50 | 52⅛ |
| Aluminum, 99 per cent... | 24.30 | 24.30 |

Base copper wire price April 25, 1928, 16 cents.

able to realize slightly higher prices for the modest tonnage traded in. Lead is steady at 6.10 cents, New York, and 6 cents, St. Louis, and tin after a slight sag is back in the neighborhood of 52⅛ cents for prompt Straits.

## *Industrial Buying Heavy in New England*

Sales of general purpose motors, control equipment and switchboards were outstanding items of interest in the electrical market in the New England district. Small motor sales mounted to over $50,000, which is slightly above the normal, with a higher trend. One order amounting to about $12,000 worth of motors was reported. Another order for complete installation of operating and control equipment for a well-known Connecticut industry totaled about $140,000.

Central-station buying is spotty. An encouraging demand for insulators and line material was recorded. Interest in arc welding is strong with orders gaining over last year. Street-lighting business is active, and one manufacturer records much activity in automatic street traffic signals, sales of which mounted to over $10,000 for the first quarter of this year. Industrially the New England district is gaining, with exceptions in a few instances.

## *Power Companies Buying in Good Volume in Southeast*

Central-station companies in the Southeast are buying conservatively, though a few large orders are reported. A company operating in the Carolinas has placed an order for 2,800 electric ranges to use in a sales campaign, and a company in Mississippi ordered motors totaling about $20,000. A company in south Georgia ordered oil engine generating equipment, amounting to $40,000, for use as a stand-by for a small hydro-electric plant. The demand for creosoted pine poles is very active and as a result deliveries are unsatisfactory. An order for $30,000 worth of oil circuit breaker equipment is in immediate prospect.

A cotton mill in Georgia bought $2,500 worth of wiring materials and $10,000 worth of motors were recently ordered. An additional order for wiring materials amounting to about $5,000 is in immediate prospect. A cotton mill in the Carolinas ordered motors amounting to $2,800 and several synchronous motor orders are being received for new ice plants in the territory, the latter orders averaging $1,000 each. Construction contracts have been let on the new building program of the Southern Railway in Atlanta and some orders for electrical materials, of which about $25,000 worth will be needed, have already been placed.

Two municipalities in Louisiana ordered "white-way" equipment amounting to $12,000 and $9,000, respectively. A club in Birmingham has placed an order for $3,000 worth of electrical cooking equipment for a completely electrified kitchen. Construction projects are as follows:

The Georgia-Florida Power Company, Valdosta, will construct 13 miles of transmission line and install two substations at Pavo and Barwick where municipal plants have been acquired. Swift & Company, Chicago, plans a cottonseed oil mill at Jacksonville, Fla., to cost $225,000. The Roberts & Grentner Properties, Inc., Miami, Fla., plans a cold storage plant to cost $300,000. The Powell Knitting Company, Spartanburg, S. C., plans an addition to cost $180,000. The South Carolina Power Company, Charleston, S. C., has acquired the municipal plant at Walterboro, S. C., and plans an addition to cost $75,000. The Diamond Ice Company, Knoxville, Tenn., will build an ice plant to cost $150,000. Lake Placid, Fla., and Danville, Va., plan ornamental lighting systems. The Virginia Electric & Power Company, Richmond, Va., plans to expend $4,000,000 for improvements throughout its territory. Of this amount $1,300,000 will be used for street railway and gas works.

## *Conditions Gradually Improving in Middle West*

While the volume of business transacted in the Middle West is not large, conditions are improving. Considerable interest is being aroused in the coming World's Fair in Chicago in 1933. The railroads are coming into the market for a considerable quantity of equipment and general purchasing of maintenance materials is heavy. The various utility companies are actively engaged in spring construction work and maintenance purchasing is particularly heavy. Among the interesting orders placed were one for labor and material to build foundations for coal handling structure, complete with appurtenances valued at $130,000; cable valued at $28,000; five 1,000 kva. transformers; six 10-ton hand operated hoists complete with appurtenances and "Mazda" lamps valued at $150,000. Jobbers sales are improving. Construction projects are as follows:

The J. W. Hoodwin Company, Chicago, will build a factory for making advertising novelties, at a cost of $100,000. The Halsom Products Company, Chicago, will build a toy manufacturing plant to cost $100,000. Kendallville, Ind., plans additions to its municipal plant, to cost $50,000. The Detroit Electric Company, Detroit, plans an operating unit on West Jefferson Street to cost $120,000. The Chevrolet Motor Car Company, Detroit, will build an addition to cost $400,000. Durant Motors, Inc., Lansing, Mich., will build additions to its plant to cost $700,000. The Northern States Power Company, Minneapolis, Minn., will make additions in its power plant at Minot, N. D., to cost $75,000. The Madison Gas & Electric Company, Madison, Wis., plans additions in its power plant at Madison, Wis., to cost $250,000. The Marshall Electric Company, Marshalltown, Iowa, will build extensions to transmission lines. The Nebraska Power Company, Omaha, Neb., will make extensions in transmission lines in the vicinity of Waterloo, Neb. Westmont, Ill., and Appleton and Neenah, Wis., plan ornamental street-lighting systems.

## *Industrial Demand Active in Eastern District*

Industrial business continues at an encouraging status in the Eastern district and sizable contracts have been placed for motors, control apparatus and accessory equipment. A leading manufacturer has secured an order from a steel tube mill in Ohio for $22,500 worth of motors. A cement company in eastern Pennsylvania also ordered nine generator units, motors and auxiliary equipment for a conveyor drive. A contract was placed by a rolling mill at Trenton, N. J., for heavy industrial equipment aggregating $168,000. Hotel interests in the metropolitan district are reported in the market for construction material. There is a marked increase in the demand for fractional-horsepower motors. The shoe manufacturing industry has been active. There is a marked decline in the call by jobbers for electric fans.

Power companies are active in the market for requirements for early delivery, particularly in connection with substation equipment. A metropolitan utility has placed an order for $25,000 worth of transformers. Other business of similar character is coming from central stations in northern New York, as well as in New Jersey. Line equipment, which has been showing a tendency to lag under a demand primarily of maintenance character, is operating under an improved call. A manufacturer of wire and cables reports business as unsatisfactory for April. May account, however, is expected to bring about a noticeable increase in orders as indicated by present inquiries. Current construction operations include the following:

The New York, New Haven & Hartford Railroad, New York, plans an electrical inspection shop on Mathews Avenue to cost $180,000. The Erie Railroad will make extensions at its shops at Port Jervis and Hornell, N. Y., and Meadville, Pa., to cost $250,000. The Wright Aeronautical Corporation, Paterson, N. J., will build plant additions to cost $2,500,000. The Public Service Electric & Gas Corporation, Newark, N. J., will build a transmission line from Metuchen to Liberty Corner, and thence through Somerset and Hunterdon Counties to Lambertville. The Otis Elevator Company will build a plant addition at Harrison, N. J., to cost $350,000. The Trenton Potteries Company, Trenton, N. J., will make plant extensions to cost $400,000. The Atlantic City Electric Company, Atlantic City, N. J., has acquired the municipal plant at Gibbstown, N. J.

England, Walton & Company, Philadelphia, will build an addition to its leather plant to cost $1,000,000. The Nice Ball Bearing Company, Philadelphia, plans an addition to cost $150,000. The Mine Safety Appliance Company, Pittsburgh, will take bids for an addition to cost $100,000. The Signal Corps, Baltimore, Md., is asking bids until May 16 for two 150-ft. steel radio towers (Circular 1). The Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids (no closing date stated) for generating equipment for naval station in Cuba (Specification 5356). The General Purchasing Officer, Panama Canal, Washington, D. C., is asking bids until May 14 for electrical appliances, wire, cable, etc. (Panama Schedule 1874.)

### *Business Quiet with Good Inquiries in St. Louis*

Business in the St. Louis district is below the average of the previous week. Manufacturers report orders received are mainly for small motors and equipment but figures are being submitted on important inquiries to be closed in the near future. Retail dealers and jobbers experienced very satisfactory business from a steady volume of small orders for miscellaneous items, with appliances and building and line construction materials the most prominent. Construction projects are as follows:

The International Shoe Company, St. Louis, will build a canvas fabric mill at Malvern, Ark., to cost $150,000. The Beaumont Export & Import Company, Beaumont, Tex., plans a lumber mill to cost $100,000. The Chase Bag Company, Dallas, Tex., plans a plant on South Lamar Street, to cost $110,000. The Pure Oil Company, Houston, Tex., plans additions in its refinery, to cost $150,000. Nocona, Tex., plans a municipal power plant. The Central Power & Light Company, San Antonio, Tex., plans a hydro-electric plant on the Rio Frio River, to cost $250,000. Swift & Company, Chicago, plans a cold storage plant at South Dallas, Tex., to cost $150,000. The Texas-Louisiana Power Company, Fort Worth, Tex., plans a power plant near Yoakum, Tex., to cost $150,000. The United Power & Light Company, Abilene, Kan.; has secured permission for a transmission line from Chandler to Luther, Okla. The Texas Power & Light Company, Dallas, Tex., has acquired the Corsicana (Tex.) Power & Light Company, and plans transmission line extensions. Bossier City, La., and Fort Stockton, Tex., plan ornamental lighting systems.

### *April Orders Off But Inquiries Good on Pacific Coast*

April ordering on the Pacific Coast has been rather disappointing, although prospective business is excellent. Bumper crops are forecast by additions to packing plants at Concord, Santa Clara, Elmhurst and Watsonville. The state of California has announced a ten-year building program for the Sacramento State fair grounds comprising six major buildings of which the livestock building will be completed for next year. Pole orders include one carload for Woodland, two carloads for Fresno and $7,500 worth of poles and pole line material for Fallon, Nev. The government has purchased 50 miles of No. 17 copper steel wire for the forest service and has placed a contract for $125,000 covering the wiring, heating, and plumbing of the submarine base in Pearl Harbor, Hawaiian Islands. Pumping plant business is running about 30 per cent over that of last year.

The Washington Pulp & Paper Company, a subsidiary of the Zellerbach Paper Company, has let contracts for furnishing approximately $250,000 worth of turbines, motors, etc., for plants building at Port Townsend and Hoquiam, Wash. An order amounting to $15,000 also was placed by the Union Bag & Paper Company at Tacoma for a switchboard. A 10,000-hp. turbine was purchased by the Grays Harbor Railway & Light Company at Aberdeen. The Weyerhaeuser Timber Company at Longview, Wash., issued specifications and will open bids in two weeks for approximately 10,000 hp. in motors, to cost about $150,000. Construction projects are as follows:

The Atchison, Topeka & Santa Fe Railway Company, Chicago, plans an ice and car re-icing plant at Ashfork, Ariz., to cost $650,000. Johns-Manville, Inc., New York, plans a new plant at Richmond, Calif., to cost $2,500,000. The San Diego Consolidated Gas & Electric Company, San Diego, Calif., plans a steam power plant on West Broadway, to cost $435,000. The Pacific Manufacturing Company, Santa Clara, Calif., plans a woodworking plant to cost $200,000. The Coast Counties Gas & Electric Company, Santa Cruz, Calif., will build a substation at Watsonville, Calif., to cost $30,000. The Public Service Company of Colorado, Denver, will build a storage plant to cost $350,000.

The Escalante Light & Power Company, Escalante, Utah, plans a power plant to cost $65,000. The Puget Sound Power & Light Company, Seattle, Wash., will build a substation on Massachusetts Street to cost $35,000. The Washington Water Power Company, Spokane, Wash., will build a substation on South Tacoma Street, to cost $50,000. The American Fruit Growers, Inc., Yakima, Wash., will build a cold storage plant to cost $140,000. The Great Western Power Company, San Francisco, Calif., has acquired the plant and property of the Quincy Electric Light & Power Company, Quincy, Calif. Tulare, Salinas, Monrovia, Orange, Auburn, Berkeley, and Sacramento, Calif., and Montesano, Wash., plan street-lighting systems.

# Activities of the Trade

### Industrial Heat School to Be Held at Mansfield, Ohio

Plans for the 1928 National Industrial Heating School, which will be conducted this year through the courtesy of the Westinghouse Electric & Manufacturing Company at Mansfield, Ohio, have just been announced by W. H. Sammis, chairman industrial heating committee, Commercial National Section, N.E.L.A. The dates for the school, which is open to representatives of public utilities, are May 14 to 26. The course will consist of lectures and studies conducted by nationally known authorities on the subject, supplemented by inspection trips through a number of large industrial plants for first-hand observation of industrial heating operation and results. Some 225 men have taken this course in the previous schools and their companies experienced profitable results.

The only cost to central-station companies sending men to take the course is the living (averaging perhaps $7 per day) and traveling expenses of their representatives for two weeks. Those desiring to take the course should send their enrollment to W. H. Sammis, chairman industrial heating committee, N.E.L.A., care of Consumers Power Company, Jackson, Mich.

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THE SAFETY CABLE COMPANY, division of the General Cable Corporation, 420 Lexington Avenue, New York City, announces that Merritt L. Tice, formerly connected with the Benjamin Electrical Manufacturing Company, will represent the company in the Southeastern part of the country.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson, Md., manufacturer of portable electric tools and grinders, announces that its Detroit branch is now located at 11501 Woodward Avenue, with J. H. Walker as manager. The company also announces the following changes in its sales organization: H. L. Balke is with the Kansas City branch, covering the territory around Omaha, formerly covered by S. D. Shawgo; G. F. Parr is with the Buffalo office, and has taken over the territory of J. H. Hutton; G. N. McCarthy has filled the vacancy at the Buffalo office made by H. B. Austin, who has been transferred to Chicago, and J. A. Murray is working in Baltimore, taking over the accounts formerly sold by Curtiss Watts.

THE EDISON ELECTRIC APPLIANCE COMPANY, 5600 West Taylor Street, Chicago, announces a new "Hotpoint" iron known as the "Super-Automatic" iron with the heat throttle.

THE DAMPNEY COMPANY OF AMERICA, Hyde Park, Boston, announces that the sale of its "Apexior" protective coatings for power plant equipment will be handled in Iowa, Kansas, western Missouri and eastern Nebraksa by F. W. Hay & Company, with main office at 2732 Cherry Street, Kansas City, Mo., and branches in Omaha and Cedar Rapids.

THE INGERSOLL-RAND COMPANY, 11 Broadway, New York City, announces the opening of a branch office at 226 West A Street, Picher, Okla., to serve northern Oklahoma, southern Missouri and Arkansas.

THE WESTINGHOUSE LAMP COMPANY has announced a reduction in the list price of its flashlight, radio panel, and toy train incandescent "Mazda" lamps, to become effective on May 1. The reduction, amounting to 23 per cent, was made possible, according to officials of the company, by the increased demand for these types of lamps, and particularly so by lower manufacturing costs, made possible by newly developed machines.

# New Equipment Available

## Magnetic Motor Starting Switch

The "Circle T" magnetic motor starting switch rated at from 1 hp. to 15 hp. has been placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Conn. In this switch a set of moving contacts is used to bridge the gap between two sets of stationary contacts. High interrupting capacity is maintained because of this contact construction. Overload and undervoltage protection is obtained by thermal relays of the inclosed type. The contacts of this switch are self-aligning and self-cleaning.

## Semi-Portable, Single-Stage Compressor Unit

A semi-portable, single-stage, double-acting, multiple-belt-driven air compressor which is completely self-contained and fully equipped has been placed on the market by the Pennsylvania Pump & Compressor Company, Easton, Pa. The motor, starter, multiple-belt drive, air receiver, air filter and automatic start and stop control are all assembled in place, forming a compact unit occupying the minimum of floor space. The air cylinder and all working parts are automatically lubricated. The compressor is equipped with Pennsylvania air-cushioned valves and contains all other features which are built into the company's standard compressors. The unit is equipped with a 10-hp. high-torque motor operating the compressor at 400 r.p.m. The unit has automatic pressure control between 85 lb. and 125 lb., is 6 ft. 8 in. long by 2 ft. 4 in. wide and weighs 1,380 lb. Another unit also is built in a two-stage type for pressures from 125 lb. to 250 lb.

Solenoid Brakes.—A complete new line of solenoid brakes is now being offered by the General Electric Company. The line, bearing the designation CR-9516, includes brakes for operation on alternating and direct current, and involves in its construction the use of a spring-setting device. The company claims simplicity as the main feature of the new line. The brakes are especially designed for severe service in connection with mill, crane and hoist motors. The manufacturer claims smooth operation for making quick stops in either direction of rotation, with a dependable holding value. The brake mechanism is held in the "off" position by a coil and plunger; when power is applied to the motor, the coil is energized and the brake is released, and, when the power is shut off, the spring-setting device forces the mechanism into the closed or braking position. Both alternating- and direct-current brakes use the same brake mechanism and frame, the solenoids being interchangeable. The solenoid assembly may be quickly removed from the brake mechanism by taking out four bolts, lever or brake adjustments remaining undisturbed. The coil only may be removed, if desired, from the larger sizes.

## Portable Pole Saw

The Wolf portable timber-sawing machine for use in pole yards for the roofing of poles, the cutting of anchor blocks, the cutting up of old poles for fire wood and other operations has been placed on the market by the Reed-Prentice Corporation, Worcester, Mass. The company claims that the Wolf saw operated by two men will perform the work of at least eight men with hand cross-cut saws, and any operation ordinarily handled with cross-cut saws can be speeded up with the Wolf saw. The machine is available in alternating-current, direct-current and compressed-air drive and has a capacity up to timbers 24 in. in diameter.

## Air Filter

A unit type air filter, for cleaning air used in cooling large motors, compressed air and similar purposes, using a blanket of cellulose material as the dirt-collecting medium, has been developed by the National Air Filter Company, Chicago. The new material, developed by the Kimberly-Clark company especially for the new filter, consists of a mat of many layers of very fine cellulose fibers. It will be known commercially as "Airmat." In a series of experimental tests the manufacturer states that he found the filter showed a surprisingly high efficiency in stripping the air passed through it, not only of the most minute particles of solid matter but of all particles of oil and oily soot. The material has a very high absorptive capacity for liquids.

A single unit consists of a sheet metal box 12 in. high, 24 in. wide and 24 in. long with a filtering capacity of 1,000 cu.ft. of air per minute. These units can be used singly or placed in multiple installations of any capacity, much after the fashion of sectional bookcases. The filtering material, resembling a very light fluffy white blanket, is carried between two frames of coarse wire screen hinged together on one side and opening out like a book. These frames are the proper size to receive a single sheet of the "Airmat," 24 in. square. Each unit contains four such frames, which form a set of staggered partitions being placed in cross-section like a letter W so that 16 sq.ft. of filter surface is contained in each individual unit. A simple spring clip holds the frames in position and they may be easily removed from the unit, opened up and a fresh blanket of "Airmat" inserted in a few seconds time without disturbing the unit itself.

## Recorder Controller

A new recorder and contacting controller which combines in one case the features of a recorder and a thermometer controller is being marketed by the Bristol Company, Waterbury, Conn. The equipment is a single pen recording system with controller system and scale mounted directly above it. The recording pen and moving contact of the controller are each actuated by separate pressure elements which are exactly alike in construction. These elements are connected through one capillary tube to the sensitive bulb, and arranged in this way the record is not impaired by the retarding effect of the controller. Also the recorder draws a true record both above and below the control point.

The recorder controller is arranged for a contact capacity of 1,000 watts by equipping it with self-contained automatic switches. To use the instrument it is only necessary to set the control to the desired temperature by moving an index pointer over a scale to the exact degree to be controlled. This index pointer is very long and it is thus possible to adjust it accurately and easily. The large current-carrying capacity of this controller makes it possible to adapt the instrument to many control applications without the use of relays.

Highway Lighting Unit.—A lighting unit designed especially for the illumination of highways has been placed on the market by the General Electric Company. The new unit is said to be of very simple construction and the light is diffused entirely by means of the combination glass globe and refractor which incloses the electric lamp. It may be mounted on standard poles, and does not require installation at excessive heights. Although particularly designed for highway lighting, it may be used in residential sections. The unit is designed for spacing at intervals of approximately 250 ft., and standard poles 25 ft. in height, or even less, may be used for mounting. The usual variety of types of casing and reflector will be available with these units, and several types and lengths of bracket can also be used.

Current Transformer.—A line of dry type current transformers, known as the type LD, has been placed on the market by the Packard Electric Company, Warren, Ohio. They have been developed especially for switchboard work for controlling relays, circuit breakers, etc., and where accuracy is not of prime importance, and are recommended for all usual light-duty work, such as supplying an ammeter, single watt-hour meter or for relay work where the burden does not exceed 25 va. Secondary binding posts are provided. The company also has revamped its K line of dry type current transformers, which are intended for accurate metering service.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued April 10, 1928)

1,665,200. Cord Holder for Vacuum Cleaners, Lamps, and the Like; H. O. Briggs, Minneapolis, Minn. App. filed April 9, 1925.

1,665,219. Heating Element for Electric Irons; W. A. Rankin, Rochester, N. Y. App. filed May 19, 1923.

1,665,223. Circuit Breaker; F. W. Roller, East Orange, N. J. App. filed Oct. 24, 1924. Trip free type.

1,665,226. Magnetic Chuck; F. L. Simmons, Woonsocket, R. I. App. filed Jan. 10, 1927.

1,665,291. Operating Gear of Electric Switches; A. Allan, North Shields, and H. W. Clothier, Walls-End-On-Tyne, England. App. filed Jan. 21, 1926. Oil-break switchgear in which the main oil-break switch with its tank can be removed entirely from the rest of the gear and if desired replaced by another similar oil switch and tank.

1,665,304. Short Circuiting Device for Electric Motors; H. L. Johnston and M. K. Akers, Troy, Ohio. App. filed March 23, 1925.

1,665,313. Protective Device for Three-Phase Alternating-Current Units; J. D. Lewis, Yonkers, N. Y. App. filed April 27, 1923.

1,665,325. Electrical Network and Its Operation; E. Peterson, New York, N. Y. App. filed March 18, 1926.

1,665,341. Thermostat; V. A. Boker, Minneapolis, Minn. App. filed April 2, 1925. Adapted for controlling the heating of the crucible of type setting machines.

1,665,347. Rail Bond; E. M. Deems, Forest Hills, N. Y. App. filed Oct. 15, 1925.

1,665,348. Electrical Water Heater; H. E. Dineson, Bridgeport, Conn. App. filed June 11, 1926.

1,665,367. Electric Heater; W. S. Johnson and J. W. Sheffer, Berwick, Pa. App. filed March 25, 1921.

1,665,381. Automatic Fire Alarm; J. Siddall, Arlington, and W. H. Siddall, Kearny, N. J. App. filed Nov. 10, 1921.

1,665,446. Fuse Clip; N. J. Conrad, Wilmette, Ill. App. filed May 25, 1925. For high-voltage fuse.

1,665,472. Electrical Hair Curler; A. H. Opperman, Indianapolis, Ind. App. filed April 25, 1925.

1,665,484. Device for Application to the Openings of Outlet Boxes and the Like; R. D. Thompson, Toledo, Ohio. App. filed Oct. 19, 1923.

1,665,495 Electric Socket; E. H. Freeman, Trenton, N. J. App. filed July 10, 1926.

1,665,510. Cord Guide; A. S. Spidel, Brewster, Ohio. App. filed Oct. 18, 1926. Cord guide members for the caps of separable attachment plugs.

1,665,528. Electric Fuse; H. T. Bussmann, St. Louis, Mo. App. filed March 20, 1922. Renewable ferrule contact type.

1,665,529. Quick-Make and Quick-Break Switch; F. LeG. Bryant, Johnson City, N. Y. App. filed March 10, 1927.

1,665,550. Contact Holder; J. T. Janette, Chicago, Ill. App. filed March 30, 1925. For holding contacts or brushes adapted for various purposes.

1,665,560. Variable Traffic Signal; R. O. Nelson, Portland, Ore. App. filed May 16, 1925. Automatic signal device for the intersection of a main or arterial highway and a cross road.

1,665,562. Starter for Electric Motors; W. C. O'Brien, Baltimore, Md. App. filed Nov. 4, 1924.

1,665,592. Crossing Signal; J. W. Kennedy, Canton, Ohio. App. filed Aug. 13, 1923.

1,665,603. Storage Battery; P. E. Norris, Wilkinsburg, Pa. App. filed May 26, 1924.

1,665,604. Storage-Battery Separator; P. E. Norris and H. H. Aldrich, Wilkinsburg, Pa. App. filed Oct. 1, 1924.

1,665,613. Coupling Device for Rotatable Elements; H. L. Tanner, Brooklyn, N. Y. App. filed June 11, 1920.

1,665,619. Apparatus for Waving Hair; C. A. Ackley, New York, N. Y. App. filed March 25, 1926.

1,665,622. Calling Device; L. L. E. Chauveau, Paris, France. App. filed Feb. 23, 1922. Selective.

1,665,629. Bootleg; F. C. Lavarack, Montclair, and W. H. B. Lavarack, Norwood Borough, N. J. App. filed June 3, 1925. As used in railway signalling.

1,665,662. Electromagnetic Detecting Device; C. E. Godkin, Hayward, Calif. App. filed Dec. 15, 1925. For use in detecting oil.

1,665,677. Alarm Device; W. C. Roe, New York, N. Y. App. filed Jan. 10, 1923. For burglar alarm systems.

1,665,691. Two-Voltage Direct-Current Generator; L. Dreyfus, Vasteras, Sweden. App. filed Feb. 23, 1927. Intended to operate in parallel with a storage battery.

1,665,703. Portable Electric Lamp; J. Kernes, Chicago, Ill. App. filed Nov. 8, 1926.

1,665,735. Bread Toaster; T. C. Forbes, Hopkins, Minn. App. filed Jan. 5, 1927. Automatic.

1,665,737. Automatic Switching-Cord Reel; J. J. Gough, Chicago, Ill. App. filed Nov. 4, 1925.

1,665,742. Induction Motor; F. S. Kingston, Warren, Ohio. App. filed April 28, 1927. Single phase induction motor employing the split phase method of starting.

1,665,746. Curling-Iron Heater; H. G. Levy, San Francisco, Calif. App. filed March 7, 1924.

1,665,768. Electric Iron; G. Browning, Wilmette, Ill. App. filed Aug. 15, 1925.

1,665,772. Storage-Battery Construction; C. C. Carpenter, Niagara Falls, N. Y. App. filed Feb. 9, 1918.

1,665,792. Electric Cigar Lighter; G. Parker, Meriden, Conn. App. filed April 8, 1926.

1,665,793. Automatic Electric Steam Boiler; O. A. Sandborgh, Stockholm, Sweden. App. filed Aug. 29, 1921.

1,665,799. Incandescent Lamp; A. B. Smith, South Brownsville, Pa. App. filed Oct. 28, 1925. Filament supporting stem equipped with suitable reflective material in order to augment the volume of the light ray.

1,665,802. Detachable Electric Fixture; W. Symmes, San Francisco, Calif. App. filed Nov. 8, 1921.

1,665,841. Electric Cut-Out; G. R. Brown, Bridgeport, Conn. App. filed Sept. 17, 1925. Plug type.

1,665,845. Antisludging Means for Oil; D. C. Cox, Soldier Summit, Utah. App. filed Sept. 28, 1926.

1,665,851. Electric Butt-Welded Tubing and Method of Making the Same; J. W. Harris, Washington, D. C. App. filed Sept. 26, 1924.

1,665,852. Regulating System; M. Herklotz, Berlin, Germany. App. filed Feb. 27, 1926. For controlling a characteristic of the output of an alternating-current generator in which the characteristic, which may be the voltage, current, power, power factor, etc., is controlled by varying the excitation of an exciter.

1,665,854. Alternating-Current Device; B. E. Lenehan, Wilkinsburg, Pa. App. filed Dec. 15, 1924. Means for readily adapting standard wattmeters for operation as reactive-volt-ampere meters.

1,665,857. Electrical Transmission System; J. C. Needham, London, England. App. filed May 26, 1920. By means of which the speed of a moving body can be readily ascertained from a distance or variations in speed can be employed to transmit orders.

1,665,858. Circuit Interrupter; W. L. Newmeyer, Wilkinsburg, Pa. App. filed July 11, 1924. Of the latching type.

1,665,861. Electric Heater; M. K. Purdy, Stroudsburg, and W. H. Reagle, Tobyhanna, Pa. App. filed Aug. 31, 1927.

1,665,869. Electric Welding; J. M. Weed, Scotia, N. Y. App. filed May 18, 1925. Arc welding system.

1,665,890. Synchronous Motor Specially for Driving Clocks; R. Michl, Kosice, Czechoslovakia. App. filed June 10, 1925.

1,665,893. System of Distribution; D. C. Prince, Schenectady, N. Y. App. filed Sept. 23, 1924.

1,665,901. Speed-Regulator System; J. H. Ashbaugh, Pittsburgh, Pa. App. filed Sept. 26, 1925.

1,665,917. Regulator System; R. D. Evans, Pittsburgh, Pa. App. filed April 12, 1921. Which will accurately function on either a balanced or an unbalanced electrical system.

1,665,918. Compensated Voltage Regulator System; R. D. Evans and H. K. Sels, Pittsburgh, Pa. App. filed March 15, 1923.

1,665,939. Regulator System; S. A. Staege, Pittsburgh, Pa. App. filed April 15, 1926. Rotary contactor type regulator system.

1,665,941. Electric Heater; A. E. M. Van Der Meersch, Chelsea, London, England. App. filed Dec. 8, 1926.

1,665,949. Water Heater; J. G. Chalmers and B. C. Salamis, Montreal, Quebec, Canada. App. filed Aug. 27, 1926.

1,665,956. Fire Alarm; S. Giangrasso, Portland, Me. App. filed Aug. 28, 1926. Of the audible signal type.

1,665,962. Storage-Battery Plate and Method of Producing Same; C. W. Jenner, New Westminster, B. C., Can. App. filed June 2, 1927.

1,665,987. Pilot Light; J. T. Smith, San Francisco, Calif. App. filed June 28, 1926. For use with heating equipment such as flat-irons.

1,666,007. Separator and Method of Making the Same; W. S. Gould, New York, N. Y. App. filed Oct. 23, 1923.

1,666,026. Process of Welding; R. Applegate, Cleveland, Ohio. App. filed Oct. 10, 1921. By the electric arc involving the use of a degasifying substance.

1,666,041. Traffic Signal; F. Buchanan, Syracuse, N. Y. App. filed Sept. 24, 1924.

# New Trade Literature

**CONDUIT FITTINGS FOR RAILWAY MAIL CARS.**—The Crouse-Hinds Company, Syracuse, N. Y., has issued bulletin No. 2112, entitled "Railway Mail Car Lighting and Fan Installations." The bulletin describes and illustrates the various types of fixtures, condulets and switches for railway mail car lighting and fan installations.

SWITCHING AND OUTDOOR STATION EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-966, covering its indoor metal-clad switching equipment. The company also is distributing bulletin GEA-899, describing and illustrating its types HD-1 and HD-2 disconnecting switches for outdoor station equipment.

INSULATORS AND TRANSMISSION LINE HARDWARE.—Catalog No. 4 issued by the Lapp Insulator Company, Inc., LeRoy, N. Y., describes its vacuum process high-voltage porcelain insulators, its special high-voltage porcelain designs and its transmission line hardware and appliances. The catalog is well illustrated and contains several Lapp factory views. Porcelain processes are described and compared with the Lapp vacuum process and the Lapp clay-mixing process. A chapter also is devoted to Lapp standard practices. The various types of insulators, bushings, etc., are fully described and a line drawing gives all the dimensions. Attention is called to the Lapp method of packing.

ELECTRIC EQUIPMENT. — Bulletin GEA-884 issued by the General Electric Company, Schenectady, N. Y., covers its direct-current induction and synchronous motors and control particularly adapted to building and flat-glass manufacture. Illustrations are given showing the application of the motors to air compressors in a glass plant.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Hamburg, Germany (No. 30,832), for electrical advertising novelties and household electrical appliances, including refrigerators and washing machines.

An agency is desired in Santo Domingo, Dominican Republic (No. 30,795), for electromedical apparatus.

An agency is desired in Bogota, Colombia (No. 30,796), for high-grade flashlights.

An agency is desired in Prague, Czechoslovakia (No. 30,833), for household electrical accessories, including dishwashers.

Purchase is desired in Shanghai, China (No. 30,791), of lighting switches and receptacles.

An agency is desired in Vienna, Austria (No. 30,793), for electric household refrigerators.

An agency is desired in Sheffield, England (No. 30,797), for electric household refrigerators and units.

An extensive hydro-electric project involving $30,000,000 is planned in British Columbia, Canada (No. 274,934).

# Electrical World

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## *Boulder Dam and the Congressional Situation*

DEBATE on the Boulder Canyon bill has been in full swing in the Senate, but the measure will soon have to make way for the tax bill and possibly for action on the expected veto of the flood-control bill. As a matter of fact its proponents fear its defeat and are prepared to compromise on a low dam at Boulder Canyon with a foundation capable of sustaining ultimately a structure of the height sought in the present Swing-Johnson bill. However, in view of the opposition to the measure and to the absence of any treaty between the states in the Colorado River basin apportioning the water, it is problematical whether any action will be taken at this session of Congress.

Fortunately, time has sufficed to shed light on many of the questionable features of the proposed measure, on the engineering aspects of the project, on the selfishness of California—and especially Los Angeles—and on the rights of the other states. The fact has also been accentuated that every one wishes to protect the Imperial Valley, although the menace is not so great as the California senators would have people believe. Besides, since Dwight Morrow has been Ambassador to Mexico there is a general change of sentiment toward the Southern republic and the administration is not now seeking clubs like the Boulder Canyon Dam to hold over Mexico's head. Best of all, however, is the growing resentment against the government engaging in business under any pretext, and it is that sentiment—one the politicians are beginning to discern—which will play an important part in keeping Congress within bounds.

* * * *

## *Worcester Rate Adjustment a Sensible Step*

PENDING final determination in the federal court of the Worcester case against the Massachusetts Department of Public Utilities, the contestants have agreed on a six-cent rate. The injunction against the commission was modified in the District Court at Boston to permit the new rate to become effective, and domestic users of electricity in Worcester will receive the benefit of the reduced rate at once. Both the commission and the utility company are to be commended on such a sensible arrangement.

From the viewpoint of regulation a 15 per cent reduction in the Worcester rate is a victory for the Massachusetts Department of Public Utilities. To be sure, 15 per cent is not so drastic a cut as 30 per cent; but a bird in the hand is worth two in the bush. The Worcester Electric Light Company would undoubtedly suffer a loss in income were the 30 per cent reduction to be applied at once. As it is, the courts may sustain the commission, in which case the full reduction will become effective; but the litigation might consume years. Meanwhile a voluntary cut of 15 per cent is granted, and by the time the case is settled—presuming that the decision goes against the utility, which is not at all certain — the company will have adjusted itself to the change. Regardless of the final outcome, however, the present reduction will stand, and if after a reasonable trial it is shown to be highly remunerative, we feel certain that the Worcester Electric Light Company will voluntarily grant to the Massachusetts commission what the latter may not be able to wrest from it by law. Such, certainly, would be a reasonable and sensible disposition of the case and one in entire harmony with the best public policy.

* * * *

## *Is the Federal Trade Commission Getting Anywhere?*

WHEN the public utility companies of the country were by action of the United States Senate ordered to be investigated by the Federal Trade Commission, the supposition was that the Federal Trade Commission, following its usual custom, would make a thorough investigation and report its findings in due season. That, subsequent developments have shown, was a delusion. The *ex parte* hearings being conducted in Washington are a joy to the tabloid and radical press, whose staffs crowd the hearing room and mull over every exhibit and piece of evidence, seeking sensation and scandal. Moreover, either by coincidence or by careful planning, some of the testimony sought relates to Boulder Canyon, which is now being debated in the Senate. If the proponents of that measure can get any help from the testimony before the Federal Trade Commission, they are welcome to it, for apparently they will need all the help they can muster and even then not succeed in getting their measure passed.

Touching the basic functions of the electric light and power industry—that is, the technique and economy of its service—there is not a word in the record, nor apparently, for obvious reasons, will much be sought. Along these lines the industry is well-nigh invulnerable, and it is because of that that municipal plants are losing ground and that the United States excels electrically. From a public relations angle the industry has much to learn, and it is fortunate for it that the product itself so far excels the sales argument made for it. Were this not so, the critics and defamers of the industry might be able to show some progress; but the economic performance of the industry is a rock against which they have learned from bitter experience that it is useless to dash their heads. For that reason they concentrate on and magnify propaganda, little realizing that a pound of fact will outweigh a ton of propaganda and that it is the facts of the electric light and power industry, and not the propaganda, that have made it so successful. We had hoped the Federal Trade Commission would bring these points out, and it may be that eventually it will. So far, however, it has merely reported some spicy gossip and old women's tales.

* * * *

## *Flexibility in Standardization*

THE American Engineering Standards Committee has changed its procedure in order to speed up standardization work. A sectional committee may now be autonomous; a proprietary standard is recognized and also the right of the proprietary organization to revise this standard, and a third change permits of making a standard by the action of a general conference of interested parties. Flexibility is provided in standards making, so that a quick procedure can be followed for any standard at issue.

Comments on the new procedure will be pro and con. Some of the member societies may object to the non-use of the sponsor in all cases of standards making, and there may be disputes as to jurisdiction or the method of making a standard. But only selfish interest can wreck the new plan. It is a great step in advance toward the national standardization plan advocated by the ELECTRICAL WORLD. It deserves the support of the electrical industry and a thorough trial.

* * * *

## *The Key to the Great Power and Industrial Heating Load*

IT IS interesting and fortunate that the development of the further markets for electric power and electric heat in the industrial field both call for the same general approach on the part of the sales departments of the power companies. In each case the major consideration is the analysis of the diverse production problems of the many types of manufacturers to whom these applications of electric service offer opportunities to reduce costs, increase output or improve the quality of the product. Two kinds of service are offered, but for both the first step is to study the production processes of industry.

The further building of both power and industrial heating load is essentially a selling job, and it requires the same kind of man power. It calls for technically trained salesmen who can go into factories and be helpful, because they understand the mental attitude of the factory man and can sense his troubles, talk his language and win his confidence and co-operation. For electric motors and electric furnaces are not purchased save as they give promise—nay, conviction—of resulting economies through improved control, saving of space, elimination of labor, faster speed, reduction of waste or some other desired advantage. The first prime qualification of the power company's engineer, therefore, is his ability to think as a practical factory man.

The basic resource for such work is experience data—information on the conditions surrounding the various types of factories, their peculiar problems and case records that prove the value of electric power or heat. The power companies need a generous fund of such guidance well organized for study and for use. With it the utility man himself may have a practical competence in specifying the smaller sizes of motors and the simpler forms of heat equipment. But for the more intricate installations he must have recourse to experienced utility engineer salesmen and to the manufacturer's specialized application engineers. A poorly sold job is a boomerang where further business is concerned.

It is roughly estimated that but half the power used by industry is now purchased from central-station systems and that the industrial heating load will some day exceed the motor load in size. It is worth working for—and now. But, first of all, it must be made a matter of policy with every company to provide and sustain the man power to develop this waiting business. Here is the key to this great market.

* * * *

## *Scholarship Brings Dividends*

BUSINESS success in the telephone industry depends largely on scholarship. Walter S. Gifford, president of the American Telephone & Telegraph Company, so declares in a recent article in *Harper's Magazine.* Records of 4,125 graduates from 104 colleges were studied carefully and showed that 498 men who had been graduated in the first tenth of their respective classes began to forge ahead of their fellow graduates after about five years of employment by the Bell system. The advantage continued to exist and after twenty-five years of employment these men advanced very rapidly. According to these records, men from the first tenth in college have four times the chances of those from the lowest third to stand in the highest-tenth salary group.

The trend toward the operation of business establishments by hired managers places a premium upon mentality and knowledge. The robust athlete with his 'varsity letter must add to it a Sigma Xi or a Phi Beta Kappa key if he expects to be a leader of his business associates.

* * * *

## *New Light on Conduction*

ELECTRICITY is thought to be granular in structure, and electric conduction is said to be either electronic or ionic in solids, liquids and gases. Electronic conduction occurs in copper wire, for example, and is not associated with the transfer of matter, but in ionic conduction electricity is associated intimately with the transfer of matter. There is no order in the matter, for both types of conduction occur in liquids, solids and gases. Nor does either theory of conduction afford us a conception of what electricity is as a physical entity.

We have become accustomed to using these theories to develop laws which engineers use in practical calculations. One of these laws, intimately related to the theory of electronic conduction, states that resistance will become infinite in conductors when the temperature of the material drops to absolute zero. Recent experiments with liquefied helium by Kammerlingh-Onnes give data which prove the exact opposite. The conductivity of certain metals becomes infinite instead of zero at absolute zero. Instead of resistance increasing as the temperature decreases, the opposite effect occurs, and in certain metals a sudden and very rapid decrease in resistance occurs at a definite temperature. Mercury, tin, lead, thallium and their alloys show this phenomenon and have virtually zero resistance at absolute zero. Why this phenomenon occurs nobody knows, nor does it seem to have any practical importance to engineers. But no one can predict the future, and this phenomenon, recent research work on the effect of purity on conductivity, other recent researches which seem to indicate that magnetism is caused by electronic currents—all these have an interrelation which will be found by some research worker.

Practical applications always follow hard on new knowledge, and the recent researches at least permit engineers to discard another so-called law in electrical engineering. Fortunately Ohm's law seems able to stand the scrutiny of modern experimenters.

* * * *

## *Capitalization and Regulation*

A SECOND refusal by the Public Service Commission of Maryland to approve the purchase of four small light and power properties in that state by a Chicago holding company has followed a rehearing necessitated by a court decision that disapproval could not be based merely on the commission's opinion that no benefit to the public was involved in the sought-for transfer. A utility sale, the court pointed out, does not have to be shown to be of positive benefit to the public; it is enough that it be not detrimental to it. It may easily be that the public has nothing to gain by the sale of Company A to Company B. But if the public loses nothing, its interest is not affected and the commission should not interfere in what then has the character of a private negotiation.

Accepting this dictum as in duty bound, the Maryland commission again dismissed the petition, this time stigmatizing the proposed sale as "detrimental" to the public interest and thus substituting a positive for a negative reason to explain its action. Its real ground of objection was that the sum to be paid was far in excess of the reproduction cost arrived at by the commission engineers. It thus refused to indorse the principle that since such capital expenditures do not influence the rate base they can be approved, even when extravagant, without injury to customers. In view of the inflated prices often paid by expanding companies for competing, obstructive or "logically belonging" plants—sometimes to the enrichment of municipalities, which thus occasionally vindicate as a temporary expedient the policy of public ownership in a way the original proponents little meant—it will be interesting to see whether the Maryland commission's stand will be maintained and whether it will be followed by other commissions.

* * * *

## *Making Research Developments Available to Industry*

REDUCING the time lag between the discoveries of pure scientific research and their application in industry is directly dependent not only on the growth of fundamental research resources, but also on adequate industrial research laboratories to apply the discoveries. The smaller the time lag, the more prosperous the industry and the nation. Pure scientific research has developed theories which at the time of discovery have appeared to be little more than interesting curiosities. At a later date industrial research laboratories, using these theories as a basis, have developed a means of applying them to industry so that finally they become an every-day necessity. In this way our national wealth is increased.

When Michael Faraday in 1831 discovered the principle of electromagnetic induction, he had no definite idea concerning any use to which it could be put, although he expressed his confidence in its ultimate practical application. When asked by the Prime Minister of his country as to its use, he replied: "My Lord, some day you may tax it." Events have proved to a degree undreamed of even by Faraday how true his words were. The discovery some months ago that a single copper crystal of large size had a conductivity 13 per cent greater than ordinary copper wire with its numerous crystals arranged in all directions may some day be put to work through the medium of our industrial research laboratories.

It is significant that the industries which have the best established industrial research laboratories are built on fundamental scientific research. The industrial research laboratory has played a major part in the development of the electrical industry. High-pressure and large-capacity steam generating units have been made possible only by continued research work. As one manufacturer expressed it: "Research has sold itself on the basis of dividends on every dollar spent in studying problems, and the return has more than justified it." Further development of our resources for industrial research is fraught with possibilities beyond our ken.

* * * *

## *Chemical Applications of Electricity*

RESEARCH workers persist in their efforts to generate electricity by chemical action, but only primary and storage cells of relatively low capacity have resulted from their efforts. Nothing yet discovered gives promise of energy production on a commercial scale by the use of chemical reactions. At the Bridgeport meeting of the American Electrochemical Society this topic was discussed at length. Papers outlined many improvements in primary and storage batteries, but the ingredients used fifty years ago still persist in the modern devices. Greater purity in materials, better manufacture and slight improvements obtained by adding small amounts of other material make the modern cells better than those of the days of Le Clanché, but no one has been able to find basic constituents superior to those discovered in the early days.

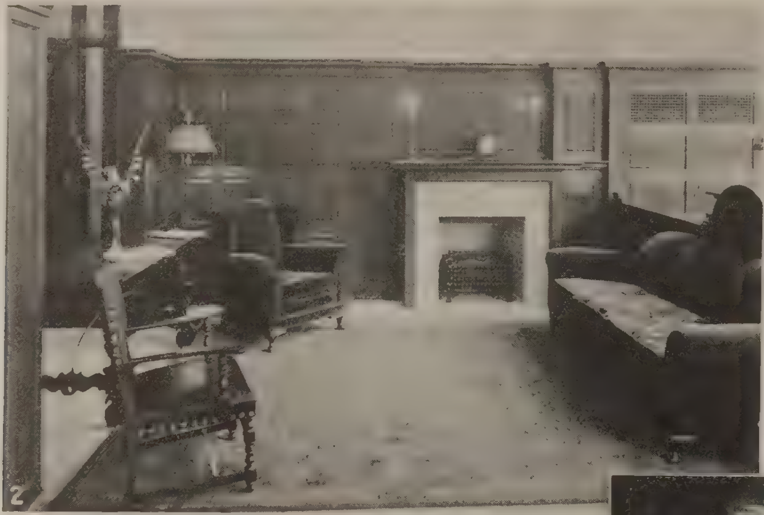
Great advances, however, have been made in the applications of electricity to chemistry and metallurgy. Electrochemical, electrothermic and catalytic effects have been introduced to improve processes and to make new products. Chromium plating is a new and very valuable application; hydrochloric and nitric acids are produced by direct distillation, using the acid itself as a resistor heater; the induction furnace for melting brass and silver has been welcomed: the arc and resistor furnaces have improved processes and products in ferrous and non-ferrous melting and treating.

It is in these directions that the greatest advances are now being made. These applications have resulted in marked economies, improved products and new products, and yet only the surface of possibilities has been scratched. Engineers would do well to keep abreast of the notable developments brought about by the electrochemists and electrometallurgists. They are makers of new industries, and their tools are electric.

# *Public Relations Aided by Design of Utility Office Building*

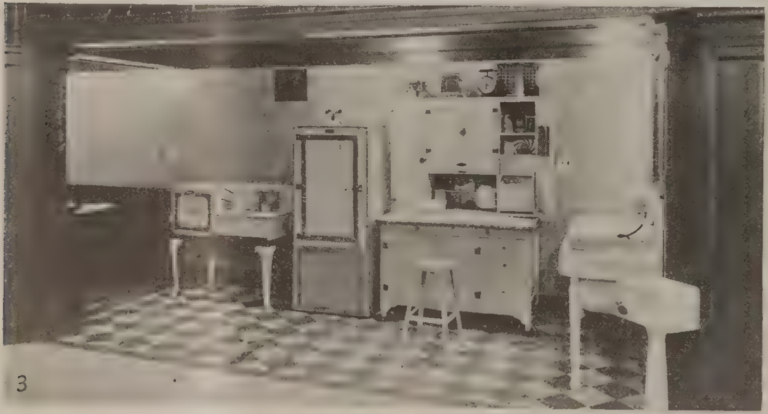
1

*Electric shop, with lamp department, cashiers' counter and sales department at rear*



2

*"Meet Me" corner, for customers' convenience near entrance of electric shop*



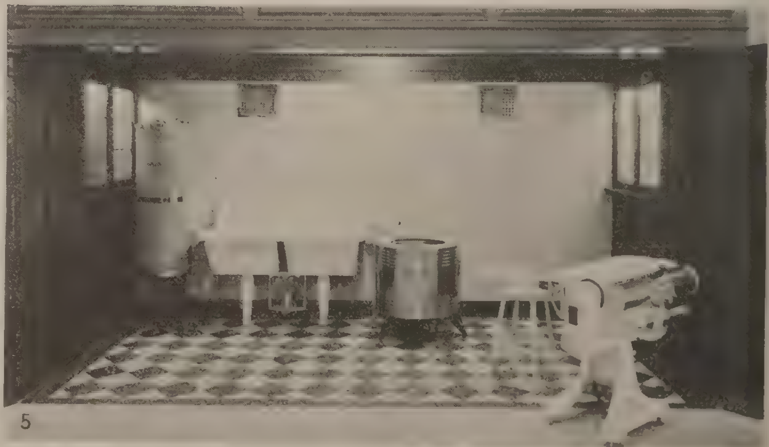
3

*Model kitchen and breakfast nook in street floor alcove*

4

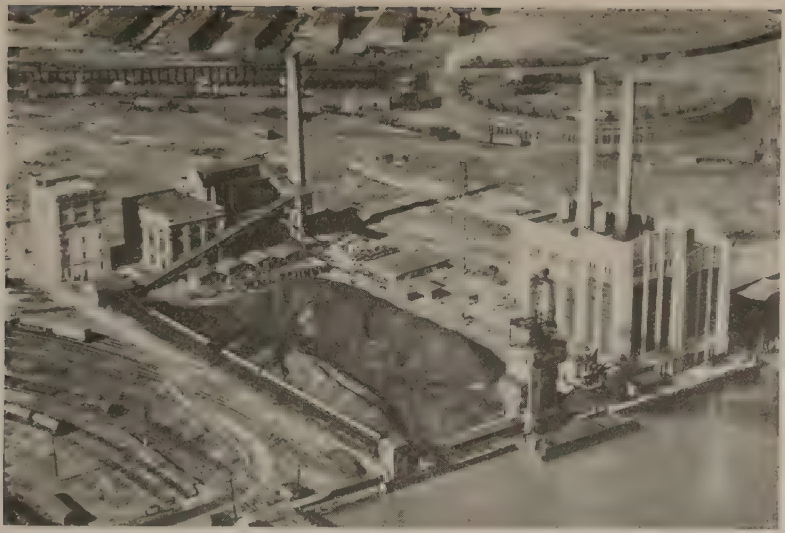
*Night view of company's new home*

ONE OF the most beautifully appointed utility office buildings in the Northeast was thrown open to the public recently by the Public Service Company of New Hampshire, at Manchester. With a finely equipped street and mezzanine-floor electric shop, a heavy-duty appliance department in the basement, executive offices and auditorium on the upper floors, the new headquarters combines hospitality to customers with modern display methods.



5

*Model laundry with electrically heated boiler and illuminated window effects to reproduce outdoor scenery*



# Baltimore's New Station*

### One boiler used per turbine. Low voltage auxiliaries. Automatic equipment employed. Descriptive features at Gould Street plant

THE new Gould Street plant of the Consolidated Gas, Electric Light & Power Company, which began operation in January, 1927, is located in the city of Baltimore on the Patapsco River, an arm of the Chesapeake Bay. The new station has one 36,000-kw. unit operating and a second duplicate unit which will begin operation next month. The plant is designed for four 36,000-kw. units, a total of 144,000 kw. at 60 cycles. The energy is distributed by underground cable at 13,200 volts without transformation. The plot measures 405 ft. x 635 ft. and is of sufficient size to supply load growth for perhaps ten years.

## Coal-Handling Facilities

Coal is unloaded from barges by an electrically operated tower with Mead Morrison equipment and a 2-ton bucket, the present tower having an all-day capacity of 165 tons per hour. The future twin tower will increase the capacity to 300 tons per hour. The coal from the tower hopper passes through a Bradford breaker and thence by belt conveyor to yard storage or coal preparation building.

All of the conveyors are equipped with 36-in. rubber belts and have a capacity of 336 tons per hour. There is no speed adjustment on any of the belts; the ribbon principle is used, the rate of feed or thickness of ribbon of coal is regulated by the apron feeder which delivers coal to the Bradford breaker. At the present time coal is being stocked out and reclaimed by a gasoline-engine-driven, crawler crane, equipped with a 1-yd. grab bucket. The capacity of this rig is about 60 tons per hour. When the third generating unit is installed it will be necessary to purchase a traveling bridge.

The machinery in the coal preparation house for preparing and transporting the coal comprises two 20-ton Raymond roller mills, each with a separate exhauster and circulating system and steam air heater; two transport pumps, each having a nominal rate of capacity of 40 tons per hour, and two 735-cu.ft. motor-driven air compressors. The original installation included steam driers, but these have been replaced by the system of drying in the mill. Air from a tubular air heater using steam at boiler pressure is blown into the circulating air as it enters the mill, providing hot, dry air to absorb moisture from the coal in the mill. Sufficient air is bled off from the top of the cyclone to discharge the moisture picked up and keep the humidity of the air in the circulating system below the dew point. This air bled off is replaced by heated air coming from the air heater, which is mixed with the recirculating air before it enters the mill. The cyclones in which the air and coal are separated discharge the coal into the hoppers above the coal transport pumps. The air drawn off from the circulating system passes through a concentrator, in which the heavier solids are removed, and from there it passes through a washer.

All of the equipment in the preparation plant is electrically driven, using 440-volt, three-phase, 60-cycle, squirrel-cage type motors. There are no circuit-interrupting devices in the preparation plant. Motors are controlled from watertight push buttons operating contactors located in a control room. Sequence interlocks are provided on the controls to prevent flooding or jamming of the coal-feeding system.

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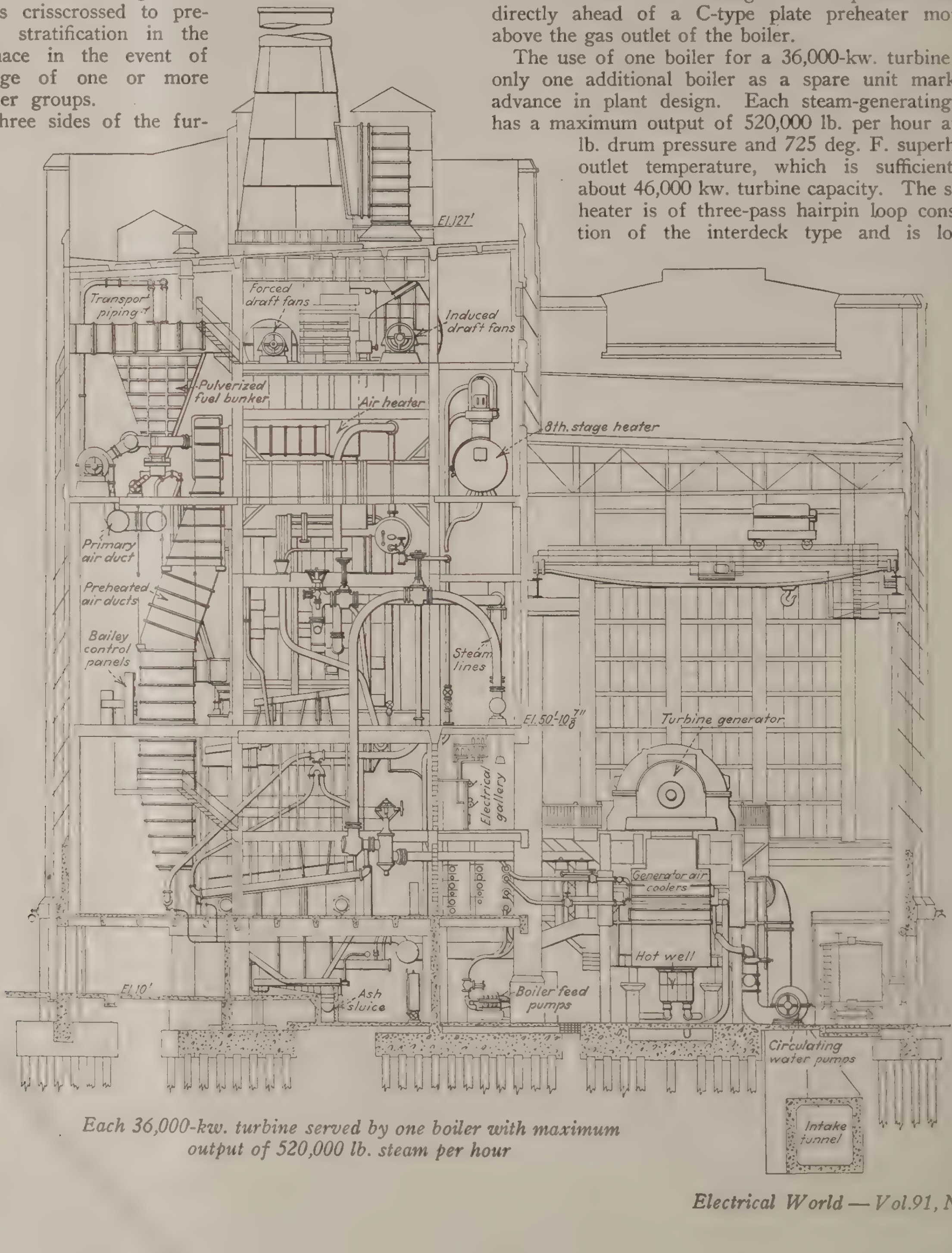
**Abstract of paper by A. S. Loizeaux, electrical engineer of the Consolidated Gas, Electric Light & Power Company, presented at regional meeting of the A.I.E.E., April 18, 1928.*

Coal is pulverized in the mills so that 70 per cent will pass through a 200-mesh screen. After collection in the cyclones, pulverized coal enters the transport pumps and in combination with compressed air is transported through 6-in. pipe lines about 75 ft. long to the bunkers in the power house. The transport pumps and pipe lines are in duplicate and are so arranged that either pump can handle the output of either or both mills. The two boiler bunkers may be fed by either of the transport lines, selection being obtained by electrically operated transport valves located over the bunkers. The powdered fuel bunkers are insulated to prevent condensation inside the bunker. The coal is fed by four quadruplex screw feeders per boiler to sixteen Lopulco type burners through 6-in. pipes crisscrossed to prevent stratification in the furnace in the event of outage of one or more feeder groups.

Three sides of the furnace are water-cooled by fin-tube surface backed by special tile, rock-wool insulation and steel casing. The front wall is of firebrick, cooled by the preheated secondary air, admitted to the furnace through ports at sixteen levels in this wall. A water screen interconnected with the rear wall circulating system protects the ash hopper.



*Each 36,000-kw. turbine served by one boiler with maximum output of 520,000 lb. steam per hour*

Primary air, used to convey powdered fuel from the screw feeders to the burners, is a mixture of preheated air tapped from the secondary duct and tempered room air. Primary air is supplied by two fans per boiler, connected on the discharge by an air bus, which makes any fan available for either boiler. Two forced-draft fans per boiler furnish the secondary air taken from the room and discharged into a plenum chamber directly ahead of a C-type plate preheater mounted above the gas outlet of the boiler.

The use of one boiler for a 36,000-kw. turbine with only one additional boiler as a spare unit marks an advance in plant design. Each steam-generating unit has a maximum output of 520,000 lb. per hour at 450 lb. drum pressure and 725 deg. F. superheater outlet temperature, which is sufficient for about 46,000 kw. turbine capacity. The superheater is of three-pass hairpin loop construction of the interdeck type and is located between the fifth and sixth rows of boiler tubes, as shown in the illustration at the right.

Hydraulically operated ash gates are provided on the bottom of each end ash hopper which allow the ash to drop on inclined feed plates, from which it is washed into the main sluice by jets of water.

The alternator is a 43,750-kva., 13,200-volt, 62½-cycle machine, which is designed to operate later at 60 cycles. In addition to the main generator there is a shunt-wound shaft exciter, rated at 250 kw., 250 volts direct-current overhung on the main shaft, and beyond this and connected by means of a Fast flexible coupling is an auxiliary generator having a capacity of 1,500 kva.

The turbine is a thirteen-stage Rateau impulse machine of 36,000 kw. capacity and drives the main generator through a Fast flexible coupling. It is a modified form of a turbine of lower normal rating of the non-bleeding type. The initial stages, however, have been opened up to pass the additional steam used in bleeding. Steam is supplied at a normal pressure of 390 lb. and a total temperature of 700 deg. F. Steam is bled at the third, fifth, eighth and tenth stages at full-load pressures of 193, 99, 30 and 9 lb. absolute respectively. The turbine is designed for highest efficiency at 25,000 kw. load, and when bleeding steam at four points the unit can produce a net station send-out of 36,000 kw. A larger output can be produced by bleeding at the two lower points only.

A 30,000-sq.ft., two-pass condenser is bolted directly to the bottom of the turbine exhaust casing and is supported partly by the casing and partly by springs on structural piers on the basement floor. The circulating water passages are so arranged that the cooler water leaving the air devaporizing and cooling section is returned in the second pass in the annular ring of tubes around the outside of the top section with which the exhaust steam first comes in contact. The shell is eccentric with the tube sheet, providing a steam belt which on one end extends to the hot well, and prevents excessive condensate depression. The tubes are rolled into both tube sheets.

### Generator Cooling

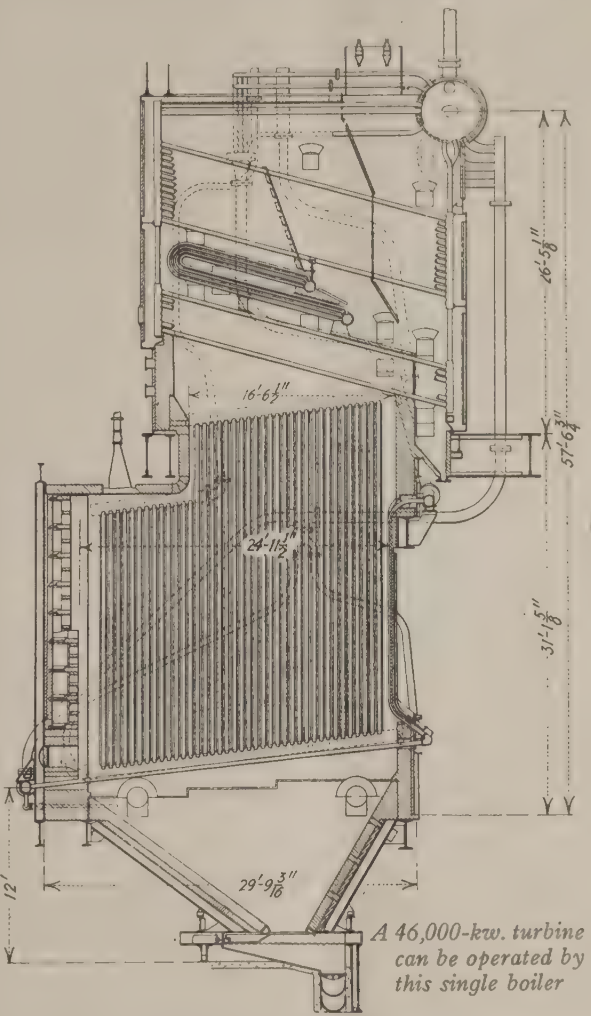
Both the main and auxiliary generators have closed recirculating air cooling systems with two banks of coolers in each, one bank using condensate and one harbor water. The harbor water coolers are connected in parallel with the condenser circulating water system. Condensate cooling is sufficient except for the summer months. The harbor water bank alone will provide sufficient cooling for maximum requirements.

Air is removed from a devaporizing section at the bottom of the condenser by a steam-jet air pump provided with a two-pass intercondenser, cooled by condensate only. Vent steam from the two top stage bleeder heaters and from the vent condenser of the deaërating heater is also condensed in the intercondenser. The exhaust from the second stage jet is condensed in the after condenser.

IMPORTANT RATIOS FOR GOULD STREET STATION

| | Present | | Ultimate | |
|---|---|---|---|---|
| Condenser surface per installed kilowatt, square feet | 0.833 | | 0.833 | |
| Circulating water per installed kilowatt, gallons per minute | 1.25 | | 1.25 | |
| Kilowatt installed capacity per boiler | 18,000 | | 28,800 | |
| Boiler heating surface per installed kilowatt (including water screens) | 1.617 | | 1.009 | |
| Furnace volume per installed kilowatt, cubic feet | 1.167 | | 0.729 | |
| Furnace volume per rated boiler horsepower, cubic feet | 7.22 | | 7.22 | |
| Square feet of area and cubic feet of volume of buildings per installed kilowatt | | | | |
| | Present | | Ultimate | |
| Turbine room | 0.1903 | 16.32 | 0.1523 | 13.06 |
| Boiler house | 0.2333 | 27.20 | 0.1400 | 16.33 |
| Coal preparation plant | 0.0776 | 5.51 | 0.0388 | 2.755 |
| Switch house | 0.0776 | 7.92 | 0.0388 | 3.58 |
| Total buildings | 0.5788 | 56.95 | 0.3699 | 35.725 |

Circulating water from the Patapsco River passes through bar iron trash racks and traveling water screens into an intake tunnel which will extend the length of the turbine room. Each condenser is supplied by two motor-driven pumps of 20,000 gal. per minute capacity each, both of which are required under full-load conditions in the summer. A steam-jet ejector is used for priming the circulating water pumps.

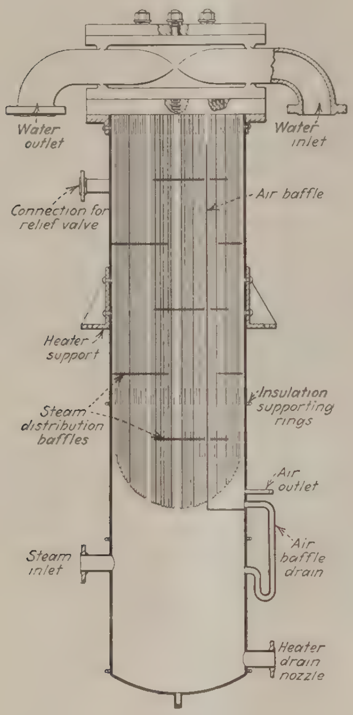


*A 46,000-kw. turbine can be operated by this single boiler*

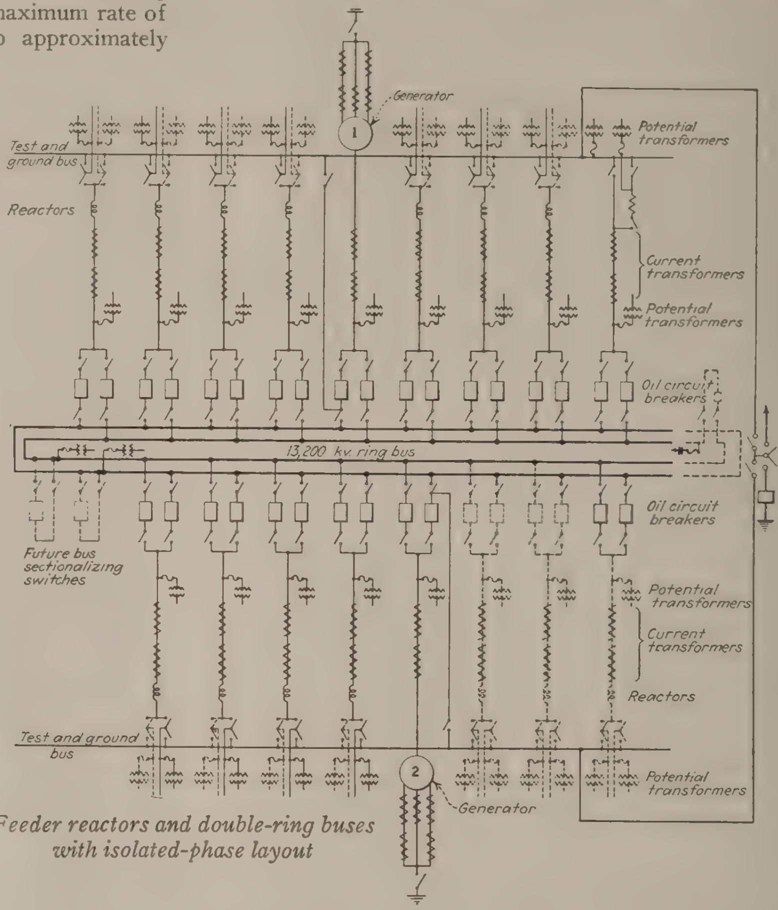
It has sixteen powdered coal burners, fin-tube cooled side walls and furnace measuring about 25 ft. deep by 31 ft. high.

The third-, fifth- and tenth-stage bleeder heaters, the evaporator condenser and the after condenser are of the vertical closed type with four passes each. The construction of these heaters is shown in an accompanying illustration.

The eighth-stage heater is of the direct-contact deaërating type in which part of the bled steam is used in a section into which the condensate is sprayed through jets and part is used in another section similar to the open type feed heater in which trays are located and from which the air is removed. The pressure in the heater varies as the bled steam pressure varies. This heater is in the boiler house at an elevation of 80 ft. above the boiler feed pumps, which take their water from it. With a shell capacity of 6,400 gal. it serves as a closed surge tank. The only condensate in the cycle which comes in contact with air is the condensed drip in the after condenser, which passes through the deaërating heater on its way back to the boiler.



*Hairpin type construction used for bleeder heaters and evaporators*



*Feeder reactors and double-ring buses with isolated-phase layout*

Make-up is supplied by a low heat level interstage evaporator of the vertical single-effect recirculating film type, using city water as feed at a maximum rate of 10,000 lb. per hour, corresponding to approximately 2½ per cent of the total full-load turbine steam flow. Fifth-stage steam is used and the vapor is condensed in the evaporator condenser.

One five-stage motor-driven boiler feed pump of 1,000 gal. per minute capacity is provided for each main unit, with one spare unit of the same size for each group of two units so arranged as to be available for either. A steam-turbine-driven four-stage pump, serving as a boiler protector only, is installed.

### WELDED PIPING USED

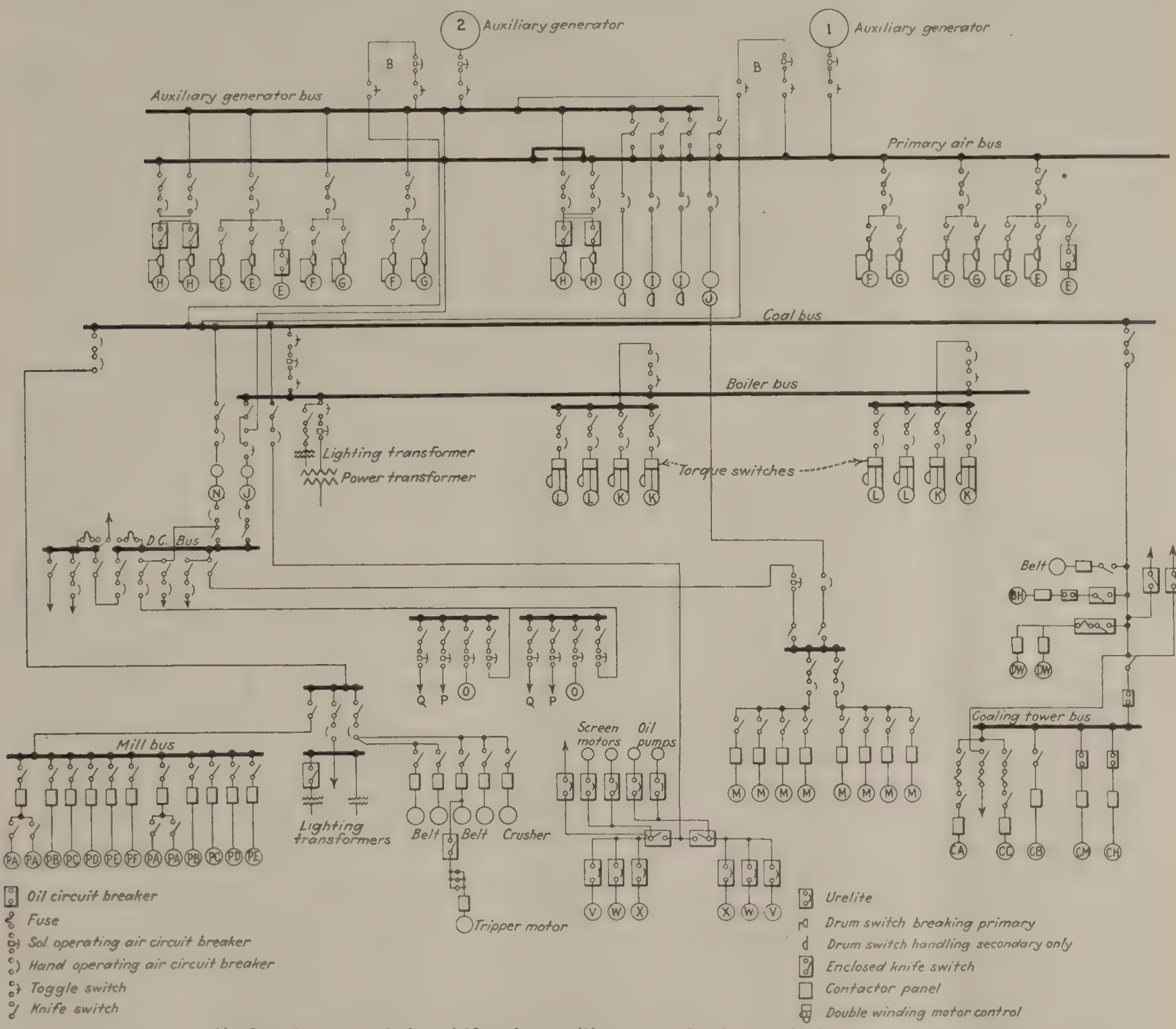
The single row of boilers parallel to the row of turbines makes for a very simple steam piping system. Steam is conveyed from single outlets on the Nos. 1 and 2 boilers to a four-neck manifold, from which is taken the No. 1 turbine lead and a tie to a second manifold. The second manifold is a duplicate of the first, with a connection from the No. 3 boiler and the No. 2 turbine in addition to a future manifold. Boiler and turbine leads are 16-in. outside diameter seamless tubing, designed for steam velocities of 9,000 ft. per minute at rated load. Sargol joints, 600-lb. standard, with serrated faces are used throughout, but valve flanges are made up with gaskets and not welded. An emergency closing valve was used on the No. 1 turbine lead, but it will be omitted on the second unit. Motor-operated stop valves are used with additional remote control stations on the turbine platform.

One main and one auxiliary header is used on the boiler feed system with one feed line to each boiler from each header. All feed lines are of seamless steel extra heavy iron pipe size. Eighty-five per cent magnesia insulation with a cement finish covered by 8-oz. army duck is employed throughout.

The generating voltage is 13,700 at the bus and about 13,300 at city substations, the nominal voltage at the point of usage being 13,200. From the power house the energy is carried through the cable tunnel to the isolated phase switch house by means of three 1,000,000-circ.mil lead-sheathed cables per phase. Insulation used on these cables is the standard for substation work, being $\frac{4}{32}$-in. thick, 30 per cent Hevea rubber and $\frac{10}{32}$-in. varnished cambric.

The switch house has a basement and six floors. The side aisles of the basement are used for the high-tension potheads, this being the first and only place the phases come together. The center of the basement has been reserved for a 4,000-volt distribution substation in the future. The first main floor has C phase equipment, the second carries B phase, and the third A phase. The operating mechanisms for the oil switches, bus disconnects and pothead disconnects are located on the fourth floor, together with the connections to the specially calibrated instrument transformers used on the water rate test circuits.

The oil switches on the outer ring bus have a rupturing capacity of 40,000 amp., r.m.s. at 15,000 volts, based on the standard A.I.E.E. duty cycle, and they are built to operate on 15,000 volts, although standard 25,000-volt insulation is provided throughout. All generator and test bus tie circuits are equipped with 2,000-amp. apparatus, while the outgoing feeders have 600-amp. oil switches and disconnects.



*Air breakers used for 460-volt auxiliary supply from shaft-end generators*

*B*—Tie auxiliary generator to coal bus.
*E*—Drip pumps.
*F*—175-hp. circulating pump.
*G*—125-hp. condensate pump.
*H*—75-hp. primary air fan.
*I*—500-hp. boiler feed pump.
*J*—50-kw. motor-generator set.
*K*—200-hp. forced-draft fan.
*L*—550-hp. induced-draft fan.
*M*—5-hp. coal feeder motors.
*N*—200-kw. motor-generator set.
*O*—250-kw. exciter. *P*—Main field.
*Q*—Auxiliary generator field.
*V*—50-hp. service water pump.
*W*—50-hp. harbor water pump.
*X*—125-hp. harbor water pump.
*PP*—Preparation plant bus.
*CH*—300-hp. hoist motor.
*CM*—60-hp. trolley motor.
*CB*—100-hp. Bradford breaker.
*CA*—5-hp. apron feeder.
*CC*—Air compressor.
*PA*—1-hp. mill feeders.
*PB*—200-hp. mill.
*PC*—100-hp. mill exhauster.
*PD*—75-hp. transport pump.
*PE*—150-hp. air compressor.
*PF*—75-hp. drier exhauster.
*DW*—10-hp. dock winches.
*BH*—60-hp. barge haul.

The inner ring bus is equipped with switches having a rupturing capacity of 40,000 amp. on the generator and test bus tie circuits only. The feeder switches have a rated rupturing capacity of 30,000 amp.

Each three-phase feeder is equipped with three single-phase reactor coils, one on each phase floor, these coils having an impedance of $\frac{3}{4}$ ohm, which limits a dead short circuit or ground to a maximum of 10,000 amp., which is only one-third or in some cases one-fourth of the rated rupturing capacity of the switch.

Each machine has its own exciter bus which supplies excitation to the fields of both the main and auxiliary generators. Power is usually fed into this bus from the shaft exciter, but an emergency supply is available from a 200-kw. motor-generator set.

Station auxiliaries are designed for 460 volts rather than 2,300, because the lower voltage motors were lower in cost and kept in manufacturers' stocks. It was felt that the lower voltage was also somewhat safer and could be handled well by carbon circuit breakers. Carbon circuit breakers occupy less space than oil switches that would be required for 2,300 volts. Their cost was lower and they are subject to inspection during operation as they are mounted on the front of the auxiliary switchboard. The fire hazard with oil switches is also avoided.

The supply of fuel and air to the boilers and the removal of gas is controlled by Bailey automatic equipment which governs the speed of the forced-draft fans, induced-draft fans and coal feeders. The circuits controlling the fans, feeders, etc., have been interlocked to shut down the equipment automatically in the event of failure of any part of the apparatus which might result in explosive mixtures in the furnace.

The induced- and forced-draft fan controls are the most unique in the plant. Due to the large size of the boilers and the high guaranteed rating of 550 per cent nominal rating, each of the boilers requires 1,500 hp., divided up as follows: Two 200-hp. forced-draft fans, which introduce fresh air to the combustion chamber, and two 550-hp. induced-draft fans which blow the hot gases up the stack.

The control for each fan consists of a low-speed secondary regulating resistance drum, a transfer switch for changing the number of poles by altering primary connections, a high-speed secondary regulating resistance drum, a balanced high-speed drum for the last five-speed points, a torque switch for starting and the necessary circuit breakers and relays for interlocking and automatic protection. This combination of apparatus provides approximately 55 speed points for each fan.

In order to start up the fans it is only necessary to push a button. When the automatic combustion control calls for more draft the drums begin to rotate, the primary circuit breakers are automatically closed, the torque switches revolve until the motor starts up and the drums are set on the desired operating point automatically. In the case of the induced-draft fans, stack dampers are controlled by the same combustion control drive and a range of natural draft is utilized before the primary breakers close and the fans start. The speed range of the induced-draft fans is from 110 to 870 r.p.m. and on the forced-draft fans the speed range is from 145 to 1,170 r.p.m.

Primary air fans are controlled by manually operated secondary regulating resistance drums having eleven points, five of which are balanced. Their speed range is from 700 to 1,750 r.p.m.

An elaborate system of interlocks has been provided to take care of emergencies in operating and to prevent situations which might cause an explosion of the powdered coal mixture in the boilers. Relay protection is provided to trip the fan circuit breakers on loss of 460 volts service. In case the two induced-draft fans are tripped the two forced-draft fans are automatically removed from the line to prevent the formation of positive pressure in the furnaces. If, at this time, the combustion control is still calling for mechanical draft, three of the four coal feeder motors are shut down.

The coal feeder motors are 5 hp., 250 volts, d.c., inclosed, and have a speed range of from 400 to 1,600 r.p.m. The 500-hp. boiler feed pumps are controlled by motor-operated drums having 36 points and a speed range of from 1,400 to 1,750 r.p.m.

The 125-hp. condensate pumps have 24-point hand-operated secondary regulating resistance drums with eight balanced points, giving a speed range of from 1,400 to 1,750 r.p.m. The 175-hp. circulators also have hand-operated drums with a speed range of from 175 to 350 r.p.m. in eleven steps, five of which are balanced.

Throughout the design of the Gold Street plant the object was to secure maximum reliability with minimum total costs per kilowatt-hour. By total costs is meant not only operating labor and superintendence, maintenance and fuel cost, but fixed charges on the investment. This criterion was used in the choice of apparatus, the cost of the apparatus being weighed against its ability to reduce production costs.

The actual cost of the first unit and the estimated costs of three additional units are shown in the following table (the estimated cost of the completed plant of 144,000 kw. being $88.26 per kilowatt):

| | One Unit (Actual) | Two Units (Estimated) | Three Units (Estimated) | Four Units (Estimated) |
|---|---|---|---|---|
| 1. Investment cost as per report of June 20, 1927... | $4,681,821 | $7,396,224 | $10,090,322 | $12,709,909 |
| 2. Capacity, kilowatts...... | 36,000 | 72,000 | 108,000 | 144,000 |
| 3. Cost per kilowatt......... | $130.05 | $102.73 | $93.43 | $88.26 |

The wide spread between the cost per kilowatt of the first unit and the cost per kilowatt of the completed plant is due to the many items included under the first unit, which are designed for the completed plant, such as land, receiving platform for coal storage, coal handling, preparation plant, etc.

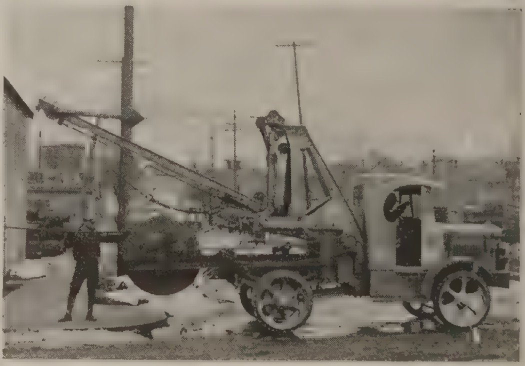
The capacities given in the above table are the net send-out capacity with four-stage bleeding.

Under two-stage bleeding conditions capacity is increased considerably and a net send-out capacity of 40,000 kw. is readily obtained, and will be obtained in the event of need, for peak-load conditions. Figuring this higher capacity the investment costs become as follows:

| | One Unit (Actual) | Two Units (Estimated) | Three Units (Estimated) | Four Units (Estimated) |
|---|---|---|---|---|
| 1. Investment cost as per report of June 20, 1927... | $4,681,821 | $7,396,224 | $10,090,322 | $12,709,909 |
| 2. Capacity, kilowatts...... | 40,000 | 80,000 | 120,000 | 160,000 |
| 3. Cost per kilowatt........ | $117.05 | $92.45 | $84.08 | $79.44 |

The investment figures given include all expenses of every nature in connection with this plant, covering such items as preliminary engineering, old buildings used, interest during construction and during tuning up period, also a portion of the floating equipment of the company properly allocated to serve this plant.

## Cable Pulled by Reel on Derrick Truck



THIS power-driven wire reel has been found to reduce time and labor greatly in removing large overhead cables and indicates one of the many uses for a 10-ton derrick truck utilized by the Northwestern Electric Company, Portland, Ore. The cable-pulling attachment can be removed easily and the derrick used for handling heavy material and equipment.

# Proper Location of Disconnecting Switches Insures Safety

By W. Specht
*Switchboard Engineering Department, General Electric Company*

DISCONNECTING switch placements should be carefully planned if adequate safety is to be afforded operating men. Not only is the question of proper height involved but the width of aisles is also important. These values have been analyzed, and as a result the accompanying chart has been developed.

The curves inclose areas from which the safe location of disconnecting switches using 4-, 8-, 12- or 16-ft. switch hooks can be determined. These areas are based on a minimum operating angle of 30 deg. from the vertical and a proper maximum and minimum height for the lower end of the operating hook, permitting the operator to use both hands even in the maximum position, thereby assuring easy and steady manipulation of the hook.

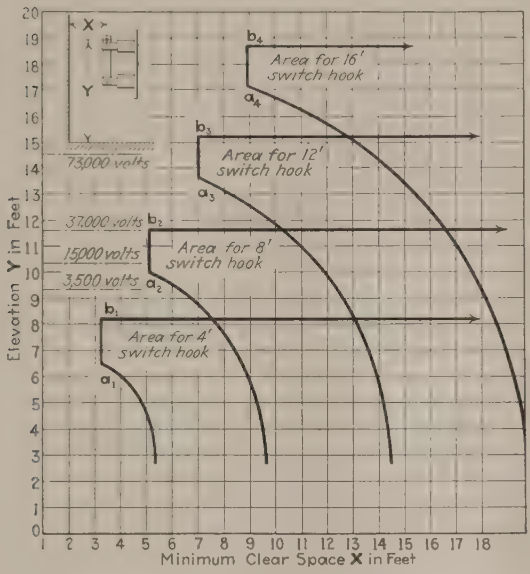


*Chart aids in designing switch placements*

If the width of the aisle is given and therefore the dimension $X$ is known (see upper left-hand corner of illustration) it is then an easy matter to determine the possible dimension $Y$ by finding the value of $X$ on the horizontal scale and following it vertically until the circular curve bounding the area corresponding to the switch hook used is reached. Between this point and the point where the line leaves the area, vertically above it, lies the possible dimension $Y$. Likewise, if $Y$ is given, the minimum dimension $X$ can be determined in a similar manner.

Assume that a 15,000-volt disconnecting switch is to be mounted in an aisle 6 ft. 7 in. wide, which will require the use of an 8-ft. operating hook. The distance from the wall, on which the disconnecting switch is mounted, to the eye of the blade is given as 11 in. What is the permissible $Y$ dimension?

Taking the above dimensions into consideration, $X$ is equal to 79 in. minus 11 in., or 68 in. (5 ft. 8 in.). Following the vertical at $X = 5$ ft. 8 in. it will be seen that the circular curve is intersected at $Y = 9$ ft. 8 in. and the horizontal line of this area (directly above) at $Y = 11$ ft. 8 in. This means that the disconnecting switches may be mounted with the $Y$ dimensions between 9 ft. 8 in. and 11 ft. 8 in. and at both extremes can be conveniently operated by an 8-ft. switch hook. Values of $X$ falling to the left of the vertical line indicate too narrow aisles.

Assume now that the height $Y$ is limited, say, to 9 ft. 6 in. Then find the horizontal line corresponding to this dimension and follow it until it cuts the vertical or circular curve bounding the corresponding area (in this case for the 8-ft. switch hook). In the present case it will be found that the circular curve is intersected at $X = 6$ ft. 0 in., which is the minimum dimension. Of course, there is no limit for $X$ maximum and therefore the areas in the illustration have no boundary on the right-hand side.

The marking along the vertical scale 3,500 volts, 15,000 volts, etc., are the minimum vertical dimensions $Y$ for the voltages indicated when disconnecting switches need not be protected by barriers. This makes it easy to see whether barriers must be furnished after the $Y$ dimension has been determined. For instance, in the last example with the $Y$ dimension = 9 ft. 6 in. and a 15,000-volt disconnecting switch it is immediately seen that barriers are required.

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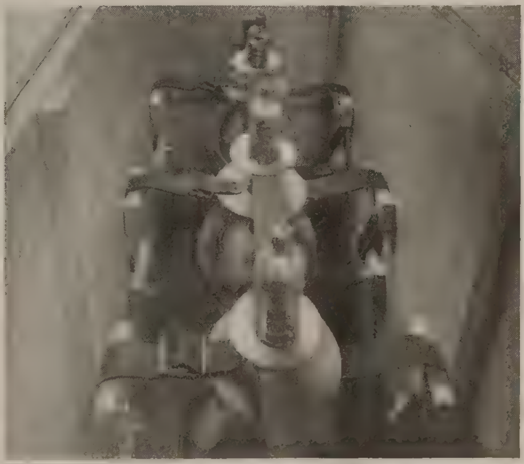
# Carrier for Kenotron Tubes

By R. W. Chadbourn
*Department of Standardizing and Testing*
*Boston Edison Company*

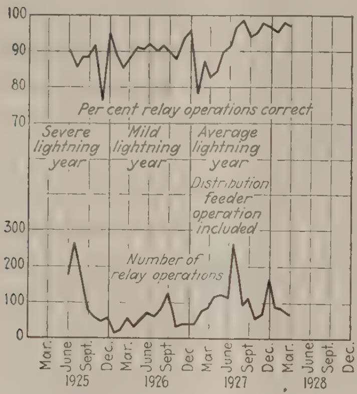


TO SAFEGUARD kenotron tubes against breakage during transportation in a portable testing unit recently built for the Edison Electric Illuminating Company of Boston a special box was constructed to carry five tubes in a vertical position, as shown in the accompanying illustration. Each tube is held in place by two short straps of canvas secured to the sides of the box. In the center of each strap is a round piece of leather with a hole cut to fit the end of the tube. The top strap has a safety buckle which permits its removal from the tube. The tube can then be lifted out of the hole in the lower strap. As a further safeguard a long strap runs longitudinally through the box and acts as an anchor for all five tubes.

# Direct Benefit of Field Testing of Relays

By B. M. Jones
*Equipment and Protection Engineer*
*Duquesne Light Company*

THE direct benefit of field testing of protective relays is the improvement in the service rendered and the improvement in the operating performance of these relays with their associated devices, the first being by far the most important and the object for which all operating companies strive.



*Relay performance improved since adopting field testing*

The accompanying graphic record shows the relay operating performance of the Duquesne Light Company from June, 1925, to and including the first quarter of 1928, and the benefit of the field relay testing improved correspondingly with the relay performance. The average for the portion of the year 1925 was 88.4 per cent, for the year 1926 91 per cent, for the year 1927 92.5 per cent, and for the first quarter of 1928 96.7 per cent. This percentage of correct performance includes the performance of the relays themselves, the current transformers, the potential transformers, the tripping battery, all control and switchboard wiring, the mechanical adjustment of the breaker and its auxiliary switches and all devices that go to make up the automatic circuit-interrupting device. This method of rating the relay performance is in accordance with the recommendations of the relay sub-committee of the A.I.E.E.

With a simple transmission system the adequate relaying of the lines and equipment is relatively simple and field testing is not so important. However, with a complicated transmission system and the various complicated relay schemes that must be used, the matter of field testing becomes of utmost importance, and to the relay engineers and operating departments of our company this method is the most dependable means that we know of to assure the relays and associated devices being in the proper condition for isolating faulty equipment in the minimum time.

A large part of the improvement shown on the graph is derived from the testing of directional line ground relays by actually grounding the line. The article in the ELECTRICAL WORLD of March 17 entitled "Field Testing of Relays," by Messrs. Evans and Salsbury of our company, describes in detail the methods used for the field testing of relays. The test plan involves the use of a truck-trailer with voltage regulators, circuit breaker, storage battery, water barrel load, instruments and auxiliary and control equipment.

It has cost some money to make the field relay tests, but our company feels that this investment has returned very large dividends, and such tests are not being restricted in any manner.

# Mercury-Arc Rectifier Inspections

By O. M. Ward
*Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.*

INSPECTION of mercury-arc rectifiers on the Milwaukee Electric Railway & Light Company system must be made once a week, and if anything unusual is noticed during inspection or operation a verbal report must be made to the chief operator as soon as it is possible to do so.

The report form which follows is made out in duplicate, one copy being sent to the chief operator and the other kept at the station, so that the inspector may have the guidance of previous inspection:

## *Inspection Report for Mercury-Arc Rectifier Stations*

Date................

**26,400-Volt Equipment:**
Insulators. Are any broken?......Do any show leakage?......
Lightning Arresters. Condition..............................
Disconnecting Switches. Is there any signs of heating?........
Do switches show mechanical defect?....................
Fuses. For auxiliary transformers.
(Inspect every three months) ............................
Date of last inspection.....Mechanical condition of fuse.....

Oil Circuit Breakers.
Date of inspection.........Was oil sample taken?..........
Date.................Oil sample to be taken every three mo.
Date oil was changed........Were contacts inspected.......
Condition ..........................................

Operating Mechanism. Oiled....Do any parts show wear?....
Which ..............................................
Main Transformer and 60 Kw. Auxiliary Transformers.
Oil level ..............Insulators cleaned ..............
Is temperature normal? ............Connections ...........

Rectifier. Insulators cleaned ...........................
Mercury Seal.
Is level correct?......What was rectifier temperature?......
Was ignition mechanism checked? .......................
Date water chamber was painted .........................
Date water was added to circulating system ..............
Date alcohol was added ..................................
Date alcohol was taken out...............................
Condition of hose connection ............................

Vacuum Pump. Date oil was changed........Packing........
Motor .........Heating plate .........Bearings .........
Vacuum gauge ........Contacts ........Resistance ........
Motor Circulating Pump Bearings. Packing..................
Thrust bearings.......Water connections.......Motor......

Fan. Motor ......Bearings ......Bearing oil changed......
Date fan started ...........Date fan stopped ...........

A.C. Relays. No...... No...... No...... No...... No......
Res. for relay ...... ........ ........ ........ ........
Contacts ........ ........ ........ ........ ........
Mechanical Oper...... ........ ........ ........ ........
Time delay relay setting ...... ........ ........ ........
Indicate if any relay settings have been changed............
..........................................................
..........................................................

Excitation Transformer and Automatic Equipment for it.
Are there any signs of heating?..........................
Were connections checked? ...............................
Date cleaned..........Was ignition coil checked?..........

**600-Volt D.C. Equipment:**
Circuit Breaker. Mechanical operation......................
Main contacts...............Operating coils...............
Auxiliary contacts ..............Resistance ..............
Are lockout signals O.K.?......Any lamps burned out?......
Relay No. 13 .............................................
Relay No. 12 .............................................

Wattmeter Readings. To be taken once each month.
Date ........... Reading ........... Constant ...........
Veeder Counter Readings. To be taken weekly. Date taken....
D.C. Breaker. Present reading...Previous reading...Diff....
A.C. Breaker. Present reading...Previous reading...Diff....
Condition of Building. Report monthly ......................
Remarks. Report any unusual conditions......................
..........................................................
..........................................................
..........................................................
Inspector....................

# Operating Experiences

## at Gould Street Station*

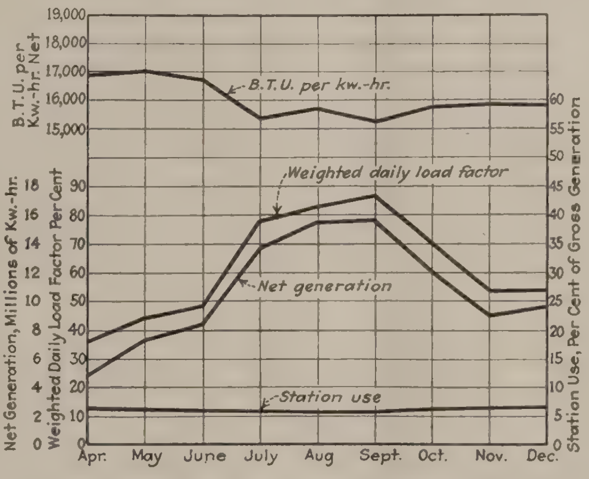
Performance obtained during initial operation of the new station of the Consolidated Gas, Electric Light & Power Company of Baltimore and methods adopted to overcome usual preliminary troubles

TROUBLES which have developed in the coal-handling equipment of the new Gould Street station of the Consolidated Gas, Electric Light & Power Company have not resulted in any great amount of inconvenience. Of major importance was the failure of some parts used in propelling the airplane tripper and its unloader belt, the drive being from the main conveyor belt by means of gearing and clutches. One of these failures resulted in a runaway condition, with considerable damage narrowly averted. The weakness was obviated by adopting a cable-haulage arrangement actuated by a separately controlled motor.

A pulverized-coal system handling wet coal is subject to many ills, and it is difficult to obtain proper flow at many of the points where gravity is the moving force. Very unsatisfactory grinding is obtained with wet coal. After the coal is ground, some of it forms a pasty mass and sticks at almost every conceivable point. A mucky mass very often collects in the mill, choking up the air passages. Vent lines become choked. Cyclone separator discharge lines become plugged. Transport pumps and lines become plugged. The coal cakes in the pulverized coalbins and arches over the feeder screws at the boiler, causing burners to become extinguished. Even the burner pipes become so choked that in many cases it is necessary to take pipes down for cleaning, as rapping on the pipe is often ineffective. There is also much difficulty from irregular feeding of the coal to the furnaces, which greatly reduces the furnace efficiency.

The steam-heated grid type driers originally installed were found to be inadequate for our conditions. As already explained, the delivery of fine coal to the drier resulted in arching and inability to get the coal to flow through the drier. There was also additional trouble due to the pulling along of considerable coal by the air used to remove the moisture. A large amount of air is necessary, and while it was put through a cyclone separator, the separation was incomplete, causing a considerable loss of coal. The coal recovered in this cyclone separator was discharged into the hoppers of the transport pumps. There was the additional objection that much of this coal was coarser than desired. Some of the drier grids were removed to better these conditions. While feeding was bettered, drying was less complete.

Furthermore, the amount of moisture removed was not so great as was necessary for the satisfactory milling and handling of the coal. Failure in this respect caused the consideration of other means of obtaining the desired result. We believed that the most reasonable scheme would be that of drying the coal, which is in a finely divided state, in the air circulatory system of the pulverizing mills, and that it should give up its free moisture very readily. Due to the relative locations of the mill house and boiler room, it was not feasible to use either stack gases for supplying the heat required or the air vented from the mill system for primary air. Accordingly, it was decided to heat the make-up air by means of high-pressure steam, so as to obtain the maximum temperature, thereby permitting us to supply the necessary heat with a minimum of air. This permits of using apparatus that is much more compact and reduces to a minimum the amount of fine coal that is lost in the vented air. The mill drier is not effective in drying the coal until it enters the mill, and this, of course, does not help the flow of coal to the mill. High moisture, however, has caused no appreciable difficulty in feeding the mills, since the grid driers have been removed. The mill drying system is performing very satisfactorily and has practically eliminated the many annoyances incident to wet coal. In regular operating practice the mill drier has been successful in reducing the moisture content of the coal from 6 per cent entering the mill down to 1.7 per cent leaving the mill.



*Nine months' records at new Baltimore station*

Attention was concentrated on securing dependable operation and not on output.

The air washer as originally installed for use with the grid type driers did not remove the coal dust to a sufficient degree. It was also inadequate when the mill

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*Abstract of paper by A. L. Penniman, Jr., and F. W. Quarles of the Consolidated Gas, Electric Light & Power Company, presented at the regional meeting of the A.I.E.E., Baltimore, April 18, 1928.*

type drier was put in commission. In order to obtain satisfactory removal, it was necessary to increase both the amount of steam and water used. At the present time approximately 1,150 lb. of steam and 2,000 gal. of water are used per hour, with a dust concentration of about 0.8 grain per cubic foot of air entering the washer, the amount of air handled being approximately 1,240 cu.ft. per minute.

### Mills Work Well

On the whole, the pulverizing mills have performed very satisfactorily, although, of course, there is considerable wear of the grinding rollers and bull ring of the pulverizing mills and of the blades and wearing plates of the mill exhausters. These mills, designated by the manufacturer as of 20 tons per hour capacity, have pulverized at an average rate slightly in excess of 24 tons per hour each, the coal leaving the mill having an analysis about as follows:

| | |
|---|---|
| Moisture | 0.76 per cent |
| Volatile | 25.28 per cent |
| Fixed carbon | 63.76 per cent |
| Ash | 10.20 per cent |
| Sulphur | 2.02 per cent |
| Amount through 200-mesh sieve | 74.2 per cent |
| Amount through 100-mesh sieve | 89.4 per cent |
| Retained on 40-mesh sieve | 0.4 per cent |

At times there has been some difficulty experienced due to coal hanging up in the cyclone separators or in faulty delivery to the hoppers of the transport pumps, because of improper functioning of the flappers of check valves or the choking of vent lines from hoppers to suction pipes of mill exhausters. One other difficulty is the collecting of a mucky mass of coal and water in the chamber of the mill that receives the air returned from the cyclone separator. A muck-collecting pocket installed on one of the mills served to alleviate this condition somewhat. However, the better drying obtained when the mill type drier was installed eliminated all trouble of this nature.

### Coal Transport System

There was considerable trouble with the operation of the pulverized-coal transport system when the plant became active. Most of the difficulties resulted in the plugging of transport lines, which, being new and rough, were accredited with the responsibility for part of the troubles. The starting up of this system occurred during cold weather, and this, in conjunction with the faulty performance of the driers, was responsible, no doubt, for the greater portion of the plugging. Also, the size of the hoppers above the transport pumps was thought to be too small for even delivery to the screws of the pumps and partially responsible for the pumps plugging. Accordingly, they were increased in size by adding height with filler pieces having rectangular openings to conform to the hoppers. It was discovered that considerable water collected in the cylinders of the pumps after being shut down several hours. Keeping the pumps drained was the logical answer to this difficulty. Increasing the air pressure on the nozzles of the pumps also helped to keep the boilers supplied with coal. Later, when the transport lines were worn smooth and the mill drier system was in service, trouble with the transport system practically disappeared.

Coupled with the difficulties of pumping the coal was the difficulty of the sticking of the transport line switching valves. This was alleviated somewhat by applying brass liners to the valves. This has not been an absolute remedy, as it is necessary to operate the valves frequently, and even then occasionally to dismantle them for complete cleaning. A careful analysis of the factors involved is now under way and it is hoped that this will result in eliminating any abnormal routine operation of the valves to prevent their sticking.

The amount of power used in the grinding and transporting of the pulverized coal averages approximately 19.6 kw.-hr. per ton of 2,000 lb. The expenditure for the maintenance of pulverizing equipment has been approximately 13.9 cents per ton.

### Boiler Room Operation

The greater amount of effort for tuning up and making structural changes to approach or exceed design conditions has been put forth in the boiler room. While efforts have been made to hasten the process, at this date there are several matters that have not been brought to a satisfactory state.

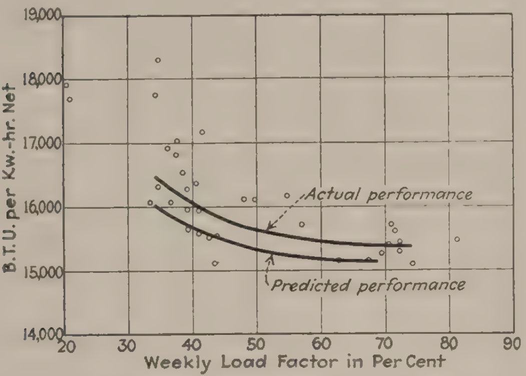
At the outset considerable difficulty was experienced with poor feeding of the coal due to insufficient drying and condensation on the walls of the bunkers. It frequently became necessary to empty a bunker of the coal which would flow and then have men enter the bunker and scrape down the pasty masses of coal clinging to the walls and arched over the feeder screws. This condition was eliminated almost entirely by the mill type drier when it was put in operation. Since our early experiences, No. 1 bunker has been covered with heat-insulating material and an investigation has been made on No. 2 bunker by forcing preheated air over the coal from one end to the vent at the opposite end to reduce the humidity of the air over the coal. The use of hot air results in less condensation on the walls, but there also is an increase in the amount of coal lost out of the bunker vent. A combination of heat insulation with the use of hot air would probably give a still better feeding performance.

With the coal-feeding equipment originally installed it was impossible to reach the maximum designed capacity, part of the fault being insufficient motor speed. However, sufficient coal could not be supplied after the motor speed was increased to that designated. New screws, having a considerably greater capacity, were furnished for one boiler. These screws caused flooding to take place at lower ratings, resulting in very dense smoke and, in one or two cases, in the loss of much coal to the ash hoppers. Also, these screws had so much capacity that it was considered advisable to abandon them and hob out the original screws. Flooding also took place on these modified screws, and to eliminate this spring-loaded disks were applied to the discharge end of the screws to provide a uniform resistance to the coal being fed. These very successfully reduced the pulsations experienced with the feeders having greater capacity than the original.

The controls of dampers in the various ducts were originally unsatisfactory, in that it was possible for sudden changes to occur if the hand slipped on the operating chains. In the case of the primary air system, a damper got out of control and was responsible for an explosion occurring in the furnace of No. 1 boiler, this explosion resulting in bulging of the steel casing and the bending of several side-wall tubes. By applying worm wheels and sectors to these dampers the control has been made positive and easier to manipulate.

In order to guard against future explosions displacing the furnace sides, a horizontal steel buckstay was applied around the middle of the furnace for additional strength, as it was assumed that the air and gas passages should furnish sufficient relief for the expansion of the products of combustion resulting from such explosions. The boiler control, also, was provided with some features to eliminate some of the provoking causes of explosions. Furnace contactors were provided to trip out three of the four coal feeder motors per boiler on the occurrence of excessive furnace pressure. Primary air pressure contactors were arranged to trip out the same three feeder motors and to turn on the steam to the burner aspirators on the occurrence of low primary air pressure. The forced-draft fan control is arranged to trip if both induced-draft fans are tripped. Since these modifications have been made no occasion has arisen necessitating their functioning.

Changes have been made in the burner design with respect to what is termed the tertiary air; that is, the heated air which is forced downward around the burner nozzle. These changes have been made with the idea of producing a longer downward sweep of the flame with less and hotter primary air. The present indications are that the new arrangement is very beneficial.



*Predicted and actual performance at Gould Street*

The points plotted for actual performance show quite a wide variation, not only because of the changes made in the plant during the year, but also because comparatively small error in estimating coal causes a large error in consumption when consumption is least. It is expected that the installation of automatic coal scales to weigh the coal entering the mills will greatly decrease this error.

Experimental observations were resorted to in order to obtain a better distribution of air across the furnace. The number of port openings in the front wall was substantially reduced, which, by proper selection of the ones to be closed off, improved the distribution, produced greater turbulence and also made available a higher tertiary air pressure. It was then possible to exercise more control over the tertiary air.

The spring-loaded dampers governing the flow of secondary air to lanes in the front wall have performed unsatisfactorily at times and it has been necessary to provide hand control to those governing the air admitted by the four uppermost lanes. It is now considered desirable to have all of the spring-loaded dampers operated by hand from the main boiler floor.

Some difficulties have been encountered with slagging of the lower rows of boiler tubes. This slagging usually occurred after the boiler had been carrying about 400 per cent rating continuously for 48 hours or longer. Little trouble was experienced when less load was carried at night than in the daytime, and it has been noticed that much slag which had accumulated when operating at high rating fell off when the rating was reduced for several hours. On one of these occasions when a high rating had been maintained for longer than 48 hours an attempt was made to cause the slag to drop by increasing the excess air, but this apparently had little effect. One proposal advanced to prevent this trouble was to remove every other tube in the bottom row of boiler tubes, which would mean that the spacing of this bottom row would then be approximately the same as that of the water screen and, consequently, slagging would be greatly reduced. The boiler manufacturer has recommended against removal of these tubes and, instead, suggests removing every other tube in the lower row and installing deformed tubes which would have a drop of 7 in., thereby accomplishing the same result with no loss in heating surface.

The air heaters are arranged with straight vertical flue gas passages and U-shaped air passages, the air entering and leaving on the same side of the heater, thereby providing very unequal resistances to flow in the air lanes. The result of this was a wide spread in the air temperatures leaving the air heater, there being about 200 deg. F. temperature difference between the top and bottom of the duct discharging air from the heater. A deflecting-type baffle was applied to guide the air toward the lanes having the longer paths. Another scheme which was also experimented with consisted of adding resistance at the air inlet to the shorter paths, the increased resistance to flow of air being obtained by the application of metal strips. The two schemes materially helped the situation and were of about equal merit, although neither attained the desired result. Both schemes are objectionable from the standpoint of power loss caused by the increased duty placed on the forced-draft fans. The air heater manufacturer is now taking the necessary steps to improve the performance of this apparatus.

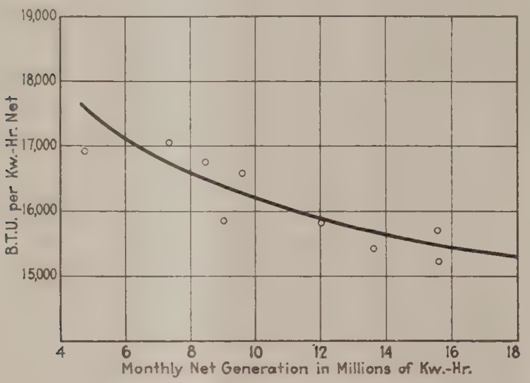
The bearings on the primary air and induced-draft fans are of the ring-oiled type, provided with an integral oil cooler built into their bases to eliminate the necessity of separate oil pumps for the circulation of the oil and also to permit the use of harbor water for cooling. There was some trouble from the leakage of water into the oil reservoirs, which was eliminated by a slight change in the design of the coolers.

The induced-draft fans are of the plate type because of the high duty imposed by the requirement of handling 135,000 cu.ft. per minute of 450-deg. F. gases against a static head of 15.8 in. of water. These fans have given excellent service except for some slight vibration due to the bearing pedestals being somewhat light. This has been corrected by the application of bracing. Two failures of an induced-draft fan motor have occurred, the reason for which cannot be ascribed to overload or faulty control.

Five failures of fin tubes constituting the back furnace wall have occurred. These tubes have all failed in the same manner and almost at the same spot, namely, the outside of the top bend of the rear wall tubes near the sides of the furnaces. In one case a large bulge was noticed before an actual rupture occurred. The water circulation is to be investigated to determine whether or not there is considerable difference in rapidity of water circulation in different parts of the back wall. The obtaining of this information will no doubt make possible a satisfactory analysis of this condition.

Because of the high rating for which these boilers are designed, it was necessary to supply two 6-in. feed-water regulating valves. It was found that the thermostatic tubes of the feed-water regulators were not sufficiently powerful to operate the valves properly. New pistons were designed by the manufacturer in an effort to reduce the friction, which was apparently caused by water flow, since the friction was quite low when no water was flowing through the valves. The new pistons did not prove entirely satisfactory and attention was directed toward the use of hydraulic power, utilizing the thermostatic tube to actuate only a pilot valve. Operation was so much more satisfactory that the manufacturer equipped all the regulators similarly.

Soon after starting the plant it was determined that the moisture content of the steam leaving the boiler drums was higher than desirable. The boiler manufacturer has developed and installed a new type of baffle which has produced excellent results. This improvement should be of much benefit in the maintaining of cleaner surface on the interior of the superheater tubes, since the moisture, of course, carries solids in solution. It also will reduce the duty on the superheater for a given temperature of steam leaving the superheater.



*B.t.u. per net kw.-hr. at different monthly outputs*

The plant operated for a large portion of the year 1927 with lower superheat than the design value. It was held advisable to delay the raising of the steam temperature until other apparatus which would influence the result had been tuned up. Just recently the baffling of the gas passage at the superheater has been changed to give the desired steam temperature. The remaining feature to be reckoned with is the pressure drop of the steam through the superheater, this being approximately 35 per cent higher than expected.

As to the matter of combustion control, several difficulties were experienced in the burning out or breaking down of coils and grounding of wiring. Discharge resistances were provided to lessen the inductive kick from the coils and wire with varnished cambric insulation was used in the control boxes to withstand the oily atmosphere. The pole-changing feature of the motors contributed some complications on account of the necessity of providing control overlap.

The combustion control is normally set to maintain a 15 per cent $CO_2$ average across the section of the boiler gas outlet. This setting is interfered with to some extent by a variation in feed water temperature. This is particularly so if the two higher pressure feed-water heaters are cut out of the circuit at 20,000- to 35,000-kw. load on one boiler. An attachment has been designed quickly to correct the meter for this condition and is being installed. The combustion control which we have installed is not suitable for quick changes in load, this having been demonstrated several times. It is our usual practice to operate on semi-automatic control for the quick changes in load which can be anticipated, such as the noontime drop and the morning pick-up.

There are eight 4½-in. high-lift safety valves on the drum and two on the superheater outlet of each boiler, each drum valve having a relieving capacity of 52,500 lb. per hour and each superheater valve 35,000 lb. per hour. While these valves have not been tested for relieving capacity, two occasions have arisen when the entire plant load has been lost in which the safety valves relieved a total of 380,000 lb. per hour satisfactorily. One of these occasions was when an air drill penetrated the high-voltage leads from the main generator, causing the differential relays to trip out the oil switch and field breaker, the other when the throttle valve of the main unit became unlatched. The leakage and maintenance of these valves has been very slight and, as a matter of fact, has not been any higher than has been experienced at the Westport plant on 200-lb. pressure service.

There are three ash gates per boiler, 41 in. x 56 in., actuated by oil-operated cylinders which at times have refused to move due to friction, distortion and failure of cast-iron plates. In certain places where two ferrous materials rub on each other, one of them has been replaced by non-ferrous material, clearances have been increased and the cast-iron support plates have been reinforced with steel. The result has been almost complete elimination of the sticking difficulties.

### TURBINE ROOM

Since No. 1 turbine was placed in operation slight trouble has been experienced with it. On one occasion sticking of the primary control valve stem occurred. This stem was made of "Ascoloy" and slides in a Monel bushing. These two metals apparently are not very satisfactory for sliding contact. The Ascoloy stem was replaced with one of medium-carbon machinery steel and the bushing enlarged to give a greater amount of clearance, the packing being relied upon to serve partially as a guide. It is contemplated that an Ascoloy stem will again be used, but with a cast-iron bushing so contained in a steel cage that the cast iron will not be able to break up and go through the turbine. Another difficulty which was experienced soon after the turbine was started up the first time was undesirable vibration of the throttle and control valves. This was remedied by the elimination of undue play at certain points and the redistribution of the weight of the pipe, control and throttle valves among several hangers.

The main condenser, while of somewhat radical design, in that the tubes are rolled into the tube sheet at both ends, has given but little trouble. The noticeable leaks which have occurred have been very few. In spite of the fact that the circulating water is high in salt content, we have been able to maintain the solids in solution in the condensate at a very low value. Computations made before the plant was put in commission indicated that if the leakage was as high as usually obtained with packed tube condensers it would be necessary to blow down the boilers very frequently, or continuously, in order to maintain the boiler water concentration at as low a value as was considered desirable. The following figures are indicative of the purity of the condensate as usually obtained: Total solids, two parts per million; electrical resistivity, 1,000,000 ohms per cm.-cube.

While the dip cells used in determining the electrical resistance of the condensate are subject to erratic behavior at times, the electrical resistance characteristic has been of great help in showing relative performance, because of the rapid change in resistance for a small change in the amount of leakage. Only one leak of consequence has shown up, this one apparently being due to a condenser tube not being rolled in at one end, the flare serving to keep the leakage down for a long time.

The circulating pumps originally furnished required too much power because of the water quantity pumped exceeding the design value and, in order to lessen the load on the motors, it was decided to turn down the impellers.

One trouble which has been had with the steam-jet air pump intercondenser has been the erosion of tubes from the discharge of steam from the pipes used to vent some of the bleeder heaters. Some tubes were removed and a baffle installed to decrease the velocity of the steam hitting the tubes.

The difficulties experienced with the closed bleeder heaters has been confined mainly to those under boiler feed pressure, the most annoying one being the leaking of gasketed joints. Some of this was a result of poor machining. Remachining and the use of different gasket material have eliminated this annoyance almost entirely. One other source of annoyance has been the leaking of a porous, cast-steel water box, which is to be replaced by the manufacturer. The eighth-stage bleeder heater is of the deaërating type and has given no operating troubles. It has delivered water having less than 0.05 cu.cm. per liter of oxygen.

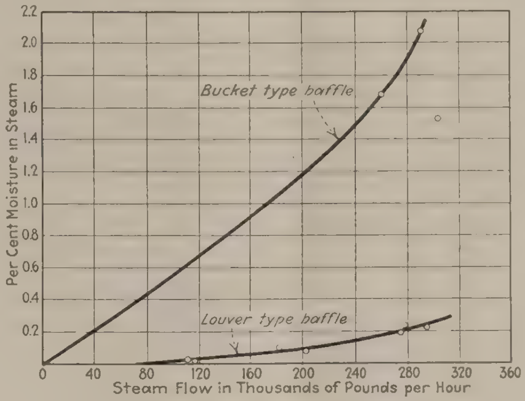
As originally furnished, the evaporator, while its capacity was all that was expected, did not produce a distillate measuring up to the standard required. Considerable experimental work was required before this standard was attained. We were fortunate during this time in having a boiler operating in the old plant supplying steam for heating purposes. Thus, the heating boiler acted as an evaporator and the heating system as an evaporator condenser. The quality of the water obtained in this manner was good and the amount was great enough for make-up purposes. The changes in the design of the evaporator were completed at about the time that the heating season ended. The evaporator is now producing water of the following quality: Total solids, 3.4 parts per million; electrical resistivity, 227,000 ohms per cm.-cube.

With low condenser leakage and water of this quality we have been able not only to hold the boiler water concentration to a low figure but have not been required to blow down the boilers at all on account of concentration, the concentration not having exceeded 500 parts per million.

While the boiler feed pumps are boiler auxiliaries, we are treating them under the head of turbine room equipment, since they are actually in the turbine room and are connected in between the low- and high-pressure bleeder heaters. The motor-driven boiler feed pumps have given but little trouble structurally. On one occasion there was a cessation of pumping, which appeared to be due to vapor binding. This was ascribed to hot water discharged from the evaporator condenser drip pump being fed to the suction side of the boiler feed pump. While there was an economic advantage to the scheme from the standpoint of heat efficiency, it was considered to be outweighed by the demand for safe operation and, accordingly, this water was delivered to the eighth-stage heater. Since then no further trouble of this nature has occurred. A shifting of the impellers and balancing drum occurred on the emergency steam-driven boiler feed pump. This was apparently due to the wearing sleeves turning enough to allow the shift to take place. When repairs were made these sleeves were driven up hard and locked so that this trouble is not expected to occur again.

### Over-All Performance

Whereas the plant delivered power to the bus for the first time on Jan. 4, 1927, the amount of generation for the first three months was comparatively small, because of the decision to concentrate attention on those details which most affected the dependable operation of the plant.



*Effect of changing baffles in steam drum*

Two curves are shown, one of which is that of the predicted performance of the plant in B.t.u. required per net kilowatt-hour of station sendout plotted against weekly load factor in per cent; the other curve is that of the weekly performance in B.t.u. actually used, plotted in the same manner.

### Conclusions

From this outline it is apparent that the plant has been subject to the usual minor changes and adjustments during the initial period of service. None of the troubles experienced were insurmountable and can all be traced to the fact that most of the equipment affected was of the largest sizes that were obtainable, operating in many instances at rather high capacities. This introduced some problems that were entirely new, it being necessary for the manufacturers supplying equipment to do a certain amount of development after their apparatus was placed in service. While such a procedure is necessarily slow, it is felt that the manufacturers affected have made a very satisfactory record in solving their individual problems and in making necessary changes and connections.

The actual performance has approached fairly close to the anticipated, and it is apparent that, when the air heater performance is improved and the effect of the recent increase in steam temperature is realized, the anticipated performance will at least be met and possibly slightly bettered.

# Data on 100,000,000-Kw.-Hr. Systems

### "Electrical World" shows United States has 124 systems each with annual output exceeding 100,000,000 kw.-hr. They generated 64,380,010,246 kw.-hr. in 1927

GROWTH in output of individual companies, a continuation of the process of consolidation of smaller units or groups into larger systems, a rising percentage of the nation's output from these larger systems, and an increase in energy generated per unit of installation are revealed by a comparison of the returns from the annual surveys of systems with more than 100,000,000 kw.-hr. output annually made by the ELECTRICAL WORLD. Details to the extent of about 7,200 items are given in the supplement to the present issue. The results are briefly summarized in the tables on this page.

Of the large light and power systems on the North American continent, 124 are in the United States, fifteen in Canada, and two in Mexico. In addition, fourteen railway systems fall, by virtue of their size, into the same classification. The 124 first mentioned operated 1,423 plants with a total rating of 24,275,311 kva., divided into 17,255,891 kva. in fuel-burning plants and 7,019,420 kva. hydro-electric. These plants generated 64,380,010,246 kw.-hr. during the year; 9,227,208,954 kw.-hr. was added by purchase, making an aggregate output of 73,607,219,200 kw.-hr. The energy generated by all electric light and power plants was, according to the latest revision, 74,753,227,000 kw.-hr. The present survey, therefore, accounts for 86.2 per cent of that total; the aggregate output, including purchase, is almost equivalent to the energy generated by the entire industry, though it must be noted that this aggregate necessarily involves duplication because of resales.

In 1926 the major companies generated 58,073,674,401 kw.-hr. in plants aggregating 22,559,063 kva.* The kilowatt-hour increase is about 11 per cent, and the energy generated per kilovolt-ampere rose from 2,570 to 2,610 kw.-hr.

For the first time a decrease is noted in the number of systems, from 126 in 1926 to 124 in 1927, notwithstanding the addition of ten new names for which no comparable earlier figures could be published, as well as several other cases where a new name could be more or less closely identified with properties previously listed. These additions were more than balanced by absorptions, consolidations and eliminations made to avoid duplication of statistics. The details can be ascertained by reference to the supplement, in particular the copious footnotes and sidenotes there given. It should be noted that in this compilation, as in earlier ones, a system may consist of more than one company provided all are operated as a single physical unit under a common management. Thus the trend toward co-ordinated operation, often followed later by actual financial amalgamations, is reflected in the data showing fewer but larger systems.

The number of systems with more than 1,000,000,000 kw.-hr. output has risen to 21, three more than in the preceding year. Their combined output was 39,671,078,953 kw.-hr., or considerably greater than that of all the rest put together. The leaders, in order, are the Buffalo, Niagara & Eastern system, the Commonwealth Edison of

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*This is 500,000 kva. lower than the figure published in the issue of April 30, 1927, the Mohawk-Hudson system having been incorrectly credited with 711,600 instead of 211,600 kva. in hydro.

*Table I—Generator Rating and Output of Systems Reporting More Than 100,000,000 Kw.-Hr. During 1927*

(Summary of detailed tabulation in the supplement to this issue of the ELECTRICAL WORLD)

| | | Number of Generating Plants and Generator Rating | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | All Plants | | Fuel Burning | | Hydro-Electric | | | | |
| Section | Number of Companies or Systems | No. | Rating Kva. | No. | Rating Kva. | No. | Rating Kva. | Energy Generated, Kw.-Hr. | Energy Purchased, Kw.-Hr. | Total Energy Output, Kw.-Hr. |
| *United States* | 124 | 1,423 | 24,275,311 | 801 | 17,255,891 | 622 | 7,019,420 | 64,380,010,246 | 9,227,208,954 | 73,607,219,200 |
| New England | 14 | 79 | 1,718,644 | 29 | 1,365,254 | 50 | 353,390 | 3,484,486,229 | 633,510,195 | 4,117,996,424 |
| Middle Atlantic | 22 | 202 | 6,361,855 | 112 | 5,022,164 | 90 | 1,339,691 | 18,459,317,374 | 2,763,764,151 | 21,223,081,525 |
| South Atlantic | 12 | 170 | 2,463,461 | 89 | 1,543,635 | 81 | 919,826 | 5,223,811,976 | 724,268,924 | 5,948,080,900 |
| East North Central | 28 | 283 | 5,858,279 | 159 | 5,513,989 | 124 | 344,290 | 15,591,010,363 | 1,892,726,792 | 17,483,737,155 |
| West North Central | 8 | 100 | 1,687,668 | 56 | 1,269,368 | 44 | 418,300 | 3,917,579,371 | 80,728,870 | 3,998,308,241 |
| East South Central | 9 | 133 | 1,580,300 | 100 | 734,603 | 33 | 845,697 | 3,666,989,018 | 1,130,226,702 | 4,797,215,720 |
| West South Central | 11 | 206 | 757,418 | 197 | 742,486 | 9 | 14,932 | 2,167,289,548 | 349,823,896 | 2,517,113,444 |
| Mountain | 5 | 80 | 842,824 | 14 | 140,737 | 66 | 702,087 | 2,799,640,555 | 196,260,849 | 2,995,901,404 |
| Pacific | 15 | 170 | 3,004,862 | 45 | 923,655 | 125 | 2,081,207 | 9,069,885,812 | 1,455,898,575 | 10,525,784,387 |

*Table II—Allocation* of Output of Major Systems in 1927*

(Based on detailed tabulation in the supplement to this issue of the ELECTRICAL WORLD)

| | Energy Sales in Millions of Kilowatt-Hours | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Region | Residential | Commercial | Municipal | Power | Railways | Other Public Utilities | Miscellaneous | Unsegregated Output | Per Cent of Energy for Intracompany Use and Losses |
| *United States* | 5,230 | 5,540 | 2,010 | 33,698 | 5,199 | 7,388 | 356 | 2,091 | 16.4 |
| New England | 303 | 429 | 97 | 1,683 | 155 | 767 | 63 | ..... | 15.1 |
| Middle Atlantic | 1,560 | 1,706 | 492 | 10,165 | 1,659 | 2,296 | 39 | 363 | 14.1 |
| South Atlantic | 256 | 274 | 104 | 3,014 | 232 | 132 | 11 | 1,095 | 17.1 |
| East North Central | 1,567 | 1,478 | 321 | 7,836 | 1,796 | 1,754 | 43 | ..... | 15.3 |
| West North Central | 336 | 400 | 153 | 1,822 | 259 | 356 | 6 | ..... | 16.7 |
| East South Central | 215 | 267 | 55 | 2,108 | 54 | 1,085 | 19 | ..... | 20.5 |
| West South Central | 150 | 164 | 98 | 1,180 | 127 | 339 | 7 | ..... | 18.0 |
| Mountain | 125 | 110 | 47 | 1,942 | 71 | 220 | 4 | ..... | 15.9 |
| Pacific | 718 | 712 | 643 | 3,948 | 846 | 439 | 164 | 633 | 24.5 |

*To avoid misleading totals, approximate allocations have been made of sales of several companies which reported combined figures for more than one class under a single head. In a few instances sufficient information was not available to permit the making of reasonably close approximations. These are summed up in the column "Unsegregated Output."

Chicago, which has the distinction of alone reporting more than 1,000,000 kw. in plant, and the Edison-United of New York, which is also next in order as to plant, with 972,225 kw.

Power sales account for about 33,698,000,000 kw.-hr., nearly 46 per cent of the total output and more than three times the sales directly for residential and commercial lighting. In addition, more than 2,090,000,000 kw.-hr. is sold to municipalities, of which the larger part is no doubt ultimately used for lighting in one form or another. About 10 per cent of the output goes to other public utilities. This item, with its companion "purchased energy," reflects the economies of interconnection and of service from transmission lines replacing previously operated small plants. Railroads are credited with about 5,200,000,000 kw.-hr. This should be augmented by railway loads of unstated magnitude included, in some reports, under other heads, and by energy used by company-owned railways, reported by some companies with intracompany use. These figures unavoidably involve some approximations to allocate energy not completely segregated in the reports, but with this qualification the relationships shown in Table II are believed to be representative.

Losses and energy consumption by the companies themselves vary widely, depending on local conditions. They are, in general, larger in those regions having long transmission distances, either because remote sources of water power are used or because the load centers are widely scattered. The national average of energy thus absorbed is 16.4 per cent of the output.

This year fifteen Canadian companies appear; they generated 11,895,292,334 kw.-hr. and purchased 2,491,824,655 kw.-hr. Last year's list contained but ten, with an output, generated and purchased, of 9,594,982,322 kw.-hr. The gain is due both to marked growth of previously existing systems and the addition of statistics for several not before available. Mexico has two, with a combined output closely approaching 754,000,000 kw.-hr. The heavy predominance of water power in these two countries is noteworthy: Canada has 2,711,284 kva. in hydro, against only 79,750 in fuel plants; Mexico's two companies had 220,660 hydro and 16,500 kva. in fuel-burning plants.

In addition to the light and power systems there are fourteen railways in the 100,000,000 kw.-hr. class. They generated 2,866,100,884 kw.-hr. Adding purchased energy, their total comes to 4,403,351,880 kw.-hr.

# Material Loading Cages Save the Time of Line Crews

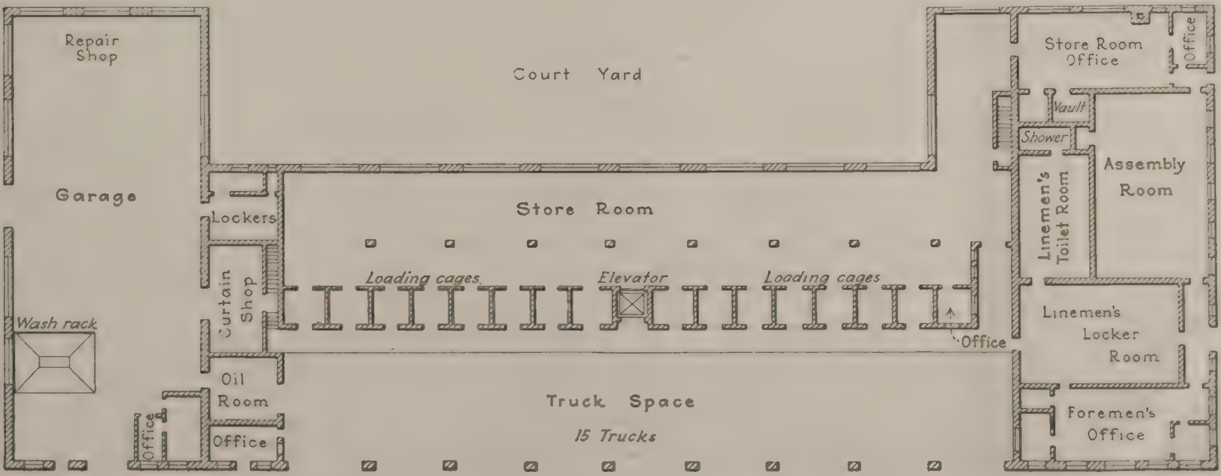
By M. T. Crawford
*Superintendent of Distribution*
*Puget Sound Power & Light Company, Seattle, Wash.*

CONSIDERABLE study has been given to improvement of efficiency in the handling of line construction work by the distribution department of the Puget Sound Power & Light Company. One of the recent steps taken along these lines was the construction of a building carefully designed with a view to facilitating the handling of such work.

*Inclosed concourse and truck-loading platform with doors opening into material cages*

An overhead chain block carrier on I-beam is used for handling transformers and other heavy material.

A reinforced concrete, fireproof building, 115x300 ft., was constructed in Seattle and occupied in 1927 as a headquarters for line construction work within a 30-minute truck-traveling time radius. Under the working rules for employees crews will spend eight hours on the job without payment of overtime under these condi-



*Distribution service building floor plan, showing material cages opening into storeroom as well as onto loading platform* tions. The first unit of this building, constructed at this time, is designed to accommodate a total of fifteen overhead and underground construction crews with their trucks. There was also provided a garage and repair shop for trucks and passenger automobiles, stores and office space, locker, washrooms, an assembly room, etc.

Careful thought was given to the arrangement of the building to provide for the routing of materials and equipment from the time they are received until they go out without confusion or loss of time. In the center front of the building, as will be seen from the accompanying floor plan, a concourse was built and provided with roller metal doors in front and a loading platform behind with standing space for fifteen line trucks. Just across the loading platform and immediately opposite each truck's standing space is a small metal cage which opens also into the storeroom.

This somewhat original feature has been found highly efficient in actual practice as it enables the material men in the general foreman's office to order out a complete bill of material on the day previous to the handling of each job. This batch of material can be put into the cage for the proper crew by the storekeeper and locked up. While the truck is in at night the material brought in from one day's job can be taken out and put in the cage and the material for the next day's work loaded on the truck, so that when the foreman arrives with his crew in the morning the truck is loaded and ready to go.

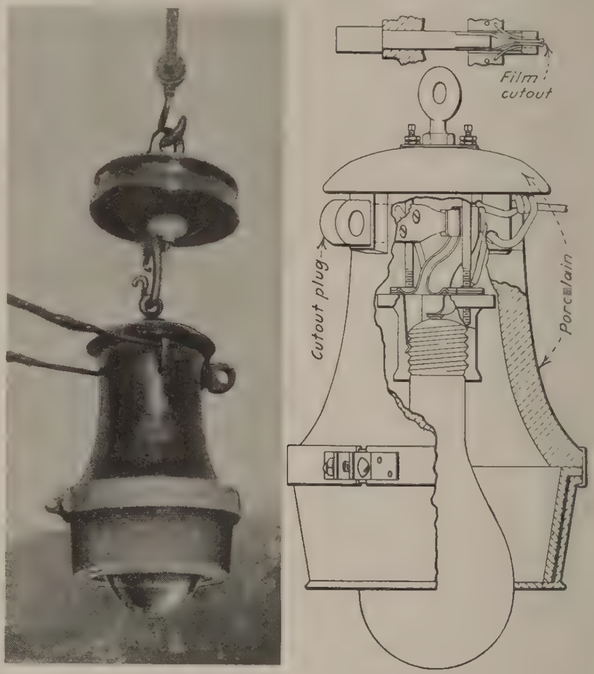
An indication of the economy which has resulted from these improved facilities may be obtained by comparing the actual efficiencies on line construction work during the last six months of 1927, when the new building was in use, with the same period in 1926, when an equally heavy volume of work was handled by the same crews out of headquarters in an old carhouse. This company has for years kept a monthly record of the number of work units completed by line crews from each headquarters. The work unit used consists of such items as a pole set, a transformer hung, etc., selected as nearly as possible to represent an equal amount of labor. While having no exact absolute value, they are very useful for comparative purposes, particularly in checking up on number of men employed and equipment operated in proportion to volume of work done at various times.

During the last six months of 1926 in the old headquarters an average of 47 units per man employed per month was maintained. During the same period in 1927 in the new building, with the improved facilities, an average of 53 work units per man employed per month was recorded. An average of 225 men were employed on line construction at this point, and the 12 per cent improved efficiency indicated from the above record resulted in a substantial saving in the cost of work. A part of this saving, however, was returned to the men, as the company pays a monthly bonus to the crew foremen and material men which is proportional to the record of work units per man employed, and the wage scale itself is also adjusted periodically on a merit rating basis. As a conservative estimate the net savings to the company, after allowing for this, is on the order of $2,250 per month during periods of heavy construction.

Other features of the new service building are a garage and repair shop at one end of the building equipped to handle approximately 150 trucks and passenger automobiles, a full basement accessible from the rear by an inclined driveway across the courtyard, storage space for automobiles and certain infrequently used tools and equipment, a testing and inspection room where distribution transformers are received, tested, repaired and issued. One end of the basement, together with the center part of the main floor, is occupied by the stores division.

## A Simplified Street-Hood

FINDING by experience that many radio interferences could be traced directly to loose screw and friction contacts in series street-hoods, the Dallas (Tex.) Power & Light Company took the bull by the horns and designed a hood that apparently will reduce such interferences to the minimum. In the ordinary type of hood there may be as many as twenty or more screw and friction contacts, each one a potential broadcasting station. The new hood contains only two contacts that are not solid and permanent—those between socket and lamp base. Also, the new hood has a porcelain cap and body assembly, thus eliminating the iron housing that is so susceptible to rust.



*Porcelain-body street-hood equipped with refractor*

The common type of series hood includes a removable lamp socket that is provided with flat spring contact terminals, between which the film cutout is placed. These terminals push into and separate the two sides of a clip which is in series with the line. There are thus at least four purely friction contacts in the ordinary hood, and in potentiality for radio trouble to these must be added the numerous other contacts held down with screws.

In the Dallas type of hood the film cutout is carried between spring fingers mounted on the end of an insulating plug that is inserted in the hood just below the cap. The sides of the clip into which cutout fingers enter are integral with the contacts of the socket, which is mounted permanently in the hood. A pair of lead wires are soldered to the contact pieces and are brought out of the hood for connection into the series circuit. The design and appearance of the new hood are shown in the accompanying illustrations.

# Let Private Enterprise Live![*]

### Entrance of government into power industry would menace private initiative and endanger the present source of capital

By MATTHEW S. SLOAN
*President Brooklyn Edison Company*

THE original electric company had a capitalization of a million dollars. The electrical industry today has a capitalization of approximately nine billion dollars. Those figures, thus set in contrast, will perhaps measure for you the growth and development of the industry as clearly and forcefully as anything that could be said about it. Approximately nine billion dollars invested in buildings and lands, machinery and equipment necessary to produce and supply the electrical service for the use of this nation—the service which takes the burden of toil off the back of the housewife and makes homes better places to live in and increases the productivity of the industrial worker and gives him the fattest pay envelope in the world! Add to that, please, the fact that this power and light industry is required to raise about a billion dollars a year of new capital to supply more and better service facilities so that it may not fall behind the needs of the nation. That capital is obtained, because:

First—The business is sound.

Second—The business is growing rapidly, and is progressive and progressing in all its phases.

Third—The business is keenly sensible of its duties as a public servant and responsive to public sentiment regarding its policies and practices.

Fourth—The business is supervised and regulated by public agencies, usually state officials, as to its standards of service, its accounting, its capitalization and the rates it is permitted to charge.

Public utilities are now the largest customers in the money market, and the power and light branch of the utility family requires more new capital than any other. Investors in the securities of the companies are the great insurance companies, savings banks—the Legislature of New York State recently passed a law permitting such investment, making the nineteenth state to do so—colleges and universities, trust funds, and customers of the companies. Since 1914 more than thirteen million shares of stock have been sold by the companies under the customer-ownership plan, providing more than a billion one hundred million dollars of new capital for carrying on the work of these utilities.

The money invested in the electrical industry has been put to good use. It has provided this country with electrical service which is surpassed nowhere in the world. It has supplied the country with the greatest electrical generating capacity for its homes and work-places, which use almost as much energy in a year as all the rest of the world. It has enabled the managements of the utility companies to experiment and to improve their machinery and their technique, scrapping machinery with seeming ruthlessness in the interest of efficiency and economy. building new lines, higher-voltage lines, interconnecting them to make more certain of freedom from interruptions of service and to put the burden of the load on the most efficient generating plants. Thus the capital obtained has enabled the industry to attain lower costs in the face of higher prices it must pay, and as a result there has been, over a period of years, a reduction in the average price of the electricity used by the public.

> *"President Coolidge said not so long ago that once government embarked in business it must become a monopoly in that business. That assuredly is the prospect in this instance. Put government-raised capital into the power and light business, as is now proposed, and you shut private capital out. You serve notice on the electrical industry that it is in competition with the great federal government itself."*

The National Industrial Conference Board reported recently that while the cost of living in July of last year was 62 per cent higher than in 1914, the price of electricity was 13 per cent lower than in 1914. These figures were arrived at after a survey covering 143 cities having a combined population of more than thirty-two million people.

The industry as it is today is the product of American initiative and enterprise—supervised and regulated by public authorities as it should be, controlled by laws and their official administrators as it should be, because it is an industry affected with a public interest, but nevertheless having opportunity, under our American system, to work out its destiny for itself and for the benefit of the public whose servant it is. We of the industry believe the record has been a good one. We are proud of it.

This industry, however, faces new conditions. We deem them a menace to the industry, but, above all beyond that, to the system under which America has grown great. Legislation is pending in Congress which would put the federal government into the electric power and light business. There are two bills for the utilization of the government's war enterprise at Muscle Shoals. They differ materially in their provisions, but the net of both is to seek to embark the government in the manufacture of fertilizer and in the production of power, competing in both lines with the capital of its citizens invested in these businesses. There is also the so-called Boulder Dam bill, termed by its advocates a measure for flood relief and for conservation, termed by its opponents—and some of them who are fighting it in Congress are no part of the electrical industry—an attempt to put the government into the power business under the guise of a public improvement. Then there are other bills and other proposals not yet brought into the form of legislation which would put the government into the power business in other sections of the country.

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[*] *From a recent address before the Bond Club in Newark.*

The electrical industry has been criticised as selfish (in fact, that is one of the mildest things said about it) because it is opposed to such legislation and such proposals. Perhaps it is. But what is the industry? It is a good deal more than the men who are on the utility payrolls, who happen by virtue of their positions as officers of the utility companies to express that opposition. It includes the investors, individual and institutional, who have put up the nine billion dollars of their savings and now are threatened with government capital in competition. Are these people selfish if they oppose having the government raise funds from them to put to work against their present investments? If they are, it's a trait which will not be found lacking in the very great majority of the people.

There is here no war emergency such as impelled the government to take over the operation of the railroads and go into the shipping business. There is no condition or situation in respect of utilization of Muscle Shoals or prevention of floods on the Colorado which could not be met without putting the government into the electrical business. Why seek to do it, unless there is an intent to change the entire policy of our country respecting government in business?

President Coolidge said not so long ago that once government embarked in business it must become a monopoly in that business. That, assuredly, is the prospect in this instance. Put government-raised capital into the power and light business, as is now proposed, and you shut private capital out. You serve notice on the electrical industry that it is in competition with the great federal government itself. You serve notice on people with money to invest that they will be in competition with government, with its power to tax and to confiscate. Will they do it? Is it good sense to expect that they will be willing to do it?

### End of Private Initiative

Creating a government power monopoly, however, would be merely the beginning. Do that, and you notify American business and the American people that the door of opportunity has begun to shut against them. You tell them that one business—a great, vital business, a key industry—has been taken out of the realm of individual opportunity and has been socialized. What will that do to our American spirit? What will it do to American business—not alone that one which happens to be on the firing line now, but to all business?

Perhaps I am unable to see this situation entirely clearly, because it is the business to which I have devoted my life which is menaced. It seems to me, however, that no one thing more far reaching in its effects could be brought about. The spirit of man cannot be crushed by obstacles, so long as there remains the opportunity for achievement. But if the opportunity itself be narrowed —if there exists the prospect that it may become still narrower—the inducement to struggle is stifled at birth.

The situation I have been discussing presents something for our consideration far bigger and broader than the future of the electrical industry, important as that may be to our country. There may seem to be in these bills merely a matter of methods and their justification at the moment—a question of expediency. That is the least part of the situation. There is involved in them a vital question of national policy, settlement of which must create a precedent of lasting import. Either this country is to remain what it has been—a land in which business is to be conducted by the people, and the people are to be economically free—or it is to be changed to something else, something not contemplated by the founders of our government. All business is to remain free from government competition and government absorption, or we are to find ourselves on the road to socialization of all business, which means destruction of individual rights, liberty and happiness as we have visioned and experienced them.

Our system of business and government, each operating in its own field, has been proved for nearly a century and a half. It has worked. Business has not been perfect, neither has government, because each can be no better than the people who are engaged in administering its affairs and human nature has not yet reached perfection. Yet the good in government and the good in business have vastly outweighed the bad, and in each field there has been advancement of ideas, advancement of methods and an attainment of results signally beneficial to our people.

The spirit of our nation and the social-economic system in which that spirit finds expression call forth and stimulate the good and discourage its opposite qualities. That, I repeat, our experience has proved. When that spirit is stifled and that system is altered we shall cease to be America, the land of opportunity.

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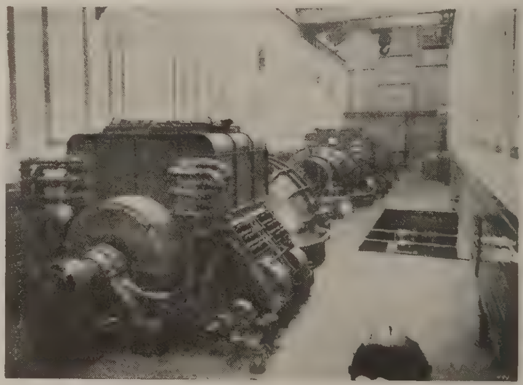
## Two 60,000-Kw. Turbo-Generators in New East River Station



STEAM is generated at 375 lb. pressure and 700 deg. F. in six cross-drum boilers in the new East River station of the New York Edison Company. Combustion chambers are entirely inclosed by water-cooled walls of the Murray fin-tube type, no brickwork or refractories being used. It is the first power station to burn pulverized coal on a large scale in New York City.

The air coolers are mounted above the generators and consist of nests of spiral-finned tubes. Each cooler is served by two motor-driven blowers supplying 110,000 cu.ft. of air per minute in a closed system. Cooling water is taken from the condenser circulating system.

# Patent Pools and Anti-Trust Laws

By David L. Podell and Benjamin S. Kirsh
*Members of the New York City Bar*

*The industrial and social value of patent interchange and its relation to the anti-trust laws and patent rights are outlined in this article by Messrs. Podell and Kirsh, which appeared in the American Bar Association Journal. A series of patent agreements among gasoline cracking refineries, made as the result of a conflict of patents, recently was held to be reasonable and lawful and was not "in restraint of trade." The whole argument for patent interchange becomes valid only when there is a need for it as in the gasoline case. Where the great majority of patents covering any product are held by one company there may cease to be any need for an interchange of patents covering that product.*

THE issuance of a large number of inter-related patents and their distribution among various independent owners in the same industry has presented forcibly the necessity of patent co-operation. An inquiry into the legal status of co-operative interchange presents the problem of the extent to which the rights acquired under the patent laws run parallel to or conflict with the liabilities, both civil and criminal, arising from a violation of the anti-trust laws.

In the annual reports of the Attorneys-General of the United States for the years 1924 and 1925 the application of the Sherman law to the acquisition and pooling of patents is noted as one of the major problems of anti-trust enforcement. It "involves the application of the anti-trust law to restraints of trade based upon the acquisition or pooling of competitive patents. The anti-trust law and the patent law have different and to some extent conflicting purposes. Combinations by means of cross-licenses under patents are now frequently encountered." It is to be observed that the Supreme Court in formulating the policy of the law has taken occasion in one important line of cases first to announce one rule of law and then to reverse its former judgment by adopting what had been the dissenting view. This was done, furthermore, over the protest of some of the justices, in whose opinion the law had already acquired the attributes of a rule of property. Of the entire field, it has been stated by an analytical writer that "few problems have given rise to more confusing diversity of judicial opinion."

Perhaps it is not amiss to point out that the term "pool" is itself unfortunate in view of its inevitable association, in our industrial history, with some of the most oppressive combinations in restraint of trade, which directly led to the formation of our anti-trust policy. For this reason, its use has been avoided, even by stanch advocates of patent interchange. By the "pooling of patents," however, we shall rather refer to the co-operative interchange of patent rights, centralized pursuant to an agreement, including the covenants and restrictions with which one can find them usually accompanied. By means of reciprocal privileges, mutually granted, the licensee gains by agreement what the patent law otherwise prohibits. The meaning of the phrase "restraint of trade," as used in the Sherman act, has been settled since the authoritative definition in the Standard oil case to refer solely to those restrictions which are undue and unreasonable and injurious to the public welfare.

No discussion of the legal questions involved can be thoroughly understood without some knowledge of the value to business and society of the co-operative interchange of patent rights. From the experience of American industry a mass of information lies available to the student of the subject. This is evident by reference to the cross-licensing arrangement in the automobile and aircraft industries and the recent resolution of the National Electrical Manufacturers' Association. One of the underlying reasons for the formation of an interchange of patent rights lies in the practical necessity to adjust infringement litigation where there is a claim of overlapping patents. No royalties, however great, would suffice to pay the tribute which protracted and costly patent litigation exacts. An inflated selling price the commodity ensues. There is a shift, by incidence, of the price of litigation to the consumer. It is, therefore, but prudent and economical business policy to compromise what otherwise would entail enormous expenditures and lead to a diminution of sales.

Fear of infringement suits, injunctions and decrees for heavy damages has dissuaded manufacturers from making expenditures to improve their plants and has resulted in enhancement of prices to secure them against the risk of operation under doubtful patents. Thus it has been said with reference to the cross-licensing agreement in the aircraft industry that it is "a practical business arrangement to do away with litigation over patents and permit the members to build planes rather than try lawsuits against each other. Moreover, a practical consideration arising from our heavily burdened court calendars is that the original trial of a patent suit is not generally reached, in many districts, before two years, and that before a final adjudication can be reached some four to seven years may elapse, if both parties insist upon exhausting their remedies. Even the payment of royalties under a cross-licensing agreement becomes, therefore, an economically sound business arrangement whereby, in effect, an insurance policy is taken out as security from attack, at a cost known in advance.

### INDUSTRY GAINS THE DIRECT BENEFITS

From a purely economic viewpoint a mere dedication of reciprocal non-exclusive licenses can be subjected to no reasonable criticism. The industry at large, which is judged by the output of its entire production, gains the direct benefits. There is an increased good will arising from greater confidence in the minds of consumers. Therefore, every product can embody the latest and most aproved engineering ideas and still retain for each manufacturer individuality of design, which is his distinguishing selling feature. The raising of standards follows as a natural consequence. Another important advantage of cross-licensing is in its value to each individual party to the agreement in securing for himself the results of a large volume of development research and the accumulated practical experience embodied in the patents of his cross-licenses. A company putting in five patents may acquire the use of 125 in return, an advantage far outweighing the exploitation of its own inventions.

It has been demonstrated by the recorded experience in the automobile industry that such agreements give an impetus to further invention. Every company is anxious to have the distinction that its product is first to embody the latest improvements in the industry. The automobile industry has found from its experience that for various reasons, such as the skepticism of other members with reference to the value of new patents, the company which secures a patent and applies it immediately to the betterment of its product has at least a year's start over its competitors. A patent owned or controlled by one member of an industry may be useless in itself, yet extremely valuable when combined in use with other patents owned by his competitors. By breaking up what has been aptly termed the "congestion of patents," every patent owner is free to improve his product. Without the privilege of making use of the numerous improvement patents, the patentee finds himself in the position of the owner of a key plot who must pay a stipend to assemble contiguous plottage. Again, the psychological factor in industry is extremely improved when its members can feel that they are united with a single purpose of bettering their product through the common utilization of technical knowledge.

### THE ANTI-TRUST LAWS AND PATENT RIGHTS

Regarding the anti-trust laws and patent rights, it is sufficient to indicate that the decided cases apply various legal tests. The chief factors thus far discussed by the courts involve the effect of the combination, its extent, its nature, the methods employed, the intent of the parties and the particular facts in the industry. It is further to be borne in mind that each case arising under the Sherman act must be determined upon a consideration of the particular facts discussed by the record. Justice Brandeis expresses the spirit of the law in the Board of Trade of Chicago against the United States: "But the legality of an agreement or regulation cannot be determined by so simple a test as whether it restrains competition. Every agreement concerning trade, every regulation of trade restrains. . . . The true test of legality is whether the restraint imposed is such as merely regulates and perhaps thereby promotes competition, or whether it is such as may suppress or even destroy competition. . . . The history of the restraint, the evil believed to exist, the reason for adopting the particular remedy, the purpose or end sought to be attained are all relevant facts. This is not because a good intention will save an otherwise objectionable regulation, or the reverse, but because knowledge of intent may help the court to interpret facts and to predict consequences."

Several questions involving the legal consequences of a combination of patentees have not yet been squarely determined by the Supreme Court. One involves the effect of an agreement among various patentees allowing a stated sum, jointly fixed, to be paid as royalties to a patentee for the use of his invention. Another is the effect of arbitration clauses by which compensation for the use of patents is determined by arbitrators as each case arises. There is, however, the recorded authority of the Department of Justice, approving, as not violative of the anti-trust laws, such a clause, found in the Manufacturers' Aircraft Association agreement. The fundamental question of law reduces itself to the proposition that where the purpose and effect of such royalty agreements are merely to secure a fair and just compensation for the use of the patents and are not unduly restrictive of free competition no violation of law occurs. If the royalty charged is small, in comparison with the total cost of the product, there does not seem to be a substantial relation between the royalty and the ultimate selling price. In other words, it is ordinarily too remote in the chain of causation to adjudge that the royalty, which is only a small fraction of the ultimate selling price, is to be deemed a controlling factor in a joint effort on the part of several patentees to regulate the price.

### ADVANTAGES OF PATENT INTERCHANGE

Viewing its underlying principles, we are led to the conclusion that it is nothing more than a scientific and intelligent co-operation of creative or inventive thought, much akin to a bureau for scientific research. In principle, it is a democratization of ownership or interest in an original or creative idea, or group of ideas, a clearing house for the advancement of invention. Indirectly, it is a dedication to society of the aggregate of such scientific data. Where the patent law would grant exclusive ownership in one, the patent pool extends it to many. That its tendency would be to improve or perfect the product has been confirmed by experience.

Patent interchange tends likewise toward standardization of the product, reduced cost of production, elimination of the enormous waste of litigation and indeed yields; in short, the advantages to the public of a better commodity at a cheaper price. Again we are confronted with the dangers of abuse of concentrated power, either by joint price fixing, boycott against competitors or other illegal restraints, by the combined patentees. There is ample power in the government to cope with such problems as they arise in a given case. That patent co-operation is capable of abuse is doubtless true, but this possibility is inherent in all joint effort. Where it is present it can be detected and penalized in accordance with the provisions of the statutes. A plan which secures to the patentee a just compensation for his novel idea and bestows upon the public the benefits of progress serves a beneficial and commendable purpose. This underlying principle seems to be in harmony rather than in conflict with the anti-trust laws.

# "Average Use" Misleading in Analyzing Promotional Rates

THE importance of drawing conclusions from thorough analysis of individual use rather than basing them on application of average figures, when rates of a promotional type are being considered, was emphasized in a recent hearing before the Massachusetts Department of Public Utilities by Vernon Tallman, manager commercial and industrial department, Charles H. Tenney & Company, Boston. He pointed out that the results of making comparisons based on "average use" are not only misleading but far from accurate.

The application of a proposed room rate schedule to the residence service of the Malden Electric Company was under consideration. By this schedule the customer would pay for service under the following rate:

| Per Room Per Month | Cents Per Kilowatt-Hour |
|---|---|
| First 3 kw.-hr. | at 10 |
| Next 5 kw.-hr. | at 7½ |
| Excess over 8 kw.-hr. | at 4 |

The company claimed that this rate would have reduced the charges to its residential customers more than $68,000 per year. This reduction was based upon a detailed study of a representative cross-section of all the company's accounts and based on actual bill computations.

A calculation of the reduction on the basis of the "average use" customer indicated a reduction of only about $23,000. The error introduced by consideration of the "average use" is, therefore, $45,000 in this particular case, and the reduction under the "average use" basis is only 34 per cent of the true reduction. Companies which have been in the habit of using the "average use" and estimating reductions based upon it may find that their actual reductions are three times as much if they analyze the bills in detail. This is a pitfall to be carefully guarded against, as is well recognized by experienced rate engineers.

By way of illustration, Mr. Tallman presented a comparison of the two methods of calculation in a simple case of five customers having six rooms each:

| Customers | Total Kw.-Hr. |
|---|---|
| Four used 20 kw.-hr. per month each, or | 80 |
| One used 70 kw.-hr. per month, or | 70 |
| Total used by five customers | 150 |
| Average per customer | 30 |

Bill for average customer calculated on old and new rates:

| | |
|---|---|
| **Old Rate** | |
| 15 kw.-hr. at 10½ cents = | $1.57 |
| 15 kw.-hr. at 8 cents = | 1.20 |
| 30 kw.-hr. | $2.77 |
| **New Rate** | |
| First 3 per room 18 kw.-hr. at 10 cents = | $1.80 |
| Next 5 per room 12 kw.-hr. at 7½ cents = | 0.90 |
| 30 kw.-hr. | $2.70 |

A saving of 7 cents per month per customer or 35 cents per month for the group.

Bills for actual customers calculated on old and new rates:

| | | |
|---|---|---|
| **Old Rate** | | |
| 15 kw.-hr. at 10½ cents = | $1.57 | |
| 5 kw.-hr. at 8 cents = | 0.40 | |
| 20 kw.-hr. | | |
| Four customers at | $1.97 or | $7.88 |
| **New Rate** | | |
| 18 kw.-hr. at 10 cents = | $1.80 | |
| 2 kw.-hr. at 7½ cents = | 0.15 | |
| 20 kw.-hr. | | |
| Four customers at | $1.95 or | $7.80 |
| 15 kw.-hr. at 10½ cents = | $1.57 | |
| 55 kw.-hr. at 8 cents = | 4.40 | |
| 70 kw.-hr. | | |
| One customer at | $5.97 | $5.97 |
| Total for group | | $13.85 |
| Average rate | | 9.2 cents per kilowatt-hour |
| First 3 per room 18 kw.-hr. at 10 cents = | $1.80 | |
| Next 5 per room 30 kw.-hr. at 7½ cents = | 2.25 | |
| Excess 22 kw.-hr. at 4 cents = | 0.88 | |
| 70 kw.-hr. | | |
| One customer at | $4.93 | $4.93 |
| Total for group | | $12.73 |
| Average rate | | 8.5 cents per kilowatt-hour |

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# 90,000-Kw. Generator Shipped Completely Wound

THE new turbo-generator unit of 90,000 kw. capacity designed for the Long Beach plant of the Southern California Edison Company is unusual because of its high rating and for the use of a terminal voltage of 16,500. The turbine is a single-shaft, tandem-compound unit. The high-pressure cylinder contains an eighteen-stage rotor and the low-pressure cylinder a three-stage double-flow rotor. Steam is used at 400 lb. gage and 725 deg. F. total temperature.

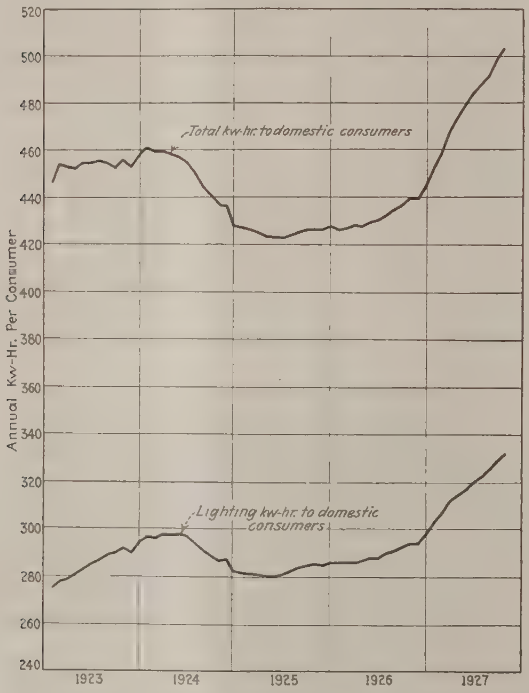
The generator was shipped completely wound, an accomplishment made possible by the welded construction of the unit. It is the product of the General Electric Company and is shown in the process of shop testing.

# 1,331 Ranges Sold in Seven Weeks' Campaign

### Southern California Edison Company has most successful campaign in its history. Dealer co-operation and old-range allowance were factors

By R. G. Kenyon
*Assistant Advertising Manager Southern California Edison Company, Los Angeles, Calif.*

MERCHANDISING accomplishments of the Southern California Edison Company for 1927 under the supervision of W. L. Frost, general commercial manager, culminated in the most successful major appliance campaign of the company's history—a seven weeks' Hotpoint range campaign. The actual ranges sold, 1,331, were more than double the quota of 600 ranges set for the entire system. Of the ranges sold, 1,003 were sold by the Edison company merchandising organization; the balance, or 328 ranges, were sold through electrical contractors or dealers. Every dealer and contractor in the territory was invited to take advantage of the public desire to buy ranges which would be created by the intensive campaign carried on by the power company. The record of 328 ranges sold through dealers and contractors amply proves that the contractor-dealer is a very valuable potential outlet for electrical merchandise when the proper co-operative help is given.



*Kilowatt-hour sales to domestic customers show effect of increased sales activities*

In this campaign ideas found profitable in previous range campaigns were adopted. Special terms of $10 down and the balance in six, twelve or eighteen months were offered. Three modes of advertising were used—window trims, newspapers and direct mail. Window-trim material was furnished all district offices and suggestions and helps for the proper use of this material were offered them. In the newspaper campaign every one of the 160 newspapers in the territory served by the company carried at least one ad every two weeks and in the larger papers one ad a week. In addition to carrying the name of the Southern California Edison Company in all cases, the dealer's name in the local district was included in the advertisement. In the direct-mail advertising a selected list of 40,000 names was circularized with a four-piece mailing campaign. The three first pieces consisted of combination broadsides and letters. The fourth piece was a return government postcard to impress upon the prospect the necessity of immediate action to benefit by the campaign. All mailings carried with them return postcards asking for information.

In the advertising copy stress was placed upon the fact that range users enjoyed a very low rate for all electricity used. In addition each piece of advertising matter carried a line telling the reader that his own electrical dealer was in position to offer the same terms of sale as the power company.

To stimulate interest in the campaign on the part of employees bonuses were offered by the company. All employees turning in prospects which developed into sales were paid a bonus of $2.50 for each prospect. In addition to this company-paid bonus, many of the salesmen added a like amount on their own account. As a consequence 374 sales were directly traceable to employee leads.

### Old Range Allowance

Departing radically from all previous sales policies, a salvage allowance was offered on consumers' old cooking equipment. Salesmen were empowered to take in trade the old range of the prospect, irrespective of make or condition, for a sum not to exceed 10 per cent of the purchase price of the new range. About 50 per cent of all sales made by the Edison sales organization were made with this trade-in allowance, a total of 484 sales out of 1,003 being thus made. In addition to this salvage allowance each Hotpoint range carried with it a premium of an Edison waffle iron and tray. To establish the real value of the waffle iron and tray it was offered as a small appliance special during the period of the campaign, at a special low price. To carry the message of this special to consumers, 240,000 stuffers were sent out with the monthly bills during the campaign. These stuffers emphasized the waffle iron special, but also carried the story that this waffle iron was obtainable free with a Hotpoint range. The dealers were privileged to make the same trade-in offer on ranges which they sold, except that they were not empowered to give away a waffle iron with ranges other than Hotpoint. The Edison company refunded to the dealer the amount allowed on the old range and also furnished the waffle irons in the case of Hotpoint range sales.

In presenting campaign plans to the Edison sales organization a series of meetings was held throughout the territory. These meetings were addressed by R. W. Turnbull, Pacific Coast sales manager of the Edison Electric Appliance Company; P. H. Booth, southern California representative of the same company; H. C. Rice, merchandising manager of the Southern California Edison Company, and R. G. Kenyon, assistant advertising manager of the same organization. Much of the outstanding success of the campaign has been attributed to the sales talks made by Mr. Turnbull at these meetings.

Since the Southern California Edison Company is primarily interested in increasing the consumption of existing customers, the results shown by the accompanying curves indicate that range campaigns such as this have had a most decided effect in accomplishing desired results. Evidences of the value of the additional sales effort put upon ranges and appliances is brought out by these curves. Both curves cover a period beginning with the first of 1923 and running through to the end of 1927. In the lower curve lighting sales to domestic customers are shown. The upper curve shows total sales to domestic customers. In this compilation all domestic consumption is covered, including lighting, cooking and water heating. It will be seen that from the low ebb of 422 kw.-hr. per customer in 1925 the company has rapidly built up the per customer consumption until it has reached the high figure of 502 at the end of October, 1927. Both curves are built up on the basis of kilowatt-hours per customer for twelve months ending each month.

# Electric Forging of Tappets Proves Successful

By Sam Stites

*Power Engineer Consumers Power Company, Battle Creek, Mich.*

AN INTERESTING application of electric heat has lately been made at the plant of the Rich Steel products Company in connection with the manufacture of tappets for automobile valves. These are usually made from ⅝-in. steel stock formed in an upsetting press. The stock is first cut into 5-in. lengths and partly machined. In the next operation about 2 in. of one end is brought to a red heat and the piece placed in a die. The die is placed in a press and the projecting red-hot end is upset. On the return stroke of the press the die is reversed by the operator and the piece is pressed out by a plunger. Heating prior to upsetting is done by a Berwick heater, made by the American Car & Foundry Company, with slight modifications to adapt it to the tappet job.

In service, the piece to be heated is held in tongs by the operator and inserted between two copper jaws forming one electrode. The second electrode is a solid block of copper pressed by a spring against the end of the stock. A transformer integral with the heater supplies the necessary current. The tappets as turned out by the press are formed to such close limits that little machining is required, and for this reason the stock must not be marred or pitted in heating. When the electric heater was first tried some difficulty arose from imperfect contact, causing burned or pitted spots at the points of contact between the stock and the electrode. This was overcome by slightly rounding the jaws at the contact point and increasing the spring pressure.

EXPERIENCE WITH TAPPET HEATER

| | | |
|---|---|---|
| Diameter of stock | ⅝ in. | |
| Length of part heated | 2 in. | |
| Weight of metal heated | 0.174 lb. per piece | |
| Demand of heater | 15.8 kw. maximum | |
| Power factor of above demand | 96 per cent | |
| | Test No. 1 | Test No. 2 |
| Time, hours (week's production) | 3 | 1 |
| Number of pieces heated | 1,054 | 13,642 |
| Kilowatt-hours used | 40 | 550 |
| Kilowatt-hours per 100 lb | 20.6 | 23.2 |
| Kilowatt-hours per 1,000 pieces | 37.9 | 40.3 |
| Cost, electricity per thousand pieces (at average annual rate) | $0.70 | $0.75 |

Note—Test 2 gave lower efficiency as operator left heat on during mechanical adjustment of press.

The results were such that two more heaters have been ordered, making four in service. Better quality of work has been obtained and the company finds the method more economical than former methods. These units give the power company a load with an annual consumption of 140,000 kw.-hr. and a revenue of about $2,500. Two test runs gave the data shown in the accompanying table.

*Heating tappets electrically cost 70 to 75 cents or less per thousand pieces for energy*

# Changing-Color Floodlighting for Philadelphia

THE color lighting of the exterior of buildings may soon prove to possess valuable possibilities for increasing commercial revenues. An attractive and spectacular development in floodlighting has been incorporated in the exterior illumination of the new home of the Philadelphia Electric Company. Changing colors are projected onto the stepped-back superstructure, upper walls and columns of the new Edison Building. The equipment used for this purpose is mounted close to the surfaces to be illuminated and the lamps are provided with color caps similar to those planned, but never used, for the Tower of Light at the Sesqui-Centennial in Philadelphia. There are 483 floodlights utilizing 500- and 1,000-watt lamps in this installation. The necessary apparatus was supplied and designed by the Pittsburgh Reflector Company, the Ward Leonard Company and the Laco-Phillips Company.

Several years ago illuminating engineers of the Commonwealth Edison Company co-operated with the owners of the McJunkin Building, Chicago, in providing for that structure exterior color illumination. Instead of utilizing wash color, use was made of harmonizing combinations of color to produce artistic effects.

# Letters from Our Readers

## *Stokers for New Detroit Plant No Reflection on Powdered Fuel*

*To the Editor of the* ELECTRICAL WORLD:

The Detroit Edison Company has just decided to install underfeed stokers for the first six boiler units of its new plant, now in course of construction, which is to be known as Delray power house No. 3. Inasmuch as this company's Trenton Channel plant, which immediately preceded this in construction, is equipped for pulverized fuel burning, the choice of stokers for Delray No. 3 might be misinterpreted as indicating that in the opinion of the company's engineers the stoker method of firing had inherent advantages over the pulverized fuel method. Any such inference would be misleading in the extreme, as other factors must be considered.

It is pertinent to explain that until Trenton Channel was built it had been the Detroit Edison Company's long-established practice in all of its power plants, at Delray, Connors Creek and most recently at Marysville, to employ an underfeed type of stoker well suited to the character of the best coal ordinarily available; a comparatively low-fusing, very high volatile bituminous coal from West Virginia and eastern Kentucky. Long experience with stokers had developed the company's stoker practice to a satisfactorily high standard at the time the Trenton Channel plant was designed. The use of pulverized fuel at Trenton was therefore a new departure in the company's practice. The factor which conclusively determined that departure was the belief, later amply borne out by the result, that with pulverized fuel the plant would very easily adapt itself to minor variations in character of coal without impairment of capacity and with a minimum impairment of efficiency. It was felt highly desirable to have at least one such plant in the system in order to facilitate classifying the incoming coal and if it should ever become necessary to permit favoring the older plants at Delray and Connors Creek in the allocation of the received fuel. The southern site at Trenton Channel and its large trackage for receipt of coal made it particularly suitable as the pulverized coal plant in this set-up. Its projected large share in total output (41 per cent in 1927) would necessarily make it an important factor in the problem of fuel supply.

Trenton Channel, with the last of its complement of six 50,000-kw. turbines now being erected, has justified the decision made at the time its design was fixed. The investment per kilowatt installed is moderate and its operating performance has never fallen below the estimate of efficiency. For more than a year and a half it has consistently bettered that estimate, and there is reasonable expectation of further improvement. Problems incidental to the method of fuel burning have been satisfactorily met; for instance, the problem of substantial reduction of the fine ash carried away by the furnace gases. The Cottrell precipitators, with which all the boilers are now equipped, seem to be entirely practicable pieces of power plant equipment and are catching large quantities of dust, which for the time being is sluiced on to nearby marshy ground.

At Delray the new plant will be handled by the same organization that has superintendence of the two older power houses, Nos. 1 and 2. The management of stokers for high efficiency will be no novelty for that group of men. Estimates of performance and of required investment for the two types of plant (stoker and pulverized fuel) indicate total costs for the Delray location so nearly alike as to suggest the question whether or not the difference is of the same order as the possible errors of estimate. The final decision to install stokers in the first section of plant was determined by a consideration ordinarily too insignificant to become a controlling factor in plant design.

Up to the present time no permanently satisfactory way has been found for disposing of the fine ash produced by pulverized fuel furnaces after it has been caught. At Trenton Channel there are still marshes to be filled in, but there are no longer any such hollows near Delray. Conversely, the sale of stoker cinders from the Delray plant in a local market which it has never been possible to satisfy will earn a credit of something more than 6½ cents per ton of coal burned. These well-burned cinders are used as aggregate for concrete roof and floor slabs, as the body of so-called cinder blocks used in building construction, and in other ways which constitute a demand for cinders all the year around. But nobody wants the fine residuum from pulverized coal fires.

The design of the new Delray boiler furnaces can be easily adapted to pulverized fuel and the plant would accommodate the necessary equipment, but until this particular commercial problem of ash dust disposal is solved the Detroit Edison Company prefers, and will continue the use of, stokers at the Delray plants.

J. W. PARKER,
Vice-President and Chief Engineer.
Detroit Edison Company.

## *Agrees as to the Undesirability of Steaming Timber*

*To the Editor of the* ELECTRICAL WORLD:

I have been much interested in the articles and discussions on the treatment of Southern pine poles and particularly in the discussion of Mr. Wilson in your edition of April 14. I agree thoroughly with him in his opinion as to the undesirability of steaming timber. If the temperature is raised too high the strength of the timber is permanently impaired. If fairly high temperature is not used the so-called steam seasoning is inefficient. Committee 17 of the American Railway Engineering Association, when it offered the new specifications to that association, made no provision for steaming timber and expressed the firm opinion that this method of treatment should not be used except in emergency. As a member of this committee I concurred heartily.

Air seasoning can be successfully practiced in almost any location on the Atlantic and Gulf Coasts if proper care is taken. There has been much timber damaged in this process, but the damage is generally caused by improper methods. An air-seasoned stick can be much more evenly treated. It has greater strength and in every way makes a more desirable pole than a steamed pole. The cost of carrying poles for the required time is not excessive, amounting to not over 10 or 15 cents for a 35-ft. B pole, and this added cost is certainly justified by the greater value of the pole when so treated.

Some other preservatives are coming into use, but they cannot be used except with air-seasoned timber. One of these seems to have great value for pole treatment.

WILLIAM G. ATWOOD,
New York. Consulting Engineer.

# Digest of Electrical Literature

### *Hydro-Electric Development and Steam Equipment*

*Waterwheel Testing and Operating Records of Plant Discharge.*—This serial report of the hydraulic power committee of the N.E.L.A. includes recommendations for the study and use of modern facilities for the measurement of hydro-electric power plant water input and available power. Conditions reported for the industry include: Definite improvements in plant earning capacity; stand-by losses that are often unknown and can be prevented; operating experiences, including methods and apparatus; special use of well-known metering principles, and the practice of including in plant design advance preparation for tests and metering work. The balance sheet idea as applied to power plant operation is explained in detail in connection with the activities of one of the largest of the hydro-electric systems, as is a description of a long-distance recording water level gage utilizing the Selsyn motor principle.—*Serial Report National Electric Light Association,* March, 1928.

*Propeller Turbines as Hydro-Electric Prime Mover.*—H. Pflieger-Haertel.—The utilization of low or medium head water power with Francis type waterwheels leads to low speeds and consequently large generators. The introduction of the propeller turbine was a marked improvement in this respect, since this construction may, according to the author, readily give a specific speed of up to 1,000, or more than twice the value of the Francis turbine. Equipped with three to six vanes, the chief characteristic of the propeller wheel is an open space between vanes, which may be as much as 50 per cent of the vane surface. A special hub construction permits a change of the angle of the vanes to regulate speed or efficiency. During 1927 a total of 100 propeller turbines were installed in Europe.—*Elektrotechnische Zeitschrift,* March 22 and 29, 1928.

### *Units, Measurements and Instruments*

*An Instrument for Measuring Very Small Displacements.*—Juichi Obata.—The construction and application of a new instrument for measuring small displacements or motions and utilizing an electrical circuit are described by the author. In its usual form the instrument consists of a tuned grid circuit, but it is stated by the author that this can easily be changed to the Colpitts-Hartley circuit. The displacement or motion to be measured is made to produce either a change in the capacity of the circuit or a change in the eddy-current loss, and in consequence a corresponding change in the anode current of the thermionic valve. This change in the anode current is measured with a galvanometer, or, if a permanent record is required, an oscillograph may be used. In this instrument the capacity method, as well as the eddy-current method, may be utilized, and the anode current may be balanced or a transformer may be inserted, all the necessary resistances and the transformer constituting a unit.—*Journal of the Institute of Electrical Engineers of Japan,* January, 1928.

*Limits of X-Ray Investigations.*—O. Morgenstern.—To find blowholes or detect a lack of homogeneity in metal castings, porcelain and other solid materials a visual investigation or a photographic record with X-rays is used extensively. The author points out that, beyond a certain thickness of the materials tested, the output of the X-ray tube, the necessary time of exposure and the clearness of the resulting negative are three factors which set a definite upper limit to the usefulness of this process. Tubes of the Coolidge type are available today for 500 watts, 1,400 watts and 5,000 watts input, while tube voltages of as high as 230 kv. can be managed. Aluminum or aluminum alloy castings up to about 12 in. thickness and iron or steel up to 4 in. represent today, and probably for many years to come, the upper limit. A 10 per cent increase in thickness requires for iron and 220-kv. tube voltage a trebling of the exposure.—*Siemens Zeitschrift,* February, 1928.

*The Design of Nomograms.*—L. B. W. Jolley.—The discussion in this article is restricted to a description of one type of diagram, but the elements of design have been thoroughly considered, offering an analysis of the determination on which the whole subject of nomograms rests. The author has analyzed the determinants, has applied the determinants to alignment charts with straight, parallel and curved scales and presents the necessary mathematical considerations. The alignment chart is not claimed as being an ideal method for the presentation of facts for analysis as it is of little use for that purpose, but it is suggested for quick calculation of data from complicated formulas and is seen as possessing manifest advantages over the more conventional methods.—*World Power,* April, 1928.

*Study of the Operation of the Multivibrator.*—Yasukazu Namba and Shogo Namba.—The multivibrator used for the purposes of frequency standardization and incorporating the valve-maintained tuning fork is considered by the authors. This discussion illustrates the experimental results obtained in the study of frequency and wave forms and discusses the findings with respect to both the analytical theory and experiments. The results of the experimental and analytical determination check very closely and are completely illustrated.—*No. 218, Researches of the Electrotechnical Laboratory (Japan).*

### *Motors and Control*

*Clutch Pulley for Induction Motors.*—J. Bethenod.—To diminish the starting current of an induction motor with short-circuited armature various types of clutch pulleys have been introduced in late years, most of them based upon a centrifugal operating principle. The pulley described in this article, contrary to former designs, is exceedingly simple, having no springs or internal bearings. The construction consists of an inner pulley, keyed to the motor shaft, and a concentric outer pulley, loosely turning around the former. Between these two are arranged twenty identical punched U-shaped metal pieces, which can rock over ribs cast into the two pulleys. When the motor assumes speed, these pieces begin to press against the inner periphery of the pulleys, causing such an amount of friction as to take the outer pulley along gradually. Holes are provided in the sides to admit a current of cooling air.—*Revue Générale de l'Electricité,* March 24, 1928.

*Electrical Drives in Rubber Factories.*—The power requirements and motor specifications in connection with the various processes in rubber manufacture have been outlined in relation to several specific installations. Safety devices, including a free-fall safety brake and similar items of protective equipment, are considered. The most important feature of this safety brake lies in the fact that the weight falls absolutely freely until impact occurs between the brakeshoe and the brake disks. As soon as the brakeshoe is applied the weight is released through special mechanism in such a way that the energy stored up in it is applied without shock to the brakeshoe. Consequently, the rapid application of the braking force insures that the required bodies are brought to rest in the shortest time and without vibration.—*Brown Boveri Review (Switzerland),* April 1928.

### *Heat Applications and Material Handling*

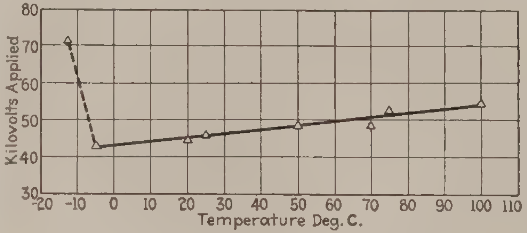
*Annealing of Non-ferrous Metals in the Electric Furnace.*—Robert M. Keeney.—Selection of the source of heat for the annealing of non-ferrous metals and alloys is an economic problem, according to the author, and the decision should be based on the overall cost of the finished product with the different forms of heat. For annealing in finished stages electric furnaces are said to have proved more economical than oil or gas, in many cases resulting in an annual return of 50 per cent on the investment. In the rolling mill, however, little progress has been made, although the cost of electric annealing, on a heat basis only, compares favorably with the cost of oil annealing. This situation is due to failure to consider economies in over-all cost which electric annealing may produce, the basis on which electric heating has made such great progress for tonnage production in the motor industry.—*Report American Electrochemical Society,* April, 1928.

*Condensers for Welding Machines.*—I. C. Fritz.—Various attempts have been made in the past to overcome the very low power factor of arc-welding and resistance-welding machines. Arc-welding sets with an induction motor and direct-current generator operate usually with 0.4 to 0.8 power factor and an efficiency of 50 per cent, while single-phase arc-welding transformers produce as low as 0.1 power factor load. It is suggested here that by connecting a small condenser across the primary of the welding transformer the power factor can be restored to unity. If a compensation to 0.8 is satisfactory the condenser will be found to weigh about one-half of the transformer weight, to require about three-quarters of its space, and its cost is one-third that of the transformer. A welding outfit for 14 kva., requiring previously special connection to a power line, can be connected to the light supply when equipped with a compensating condenser, since it will call for only 4 kva. actual power consumption. — *Elektrotechnische Zeitschrift,* March 8, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*The Effect of Curved Boundaries on the Distribution of Electrical Stress Around Conductors.*—J. D. Cockcroft.—An investigation, by the method of conformal transformation, of the distribution of electrical stress around certain systems of conductors which are important in high-tension practice. The effect of rounding the edges of the conductors in reducing the high stresses at the edges has been determined quantitatively and particular attention has been devoted to this phase of the subject. The methods used are applied to calculate the variation of the breakdown voltage with spacing distance between the electrodes. The two-thirds power law is derived as a limiting case for some of the electrodes and the effect of variation of electrode shape and of physical assumptions is shown. The theoretical results are compared with such experimental data as are available. Approximate formulas are derived, for the capacity of coaxial rectangular cylinders, which are an extension of the well-known correction for the corner of a Leyden jar, and their application to heat-conduction problems is pointed out. The results are reduced to graphical form.—*Journal of the Institution of Electrical Engineers (England),* April, 1928.

*Liquids as Insulators.* — Frank M. Clark. — A general consideration of liquid dielectrics has been undertaken by the author. These are said to bear a strong resemblance to gaseous dielectrics whose characteristics were described in a previous article in the same publication. The chemical, physical and electrical properties of the ideal liquid dielectric are outlined, as are those of the materials at present available. Temperature effects are considered to offer a major factor in the alteration of the properties of such insulating media and the author has included a consideration of the influence of catalysts upon the oxidation process as well as a review of the methods for detection and measurement of oil sludging characteristics. Other properties are likewise reviewed in considerable detail in connection with the test results and investigating procedure. — *General Electric Review,* April, 1928.



*Dielectric strength of mineral oil varies with temperature*

*Effect of Temperature and Other Factors on the Performance of Storage Batteries.* — G. W. Vinal and C. L. Snyder.—Experiments are described in this paper in which the effect of extreme conditions, such as low temperatures and high discharge rates, are determined separately for positive and negative plates of a lead storage battery. It was found that the temperature effects are less for the higher concentrations of the electrolyte in the case of positives, whereas the reverse is true for the negatives. Under extreme conditions, such as in airplane service, the negative plates are likely to become the limiting factor in determining the capacity. The best concentration of electrolyte for use in batteries under extreme conditions is a compromise between the requirements of the positive and negative plates. The change in capacity with temperature, when the capacity is limited by the positives, is inversely proportional to the changes in viscosity of the solution. The conditions under which localized freezing is liable to occur are indicated. The possible effect of these various factors upon the operation of airplane batteries is another phase of the subject which is discussed. — *Report American Electrochemical Society,* April, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*The Principles of Relay Timing in Connection with Automatic Telephone Circuits.*—T. H. Turney.—The author has developed the theoretical considerations involved in the relay timing of automatic telephone circuits. The relay is first considered as a simple coil which leads logically to Helmholtz's law. The inclusion of a slug, ignoring flux leakage, increases the time constant of the relay. As the rise of flux no longer obeys Helmholtz's law when flux leakage is present a rough treatment giving two exponential terms is utilized in place of one. In order to examine the effect of flux leakage a little more thoroughly the relay core has been viewed as a transmission line. The slug becomes distributed inductance, and the resulting telegraph equations have been solved by Heaviside's expansion theorem. In no case is the actual motion of the armature considered in this paper. —*Journal of the Institution of Electrical Engineers (England),* April, 1928.

## *Miscellaneous*

*A Method of Analyzing the Performance Curves of Centrifugal Pumps.* —Joseph Lichtenstein.—Development of analytical and graphical methods for determining correction factors from test curves for use in bringing theoretical pump equations into harmony with practice are given in this discussion. It is stated by the author that centrifugal pump practice still bases its calculations on the one-dimensional theory which assumes a frictionless fluid flowing through an impeller with an infinite number of blades. It is evident, according to the author, that the results of this theory cannot well conform with actual practice where the number of blades is small and where friction and a turbulent flow of water are encountered. Attempts to introduce a theory better adapted to the actual pump design have been made. These theories are not utilized by the pump designer because they are more complicated and not so general as the classical theory, being based on certain profiles which would limit the engineer in his designs, but especially because they are also based on a frictionless non-turbulent flow, a supposition far from reality. The present discussion is therefore based upon empirical factors rather than upon theoretical ones. Certain assumptions have been made upon which the various factors are developed. The discrepancy between the theoretical results and the classical one-dimensional theory used in calculating centrifugal pumps and the actual practices introduces correction factors that can only be deduced from tests. Correction factors have been introduced in the equations of the classical one-dimensional theory and new equations have been developed which can be used for calculating new pumps.—*Transactions American Society of Mechanical Engineers,* January-April, 1928.

# News of the Industry

## Maryland Commission Again Refuses to Sanction Sale

The Maryland Public Service Commission on April 26 dismissed for the second time the application of the Electric Public Utilities Company of Chicago for permission to purchase for $518,000 the Home Electric Light Company of Lonaconing, the Emmitsburg Electric Company, the Antietam Electric Light & Power Company and the Midland Electric Light Company, all in western Maryland. During the rehearing the commission was informed by its engineers that the reproduction costs of the properties of the utilities would be approximately $315,000, less depreciation.

No detailed criticism of the proposed transaction was given out last week by the commission, which simply said that it "would be detrimental to the public interest." Last year when it disapproved the transaction the commission gave as its reason that it could not "see wherein the public will be benefited in the slightest degree." An appeal was taken to the Circuit Court of Baltimore, which upheld the commission. Then the case was taken to the Court of Appeals, which found this negative reason insufficient and sent the case back to the commission (Electrical World, March 10, page 528).

Considerable interest has been aroused in public utility circles and among state commissioners by this case because of its bearing on the proper commission attitude toward the proposed acquisition of independent properties at inflated prices.

## International Rules for Tests of Hydraulic Machinery

At the instance of the World Power Conference the International Electrotechnical Commission undertook at its meeting in Bellagio last year to elaborate suggestions for an international agreement regarding the regulations to govern water-power plants. The rules agreed upon in sectional conference were referred to the national committees of Germany and Sweden, to which had been granted the right to appeal before Jan. 31, after which the rules were to be proposed as international regulations.

A German hydraulics committee was formed, with the permission of the German National Committee, to study these questions, and this committee has recommended acceptance of the Bellagio agreement as containing general rules in outline, inside of which each country would be free to compile its own rules according to the local requirements. The committee is now revising the German rules, which may then serve as a basis for additional international agreements.

Above all, the question of the measurement of water volume is receiving undivided attention, and all available experience and comparative results, as well as tests now being made in German and foreign hydraulic laboratories, will be turned to account. The book of rules is to be supplemented by an appendix containing the principal terms in several languages, and formulas and values will be published in both the metric and English systems of weights and measures.

## Federal Trade Commission Digs Diligently

### Unearths Payments by Joint Committee to Former Governors of New Mexico and Nevada, but Bulk of Testimony Adduced Lacks Interest

Open sessions of the investigation of public utility companies ordered by the Senate continue to be held in Washington by the Federal Trade Commission and to elicit testimony varying from details of the purest routine to making public financial transactions which have been seized upon as ammunition by the newspapers and politicians eager to score points against the industry.

The most fruitful of the latter, from the point of view of opponents of privately owned utilities, was brought to light on Wednesday of last week, when a total of $5,299 was shown to have been paid to the law firm of Meechem & Vellacott of Albuquerque, N. M. This amount, according to Ira L. Grimshaw, assistant director of the Joint Committee of National Utility Associations, was for the firm's services in reporting the conferences of Western governors called in 1927 to endeavor to settle state disputes over Colorado River development. Judge Healy, the Federal Trade Commission's counsel, pointed out that Mr. Meechem, formerly Governor of New Mexico, had been appointed by Governor Dillon of that state to represent it at the conference. Mr. Grimshaw implied ignorance on his own part of that fact, and Mr. Meechem subsequently said to newspaper men in the West that there had been no desire or attempt to conceal his employment by the joint committee.

On the following day Judge Stephen B. Davis, director of the joint committee, was asked about $600 paid to former Governor James G. Scrugham of Nevada for expenses of two trips East. Judge Davis said these trips were financed at Mr. Scrugham's own suggestion and that the latter was working with the committee to reconcile diverse opinion on the Colorado problem. Mr. Scrugham was a member of Secretary of the Interior Work's fact-finding commission on Boulder Dam.

Distribution of Literature

Since its organization in June, 1927, the joint committee, testimony showed, had distributed nearly two million pieces of publicity and had paid $55,000 for salaries, $30,000 for booklets and other literature, $31,000 for special publicity services and $37,000 for its Washington office. No expenditures had been made to public men for articles or for the use of their name except the $7,500 paid, as reported last week, to Richard W. Child, former Ambassador to Italy, for his work on a Boulder Dam booklet edited by Frank Bohn. No money had been paid directly or indirectly to schools.

Edward S. Mansfield, in charge of educational activities in New England for the National Electric Light Association, told of a survey on co-operation between utilities and educational institutions being made under N.E.L.A. auspices by Dean C. O. Ruggles of Ohio State University.

Josiah T. Newcomb, counsel for the joint committee, testified that he did not feel the committee had been organized to oppose government ownership, though the members were against it. He agreed that the committee's principal function and his own were to represent the utility companies in all matters of pending legislation before Congress. He referred to an interview in which Senator Walsh of Montana was represented as saying that the utilities and their controllers had "taken two billion dollars from the circumambient atmosphere" and had issued securities with no assets behind them. The committee desired to dissipate such misinformation. Mr. Newcomb admitted the interest taken by his committee in tax revision, federal regulation of interstate transmission of energy, government operation of the Muscle Shoals plants, flood-control legislation, the Boulder Dam project and similar matters of legislation.

N.E.L.A. Witnesses

Paul S. Clapp, managing director of the N.E.L.A., and George F. Oxley, in charge of publicity, appeared before the commission on Friday and explained the advertising and other policies of the association. Mr. Clapp declared himself opposed to political propaganda.

When the commission resumed its

hearings on Wednesday, May 2, Clarence G. Willard of New Haven, secretary of the Connecticut Committee on Public Service Information, and A. Bliss McCrum, secretary of the Public Utilities Association of West Virginia, were examined and told about their activities. Mr. Willard testified that he was co-author of the "Connecticut Public Utilities Catechism," used in seventy high schools of his state. Mr. McCrum had taken part in opposition to the Boulder Canyon bill, acting, he said, at the behest of Mr. Oxley.

Other officials of public utility associations summoned to appear include Walter H. Johnson, Walter E. Long and A. G. McKenzie of Philadelphia and A. B. Millar of Harrisburg, representing electrical associations, bureaus or committees in Pennsylvania. A. B. Tunis and A. H. Herrmann of the Public Utilities Association of Virginia were summoned last week, but their testimony contained nothing of moment.

Senator Walsh took occasion last Friday to deplore from his seat a lack of public attention to the investigation and said that to insure greater publicity for the testimony elicited he would from time to time address the Senate on points revealed. Thus he will get extracts from the evidence into the *Congressional Record.*

# Boulder Dam Debate Waxes Warm

## Senator Ashurst of Arizona, Leading Opposition, Denounces Stand of California as Selfish—Chances of the Bill's Passage Thought to Diminish

By Paul Wooton

Washington Correspondent of Electrical World

When the debate on the Boulder Canyon Dam bill began in the Senate last week some of its opponents were willing to concede that the bill would pass that chamber. After a week of debate, however, the chances of the bill to get through the Senate have diminished. In the meantime no progress has been made with the measure on the House side. The rules committee has had several hearings, but as yet has given no intimation as to its intention to give this legislation a preferred status.

Unquestionably the most effective point which is being made against the bill in the Senate debate is that the government cannot afford to embark upon an experiment with the highest dam ever built with insufficient engineering data. In view of the St. Francis Dam disaster it is being argued that the United States must be one hundred per cent sure before undertaking this project. The fact that Senator Smoot, the chairman of the finance committee, with all the prestige which goes with that position, is so vigorous in his opposition has had no little influence in building up sentiment against the legislation.

A determined filibuster against the bill, led by Senators Ashurst and Hayden of Arizona, is being aided by the legislative situation. The tax bill is certain to displace the Boulder Dam measure for a week or more. The conference report on the farm relief bill will take time and other appropriation bills have to be considered. In addition, various other important measures are on the calendar for which consideration is demanded, and if the President vetoes the flood prevention bill, that question will again be precipitated into the debating arena.

Senator Johnson of California, who is leading the fight for the bill, has contented himself with very limited remarks, mostly confined to explanations of the bill's provisions. He urged the passage of the measure as the duty of Congress to rescue sixty-five thousand Americans in the Imperial Valley from the threat of flood and to solve the international problem which exists on the lower reaches of the river.

### Ashurst Versus Johnson

Senator Ashurst, who is leading the opposition, and between whom and Senator Johnson a heated exchange of words took place, takes strong exception to the constant references by the bill's supporters to the "power trust." He pointed out that all but one of the senators who are supporting the Johnson bill voted against the Walsh resolution. He declared that the Boulder Canyon Dam would offer no flood protection for the Imperial Valley within the lifetime of any one now occupying a seat in the Senate. He urged that Congress pass the bill providing for the protection of the Imperial Valley against flood and take up as a separate matter a decision as to whether or not Los Angeles should have potable water at the expense of the government and whether or not Los Angeles and other cities on the coast should have electrical energy at the expense of the government. He charged that the California senators fear that a flood-control dam might destroy their hope of obtaining water and electricity for their state at government expense.

In the course of the debate Senator Johnson expressed the opinion that Senator Ashurst had not offered his flood-control amendment in good faith. In reply Senator Ashurst said the project would have a better chance for approval when California statesmen speak with the voice of reason, instead of with the voice of selfishness and a "display of a forked tongue." He concluded those particular remarks by declaring that the present bill fails to square with the idea of fair play that even bullies and prize fighters hold.

### Wants Sixteen-Hour Debate

Urging that the Boulder Dam bill be considered on its own merits irrespective of appeals to prejudice concerning the alleged interests of power companies in the contest, Representative Douglas of Arizona on May 2 asked the House rules committee, if it should give time for the consideration of the bill, to allow the opposition to the measure abundant opportunity to develop its case on the floor. "If you see fit to bring this bill before the House," he said, "sixteen hours of general debate will be necessary to inform the members of vital issues at stake concerning the interests of the people of seven states and an expenditure of $300,000,000."

Mr. Douglas put forward as his chief objection to the bill the incongruity of undertaking an enormous and expensive power development to provide against floods in a region where there is no pressing flood menace. He also took issue with the statement that Los Angeles needs an additional water supply, substantiating his point with a quotation from a California state engineer to the effect that the city at present has enough water for fifty years. In answer to statements that there is a great need for more power in southern California, Mr. Douglas pointed out that both the city of Los Angeles and the Southern California Edison Company reduced their rates in 1927 in order to stimulate demand.

In conclusion Mr. Douglas sounded the warning that the whole policy of the government is at stake in the issue. "If the government is to go into the power business at Boulder Canyon," he said, "the field will be opened to put it into any competitive line of business." He also declared that the government could construct a steam power plant at Los Angeles, if its object is power development, and save expense.

Despite requests of representatives from other Colorado Basin states that time be given them to make statements, Chairman Snell of the rules committee announced that he had given the subject all the time that he could and that the committee would now devote itself to the consideration of the rule.

# Senator Smoot Takes a Hand in Boulder Dam Debate

An amendment in the form of a substitute for the Boulder Dam bill by which the problem of developing the Colorado River would be referred to a board of engineers which would make recommendations for flood-control measures was offered on May 1 by Senator Smoot of Utah. The Senator made the proposal at the close of a long speech begun on April 30, in which he criticised in detail the proposed engineering plans for the development of the Colorado River.

The Smoot substitute would make available an appropriation of $20,000,000 "for the purpose of carrying out the investigation and building the flood-control structures." If a storage dam is the type of flood-control structure decided on, Senator Smoot's proposal provides that the seven-state Colorado River compact shall be consummated before the dam is begun, or "if the present incomplete Colorado River compact proves too difficult of ratification, an easier compact, not involving the troublesome question of title to water rights, may be substituted."

Senator Smoot, who is chairman of the finance committee, also announced that he would call up the tax bill on May 3, after which he would seek to keep it continuously before the Senate until it is disposed of. This action will displace the Swing-Johnson bill on the calendar, at least temporarily.

## Representative Berger "Goes the Whole Hog"

A national "superpower system" is provided in a bill introduced in the House on Monday by Representative Berger of Milwaukee, a Socialist. Declaring that the so-called "superpower lobby" represents "the most corrupting influence in the United States today," Mr. Berger said his measure is designed to bring about conservation of the nation's natural resources, the co-ordination of irrigation, flood control, navigation and hydro-electric power production, the enlargement and expansion of the Reclamation Service in the field of agriculture, and federal aid to states, cities, counties, districts and other political subdivisions in the development of superpower systems, with service at cost.

## P. G. & E.'s New Mokelumne River Project

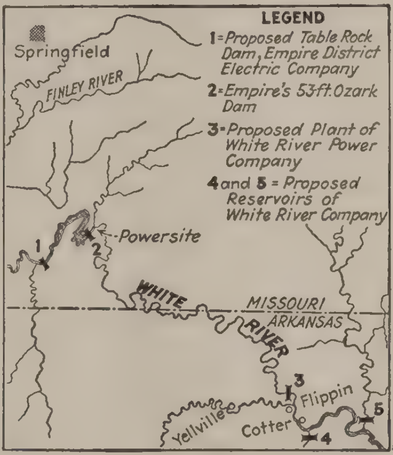
The Pacific Gas & Electric Company has filed with the Federal Power Commission an application for the further water and power development on the upper Mokelumne River, 50 miles northeast of Jackson, which has previously been described in the ELECTRICAL WORLD. The company proposes to erect a rock-filled dam, with a concrete face, approximately 300 ft. in height, 800 ft. thick at the base and 25 ft. wide at the top. The crest will be 1,300 ft. long and the storage capacity 130,000 acre-feet.

The application further calls for the erection of the Salt Springs power house at the base of the dam, which will have an installed capacity of 11,000 hp.; the construction of a concrete-lined canal and tunnels for the conveying of water from Salt Springs to a proposed regulating reservoir on Tiger Creek; the construction of a forebay on Tiger Creek from which water will be dropped approximately 1,200 ft. through penstocks to the proposed Tiger Creek power house, which will have an installed capacity of 67,000 hp., and the erection of a 110,000-volt power line from the Salt Springs power house to the Tiger Creek power house.

## N.E.L.A. in Joint Conference on Shift of Industry

A joint conference of the policy holders' service bureau of the Metropolitan Life Insurance Company and the civic development committee of the N.E.L.A. was held in the Metropolitan Life Building in New York City on Thursday. The purpose of the conference was to discuss a survey of what industries are moving, where and why, and the relative advantages of small and large cities as manufacturing sites, and to consider ways in which the personnel of the two organizations can co-operate in collecting fundamental industrial economic figures. Preston S. Arkwright, president of the Georgia Power Company, is chairman of the N.E.L.A. civic development committee, containing thirteen prominent executives.

## Projected Water Power in the Ozarks, 245,000 Hp.


LEGEND
1=Proposed Table Rock Dam, Empire District Electric Company
2=Empire's 53ft. Ozark Dam
3=Proposed Plant of White River Power Company
4 and 5 = Proposed Reservoirs of White River Company
Springfield
FINLEY RIVER
Powersite
1
2
WHITE RIVER
MISSOURI
ARKANSAS
3
Flippin
Yellville
Cotter
4
5

RECENT granting by the Federal Power Commission of a preliminary permit to the White River Power Company for a long-mooted hydro-electric project in the Ozarks at the Missouri-Arkansas border has revived hopes of extensive new water-power development in that region. The permit embraces a 226-ft. dam near Cotter, Ark., with backwater to the Empire District Electric Company's Ozark dam at Powersite, Mo.; two high reservoir and power dams on the North Fork and Buffalo Fork and a series of low-head power dams between Cotter and Wall's Ferry. The aggregate immediate installation of the White River Power Company's project is placed at 165,000 hp. or more, and it is maintained that double this amount of power can be generated when required. The Empire District Electric Company on its part is sponsor for an 80,000-hp. project at Table Rock, in Stone County, Mo., further along the river, where a dispute with county authorities is delaying action.

## Electrochemists at Bridgeport Discuss Batteries

The chemical production of electricity was the major topic of the American Electrochemical Society at the spring meeting held at Bridgeport, Conn., on April 26 to 28. More than two hundred members were in attendance.

Two sessions on Thursday dealt with primary cells. The modern dry cell was discussed in several papers with especial reference to life tests and depolarizers. One notable paper by Bruce K. Brown dealt with the use of graphitic oxide instead of manganese dioxide as a dry-cell depolarizer. The graphitic oxide gives a cell of lower voltage and is more expensive at the present stage of development but has promising possibilities. Marion Eppley gave two research papers on requirements in the production of standard cells. M. L. Martus discussed the caustic-soda battery and told about its characteristics. For the first time the technical details of the aluminum electrolytic rectifier were published in a paper by W. E. Holland, and a companion paper by H. O. Siegmund discussed the aluminum electrolytic condenser. Other papers dealt with storage batteries and storage-battery testing.

On Thursday night two excellent lectures were given. Dr. S. C. Lind, retiring president of the A.E.S., gave a lecture on the theory of chemical action in electric discharges in gases. He precipitated oils and solids from hydrocarbon gases by means of radium emanations and duplicated these tests with electric discharges. The second lecture was by Dr. Bergen Davis and dealt with the refraction of X-rays. These rays were observed by a double refracting spectroscope and their angle of refraction was measured.

Electrothermic applications of electricity were discussed on Friday. Robert M. Keeney, illustrating his paper with a film, described the growth of electric heat in industry and cited details of development in Connecticut. R. H. Leach gave operating data on the induction furnace for melting silver. C. M. Hoff told of the production of nitric and hydrochloric acid by use of electrodes immersed in the impure acids. By this means the resistance paths became heated and the boiling which resulted permitted distillation of pure acids. He said the new process replaced eight men with one and reduced production costs very greatly.

On Saturday the session was devoted to electrodeposition. Especial attention was given to chromium plating, and a noteworthy paper on this topic was presented by L. E. Grant and L. F. Grant. Chromium plating is looked upon favorably in industry, but to get good commercial results precision control and knowledge are required.

Visits were made to manufacturing plants in Bridgeport, Waterbury and New Haven. Paul J. Kruesi, president of the American Lava Company and other electrochemical concerns in Chattanooga, Tenn., was elected president. The fall meeting will be in Charleston, W. Va., on Sept. 20, 21 and 22.

## A.E.S.C. Changes Its Procedure

*Flexibility Made Main Element in Rules Adopted to Speed National Standardization—Steps in Development and Approval Are Listed*

EXTENSIVE revision of its rules of procedure to speed industrial standardization work on a national basis is announced by the American Engineering Standards Committee. The chief object in broadening the procedure has been to make it so flexible that it may easily fit all of the varied conditions to be met in the wide range of industrial subjects covered by the committee's work. The revision is based upon the experience of the committee during its nine years of activity as a national standardizing body.

Three important changes are made in the procedure. Heretofore each sectional committee—essentially a joint committee composed of representatives of the various groups interested in the particular work in hand—has acted under the administrative support and direction of one or more of the interested bodies, which have been termed sponsors. A sectional committee may now operate autonomously, reporting directly to the A.E.S.C., or it may act under sponsors as before. The second change recognizes "proprietary" standards and makes possible the revision of such standards within a single organization on condition that it be shown that a standard is acceptable to the groups concerned. This method is particularly applicable to highly specialized fields in which the standard of an organization has already achieved a position of recognized eminence. The third change provides for very simple cases. The approval of standards under such cases is based upon the action of a conference followed by written acceptances of the interested groups.

The revised procedure states that the different methods are founded on the principle that the basic test to be applied in all cases is the fact of the assent, affirmatively expressed, of the groups having substantial interest in the standard. Such groups have an inherent right to representation on the body dealing with the subject matter of the standard, but it is not essential that this right be exercised.

The steps in the development on revision of a standard by a sectional committee will be:

1. Standardization proposed by responsible body.
2. General conference called by the A.E.S.C. to consider proposal and to decide whether the work shall be done; if so, whether the sectional committee shall operate under a sponsor or autonomously.
3. Recommendation of conference acted upon by A.E.S.C.
4. Organization of a sectional committee.
5. The make-up and personnel of sectional committee approved by the A.E.S.C.
6. Standard drafted by sectional committee.
7. The draft standard published or circulated for criticism.
8. Proposed standard approved by sectional committee by letter ballot.
9. Proposed standard approved by sponsor, if there be a sponsor, or formally indorsed by at least one co-operating body if the sectional committee is autonomous.
10. Standard approved by the A.E.S.C.
11. Standard published by sponsor or by the A.E.S.C. if sectional committee is autonomous.

The steps in approval of existing or proprietary standards will be:

1. An existing or a proprietary standard submitted to the A.E.S.C. for approval by a responsible body.
2. Investigation of facts regarding consensus through A.E.S.C. agencies, or the development of the acceptability of the standard through a representational committee.
3. Standard approved by the A.E.S.C.
4. Standard published.

The steps in the development of a standard by general acceptance will be:

1. Standardization proposed by a responsible body.
2. Survey of field made and draft standard produced by working committee.
3. Draft standard considered by general conference.
4. Proposed standard formally accepted by groups concerned.
5. Standard approved by the A.E.S.C.
6. Standard published.

The governing authority of the American Engineering Standards Committee is at present vested in 63 men, representing 36 national organizations, industrial, technical and governmental. About 350 national organizations are officially co-operating in the work, with 2,100 individuals engaged on various committees. Up to the present time 111 national standards have been approved, and 164 additional projects representing almost all branches of industry are under way.

## "Teach Children to Respect Utilities"

### Before State Association Governor Baker of Missouri Advocates Public Instruction Concerning Them—Glowing Predictions Made About Farm Service

FOUR hundred representatives of Missouri utility companies attended the three-day convention of the Missouri Association of Public Utilities at Jefferson City on Thursday to Saturday of last week. The address of welcome, delivered by Governor Sam A. Baker, went further than to express the customary amenities. The Governor strongly advocated the study in the public schools of the state of public utilities and the service they render. "I believe the public school curriculum should be so modified as to have a place for public utilities," he said. "Teach the children from the time they know anything to respect public utilities and to have some knowledge of them. There are still some of our greatest educational institutions that never undertake to teach anything about public utilities. We have the school of journalism, we have the school of engineering, we have the school of pharmacy, we have the medical school, and we should, right along with these activities, teach the benefits of public utilities."

A miniature electrified farm was an exhibit of the convention as the joint contribution of the agricultural colleges and the power and light companies of Missouri, Iowa, Kansas and Nebraska. R. R. Parks of the Missouri Agricultural College, Columbia, had charge of the farm. President W. H. Henby in his address predicted that eighty thousand Missouri farms will be electrified by 1948 and that the total cost of this development to the farmers and utilities will be about $200,000,000. He declared that the electrification of farms is the biggest task before the utilities, that rapid progress is being made and that the job will be done. He said that about five thousand Missouri farms are now using electricity.

"There is a vast field open to the utilities in assisting the chambers of commerce and other civic organizations in industrial development of the communities in which they operate," F. S. Dewey, vice-president of the Kansas City Power & Light Company, declared. He pointed out that the kilowatt-hours of electricity and cubic feet of gas produced by the utilities form a good measuring rule in determining the industrial development of any given territory.

Earle W. Hodges, director of public relations for Henry L. Doherty & Company, said that whether a public utility was a "good citizen" depended very largely upon its employees. Missouri utilities, he said, are following the proper trend by instilling into their workers civic and state pride. He advocated newspaper advertising to keep the utilities in close touch with the public.

L. A. Petit, Jr., operating vice-president of the Missouri Power & Light Company, Kansas City, Mo., in an address on Friday pictured electricity as an economic and social equalizer and declared that the liberal use of electric power in industry has done more to improve the standard of living and to increase per capita wealth in America than any other single thing. It has also, he said, increased the productivity of labor, thus making possible higher wages and a shorter work day. It would make decentralization of industry possible and raise agriculture to the same plane of prosperity that industry has occupied.

L. A. S. Wood, manager of the street-lighting section of the Westinghouse Electric & Manufacturing Company, South Bend, Ind., spoke on "The Public Utility Company's Responsibility in Relation to Street Lighting," and W. L. Berry, assistant sales manager of the Union Electric Light & Power Company, spoke on "Load Building."

Thomas J. Brown, chairman of the Missouri Public Service Commission, was the only speaker at the annual banquet, held at the Missouri Hotel on Friday night. The trend of his remarks was that the public utility is as much an agent and servant of the public as are members of the commission and he urged a better understanding of the meaning of state regulation and the workings of the commission, whose duty it is to see that good service is furnished and that the company in return has just and adequate rates. "Regulation means to a great extent the elimination of competition" he continued. "When I became a member of the state commission I was firmly convinced that competition should not be eliminated. I am now entirely 'sold' on the idea of state regulation."

A feature of the final session on Saturday morning was a technical paper on the steam-heating business prepared jointly by W. C. Kaber, engineer of the steam-heating department of the Union Electric Light & Power Company of St. Louis, and T. S. Ayers, superintendent for the same company.

New officers were elected as follows: President, A. E. Reynolds, Springfield Gas & Electric Company; first vice-president, T. J. Stricker, Kansas City; second vice-president, E. D. V. Dickey, Hannibal; third vice-president, Samuel W. Greenland, St. Louis; secretary and treasurer (re-elected), F. D. Beardslee, St. Louis.

## Progress in Electric Welding Reviewed by Society

Continued progress in the art of fusion welding by electric and gas processes was made evident by papers, discussions and committee reports at the annual spring meeting of the American Welding Society, held at the Engineering Societies Building, New York, April 25, 26 and 27. This progress, it was shown, is mainly in the perfecting of technique, the establishment of preliminary standards for qualifying welders and supervising their work and the advancement of the test programs for welded pressure vessels and steel structures.

At a meeting of the pressure-vessel committee it was pointed out that the support of tank manufacturers and manufacturers of electric welding equipment is needed to insure an early start on an extensive test program to be carried on jointly by the American Welding Society and the American Society of Mechanical Engineers. These tests will supply essential data sought by the A.S.M.E. boiler code committee as a basis for proposed modifications in the code for unfired pressure vessels.

The meeting of the structural steel welding committee brought out the fact that funds for a similar structural research program are fully subscribed, assuring the completion of tests to establish unit stresses and other data.

A preliminary progress report on qualifications of welders, inspection and supervision was presented by H. H. Moss and A. M. Candy. This covered the fields of structural steel and industrial piping and was followed by prepared discussions covering structural steel, piping and pressure vessels.

The meeting closed with a session on the welding of the new Ford car, in which all processes are used, and a meeting of the American Bureau of Welding, at which the progress made by various research committees of the society was reviewed.

Officers elected for the ensuing year are: President, F. T. Llewellyn; senior vice-president, A. E. Gaynor; divisional vice-presidents, Ernest Lunn, J. W. Meadowcroft and H. P. Peabody.

## Purchases and Mergers

*Ashtabula, Ohio, Votes to Sell Municipal Plant if $2,225,000 or More Can Be Realized—$2,000,000 Cash Offered for Freeport (N. Y.) Municipal Plant*

VOTERS of Ashtabula on April 24 approved a proposal to sell the municipal light and power plant for not less than $2,225,000. The issue carried by a majority of 1,036 votes. Last November a similar proposal was defeated by 32 votes. The voters last week also authorized the Cleveland Electric Illuminating Company to extend its lines inside the city limits of Ashtabula to serve the docks and railroads. Ashtabula, which has a population of 25,000, is the largest city in Ohio depending for electric service entirely on a municipal plant. The Public Ownership League of America devoted eleven pages of *Public Ownership*, its monthly journal, edited by Carl D. Thompson, to arguments against authorizing the sale.

The Long Island Lighting Company has made a formal offer to the Village Trustees of Freeport, N. Y., to buy the municipal light and power system for $2,000,000 cash. The sum would, it is said, wipe out Freeport's bonded indebtedness and leave a margin. It is expected that public opinion on the matter will be indicated at a proposed forthcoming referendum on the question of floating a bond issue of $250,000 for the purchase of equipment for the municipal plant. The Long Island Lighting Company's offer will hold good until Nov. 1.

Acquisition by the American & Foreign Power Company of the Mexican Utilities Company is announced. The Mexican Utilities Company was organized in 1925 and controls the Guanajuato Power & Electric Company and the Central Mexico Light & Power Company. Irving W. Bonbright is chairman of the board.

The proposed merger of the Washington (D. C.) traction companies, now before Congress, has attracted criticism at the hearings of the District committee of the House, where William A. Roberts of the Federation of Citizens' Associations declared that control of the Washington Railway & Electric Company and the Potomac Electric Power Company reaches back to the North American Company. He expressed the opinion that the La Follette anti-merger act makes unlawful the indirect control which, under the proposed plan, the North American might have over the local power supply and the potential source at Great Falls in view of its holdings in the Washington Railway & Electric. The Senate committee is understood to be waiting on the House, and doubt is expressed whether final action will be taken this session.

The Central Hudson Gas & Electric Corporation has made application to the New York Public Service Commission for authority to acquire for $500,000 all of the outstanding capital stock and mortgage bonds of the Red Hook Light & Power Company and the outstanding stock of the Ducci Realty Corporation, which owns real estate and water rights in Bingham Falls, Columbia County, where the Red Hook hydro-electric company's plant is located. The Central Hudson Gas & Electric Company has also made application for authority to acquire the outstanding capital stock of the Millerton Electric Light Company, serving Millerton and the town of Northeast, in Dutchess County, and for approval of the merger of the Millerton company with the Central Hudson Gas & Electric. The Millerton company is now controlled by the Connecticut Power Company of New London. The price stated is $105,000 in cash and 2,000 shares of Central Hudson non-par-value common stock.

Sale of the Waverly (Ohio) municipal light plant to the Ohio Utilities Company took place recently.

The Ohio Electric Power Company of Oberlin has purchased from the New Bremen corporation the transmission and distribution line serving the village of Lock Two. New Bremen obtains its own energy from the company.

Purchase of the electric light system at Sharpsburg, Ky., by the Kentucky Electric Development Company, Louisville, is announced. This company has been in operation a little more than a year and now furnishes power for seven towns in Pendleton and Shelby Counties.

When the Stonewall Power Company sold out its entire interests last week to the Virginia Public Service Corporation of Charlottesville, for approximately $250,000, a fight for the right to supply electric light and power to Mannassas and Prince William County was brought to a conclusion. About a year ago the Virginia Public Service Corporation made the Town Council of Manassas an offer of between $80,000 and $90,000 for its franchise, power plant and lines. This offer was rejected by the Town Council. A few months later a corporation, with headquarters in New Jersey, known as Rivers & Streams, Incorporated, began the construction of a dam at Bland's Ford, on Occoquan Run, and acquired all lines and rights outside of Manassas, subsequently selling out to the Stonewall Power Company.

The municipal electric light, water and ice plants in Donalsonville, Ga., have been sold to the Georgia Power & Light Company, not to the Georgia Power Company, as erroneously reported last week.

Jonesboro (Ark.) citizens are at loggerheads over the proposed sale of the municipal water and light plant, a property owners' league advocating disposing of it for $1,200,000.

On April 1 the electric and gas properties of the Central Power & Light Company at Natchez, Miss., were transferred to the Southwestern Gas & Electric Company, an operating subsidiary of the Central & Southwest Utilities Company, because of the great distance separating Natchez from the remaining properties of the Central Power & Light Company and the proximity of Natchez to the properties of the Southwestern Gas & Electric. All are Insull companies.

James R. Darby, owner of the Weimar (Tex.) Power & Light Company, has sold the business to the Middle States Utilities Company, with headquarters at Chicago.

That company also has purchased the La Grange (Tex.) Light, Power & Water Company.

The Walterboro (S. C.) municipal electric plant has been bought by the South Carolina Power Company for $56,000.

Fifty thousand dollars has been offered for the Benson (Minn.) municipal electric plant by the Otter Tail Power Company. Engineers have informed the city that it would take $223,000 to modernize the plant.

An offer of about $57,500,000 by the Power Corporation of Canada, through A. J. Nesbitt of the Nesbitt, Thomson Company of Montreal, for the British Columbia Electric Railway Company brings the number of bids recently made for control of the latter property to four, of which the one just referred to is much the highest. The other three bids include a previous one from the Nesbitt interests, one from the Holt interests of Montreal and one from Lord Rothermere and his associates in England, where the company's stock is now held.

## Briefer News

New Transmission Line for Iowa.—A 47-mile high-tension line connecting the Northwestern Light & Power Company plant at Sibley, Iowa, with George, Boyden, Little Rock and Hull is being planned by the utilities company and will be started soon. The approximate cost is $100,000.

Possibilities of Chilco River Watershed in British Columbia.—The government of British Columbia will take steps this summer to determine definitely the water-power possibilities of the Chilco River country, midway between Vancouver and Prince George, over which a water-power reserve was placed a year ago. The water powers of that locality have been estimated to be capable of developing 1,000,000 hp., and the government will now send a survey party to make scientific measurements. This will probably take three years.

Mechanical Engineers' Pittsburgh Meeting.—"Some Economic Factors in Power-Station Design," by H. B. Brydon, and "High-Pressure Steam Boilers," by George A. Orrok, are the two papers scheduled for presentation on Thursday morning, May 17, at the central-station power session of the spring meeting of the American Society of Mechanical Engineers. This meeting will be held at the William Penn Hotel, Pittsburgh. On the preceding day there will be two papers dealing with engineering education—"Industrial Co-operation in Education," by A. T. Jewett, and "Education and Training as Applied to the Engineer," by F. L. Bishop.

Mountain States Power Moves Back to Albany, Ore.—Moving of the general offices of the Mountain States Power Company from Tacoma, Wash., to Albany, Ore., was effected early in April. The operating and treasury departments were moved to Tacoma from Albany about two years ago, at which time the engineering and electric new-business departments were kept at Albany so as to be near the center of the Willamette Valley Division. The principal officials returning to Albany in the present move are Vice-President C. M. Brewer, General Auditor W. L. Fitzpatrick, and John N. Adams, head of the publicity department.

Missouri Public Service Company to Have Headquarters at Warrensburg.—The Missouri Public Service Company will by June 1 establish its general headquarters at Warrensburg, Mo. The company now serves eighty towns in western Missouri.

New Plant at Yoakum, Tex., for Texas-Louisiana Power.—The Texas-Louisiana Power Company will construct a new electric power plant at Yoakum, Tex., at a cost of $150,000, it is stated. The company also plans to construct a system of power transmission lines in that part of the state, invading the field which is now occupied almost exclusively by the Central Power & Light Company.

Line Extensions in Oklahoma.—The Southwestern Light & Power Company has started construction on a 33,000-volt electric transmission line from Duncan to Addington and from Waurika to Ryan, guaranteeing uninterrupted service by a loop connected to the company's generating plant at Lawton and its standby plant at Waurika. The company is also constructing a 33,000-volt line from Clinton to Arapaho and a distribution system at Arapaho. The 22,000-volt line from Hammon to Cheyenne and Strong City is finished, as are also the distribution systems in Cheyenne and Strong City. Erection of the steel towers for the Red River crossing to connect with the transmission systems of the Southwestern Light & Power Company at Frederick and the West Texas Utilities Company at Vernon has been completed in recent weeks.

New Unit for Toronto (Ohio) Plant Nearly Ready.—The fourth unit of the Pennsylvania-Ohio Power & Light Company's plant at Toronto, Ohio, will soon go into operation, increasing the capacity of that station from about 112,500 kva. to 150,000 kva. The third unit was installed only last fall.

To Enlarge Chihuahua Hydro Plant.—Plans of the Mexico Northern Power Company for increasing the capacity of its hydro-electric plant in La Boquilla, State of Chihuahua, and construction of a large irrigation system have been approved by the Mexican government. The improvements will cost approximately $1,500,000 United States money, it is stated. This company is owned by Canadian interests. It constructed a large dam across the Conchos River about twenty years ago and installed a hydro-electric plant which, by means of transmission lines, furnishes power and light for Parral, Chihuahua, Santa Rosalia and a number of mining districts.

Northern New York Utilities to Develop 12,000 Hp. on Beaver River.—The Northern New York Utilities of Watertown, N. Y., will immediately start the development of water power at Mosher Falls on the Beaver River, where about 12,000 hp. will be developed, two units of 6,000 hp. each being installed. An additional development of 12,000 hp. may be made later. It is expected that the work will be finished this year. The Mosher Falls has a 216-ft. head. A concrete dam 100 ft.

## Floodlighting Embellishes the Original Capitol of Iowa

The dignified simplicity of Iowa's "Old Capitol" at Iowa City is especially well brought out at night by floodlighting. Four L-15 1,000-watt projectors are used to light up the tower; 12 L-1 500-watt projectors light the remainder of the building. The lighting installation was made by the General Electric Company. The old building has been termed the cradle of Iowa, as it was the first Capitol of the state. It is now the heart of the University of Iowa and houses all the administration departments of the university.

high and 1,000 ft. long is to be constructed, and 10,000 ft. of pipe line, 10 ft. in diameter, is to be laid to the surge tank, two miles away. About 320 acres of timber land will be flooded.

Rochester Gas & Electric Wants Additional Land on Genesee. — The Rochester Gas & Electric Corporation has filed with the New York Public Service Commission a petition requesting the commission to find, in accordance with the conservation law, that certain real property on the Genesee River in the city of Rochester is necessary to the improvement and full utilization of the company's water-power development in that city. Under the law the commission must make such a finding before the petitioner can institute condemnation proceedings. The commission will fix a date for a public hearing.

Plant to Be Built at Aberdeen, Wash., While Awaiting Cowlitz Power.—The Grays Harbor Railway & Light Company, Aberdeen, Wash., will build an extension to its central generating plant at Electric Park, to cost $1,500,000, W. W. Briggs, vice-president and general manager, announces. The new unit will develop 10,000 hp. and will more than double the capacity of the station. Mr. Briggs also announces that the construction of this unit will in no way interfere with the ultimate development of the Cowlitz power project, but that it is being built to provide for industrial expansion expected before the Cowlitz power becomes available five years hence.

Senate Passes Bill for Hydraulic Laboratory.—The United States Senate on April 13 passed the Ransdell bill authorizing the establishment of a national hydraulic laboratory in the Bureau of Standards. A similar bill was introduced by Senator Ransdell in 1922 by request of the American Engineering Council in an effort to carry out a recommendation made by John R. Freeman. The commerce committee on two previous occasions reported the bill favorably and urged its passage, but it took the flood of 1927 to muster the necessary support behind the bill to insure its success. The bill was supported strongly by Secretary Hoover. It authorizes an appropriation of $350,000.

Negotiation Under Way for Elephant Butte Power.—During the past year the El Paso Electric Company has been carrying on negotiations with the Water Users' Association looking toward construction of an 18,000-kw. power plant at Elephant Butte Dam in New Mexico and a transmission line to El Paso by the Water Users' Association and purchase of the power by the El Paso Electric Company. Elephant Butte Dam was constructed several years ago for irrigation purposes only, but engineers estimate that approximately 18,000 kw. of power will be available for a few months out of each year and it is this power that the electric utility would buy. An agreement has been worked out and is now under consideration by the Water Users. It will be necessary for them to secure approval of the Secretary of the Interior.

Nebraska's State Plant Is Started. —The new power plant built by the State of Nebraska at the state penitentiary, 5 miles south of Lincoln, at a cost of $150,000, has been put into service and will light all state institutions in and about the city, including the ten-million-dollar Capitol, now nearing completion. The state refused to contract for energy with the Iowa-Nebraska Light & Power Company. It claims that the new plant has a fuel-saving capacity of 50 per cent over the old equipment.

## Coming Meetings

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]**

American Institute of Electrical Engineers—New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

Indiana Electric Light Association (jointly with Indiana Public Utilities Association) — Columbia Club, Indianapolis, May 22-24. William Stokes, 1548 Consolidated Bldg., Indianapolis.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

Chief Justice Wilson of Maine Named Master in Cambridge Case.—Chief Justice Scott Wilson of the Supreme Court of Maine has been appointed master to hear the case brought by the Cambridge Electric Light Company against the Massachusetts Department of Public Utilities in connection with the commission's order reducing its maximum residential and commercial lighting rate from 8 cents to 5.5 cents per kilowatt-hour.

Middle West N.E.L.A. Meets at St. Louis Next Week.—About four hundred delegates are expected to attend the annual convention of the Middle West Division of the National Electric Light Association, composed of electric light and power companies in Missouri, Iowa, Kansas and Nebraska, to be held in St. Louis on May 9, 10 and 11. The proposed method of Mississippi River flood control will be discussed by Major George R. Young. Judge C. W. Appleton, vice-president of the General Electric Company, will discuss "Government in Business." Public utility financing will be presented from a banker's viewpoint in an address by A. C. Allyn of Chicago. Prominent representatives of the parent body also will address the gathering.

Third Unit at Bartlett's Ferry, Ga., to Go in This Year. — Preliminary work on an extension to the Bartlett's Ferry hydro-electric station of the Columbus (Ga.) Electric & Power Company is finished, and unit No. 3 will be installed, it is announced, by Sept. 1. Like the two previous units, the new generator will be rated at 22,000 hp., thus increasing the plant's capacity to 66,000 hp. Ultimately a total of 110,000 hp. may be installed. New steel penstocks, control equipment and a transmission substation form part of the work to be done this summer. The new unit will consist of a General Electric generator and an Allis-Chalmers waterwheel. The two units already in service are of Westinghouse and S. Morgan Smith manufacture.

Device for "Shocking Away" Trespassing Fish.—J. E. Yates, electrical engineer for the Pacific Power & Light Company in Oregon, claims to have perfected a safety device by the use of which hydro-electric utilities may prevent the destruction of fish by turbine wheels. According to the State Fish Commission, Mr. Yates' invention is the first of the kind to be successfully used. It consists of two rows of parallel electrodes suspended from a wooden framework above the water. The rows are 4 ft. apart and the electrodes 3 ft. apart. The electrodes are at approximately the same level near the bed of the stream. An electric field set up about the electrodes will reach in equal strength from the surface of the water to the bottom of the stream. Its strength will taper off in proportion to the distance upstream and downstream from the center of the field. The device is so constructed that when a fish approaches a tailrace it will swim into the edge of the electric field and either be immediately turned back or, if it attempts to enter the field farther, a still greater shock will be sufficient to discourage this procedure. A field current of 3 volts or 4 volts is ample to divert a 30-in. salmon, it is contended, and yet will do the fish no harm even if it swim entirely through the field. The first of these devices are being installed at the various dams of the California-Oregon Power Company.

UNDERGROUND TRANSMISSION FOR ROCHESTER, N. Y.—Plans to clear the city of Rochester of light and power poles within five years by placing all electric cables within the city limits in underground conduits are announced by the Rochester Gas & Electric Corporation through Thomas H. Yawger, superintendent of the electrical department. The plan ties in with the company's project to remove all lines from weather hazards, Mr. Yawger said.

NORTHERN INDIANA PUBLIC SERVICE PLANS NEW POWER HOUSE.—Construction of a large electric generating station at Michigan City, Ind., on the lake front by the Northern Indiana Public Service Company will begin early in 1929, according to an announcement just made by the company, though operation will not begin until 1931. The first unit—a 60,000-kw. turbine—has been ordered and will be built by the Westinghouse Electric & Manufacturing Company. That part of the building to be erected next year will afford room for a second unit of the same size. The estimated cost of the initial construction is approximately $9,000,000. Plans for the construction of a generating station in Michigan City were announced originally in November, 1925, soon after the site was purchased. A large substation has been built there since that time and is an important distribution center.

PROVINCE OF ALBERTA AND CALGARY POWER COMPANY MAY BE RIVALS FOR GHOST RIVER POWER.—Dispatches from western Canada indicate that the Calgary Power Company is seeking a license for development of hydro-electric power on the Ghost River, which rises in the Banff National Park, north of Lake Minnewanka, in the Province of Alberta. The Calgary Power Company, which operates power plants on the Bow River, has greatly extended its service north and south along the "backbone of the province," from Lethbridge in the south toward Edmonton in the north, and has applied for the right to develop 75,000 hp. from the Spray Lake site, also in the national park. The situation is complicated by the fact that the natural resources of Alberta may soon be turned over by the Dominion government to the province, which may seek to develop a hydro system of its own.

# Recent Court Decisions

NOVEL CASE OF MIXED FEDERAL AND STATE JURISDICTION.—Levin and others brought suit against the Philadelphia Electric Power Company to restrain the operation of the transmission line from Conowingo until alleged damages to their property situated near the right-of-way had been ascertained and paid. In denying an injunction, the United States District Court for the Eastern District of Pennsylvania said that the plaintiffs' action was based (a) on an act of Congress according right of action to any one whose property is damaged by operation of the transmission line as distinguished from its construction, (b) on an easement owned by the plaintiffs in the land traversed, and (c) on the allegation that the defendant was threatening to break its covenants. This, the court said, brought about a novel case of mixed jurisdiction, since (a) belonged to the federal courts and (b) and (c) to the state courts. In such a case a United States court could assert jurisdiction over the whole proceedings, but this principle did not call upon it to grant the relief asked. The act of Congress involved gave no right to security in advance of judgment. (23 Fed. [2d] 508).*

POWER COMPANY RIGHTS IN NATIONAL FORESTS.—A suit brought by the United States against the Southern Power Company of South Carolina, which involved important problems in relation to control of lands embraced within national forest reservations, has been decided in the United States District Court of South Carolina in favor of the company, whose right to maintain power lines across tracts of land included within the Nantahala National Forest is sustained. The power company urged that the rights claimed by it were in existence at the time the forest was created and that the Weeks act, under which the land was taken to be a part of the national forest, does not empower the government to condemn and take easements and similar rights already used in public service; also that the power company relinquished its easement rights and permitted the government to take title to the land in its condemnation proceedings upon the agreement of the government to grant the company a permit to occupy the lands for the use of its power lines. The question of appeal is under consideration in the Department of Justice.

RIGHT TO CROSS POWER LINE WITH AËRIAL UPHELD.—In the New York Supreme Court, sitting in Albany County, $30,000 damages was granted by a jury to B. G. Troidle, a physician, against the Adirondack Power & Light Corporation because of severe burns said to have been incurred when 2,300 volts of electricity passed through his body after he had thrown an aërial wire over the company's power line at his camp at Ballston Lake. The plaintiff claimed that the insulation of the power line had been worn by the weather. Troidle testified that he had attached the wire to the garage at his camp and then thrown it over the power line, to run it to his cottage, loosening his hold on it at the same time; that the circuit formed when the wires came in contact flung the aërial wire back against him, and that when he tried to ward it from his face the 2,300 volts passed through various parts of his body, burning him in fourteen places. Dr. Troidle purchased his camp site from the Schenectady Railway Company, from which the Adirondack Power & Light Corporation obtained permission to string its wire overhead. The doctor's lease did not invalidate the company's right in this respect, it was shown. Lawyers believe it is the first instance where a court has upheld the right of a property owner to erect an aërial across the lines of a power company.

OREGON COUNTY COURT CLAIMS REGULATORY POWER OVER LINES BUILT UNDER BLANKET FRANCHISE.—Before the Marion County (Ore.) Court will grant an application for a blanket franchise to construct electric transmission lines throughout the district, it must first receive the assurance of the necessary authority not only to direct the location of proposed lines but to order that changes be made in routing following construction. This attitude was assumed by the court in connection with an application filed by the Molalla Electric Company, a subsidiary of the Portland Electric Power Company, and the operating field principally affected is that between the capital and Portland.

# Commission Rulings

SHOULD RATE REDUCTION IN METROPOLITAN DISTRICT APPLY OUTSIDE CITY LIMITS?—On its own motion the Oregon Public Service Commission ordered an investigation for the purpose of determining whether the reduction of electric light rates in Portland under the proposed merger plan of the utilities there would apply to service furnished by the operators outside of the metropolis. The Portland Electric Power Company, a utility engaged in intrastate business and a party to the proposal, renders service to the towns of Oregon City, Hillsboro, Salem and several smaller communities between the capital and Portland. In the plans introduced for the merging of the Portland plants nothing was mentioned regarding the consumers beyond the municipal limits wherein the merger was to be effected, and the commission decided to undertake an investigation to discover any possible discrimination.

FAIR DIVISION OF TERRITORY DOES NOT MEAN INDEFINITE PRE-EMPTION.—Approval was bestowed by the Public Utilities Commission of Colorado upon an agreement between the city of Fort Morgan and the Public Service Company of Colorado as to the division of certain territory to be served by their respective electric utility plants. When, however, the commission learned that, in addition to the territory which was to be served immediately, the Public Service Company had agreed to give the city of Fort Morgan the first chance to serve the customers in another area and that the city did not desire or consent to render the service at any time in the near future, the commission said: "The commission is of the opinion that it would be unwise and contrary to the public convenience and necessity to pre-empt this territory in favor of a utility which may never be willing to serve it. . . . Therefore no certificate authorizing such service should be issued.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## C. J. Eaton Vice-President of Middle West Utilities

Chester J. Eaton, for the past nine years commercial manager of the Middle West Utilities Company, has been elected vice-president of that company, in charge of merchandising and sales. Mr. Eaton's promotion follows a wide experience in commercial work with public utilities and he is a recognized leader in the application of practical methods of developing increased use of electric services and in the popularization of appliances. Prior to taking charge of merchandising operations for the Middle West Utilities Company in 1919, Mr. Eaton directed the new-business activities of the Kentucky Utilities Company from 1912 to 1917 and of the Interstate Public Service Company from 1917 to 1919. He was associated with the Union Electric Company of Dubuque, Iowa, for two years and previous to that was engaged in commercial work for the Commonwealth Electric Company and the Chicago Edison Company before their consolidation into the present Commonwealth Edison Company.

*C. J. Eaton*

Mr. Eaton has been prominently identified with the activities of the Commercial National Section, N.E.L.A., and it is largely through his work as chairman that the committee on electrical advertising has organized and conducted its special training schools for central-station lighting salesmen. He is also chairman of the committee on employee use and selling of the electric range.

PAUL J. KRUESI of Chattanooga, Tenn., was elected president of the American Electrochemical Society at the recent convention held in Bridgeport, Conn. Mr. Kruesi's business interests have been centered in Chattanooga since 1902, when he became secretary-treasurer and manager of the American Lava Company. At the present time he is president and owner of that organization as well as president of the Chattanooga Electro Metals Company and of the Southern Ferro Alloys Company, not to mention other business interests of varied character. Before removing to the South Mr. Kruesi was identified with the General Electric Company, the Chicago Edison Company, the General Incandescent Arc Light Company, the Paragon Fan & Motor Company and the Wright Discount Motor Company. In addition to being prominent in the American Electrochemical Society, he is a member of the American Institute of Electrical Engineers, the American Iron and Steel Institute and other societies.

## I. W. Day New President of New England Division

Irvin W. Day, who was elected president of the New England Division of the National Electric Light Association at its annual meeting in Boston last week, is a well-known figure among the younger public utility executives of the Northeast. He was graduated from Cornell University in 1906 and spent several years in the steamship business. In 1912 he became assistant secretary and two years later secretary and treasurer of the United Electric Light & Water Company, Waterbury, Conn. Upon the merger of that company with the Connecticut Light & Power Company in 1917 Mr. Day was elected vice-president and a director of the merged company. When the Connecticut Electric Service Company was organized in 1925 as a holding company for the Connecticut Light & Power Company and a number of other public utilities of the Nutmeg state Mr. Day was also elected a vice-president and director of the latter organization. He is interested in and a director of a number of other companies and has been active in civic enterprises in the Naugatuck Valley. He has been an influential factor in the building up of a far-reaching Connecticut system noted for engineering excellence, commercial enterprise and sound public relations.

*I. W. Day*

## W. J. Serrill to Head Standardization Movement

William J. Serrill, assistant general manager of the United Gas Improvement Company of Philadelphia, has been elected to the chairmanship of the American Engineering Standards Committee. Mr. Serrill succeeds C. E. Skinner of the Westinghouse Electric & Manufacturing Company, who has been chairman of the standards committee for the past three years.

*W. J. Serrill*

Mr. Serrill has been prominent in standardization activities in the gas industry, and as representative of the American Gas Association he has been identified with the national standardization movement for several years. He has been active in the affairs of the Illuminating Engineering Society, having served as treasurer, vice-president and president. He is a graduate of the University of Pennsylvania. The vice-chairman will be CLOYD M. CHAPMAN, engineering specialist of New York City and representative of the American Society of Mechanical Engineers.

Among the members of the executive committee which will serve under Mr. Serrill are J. C. Parker and C. E. Skinner, representing the American Institute of Electrical Engineers; S. G. Rhodes, representing the electric light and power group, and S. L. Nicholson, representing the National Electrical Manufacturers' Association.

OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, returned from abroad April 30 on the *Leviathan* after a short sojourn in Europe.

FRANK L. DAME, president of the North American Company, was elected a member of the board of directors of the Bank of America National Association April 30 at the first meeting of the enlarged institution formed by the merger of the Bank of America, the Bowery & East River National Bank and the Commercial Exchange Bank.

## *M. O. Troy Named Manager of Central-Station Department*

Matthew O. Troy has been appointed manager of the central-station department of the General Electric Company, Schenectady, according to an announcement made by President Gerard Swope. Mr. Troy has been identified with the General Electric Company continuously since 1897, when, following graduation from the University of Virginia, he entered the testing department at Schenectady.

He was later transferred to Lynn as foreman of transformer test and in 1898 he became associated with Elihu Thomson and Richard Fleming in pioneer work on constant-current transformers. In 1901 Mr. Troy was made assistant engineer of the Lynn alternating-current engineering department, subsequently entering the transformer sales department. In 1907 he became manager of sales of transformers, lightning arresters and regulators and in 1923, when the lighting department became the central-station department, Mr. Troy was named executive assistant manager. Mr. Troy has been a leader in the Pittsfield and Schenectady sections of the American Institute of Electrical Engineers and has been active in committee work in the National Electric Light Association and is a member of the board of governors of the National Electrical Manufacturers' Association.

*M. O. Troy*

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**Theodore Beran**, who retired May 1 as commercial vice-president of the General Electric Company, as announced in the April 28 issue of the **Electrical World**, was tendered a testimonial banquet on the evening of May 2 at the Plaza Hotel, New York, by his former associates. The toastmaster of the occasion was Vice-President J. R. Lovejoy, and Gerard Swope, president, spoke on behalf of the company. On this occasion Mr. Beran was presented with a beautifully engraved tray by his associates. He is sailing on Saturday on the U.S.S. *Leviathan* for an extended trip through Europe.

**E. J. Condon, Jr.**, has terminated his connection as vice-president of the General Power & Light Company, the Arizona Edison Company and the Northern Michigan Public Service Company to engage in consulting engineering work with offices in Chicago. A graduate of Armour Institute, Mr. Condon has gained wide electrical experience in the course of his engineering career. As executive in charge of operation and management he developed successfully several central station properties in the Mountain Region and in the Middle West.

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## *C. W. Stone Becomes Consulting Engineer in Schenectady*

C. W. Stone, manager of the central-station department of the General Electric Company, Schenectady, since its formation, has been appointed to the position of consulting engineer, having requested that he be relieved of his former responsibilities. As consulting engineer he will advise and assist in all new engineering developments for the General Electric Company and will also continue to act as consulting engineer for the R. C. A. Photophone, Inc.

Following graduation from the University of Kansas, Mr. Stone joined the Franklin Electric Company of Kansas City in 1894. Subsequently he was connected with the W. S. Hill Electric Company of New Bedford, Mass., and the Hancock Equipment Company of Boston before entering the drafting department of the General Electric Company. He held many important assignments in the engineering department and on the death of C. D. Haskins was made manager of the lighting department. In 1923 the lighting department was designated the central-station department and Mr. Stone continued as its manager. Mr. Stone has been active in the affairs of the National Electric Light Association, the American Institute of Electrical Engineers and the Association of Edison Illuminating Companies and is, in addition, a member of the American Society of Mechanical Engineers, the Illuminating Engineering Society, the Franklin Institute and other technical organizations.

## *Miss Zillessen Made Advertising Manager*

Clara H. Zillessen has been appointed advertising manager of the Philadelphia Electric Company after an affiliation with that utility which covers a period of fourteen years. Miss Zillessen was born in New York City and was educated there and in New Jersey. With the exception of two years as a fashion correspondent in New York her entire business life has been spent in the electrical industry. She started advertising work for the Philadelphia Electric Company in 1914 as a copy writer and in 1922 she was made assistant advertising manager. In addition to her executive duties with the Philadelphia utility, Miss Zillessen has developed broadening outside interests. She is chairman of the women's committee of the Pennsylvania Electric Association, a member of the Illuminating Engineering Society and of the Women Writers' Club. She has contributed numerous articles to newspapers and magazines and was the first winner of the Walter H. Johnson prize, awarded annually through the Pennsylvania Electric Association for the most constructive paper on central-station operation. The announcement of Miss Zillessen's appointment was made by William H. Taylor, president.

*Miss C. H. Zillessen*

# Obituary

**James A. Skinner**, who was connected with the General Electric Company for 30 years, died at his home in East Orange, N. J., April 16, after a long illness. During the war Mr. Skinner was supervisor of industrial relations and the manager's representative on the co-operative committee for the General Electric Company.

**William Carroll**, some years ago city electrician of Chicago, died at his summer home in Hartford, Mich., April 19, in his 77th year. Mr. Carroll retired from public office in 1912 after spending 38 years in city service, during seven of which he was city electrician. He was self-taught in technical matters, but his practical experience in the electrical work of the city made his services valuable and enabled him to conduct successfully the work of an important department through varying political administrations.

**Edwin Hulley**, president of the Hulley Electric Company, Philadelphia, died suddenly at his home in that city April 23. Mr. Hulley, who was 47 years of age, was born in Philadelphia and was affiliated with the Philadelphia Electric Company for 22 years. He was a district manager when he resigned to establish the company that bears his name. Mr. Hulley was very active in civic affairs.

# Financial and Statistical News

## *Money Rates No Check Prices Rise en Masse*

THE feature of significance in connection with the rise of call money to 6 per cent early this week was its ineffectiveness as a check upon speculative activity. Of course the increase was related closely to month-end payments, and an abundance of funds was immediately attracted from interior banks. But it is interesting to note that the 6 per cent rate had practically no restrictive effect just as the advance in Federal Reserve rates in certain districts was apparently ineffective. A complete revision of theory concerning the relation between money rates and speculative activity in the markets may soon be required.

The public utility stocks were in the limelight among the issues which advanced in the face of higher money rates. Power and light common stocks advanced this week in virtually all markets, and the gains have been well sustained. The present behavior of these issues supports the theory that the utility stocks have been considerably behind the market and are now advancing into a more proper alignment in relation to the market as a whole.

Among the more active issues this week Brooklyn Edison was again prominent, advancing twelve points, to 262; Consolidated of Baltimore gained eleven points, to 93; Edison of Boston advanced seven points, to 283; Metropolitan Edison five points, to 165; Middle West Utilities eleven points, to 152, and Southeastern Power & Light eight points, to 60. In addition there were a great many gains of from two to five points.

Prospects of dividend action in Radio Corporation common are increased by a statement attributed to President James G. Harbord that a dividend cannot reasonably be delayed much longer. It is probable that the matter will be taken up this week when the preferred dividend is being discussed.

## Loewenstein May Acquire Interest in Our Utilities

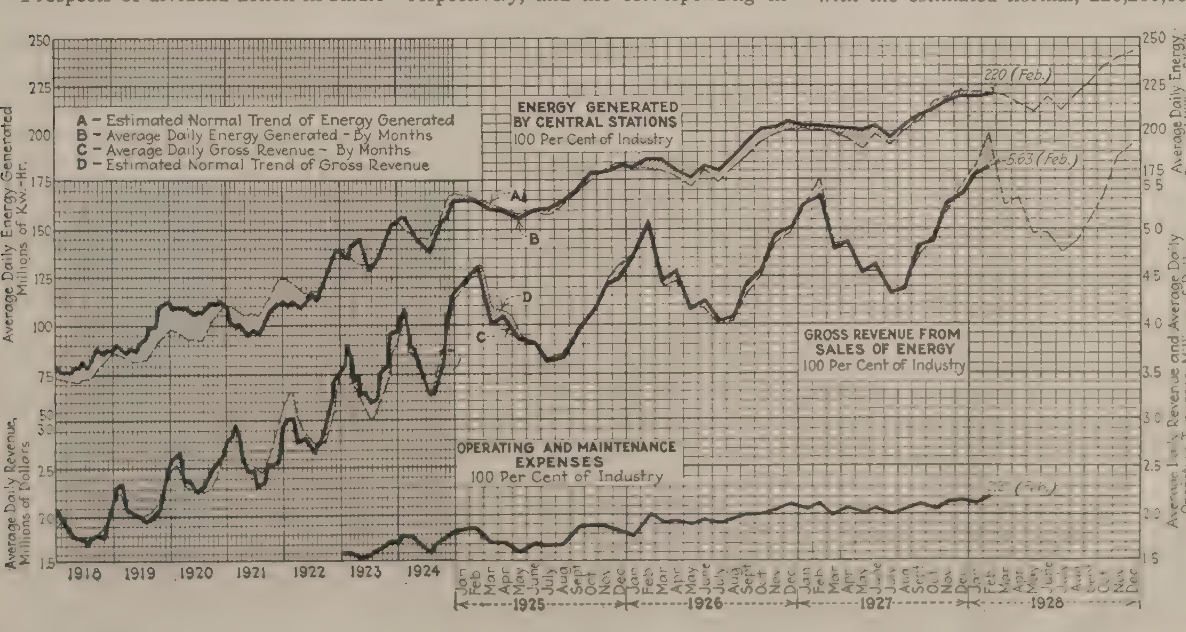
Apart from his interest in the development of hydro-electric power in the United States and Canada, nothing of unusual significance attaches to the recent visit to this country of Alfred Loewenstein, Belgian banker and financier. When interviewed with regard to the purpose of his visit, Mr. Loewenstein stated that he was interested in introducing the shares of the International Holding & Investment Company, a Canadian investment institution, into the New York market, and might possibly be in the market for certain utility stocks or properties.

Mr. Loewenstein denied the rumor that he intended to purchase control of the Brazilian Traction, Light & Power Company, adding that he was merely acting in an informal way to safeguard the interests of a group of bondholders of one of the company's subsidiaries.

## February Operations Show 8.1 per Cent Advance

FEBRUARY earnings of the electric light and power industry exceeded those of the corresponding month last year by 8.1 per cent, according to monthly reports received by the ELECTRICAL WORLD, and indicate a total for the country of $163,400,000. The rate of increase is materially larger than that of January, which, according to revised figures, amounted to 6.7 per cent, but against this must be balanced the fact that February this year had an extra day. Operating expenses, $64,200,000, also rose, but by only 6.7 per cent, this item being much less affected by the length of the month. Energy output was 6,390,701,000 kw.-hr., 12.0 per cent more than a year ago; 38.3 per cent came from water power and 61.7 per cent from fuel, the actual amounts being 2,445,189,000 and 3,945,512,000 kw.-hr. respectively, and the corresponding increases 12.5 and 11.6 per cent. As heretofore, the increasing efficiency in the use of fuel continues; the 11.6 per cent increase in output from fuels was attained with a 6 per cent increase in coal consumption, the 27 per cent increase in gas being roughly though not completely balanced by a 25.5 per cent decrease in fuel oil. In terms of coal equivalent, oil has fallen behind gas in importance.

In daily averages the month's operations broke all previous records; the revenue, $5,630,000, was higher than the average daily revenue for January, $5,560,000, which was the highest until that time; the output, slightly over 220,000,000 kw.-hr., passed the daily average for December, the previous highest, which was a little less than 217,000,000 kw.-hr., and coincides almost exactly with the estimated normal, 220,200,000,



## *Table I—Generation and Distribution of Central-Station Energy in the United States*

(100 Per Cent of the Industry)

| Month | Kw.-Hr. Generated Monthly * | | | Estimated Distribution of Energy Generated | | | | | | | | | | | | Energy Purchased by Public Utilities for Resale, Kw.-Hr. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total Energy Consumption by Central-Station Customers, Kw.-Hr. | | Energy Consumed for Lighting, Kw.-Hr. | | Energy Consumed for Power, Kw.-Hr. | | Energy Sold to Electric Railways, Kw.-Hr. | | Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr. | | | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | | | 1927 Thousands | 1926 Thousands |
| Nov | 6,517,713 | 6,063,784 | + 7.5 | 5,365,713 | 4,990,784 | 1,400,000 | 7,310,000 | 3,406,713 | 3,129,784 | 559,000 | 551,000 | 1,152,000 | 1,073,000 | | | 1,269,000 | 1,187,000 |
| Dec. | 6,811,347 | 6,375,500 | + 6.8 | 5,605,347 | 5,247,500 | 1,500,000 | 1,400,000 | 3,475,347 | 3,226,500 | 630,000 | 621,000 | 1,206,000 | 1,128,000 | | | 1,220,000 | 1,120,000 |
| | 1928 | 1927 | | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | | | 1928 | 1927 |
| Jan | 6,764,728 | †6,303,199 | †+7.3 | 5,579,728 | 5,188,199 | 1,493,000 | 1,395,000 | 3,511,728 | 3,170,199 | 575,000 | 623,000 | 1,185,000 | 1,115,000 | | | 1,315,000 | 1,148,000 |
| Feb | 6,390,701 | †5,706,468 | †+12.0 | 5,260,701 | 4,696,468 | 1,395,000 | 1,210,000 | 3,355,701 | 2,928,468 | 510,000 | 558,000 | 1,130,000 | 1,010,000 | | | 1,300,000 | 1,085,000 |

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.

based on past growth and observed seasonal variations. The average daily revenue, is, as in other recent months, somewhat below the normal, computed at $5,988,000. It is somewhat difficult to say how great is the effect, on this average, of the extra day. Operating expenses, averaging $2,210,000 a day, also reached a new maximum, but by only a small margin.

Regional analysis reveals averages not varying widely from the national, except in the South Central States where the returns indicate that the revenues exceeded those of February, 1927, by about 11 per cent. Similarly the regional averages of increase in energy output show somewhat less than the usual variation, the Southwest ranking highest, the South Atlantic Division lowest, with the others fairly close to the average for the country as a whole.

The purchase of energy for resale fluctuates more irregularly than does energy output or revenue, but in general is gradually rising. For several months it has been not far from 1,300,000,000, and that figure was again reached in February.

## Electric Supply in New Zealand

Of the electric supply in New Zealand 74.53 per cent is hydro, 23.20 per cent is steam, 1.42 gas and 0.88 oil, according to a recent letter from Charles Dash, chairman of the New Zealand Electric Power Board Secretaries Committee.

The water power that is available vastly exceeds the needs of the present population of 1,440,000, being estimated by government engineers at 4,887,030 hp., or 3.4 hp. per capita. Energy output in 1927 was equivalent to 310 kw.-hr. per capita; the power load is fast increasing in importance so that the peak demand now generally comes on the industrial load; in addition, 7 per cent of the customers cook by electricity. In dairying, milking machines increased from 1,310 in 1923 to 6,738 in 1927, though 9,000 machines are still fuel-driven. Other items are:

Capital investment approximates 19,000,000 ($92,000,000), made up of 7,000,000 government, 8,250,000 local bodies connected with government supply and 3,750,000 local bodies not connected with government supply; distribution line miles, 15,000; consumers, 228,000.

## Electric Power in Oil Fields

The use of electrically driven equipment in the oil fields has been found effective in each of the three most important operations in the industry, namely, production, pipe line pumping and refining. On the lines of the Oklahoma Gas & Electric Company this type of load has increased at a remarkable rate, according to data recently published by the company. Beginning with a contract covering a 30-hp. motor at the end of 1919, the energy sales to oil fields have grown as shown in the table above.

| | |
|---|---|
| 1920 | 829,088 |
| 1921 | 1,502,565 |
| 1922 | 2,689,457 |
| 1923 | 6,134,607 |
| 1924 | 9,432,290 |
| 1925 | 13,192,512 |
| 1926 | 32,239,937 |
| 1927 | 158,730,509 |

## *Table II—Central-Station Financial Operations for Four Months in the United States*

(100 Per Cent of the Industry)

| Month | Total Gross Revenue from Sale of Energy† | | | Estimated Distribution of Gross Revenue | | | | | | | | Total Operating and Maintenance Expenses‡ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lighting Customers | | Power Customers | | Electric Railways | | Other Public Utilities | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Nov..... | $158,200 | $148,300 | +6.7 | $94,300 | $89,100 | $47,400 | $43,200 | $5,000 | $4,900 | $11,500 | $11,100 | $64,300 | $62,450 |
| Dec..... | 165,100 | 155,000 | +6.5 | 95,900 | 90,800 | 52,200 | 48,100 | 5,200 | 5,000 | 11,800 | 11,100 | 67,900 | 63,200 |
| | 1928 | 1927 | | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 |
| Jan...... | 171,900 | 161,100 | +6.7 | 101,500 | 95,400 | 53,400 | 49,300 | 5,700 | 5,600 | 11,300 | 10,800 | 66,100 | 63,400 |
| Feb...... | 163,400 | 151,100 | +8.1 | 96,100 | 89,800 | 50,700 | 45,700 | 5,200 | 5,400 | 11,400 | 10,200 | 64,200 | 60,200 |

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.

‡Do not include interest, taxes, depreciation or sinking fund.

## *Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

| Month | Energy Generated | | | | | | Fuel Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hydro-Plants | | | Fuel Power Plants | | | Coal | | | Oil | | | Gas | | |
| | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Short Tons | 1926 Short Tons | Per Cent Increase | 1927 Barrels | 1926 Barrels | Per Cent Increase | 1927 Thousands of Cubic Feet | 1926 Thousands of Cubic Feet | Per Cent Increase |
| Nov....... | 2,466,092 | 2,193,093 | +12.5 | 4,051,621 | 3,870,691 | + 4.7 | 3,236,107 | 3,193,212 | +1.3 | 484,261 | 926,916 | —47.5 | 5,630,302 | 3,975,408 | +41.6 |
| Dec....... | 2,697,770 | 2,377,175 | +13.5 | 4,113,577 | 3,998,325 | + 2.9 | 3,340,137 | 3,406,140 | —1.9 | 624,276 | 769,518 | —18.9 | 4,805,064 | 3,685,611 | +30.4 |
| | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | |
| Jan....... | 2,607,379 | 2,331,140 | +11.9 | 4,157,349 | 3,972,059 | + 4.6 | 3,333,658 | 3,365,461 | —1.0 | 559,914 | 786,062 | —28.8 | 4,955,906 | 3,900,868 | +27.0 |
| Feb....... | 2,445,189 | 2,172,740 | +12.5 | 3,945,512 | 3,533,728 | +11.6 | 3,135,123 | 2,958,797 | +6.0 | 515,488 | 646,558 | —20.3 | 4,899,747 | 3,859,791 | +27.0 |

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

# Electric Bond & Share Shows Larger Surplus

THE fact that both gross and net income of the Electric Bond & Share Company declined last year is due to the absence of certain substantial items of income, of a non-recurring nature prominent in 1925 and 1926, and also a decline in the volume of securities sold and construction work done for associated companies. Gross income fell off 7.6 per cent, to $18,513,299, and net income declined 15.4 per cent, to $11,899,326. The surplus at the close of December amounted to $21,039,062, having been increased from $16,766,140 due to reappraisement of securities and accounts and premium on sale of preferred stock, etc. Income figures for the past two years are shown in the accompanying table.

According to its annual statement the Electric Bond & Share Company anticipates a gradual shifting in the relative importance of some of the principal sources of income, the result of which should be better to stabilize the company's business and income. The rate of increase in the gross income derived from supervisory services rendered associated companies is expected to be less than heretofore, while the return on securities owned should become a much more important factor. One feature of interest in this connection is that the securities of the companies now associated with the Electric Bond & Share Company have become so well regarded by the investing public that the company is able to render the service of negotiating and selling these securities to investment bankers and others under a lower schedule of commissions.

INCOME STATEMENT

| | 1926 | 1927 |
|---|---|---|
| Gross income | $20,056,694 | $18,513,299 |
| Net income | 14,069,234 | 11,899,326 |
| Preferred dividends | 1,500,000 | 2,376,933 |
| Balance | 12,569,234 | 9,522,393 |
| Common dividends | 2,000,000 | *27,137,500 |
| Accumulated income | 33,940,648 | 16,325,541 |

* Includes special dividend on common stock in addition to the regular 8 per cent.

Total assets of the company as of Dec. 31, 1927, amounted to $124,195,442, but the market value is materially greater than the book value.

## Four New Issues Offered

Five-year 4½ per cent gold coupon notes of the Columbus Electric & Power Company were offered during the week ended May 3 to the amount of $2,500,000, the price being 97.80 and interest, to yield 5 per cent.

The Gulf States Utilities Company issued 30,000 shares of $5.50 dividend preferred stock at 98 and accrued dividend. Proceeds derived from the sale of these securities will be used to liquidate the floating debt of the company.

A Canadian issue appeared among the new offerings—the three-and-a-half million-dollar loan floated by the Nova Scotia Light & Power Company, Ltd. This issue was in the form of 5 per cent first mortgage 30-year sinking fund gold bonds, series A.

# *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday May 1 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new - no par | 81 | 72 | 85 |
| Ala. Pwr., $7 cum. pf.—no par | k115¼ | 114¼ | 115¼ |
| Allis Chalmers Mfg., 6% com., ex.div. | 127 | 115⅛ | 129¾ |
| Aluminum Co. of Amer., com. | 149½ | 120 | 150½ |
| Aluminum Co. of Amer., 6% pf. | 109¼ | 105½ | 109⅝ |
| Amer. & Foreign Pwr., 7% pf. no par | 109 | 105¾ | 109 |
| Amer. & Foreign Pwr., com.—no par | 38 | 22⅛ | 38⅞ |
| Amer. Bosch Magneto, com.—no par | 24⅞ | 15⅞ | 28⅞ |
| Amer. Brown Boveri Elec.† | 12⅝ | 10⅛ | 18 |
| Amer. Brown Boveri Elec., pf. $7 | 45 | 40¼ | 63 |
| Amer. Gas & Elec., 6% pf.—no par | 109¾ | 106¼ | 109¾ |
| Amer. Gas & Elec., com. †—no par | 150 | 117½ | 154 |
| Amer. Lt. & Trac., 6% pf. | 115 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 219 | 170 | 220 |
| Amer. Pwr. & Lt., 6% pf. | 108 | 104 | 109¼ |
| Amer. Pwr. & Lt., com. †—no par | 86¼ | 62½ | 87 |
| Amer. Pub. Serv., 7% pf. | a100¼ | 97½ | 101 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | a 96½ | 87½ | 97 |
| Amer. Pub. Utilities, 7% pr. pf. | 101 | 94 | 101 |
| Amer. Pub. Utilities, com. | k 60 | 60 | 65 |
| Amer. States Sec., A | a 11 | 4 | 12½ |
| Amer. States Sec., B | a 16¼ | 4⅛ | 16½ |
| Amer. Superpwr., 6% 1st pf. | l 102½ | .... | .... |
| Amer. Super pwr., Class A†—no par | 55¼ | 37 | 56 |
| Amer. Super pwr., Class B†—no par | 56½ | 37¼ | 56¾ |
| Amer. Wtr. Wks. & Elec., 6% pf. | k105 | 101½ | 106 |
| Amer. W.W. & E., com. new—no par ex.div. | 70 | 52½ | 70 |
| Anaconda Copper cap. $3 | 70¼ | 53¼ | 72⅞ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr. & Lt. 7% pf. | 108 | 107½ | 111 |
| Assoc. Gas & Elec., $3.50—50 | 54½ | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par | 96 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 48¾ | 47 | 51½ |
| BABCOCK & WILCOX, 7% com. | 123½ | 117 | 124¾ |
| Binghamton L. H. & P., $6 pf | 108 | 102 | 109¾ |
| Birmingham Elec., pf. $6 no par. | 106 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf. | k106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k165 | 135 | 170 |
| Blaw-Knox, com.† | i101 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com. | f246 | .... | .... |
| Brazilian Trac., Lt. & Pwr., com., new | f 62 | .... | .... |
| Broad River Pwr., 7% pf | 105 | 105 | 108½ |
| Brooklyn Edison, 8% com | 262 | 206¼ | 268½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | i 26⅛ | .... | .. |
| Buffalo, Niagara & East. Pwr. com. $1.20 no par | i 42½ | .... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | 99 | 98 | 101 |
| California Ry. & Pwr., 7% pf. | 135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l111¼ | 109 | 110¼ |
| Central & S. W. Util., $7 pf.—no par | a104¼ | 99¼ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a109 | 103½ | 110 |
| Central Ark. Ry. & Lt., 7% pf | 106 | 105 | 107½ |
| Central Ill. Pub. Serv., $6 pf | a 99¼ | 95 | 100 |
| Central Ind. Pwr., 7% pf. | a100 | .... | .... |
| Central Maine Power, 6% pf. | 98 | 96 | 98¼ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | k109½ | 104½ | 110 |
| Central States Elec., 7% pf. | k116 | 104 | 118 |
| Cincinnati Gas & Elec., 5% com. | g100¼ | 97½ | 100⅛ |
| Cities Service, $6 pf.—no par | l 103½ | 94¼ | 103 |
| Cities Service, pf. B—no par | l 9⅛ | 8⅛ | 9¼ |
| Cities Service, pf. BB—no par | l 97 | 88½ | 97 |
| Cities Service com.—20 | l 62½ | 59⅛ | 61¼ |
| Cities Service, Bks. Shrs.—10 | l30⅞ | 26⅛ | 30¾ |
| Cities Service Pwr. & Lt., 7% pf. | 108⅛ | 105½ | 109 |
| Cities Service Pwr. & Lt., 6% pf. | 100¼ | 95¼ | 101⅛ |
| Cleveland Elec. Illg., 6% pf. | 113 | 113 | 115⅛ |
| Cleveland Elec. Illg., 10% com. | 415 | 350 | 425 |
| Columbia Gas & Elec., 6% pf. | 109 | 107⅛ | 110⅛ |
| Columbia G. & E. com. $5—no par | 104¼ | 89½ | 106½ |
| Columbus Elec. & Pwr., $2 com.—no par | 79 | 64 | 79 |
| Columbus Elec. & Pwr., 7% | 112 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 109¾ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 109¾ | .... | .... |
| Columbus Ry., P. & Lt. com. no par | 120 | 120 | 125 |
| Commonwealth Edison, 8% com. | a184 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 103¼ | 102⅛ | 104⅛ |
| Commonw'th Pwr., $2, com.—no par | 86½ | 62¼ | 86⅞ |
| Conn. Lt. & Pwr., 8% pf. | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 118 | 121 |
| Cons. Gas of N. Y., pf. | 104⅛ | 101⅛ | 105 |
| Cons. Gas of N. Y., com. $5—no par. | 165⅛ | 119⅞ | 167⅛ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111½ | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf. | m111¼ | 110⅛ | 114¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e105¼ | 100⅛ | 105½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par. | a 92½ | 67¼ | 92½ |
| Consolidated Pwr. & Lt., 7% pf. | 105 | | |
| Consumers Pwr., 6% pf. | 104½ | 106 | 107 |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108 | 106½ | 108½ |
| Conti. G. & E. com. $4.40—no par. | k230 | 240 | 265 |
| Crocker Wheeler, com.† | 44 | 23 | 46 |
| Crocker Wheeler, 7% pf. | 93 | 77 | 95 |
| DALLAS PWR. & LT., 7% pf. | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 109 | 108¼ | 110½ |
| Derby Gas & Elec., 7% pf. | 102 | 96 | 100½ |
| Detroit Edison, 8% com | 190½ | 166¼ | 194⅛ |
| Dubilier Condenser, com.—no par | 3⅛ | 2⅛ | 5⅛ |
| Duke Pwr., cap | k138 | 130 | 145 |
| Duquesne Lt., 5% pf. | 105¼ | 104⅛ | 105½ |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 111 | 112½ |
| Eastern States Pwr. B | k 21¼ | 11¼ | 22¼ |
| Eastern States Pwr., pf. | k 99½ | 98 | 100⅛ |
| East Tex. Elec. 7% pf. | 107½ | 106 | 109 |
| Edison Elec. of Boston, $12 com | d283 | 252 | 284½ |
| El Paso Elec. 7% pf. | 110 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l110½ | 108¼ | 111¾ |
| Elec. Bd. & Sh. Sec., com. $1—no par ex. rights | l120 | 76 | 127½ |
| Electric Household Util.† | a 21⅜ | 13½ | 24 |
| Elec. Investors, 6% pf.—no par. | 103½ | 101 | 104½ |
| Elec. Investors, com.†—no par | 59½ | 40⅛ | 60¼ |
| Elec. Pwr. & Lt., ctfs. pf. | 109¾ | 106½ | 110⅛ |
| Elec. Pwr. & Lt., ctfs., 40% pd. | m127 | 120¾ | 129¾ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 44¾ | 28½ | 44¾ |
| Elec. Ry. Securities, com.—no par | 6½ | ... | .. |
| Elec. St. Battery com. $5.25 no par | 83 | 69 | 83⅛ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 106½ | 104 | 107 |
| Empire Pwr., ptc.† | 33½ | 30 | 35¾ |
| Engr. Pub. Serv. $7, pf.—no par | 110¾ | 107 | 110¾ |
| Engr. Pub. Serv., com.—no par | 40⅞ | 33 | 42½ |
| Eureka Vacuum Cleaner, com. $4—no par | 75½ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | k110 | 104 | 110 |
| F.-M., com.—$3—no par | 51¾ | 32½ | 54 |
| Federal Lt. & Trac., com $1.40 | 56⅛ | 42 | 56⅛ |
| Federal Lt. & Trac., $6 pf.—no par | 107½ | 98 | 109 |
| Florida Pwr. & Lt., 7% pf. | k108 | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf. | i114 | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf. | 82 | 75 | 85 |
| Galveston-Houston Elec., com. | 36 | 31 | 34 |
| General Cable, Cl. A | 77 | 56 | 84½ |
| Gen. Elec. $3 com.—no par | 164½ | 124 | 174½ |
| Gen. Elec., special—6% | 11⅛ | 11½ | 11⅛ |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par | 47¾ | 35½ | 48¾ |
| Gen. G. & E. (Del.) pf. A $8—no par | 130 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par. | 122 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 | 114 | 105½ | 114 |
| Gen. Pub. Serv., $7 cum. pf., no par | k117 | 110 | 120 |
| Gen. Pub. Serv., com., no par | 24¾ | 16½ | 24¾ |
| General Public Utilities, $7 pf. | k100½ | 98 | 101 |
| Ga. Lt., Pwr. & Rys., com | k 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | h105 | . | |
| IDAHO PWR., 7% pf. | 110 | 109 | 111½ |
| Ill. No. Utilities, 6% pf. | a100½ | 98½ | 100⅛ |
| Ill. Pwr. & Lt., 7% pf. | 106 | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 105½ | 102 | 107¼ |
| Indianapolis Pwr. & Lt., $7 pf. | 101½ | 100 | 105 |
| Ingersoll Rand com | k 97½ | 90 | 98 |
| Int. Combus. Engr., com. $2—no par | 53½ | 45½ | 55⅛ |
| Int. Combustion Engr., 7% pf. | 104½ | 103 | 105½ |
| Int. Util., Class A—$3.50—no par | 48¾ | 44½ | 51½ |
| Int. Utilities, Class B—no par | 13⅞ | 6¼ | 13⅞ |
| Interstate Pwr., pf.—$7—no par | 103 | 99 | 103½ |
| Interstate Pub. Serv., 7% pf. | 105 | 103 | 106½ |
| Iowa Ry. & Lt., 7% pf. | 101 | .02 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 108 | 105 | 107 |
| Johns-Manville com.†—no par | 129½ | 111½ | 133½ |
| Johns-Manville, 7% pf. | m122½ | 119½ | 121½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f* Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 28. *l*Bid price Wednesday, May 2. *m*Latest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday May 1 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS GAS & ELEC 7% pf. | l110 | 107 | 110 |
| Kelvinator Corp. | 21 | 11⅛ | 22¼ |
| Kentucky Hydro-Elec., 7% pf | a104¼ | 102 | 104¼ |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 104½ | 100 | 105 |
| LACLEDE GAS LT., 10% com. | k200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 34 | 19⅜ | 34 |
| Long Island Ltg., 7% pf | k110½ | 110½ | 112½ |
| Long Island Ltg., 6% pf. | k109 | 107 | 109 |
| Long Island Ltg., com.†—no par | k177 | 170 | 185 |
| Los Angeles Gas & Elec., 6% pf. | h112½ | 105½ | 112½ |
| Louisville Gas & Elec., cl. A. $1.75 | 36¼ | 28 | 37½ |
| MAN. ELEC. SUPPLY, cap. $5—no par | 53¼ | 50 | 61 |
| Maytag Co., com. 50—no par | 38⅜ | 30 | 40¼ |
| Memphis P. & L., pf.—$7—no par. | 110 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 109 | 103 | 109½ |
| Metropolitan Ed., pf.—$7—no par | 109½ | 109 | 111 |
| Metropolitan Ed., com. $5—no par | k165 | 125 | 155 |
| Middle West Utilities, 6% pf. | a100 | 93½ | 100 |
| Middle West Util., 6% pr. lien | a106½ | 99 | 107 |
| Middle West Util., com. $6—no par | a151¼ | 123¼ | 151½ |
| Midland Utilities, pr. ln. 6% pf. | a 95 | 94½ | 97 |
| Midland Utilities, 6% pf. A | a 90¾ | 89⅞ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 100 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | l108½ | 107 | 109 |
| Miss. River Pwr., 6% pf. | k108 | 94 | 109½ |
| Miss. River Pwr., 3% com. | 110 | .... | .... |
| Mohawk Hudson Pwr., 1st pf—$7—no par | 109⅜ | 107½ | 110 |
| Mohawk Hudson Pwr., 2d pf—$7—no par | 106 | 105 | 108½ |
| Mohawk Hudson Pwr., com.—no par | 41⅜ | 29½ | 41⅝ |
| Montana Pwr., 5% com. | 166¼ | 102¼ | 169½ |
| Montreal Pwr., 7½% com. | f103 | .... | .... |
| Mountain States Pwr., 7% pf. | k103½ | 97 | 105 |
| Mountain States Pwr., com.† | 18 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110¼ | 98 | 110¼ |
| National Carbon, 8% pf. | a136½ | 136½ | 139¾ |
| National Elec. Pwr., A† | a 30½ | 27½ | 32¾ |
| National Lt., Ht. & Pwr., com. | k 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$6—no par | k105¼ | 102 | 106 |
| National Pwr. & Lt., com.†—no par. | 34½ | 21⅞ | 34½ |
| National Pub. Serv., 7% pf. | 102½ | 99 | 103 |
| National Pub. Serv., 7% ptc., pf | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 25⅜ | 22 | 27½ |
| National Pub. Serv., B com.—no par | k 27½ | 24⅜ | 30 |
| Nebraska Pwr., 7% pf. | l110 | 110 | 111½ |
| Nevada-Calif. Elec., com. | 33 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | 63 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 111 | 98½ | 110½ |
| New Eng. Pub. Serv., pf. $7 | 107 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 100 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | 105 | 101 | 105¼ |
| New York Power & Light 7% pf. | 114½ | .... | .... |
| NiagaraFalls Pwr., 7% pf.—25 | 27¾ | 27½ | 28⅜ |
| No. Amer., 6% pf.—50 | 54⅜ | 53¼ | 55⅛ |
| No. Amer., com.—10 | 71½ | 58⅛ | 71⅞ |
| No. Amer. Edison, $6 pf.—no par | 103¾ | 102½ | 105⅛ |
| Northeastern Pwr., com. | 28¼ | 19¾ | 30 |
| No. N. Y. Utilities, 7% pf. | 109 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 27¼ | 18 | 28 |
| Northern Ohio Pwr. & Lt., 6% pf. | 100 | 90 | 99 |
| No. Ont. Lt. & Pr. 6% pf. | k 99½ | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | k 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 109 | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 147¼ | 123 | 149½ |
| No. Texas Elec., 6% pf. | 54⅜ | 45 | 70 |
| No. Texas Elec., com. | 17 | .... | .... |
| OHIO BRASS, com. B $4—no par. | k 96⅜ | 89 | 100½ |
| Ohio Brass, 6% pf. | k105 | 106 | 111 |
| Ohio Pwr., 6% pf. | 109 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf | 103 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 113 | 107 | 112 |
| Ohio River Edison, 7% pf. | 109 | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 114¾ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | k 28⅜ | 25½ | 29 |
| Pacific Gas & Elec., 8% new com. | 53 | 43½ | 53 |
| Pacific Pwr. & Lt., 7% pf. | i110 | 106 | 110 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 81 | 79⅜ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 99 | 93½ | 99 |
| Penn-Ohio Edison, 7% pf. | 106½ | 106¼ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 111 | .... | .... |
| Penn Pwr. & Lt.—$7—no par | l109⅜ | 109½ | 110¼ |
| Penn Wtr. & Pwr., $2.50 com., new | e 88¾ | 68 | 88¾ |
| Phila. Co., 5% pf.—50 | k 46½ | 45½ | 48½ |
| Phila. Co., 6% pf.—50 | 56¾ | 52 | 57 |
| Phila. Co., com.—50 | k155 | 145 | 166 |
| Phila. Elec., 8% com.—25 | c 68¼ | 55¼ | 68½ |
| Portland Elec. Pwr., 7% pf. | 103½ | 100 | 104¼ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 43 | .... | .... |
| Potomac Elec. Power, 6% pf. | j113⅜ | .... | .... |
| Pwr. Sec., pf.—no par | 60 | 50 | 68 |
| Pwr. Sec., com.—no par | 12 | 11 | 13⅜ |
| Public Serv. of Colorado, 7% pf. | 105 | | |
| Pub. Serv. of N. J., 6% pf. | 111⅞ | 103⅜ | 112 |
| Pub. Serv. of N. J., 7% pf. | h126 | 118 | 126 |
| Pub. Serv. of N. J., $2 com.—no par | 57⅜ | 41½ | 58 |
| Pub. Serv. of No. Ill., 6% pf. | a113 | 110 | 115 |
| P. S. of No. Ill., com. $8—no par | a180 | 159½ | 180 |
| Pub. Serv. of No. Ill., $8 com. | a179 | 159⅜ | 180 |
| Pub. Serv. of Okla., 7% pr. ln. | 106 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | k110 | 108 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | k110 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 104⅞ | 92 | 105⅜ |
| Puget Sound Pwr. & Lt., com. | 80 | 34⅝ | 84⅜ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 56 | 54½ | 57⅜ |
| Radio Corp. of Amer., com.—no par. | 181⅛ | 85¼ | 196½ |
| Rochester Gas & Elec. 6% pf. D | 106 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107½ | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105¾ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf | 114 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc | 9⅜ | 4¼ | 10⅛ |
| Sierra Pacific Elec., 2% com. | 38¾ | 29 | 38¾ |
| Sioux City Gas & Elec., 7% pf. | 107¼ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 109½ | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 90½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 59½ | 40⅜ | 61 |
| So. Calif. Edison, 8% pf. | 49 | 38½ | 41 |
| So. Calif. Edison, 7% pf. | 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 26 | 25¼ | 28 |
| So. Calif. Edison, 8% com. | 48⅛ | 43½ | 49⅜ |
| Southern Cities Utilities, 7% pf. | 84½ | 75 | 87 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 94 | 88 | 96¾ |
| Southwestern Pwr. & Lt., 7% pf. | k113½ | 103 | 115 |
| Standard Gas & Elec., 8% pf. | 70½ | 65 | 71 |
| Standard Gas & Elec., 7% pr. pf. | 114 | 108 | 115 |
| Standard G. & E., com. $3.50 | 70¼ | 57⅞ | 70½ |
| Standard Power & Light, com. | 43¼ | 29¾ | 45 |
| Standard Pwr. & Lt., 7% pf. | k105½ | 98 | 106 |
| Staten Island Edison, pf.—$6—no par | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | 158 | 155 | 178 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 112½ |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 68 | 62 | 69½ |
| Tenn. Elec. Pwr., 6% pf. | 103½ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109 | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | k 10 | .... | ... |
| Terre Haute, Ind. & East. Trac., com. | k 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | i114 | 113½ | 115 |
| Tide Water Pwr., 8% pf | 112 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 128¼ | 112⅜ | 134 |
| Toledo Edison, 7% pf. | 109½ | 108 | 111 |
| Toledo Edison, 6% pf | 105 | 95 | 105 |
| Toledo Edison, 6% com. | k145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 95 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c136¾ | 111¼ | 136⅜ |
| United Lt. & Pwr., pf.—$4—no par | a 57 | 53 | 57 |
| United Lt. & Pwr., pf.—$6.50—no par | k101½ | 95 | 101¼ |
| United L. & P., com. A .48—no par. | a 25 | 14 | 25½ |
| United L. & P., com. B .48—no par. | k 29 | 20 | 29½ |
| Utah Pwr. & Lt., 7% pf. | l112½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105½ | 105 | 106¼ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101 | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 37¼ | 28½ | 37⅜ |
| Utilities Pwr. & Lt., com. B $1—no par | 29½ | 18½ | 30½ |
| VERMONT HYDRO-ELEC., 7% pf. | 99 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf | k110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102½ | 97 | 103½ |
| WAGNER ELEC., 7% pf. | b104 | 96⅜ | 104½ |
| Wagner Elec., com.—no par. | b 78 | 37 | 79½ |
| Washington Ry. & Elec., 7% com. | j450 | .... | .... |
| Washington Ry. & Elec., 7% pf. | j102 | .... | .... |
| Washington Wtr. Pwr., 8% com. | 225 | 175 | 235 |
| West Penn Elec., 7% pf. | 113¼ | 109¼ | 115 |
| West Penn Elec., Cl. A $7 | 110⅜ | 106½ | 112½ |
| West Penn Pwr., 7% pf. | 115½ | 114⅜ | 117 |
| West Penn Pwr., 6% pf. | 111 | 108¾ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf | 105 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | k102 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 110 | 88⅜ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | k 33½ | 30⅛ | 34½ |
| Weston Elec. Instrument, com.—no par | 17½ | 12½ | 18⅜ |
| Wheeling Elec., 6% pf. | 106 | 95 | 109 |
| Worthington Pump, 7% pf. A | 58 | 46¼ | 58½ |
| Worthington Pump, 6% B | 50 | 41 | 51 |
| Worthington Pump, com. | 34½ | 28 | 35¼ |
| YALE & TOWNE com. $5—25. | k 80⅜ | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 28. *l*Bid price Wednesday, May 2. *m*Latest quotations available. †Dividend rate variable.

With the purpose of retiring its 7 per cent issue of cumulative preferred stock the Illinois Power & Light Corporation offered 364,740 shares of $6 cumulative preferred stock at $100 and accrued dividend.

## Allis-Chalmers Votes Stock Increase

At the annual meeting held at Wilmington, Del., May 3, the stockholders of the Allis-Chalmers Manufacturing Company voted to increase the authorized stock by $24,000,000, the proposed issue bringing the total authorized stock to $50,000,000. The plan calls for an increase from 260,000 shares of $100 par value to 500,000 shares of $100 par value. It is not contemplated that any portion of the proposed additional authorized capital stock will be issued at this time, but the board of directors deems it advisable to have such unissued stock available for possible requirements in connection with the company's future expansion and development.

## *Commercial and Municipal Operations in Canada*

Compiled from the preliminary report on the census of the Central-Station Industry for 1926, published by the Dominion Bureau of Statistics.

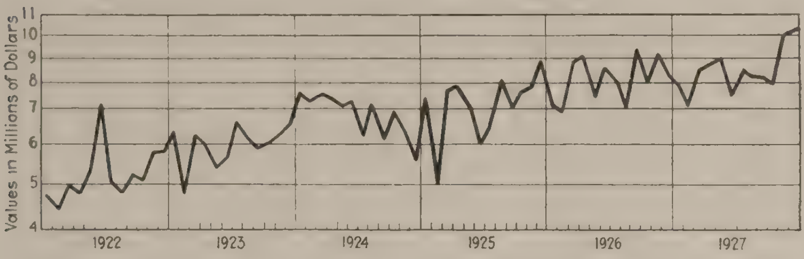
| Item | 1926 | | 1925 | |
|---|---|---|---|---|
| | Commercial | Municipal | Commercial | Municipal |
| Power plants | 393 | 202 | 365 | 198 |
| Stations buying power for distribution | 98 | 362 | 91 | 353 |
| Capital | $430,817,426 | $325,402,640 | $409,862,801 | $316,858,286 |
| Revenue* | 47,911,555 | 41,022,178 | 42,195,540 | 37,146,041 |
| Salaries and wages | 8,596,178 | 11,346,822 | 7,827,114 | 10,928,793 |
| Cost of fuel | 916,350 | 1,221,032 | 1,023,593 | 1,242,643 |
| Taxes | 3,677,777 | 363,433 | 3,093,858 | 273,232 |
| Employees, number | 6,178 | 7,228 | 6,141 | 7,122 |
| Customers, number | 584,760 | 752,802 | 559,172 | 720,559 |
| Energy generated, thousands of kw.-hr. | 7,795,121 | 4,829,518 | 6,524,094 | 3,578,489 |
| Prime movers, horsepower | 2,423,244 | 1,346,079 | 2,243,318 | 1,326,209 |
| Generators, kva | 1,938,048 | 1,057,339 | 1,803,545 | 1,041,164 |
| Pole-line miles | 14,257 | 15,438 | 13,047 | 14,606 |

*Gross revenue with duplications eliminated.

# Business News and Market Conditions

## Exports in 1927 Increase About 4 per Cent

Substantial increases are shown in the United States electrical equipment export trade in 1927. The value of exports in 1927 amounted to $102,340,129, which was the best since the record year of 1921. In 1926 electrical exports totaled $98,495,245. This increase is accounted for to a great extent by enlarged foreign markets for batteries, generators, fractional-horsepower motors, motor-driven household devices and washing machines. Exports of electric fans showed a small gain, while those for domestic heating and cooking devices declined.



*Exports of electrical machinery, equipment and supplies from the United States*
(Data supplied by the Bureau of Foreign and Domestic Commerce)

Exports to the Western Hemisphere amounted to $56,418,800, an increase of $2,994,800 over the preceding year. Canada is the largest consumer of our products and exports to that country showed an upward trend during 1927, the leading items being radio equipment. The next largest market in the Western Hemisphere was Argentina, whose imports of United States electrical equipment for 1927 amounted to $7,061,000, an increase of $1,857,400 over the preceding year.

Exports to European countries in 1927 amounted to $18,344,000, an increase of $3,960,200. Exports to Germany were valued at $1,391,800, an increase of $715,000. Shipments to Asia, Africa and Oceania showed a decrease of $3,140,000, part of which is accounted for by the large decrease of Japanese exports, which declined almost 50 per cent, or $4,239,000. Although exports to Australia, New Zealand and British India have decreased, these decreases are offset to a certain extent by an increase of trade with the Philippine Islands.

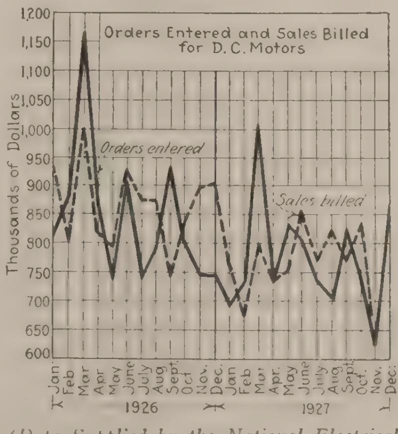
## Liege Exposition in 1930

Plans are well advanced in Belgium for the "International Exposition of Industry, Sciences, Applications and Ancient Walloon Art" to be held at Liége in 1930 in celebration of the centenary of Belgian independence. "Electricity" forms the thirteenth group under the classification of "grande industrie" and is subdivided in the following manner:

(a) Production and storage of electrical energy; (b) transmission of current; (c) transformation of current; (d) applications of electricity to (1) mechanics, (2) metallurgy, (3) chemistry, (4) transportation, (5) lighting, (6) domestic purposes, (7) telephony, telegraphy and television, and (8) the medical art; (e) methods of control and measurement.

Each of the divisions mentioned will be in turn subdivided and the entire field of electricity will thus be covered. The director of the exposition is Nello Breteuil, and its Liége offices are at 4 Place Saint-Lambert.

## Orders Entered and Sales Billed for D.C. Motors



*(Data Supplied by the National Electrical Manufacturers' Association)*

## Electric Industrial Trucks and Tractors

March shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the nine leading manufacturers in the industry, were 131, compared with 119 in February and 116 in March, 1927. The accompanying table gives the shipments for 1926 and 1927, month by month, as well as shipments for the first three months in 1928.

SHIPMENTS OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS

| | Domestic | | | |
|---|---|---|---|---|
| 1926 | Tractors | All Other Types | Exports | Total |
| January | 21 | 86 | 4 | 111 |
| February | 15 | 96 | 5 | 116 |
| March | 11 | 128 | 8 | 147 |
| April | 17 | 90 | 4 | 111 |
| May | 12 | 87 | 9 | 108 |
| June | 21 | 104 | 19 | 144 |
| July | 15 | 95 | 1 | 111 |
| August | 14 | 81 | 2 | 97 |
| September | 10 | 82 | 5 | 97 |
| October | 18 | 97 | 17 | 132 |
| November | 18 | 86 | 19 | 123 |
| December | 18 | 95 | 5 | 118 |
| Total (year) | 190 | 1,127 | 98 | 1,415 |
| 1927 | | | | |
| January | 6 | 67 | 17 | 90 |
| February | 11 | 120 | 7 | 138 |
| March | 10 | 96 | 10 | 116 |
| April | 12 | 89 | 4 | 105 |
| May | 19 | 77 | 10 | 106 |
| June | 20 | 97 | 23 | 140 |
| July | 12 | 73 | 5 | 90 |
| August | 3 | 87 | 2 | 92 |
| September | 8 | 66 | 5 | 79 |
| October | 11 | 81 | 17 | 109 |
| November | 15 | 64 | 19 | 98 |
| December | 8 | 77 | 11 | 96 |
| Total (year) | 135 | 994 | 130 | 1,259 |
| 1928 | | | | |
| January | 5 | 98 | 9 | 112 |
| February | 15 | *86 | 18 | *119 |
| March | 18 | 97 | 16 | 131 |

*Revised.

## Orders for Electrical Goods

New orders booked during the first quarter of 1928, as reported to the Department of Commerce by 86 manufacturers of electrical goods, were $244,916,615, as compared with $239,999,298 for the last quarter of 1927 and $243,651,415 for the first quarter of 1927. The accompanying table gives the totals of bookings for each quarter since the beginning of 1923, not as a complete statement of the industry but as probably sufficiently representative to indicate the trend.

ORDERS FOR ELECTRICAL GOODS

| Quarter | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 |
|---|---|---|---|---|---|---|
| First | $225,399,383 | $228,760,838 | $233,023,182 | $262,677,736 | $243,651,415 | $244,916,615 |
| Second | 240,542,824 | 221,167,876 | 227,502,652 | 248,000,075 | 236,427,121 | ........ |
| Third | 201,910,099 | 185,747,314 | 232,933,532 | 241,114,209 | *235,847,857 | |
| Fourth | 218,165,415 | 231,470,552 | 244,597,050 | 260,078,082 | *239,999,298 | ........ |
| Total | $886,017,721 | $867,146,580 | $938,056,416 | $1,011,870,102 | $954,925,691 | ........ |

* Revised

# Market Conditions

VOLUME of business as well as prospects look good in the New England district. Small motor sales showed a substantial gain. In the Eastern district a slight decline in orders is noted, but there is an encouraging volume of inquiries. A 60,000-kw. turbo-generator was purchased by an Indiana power company. Better conditions are noted in the Southeast. Order for $475,000 worth of generating equipment and $25,000 worth of oil circuit breakers were placed for a hydro-electric development in Alabama. An industrial plant in Georgia ordered $60,000 worth of rock crushing and mining equipment and an aluminum plant in Tennessee ordered three 6,000-hp. water wheels.

Equipment for a steel rod mill was purchased in the St. Louis district at a cost of $130,000. A good demand for building construction materials is reported. In the Middle West business is improving. An order was placed for $500,000 worth of paper insulated lead covered cable. Line extension and construction work is in good volume. On the Pacific Coast sales of pumping motors and small distribution transformers are good. Machinery and power apparatus orders were varied and in steady volume.

## *Better Conditions Noted in the Southeast*

Conditions in the Southeast are better both in the central-station and industrial fields. Orders were placed for generating equipment approximating $475,000 and oil circuit breakers costing $25,000 for a hydro development in Alabama. Other good business is in more or less immediate prospect on general central-station apparatus, including some steam equipment. A large school in Tennessee ordered a turbine, stokers and condensers amounting to $45,000, while a small college in Georgia ordered lighting fixtures amounting to $3,500.

An industrial plant in Georgia has ordered $60,000 worth of rock crushing and mining equipment, $15,000 of this being for motors, while an aluminum plant in Tennessee ordered three 6,000-hp. water wheels. A steel mill in Alabama placed an order for four mine locomotives costing about $30,000 and a cotton mill in South Carolina purchased stoker equipment totaling $7,500. Small individual orders predominate in the industrial field, but the total volume of business is satisfactory and the most activity to be noted is in Alabama and the Carolinas. Orders for electrical materials, amounting to about $8,000, for a silk mill in Tennessee will probably be placed shortly and electrical equipment contracts on a bleachery in the Carolinas are in early prospect. Construction has started on the first $2,500,000 unit of a $10,000,000 rayon plant in Georgia. Municipalities are purchasing in reasonably good volume. A small town ordering line construction materials amounting to $2,000, while an order for "white-way" equipment, totaling $5,000, will probably be placed at an early date by another town. Purchases by contractors are increasing. Construction projects are as follows:

The Southern States Power Company, Fernandina, Fla., plans an expansion program to cost $100,000, including a substation on Jefferson Street. A. S. Andersen, 519 Twenty-eighth Street, West Palm Beach, Fla., and associates are organizing a company to build a cold storage plant, to cost $225,000. The Echota Cotton Mills, Calhoun, Ga., plan a plant unit to cost $100,000. The Baker County Power Company, Newton, Ga., will build a steam power plant at Moultrie, Ga. Leland, Miss., will receive bids until May 22, for equipment for a municipal power plant. The Mississippi Steel & Iron Company, Jackson, Miss., plans a mill to cost $100,000. The Planters Cotton Oil Company, Yazoo City, Miss., has authorized complete electrification of its plant.

The Nestles Food Company, New York, N. Y., plans a milk plant at Newton, N. C., to cost $200,000. Standard Looms, Inc., Spartanburg, S. C., plans a plant, for manufacture of textile machinery, to cost $175,000. The Tri-State Compress Company, Huston, Miss., will build a cotton compressing plant at Memphis, Tenn., to cost $300,000. The Pet Milk Company, St. Louis, plans a milk condensing plant at Abingdon, Va., to cost $200,000. The Alabama Power Company, Birmingham, plans a transmission line for service at Center Star, Killen, Shoal Creek Bridge, Ala., and vicinity. The Southeast Georgia Power Company, Alma, Ga., has acquired the municipal plant at Broxton, Ga. The Mississippi Power Company, Gulfport, Miss., has acquired the Richton Light & Power Company, Richton, Miss. The Virginia Public Service Company, Charlottesville, Va., has acquired the Stonewall Power Company, Manassas, Va.

## *Copper in Good Demand—Prices Firm*

The general tone of the non-ferrous metal markets is firm and a feeling of optimism prevails. Copper has again had a normal week as to volume of sales, with little or no shading of prices. Zinc has advanced slightly and sold in considerably larger volume than in either of the last two weeks. On the other hand, lead and tin have been quieter than usual, with a little weaker price level for the latter metal. The monthly average prices for copper, zinc, and silver have shown a gain now for two successive months. This tendency upward, though very gradual, shows no sign of abating at the beginning of May.

NEW YORK METAL MARKET PRICES

| | Apr. 25, 1928 Cents per Pound | May. 2, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic...... | 14.00 | 14.025 |
| Lead, Am. S. & R. price | 6.10 | 6 10 |
| Antimony............. | 10 00 | 10.375 |
| Nickel, ingot........... | 35.00 | 35 00 |
| Zinc spots............. | 6.15 | 6.225 |
| Tin, Straits............ | 52⅛ | 51½ |
| Aluminum, 99 per cent... | 24.30 | 24.30 |

Base copper wire price May 2, 1928, 16 cents.

The copper market is virtually unchanged either in price or in volume of sales though there has been less tendency to offer the metal at concessions from the prices at which most of the producers have held for some weeks. Export sales are satisfactory and the price continues at 14½ cents. Sales of lead have been considerably below normal. No appreciable change is observed in the market although two sales of fair tonnage were reported below the prevailing levels of 6.10 cents, New York and 6 cents St. Louis. Several of the largest domestic producers oversold their supply of metal in April.

## *Slight Decline in Orders in Eastern District*

An encouraging volume of inquiries is reported in the Eastern district, but there is a noticeable decline in actual orders for primary equipment. An Indiana power company has contracted for a 60,000-kw. turbo-generator for delivery around the close of the year. A copper mining company in the Southwest is in the market for a 12,500-kw. unit, and is expected to place an order at an early date. A central-station company in northern New York has given a contract for cable of the medium voltage type, totaling about $15,000, and there is other business of this character in sight. Transmission apparatus also is in demand by several central-station companies in Pennsylvania and the South.

An order for switching equipment has been placed by a New York company at a price of $35,000. Transformer business continues rather spotty. One maker reports current business of lessened demand, with the bulk of the call for equipment of smaller capacity ratings; another producer says that things are fair in this line and has just contracted with a northern New York power interest for $100,000 worth. Electric railway business continues to lag. The Navy Department has ordered a turbine-gear drive for installation on a transport.

Industrial business is centered on motors at the present time and while orders are being received in reduced volume on individual account, fair gross sales are being recorded. Fractional units are in better demand than for several weeks past; one maker has secured a contract from a manufacturer of electrical apparatus for 1,000 1-hp. motors, totaling around $20,000. Control equipment sales are trending upward. Electric clock business is a feature of current activities and the improvement is expected to continue. A maker of time-pieces of this kind has placed an order for 15,000 induction motors, with an Eastern manufacturer, to cost about $50,000. Immediate construction operations in the Eastern district include the following:

The Purty Boat Works, Port Washington, L. I., will make additions to cost $125,000. The Agfa-Ansco Corporation, Binghamton, N. Y., will build a camera-manufacturing plant to cost $2,000,000. The Public Service Electric & Gas Company, Newark, N. J., plans a substation at Jersey City, to cost $75,000, and another at South Orange to cost $70,000. The New Jersey Port Commission, Camden, N. J., plans a marine terminal to cost $2,000,000. The Heimbach Baking Co., Allentown, Pa., will build an addition to cost $200,000. The American Rolling Mill Company, Middletown, Ohio, will build an extension to its Columbia mill at Butler, Pa., to cost $1,000,000.

The Board of Education, Pittsburgh, Pa., will receive bids until May 15, for equipment for a proposed trade school. The Celanese Corporation, Amcelle, Md., will add to its rayon mill at a cost of $1,500,000. The Procter & Gamble Company, Cincinnati, Ohio, will build a soap-manufacturing plant at Baltimore, Md., to cost $3,000,000. The Quartermaster Depot, Camp Holabird, Md., will receive bids until May 9, for 115 storage batteries. The Quartermaster General, Washington, D. C., is asking bids until May 18, for three 750-hp. Diesel engines for Fort Mills, P. I.

## *Pumping Motor Sales Active on Pacific Coast*

Machinery and power apparatus orders on the Pacific Coast include a 75-kva. generator, valued at $2,500, for a gas engine manufacturer; a 100-kva. gas engine generator, valued at $4,000, for a state polytechnic school; five large substation circuit breakers amounting to $17,500 for the Contracosta substation of the Great Western Power Company; two 700-hp. synchronous motors and exciter set, valued at $12,500, for a Utah copper company; a five-ton storage battery locomotive and charging set, valued at $7,000, for a Sierra gold mine, and four refrigerator type motors amounting to $9,000 for food packing plants in San Jose and Monterey.

Manufacturers report excellent sales of pumping motors and small distribution transformers. Power company inquiries cover fiber conduit, and pin type insulators for the Bay section. Two carloads of assorted poles were ordered for Sacramento, and one carload of 7,500-volt line switches for Los Angeles. An unusual inquiry for San Jose delivery covers $1,000 worth of large rubber covered cable. Street lighting business includes $48,300 worth for Santa Barbara and a number of good prospects.

The city of Seattle will shortly buy machinery for a 25,000-kw. expansion of its Gorge Creek hydro-electric plant at a cost of about $500,000. Buhl, Idaho, plans an 800-hp. municipal plant to cost $150,000. The Washington Water Power Company plans a 110,000-volt line from Chelan to Wenatchee. Motor sales were light, the majority being small units for irrigation use and orchards. Construction projects are as follows:

The Los Angeles Gas & Electric Corporation, Los Angeles, plans an automatic substation on South Woodland Avenue, and another on Lawrence Street, to cost $75,000. The Southern Pacific Railroad Company plans shop extensions at Sacramento, Calif., to cost $2,000,000. The Oregon Short Line Railroad will add to its steam power plant at Pocatello, Idaho, to cost $100,000. Lima, Mont., has authorized a municipal power plant. The Northwestern Pulp & Paper Company, Astoria, Ore., will build a mill to cost $2,000,000. Modesto, Long Beach, and Los Angeles, Calif., plan ornamental lighting systems.

## *Small Orders in Good Volume Mark New England Trend*

While heavy equipment sales have fallen off in New England and industrial activity has lessened in a number of branches, the volume of material moving and the prospects ahead are favorable. Small motor sales showed a substantial gain, and a large amount of new construction material was ordered. Industry, through reorganization of plants, is an active factor in buying. Service expansion has provided a good demand for transformers, meter sales are strong, small orders for switch and control equipment are noted, and specialties are quite active, among which may be included power tools, the sales of which are now very steady. Welding equipment and electric furnaces also are in demand.

Interior electric wiring projects are in advance over those of last year. Manufacturers of loom and paper mill machinery are busy and planning for Southern installations. Artificial ice making is receiving much attention. Among the installations planned should be added one for the Chelsea district as announced by the Boston Ice Company. The bill providing for additional water supply for Springfield, Mass., which includes plans for a 20,000 hp. development on Cobble Mountain has been signed. The Marborough Chamber of Commerce announces plans for the establishment of three new shoe industries in that city.

## *Business Improving in Middle West*

Business in the Middle West is improving. The consensus of opinion is that April sales were favorable and the outlook is promising. Considerable new building construction is under way, particularly in the suburban districts, and general employment conditions are improving. Industrial activity is somewhat spotty. Contemplated expenditures of the various railroads are large and should tend to increase the volume of business. A very large amount of line extension and construction work is being done by the various utility companies, one of the most interesting being the construction of a hydro-electric plant on the Rock River at Rocton by the Wisconsin Light & Power Company, at a cost of $250,000. Among the orders placed were one for paper insulated lead covered cable valued at more than $500,000, disconnecting switches valued at $24,000 and several construction orders totaling $60,000. Construction projects are as follows:

The Chicago, Burlington & Quincy Railroad Company, Chicago, plans a power plant to cost $80,000. The Frank Foundry Company, Moline, Ill., plans an addition to cost $200,000. The Rockford Paper Box Company, Rockford, Ill., will build an addition to cost $125,000. The Showers Brothers Manufacturing Company, Bloomington, Ind., plans an addition to its kitchen cabinet plant, to cost $100,000. The Northern Indiana Public Service Company, Hammond, Ind., plans a steam power plant at Michigan City, Ind., to cost $5,000,000. The Grand Trunk Railway System will build an engine house at Ferndale, Mich., to cost $150,000. The Macklin Company, Jackson, Mich., plans extensions in its grinding wheel plant, to cost $100,000.

The Great Northern Railway Company plans shops at Grand Forks, N. D., to cost $125,000. The Cleveland Electric Illuminating Company, Cleveland, is negotiating for the purchase of the municipal plant at Ashtabula, Ohio. The Edward J. Shannon Company, Cincinnati, plans an addition to its paint manufacturing plant, to cost $75,000. The Andrew Jergens Company, Cincinnati, will add to its soap manufacturing plant, to cost $200,000. Thompson Products, Inc., Cleveland, plans additions to its plant to cost $250,000. The E. M. Hulse Furniture Company, Columbus, Ohio, plans a plant to cost $275,000. The Appleton Coated Paper Company, Appleton, Wis., will build an addition to cost $130,000. Elmwood Park, Ill., Ames, Keokuk and Boone, Iowa, and Lincoln, Neb., plan ornamental lighting systems.

## *Steel Rod Mill Places Order in St. Louis District*

Manufacturers in the St. Louis district report the demand for stock sizes of apparatus has been considerably below normal but the belief is unanimous that the condition is only temporary. An order consisting of motors, transformers and control equipment for a steel rod mill was placed at a cost of $130,000. Another order was for a 100-hp. motor and other equipment amounting to $6,000. Jobbers report a good demand for building construction materials but no marked activity in line construction equipment. The general volume of jobbing business is considered satisfactory and the prospects look favorable. Construction projects are as follows:

The Peoples Utilities Company, Clinton, La., plans a power and ice plant at Clinton, La. The Quaker Oats Company, Chicago, will build a mill at St. Joseph, Mo., to cost $2,000,000. The General Tire & Rubber Company, Akron, Ohio, plans a factory branch at Kansas City, Mo., to cost $200,000. The Brown Cracker & Candy Company, San Antonio, Tex., plans a plant to cost $300,000. The Public Service Company of Oklahoma, Tulsa, Okla., will build a transmission line between Vinita and Jay, Okla. Bethany, Mo., plans an ornamental lighting system.

# Activities of the Trade

## Hubbard & Company Make Organization Changes

Two additions to the Pittsburgh plant of Hubbard & Company, manufacturer of pole line hardware and Peirce construction specialties, are now nearing completion. During May it is the intention of the company to move the Niles operation to Pittsburgh. The following organization changes also have been announced by C. L. Peirce, Jr., vice-president in charge of the electrical materials business of the company:

Joseph V. Smith, formerly Pacific Coast manager, is now Eastern manager in charge of the Pittsburgh plant and the territory served by it; W. R. Pounder continues as Central manager in charge of the Chicago plant and the territory it serves; Norris C. Husted, formerly manager of the Niles plant, has been made Pacific Coast manager in charge of the Emeryville, Cal., plant and the Pacific Coast territory; Wallace W. Glosser, formerly sales manager of the Verona tool works, has been made New York district sales manager with headquarters at 30 Church Street, New York City, and Thomas J. Farrell, formerly sales manager of the Universal Sales Company, has been made special representative in the New York district.

## Copeland Products to Double Manufacturing Facilities

Construction of additional manufacturing facilities now under way by the Copeland Products, Inc., Detroit, will virtually double the production of the company's electric refrigerators. Property adjoining the present factory has been leased and it is expected that it will be ready for occupancy about June 1. "Rapid growth in demand for the Copeland product has made it necessary to enlarge our plant at an earlier date than we anticipated," said W. D. McElhinny, vice-president in charge of sales. "Our present plant has been credited by manufacturing experts with unusual efficiency and we had thought its capacity sufficient to take care of our requirements for several years yet. The Copeland business showed a 40 per cent increase in 1927, as compared with a 20 per cent average increase for the industry and in the first quarter of 1928 showed a further increase of 45 per cent over the same quarter of the previous year.

"It is not in anticipation of business that may develop, but to care for orders already on hand and immediately in sight that this plant expansion has been decided upon. However, in keeping with Copeland's policy of holding fixed assets at a minimum figure, additional facilities are being leased rather than purchased. Recent additions to the Copeland line have practically doubled its sales possibilities in the household, commercial and apartment house fields. We are also facing the necessity of caring for a big business on our new "Silica Gel" units, just in process of introduction, which will embrace everything in the field of commercial refrigeration."

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The Leonard Refrigerator Company, Grand Rapids, Mich., announces that 3,782 Leonard refrigerators were shipped in a 43-car train in one day by the company over the Pennsylvania Railroad to dealers at various points through the United States, Canada and Mexico.

Landers, Frary & Clark, New Britain, Conn., manufacturers of electrical appliances, announce a new product, the "Univac" electric cleaner, selling for $34.50, with attachments $5 extra.

The Penn Electric Switch Company, Des Moines, Iowa, announces that it has taken over the Wilboken Manufacturing Company of Milwaukee, which will be continued for the present as a division of the Penn Electric Switch Company.

The Wright Manufacturing Company, Lisbon, Ohio, manufacturer of chain hoists, trolleys and cranes, announces the sale of its business and trade name to the American Chain Company, Inc., Bridgeport, Conn. There is no anticipated change in policies or sales organization of the company. H. F. Wright and W. F. Wright will continue in charge of sales and production of Wright products.

The National Lamp Works of the General Electric Company, Nela Park, Cleveland, is offering a stereopticon projection film on "Home Lighting" and a talk to accompany it. This illustrated talk is particularly useful to organizations which are interested in relighting-the-home activities. It portrays the principles of good home lighting and gives practical suggestions for properly lighting each room in the home. Copies of the film and talk are available at a cost of $5. It was prepared by M. Luckiesh of the lighting research laboratory of the company.

The General Electric Company has received an order for carrier-current communication equipment for use in conjunction with the Big Creek line No. 3 which will connect the Magunden and Gould substations of the Southern California Edison Company. The equipment will include ten coupling capacitors and the latest type of vacuum-tube carrier-current apparatus. The Southern California Edison Company previously had in operation a similar system on two of its 220,000-volt transmission lines.

The Dampney Company of America, Hyde Park, Boston, announces that the sale of its "Apexior" protective coatings for power plant equipment will be handled in southern Texas by the Maintenance Engineering Corporation, 2000 Harrington Street, Houston.

S. A. Weiss & Company announces its removal to Room 510, 342 Madison Avenue, New York City. The company represents the Minerallac Electric Company of Chicago, Thoner & Martens of Boston, the J. L. Gleason Cable Reel Company of Boston and the Line Material Company of Milwaukee.

The A. J. Lindeman & Hoverson Company, Milwaukee, manufacturer of electric cooking and heating appliances, announces that the new L & H electric ranges are now being made in color. Shades of Alice blue, Arabian tan, Nile green, Oriental yellow and coral red with a background of old ivory are available.

The General Electric Company is now issuing specifications in which the G.-E. wiring system is applied to apartment houses and apartment hotels. These specifications show the wiring layouts for typical apartments of the one-story and two-story type, also the wiring for the simplex, duplex and studio designs.

The Foxboro Company, Inc., Foxboro, Mass., manufacturer of indicating, recording and controlling instruments, announces a new push-button chart hub for use with its recording instruments. It accurately centers the chart and can be easily detached.

## Packard Electric Uses Plane in Sales Work

This Stinson-Detroiter six-passenger cabin monoplane will be used in sales work by N. A. Wolcott, president; W. F. Parker, general manager of the transformer division, and engineers of the Packard Electric Company.

# New Equipment Available

## Air Filter

The "Simplex" air filter developed by the National Air Filter Company, Chicago, consists chiefly of a large cylindrical drum which is closed at one end and carries the filtering medium on the outside surface of the cylinder. A segment of the drum which can be rotated is always immersed in oil. The filtering medium comprises layers of expanded metal for pre-cleaning and mats of heavy twisted copper ribbons of specially woven fabric wound layer upon layer for the final stage.

Under average conditions the drum is turned one-fifth of its circumference once a week and this immersion period gives the oil ample time to clean the filters thoroughly by solvent action. The company states that the "Simplex" filter combines the features of its "Rotary" and "Phoenix" air filters, but does not displace either of them. Standard sizes range from 800 to 40,000 cu.ft. per minute, and by using additional units any capacity can be secured.

## Portable Oscillograph

An improved type of portable cathode ray oscillograph for use in making laboratory and field measurements of transient electric phenomena has been announced by the General Electric Company. The unit is entirely self-contained and requires only a source of 110-volt alternating current to operate it. The company states that although extremely accurate measurements are possible with the new instrument it is ruggedly constructed and can be handled successfully with only the ordinary care required by other portable laboratory equipment. The instrument consists of two units, each mounted on a separate truck. The first unit contains the photographic recording apparatus and high-vacuum pump, while the second includes the rough vacuum pump, synchronous switching mechanism and cooling water system. The two units together weigh about 700 lb. and each occupies about the same amount of space as an office desk.

The oscillograph is of the high-voltage cold cathode type, operating on 30,000 to 60,000 volts, supplied by a transformer. The tube is built into the end of a metal bell which contains the film holder and the whole interior is exhausted of air during operation. When excited the cathode of the tube emits a stream of electrons which traverse the length of the vacuum chamber and impinge upon the film. The stream is acted upon by a number of electromagnetic and electrostatic fields imposed on it by means of several sets of electromagnets and parallel plates, so that both voltage and current waves may be recorded. When transients of very short duration are to be photographed the beam is given an undulatory path across the film by the action of an electrostatic field supplied by a high-frequency oscillator included in the unit. This greatly increases the length of the ray path and also furnishes a timing wave by which to measure the duration of the transient. The frequency of this timing wave may be adjusted for any value between 20,000 and 1,000,000 cycles per second and its voltage may be given any value from 10 to 1,000 volts, depending on the wave amplitude desired.

The oscillograph finds its greatest use in recording transient electric phenomena with wave fronts equivalent to frequencies from 10,000 to 1,000,000 cycles per second, although frequencies of 100,000,000 cycles have been recorded. Some of the classes of work for which the instrument is especially fitted are: Volt-ampere studies of lightning arresters; recording of transient phenomena during switching on power lines; volt-ampere studies of mercury-arc rectifier characteristics; measurement of power amplifier characteristics, and measurements of pressures and time intervals along a gun barrel with the movement of a bullet.

## Switchboard Wire

An asbestos and varnished cambric insulated switchboard wire, with a smooth outer cotton braid which can be furnished in either gray or black, has been placed on the market by the Rockbestos Products Corporation, New Haven, Conn. This switchboard wire is especially adapted for wiring switchboards in power plants and substations. The wire consists of a tinned copper conductor insulated with two layers of varnished cambric, 30 units of felted asbestos saturated with a flameproof and moisture-resisting compound and an outer covering of gray or black flameproof cotton braid. It is said that the braid, which is closely woven, will not break or open on sharp right-angle bends.

**Insulator.**—A line of 6,600-volt and 8,800-volt insulators in color has been placed on the market by the Corning Glass Works, 369 Lexington Avenue, New York. The insulators are known as the marker type and are intended for the purpose of identifying low-voltage distribution lines.

**Binding-Wire Tension Indicator.**—A device for use in the repair of railway and industrial haulage motor armatures has been developed by the General Electric Company. This device indicates the exact strain or tension in pounds that is applied to the steel binding wire by the binding machine or lathe and provides a simple means of keeping track of this tension throughout the full operation of binding up the armature. By its use the binding wire will not be stressed beyond the elastic limit or tensile strength of the steel and will be kept under uniform tension during the process of winding it in place.

## Starters for D.C. Motors

A complete new line of direct-current motor starters for general purpose applications has been introduced by the General Electric Company. These starters are designed to provide definite time acceleration for constant- and adjustable-speed motors and are divided into five types, bearing the designations CR-4065, CR-4066, CR-4166, CR-4068 and CR-4168. One of the principal advantages of the new design is the fact that, despite a reduction in size, the number of accelerating points has been increased. An improved appearance is secured by the use of drawn-shell inclosing cases.

The CR-4065 starter is a constant-speed type for general purpose applications and the CR-4066 is the same type with the addition of dynamic braking. The CR-4166 is an adjustable-speed type with dynamic braking and full-field features. The CR-4068 is a constant-speed type, reversing, with dynamic braking. The CR-4168 is an adjustable-speed type, reversing, with dynamic braking and full-field features.

On those starters provided with dynamic braking a small relay is used to prevent the solenoid from being re-energized until the motor has come to rest. The contacts of this relay are connected in the pick-up circuit. Thermal overload protection is provided by means of single-coil relays designed for overload protection and having a thermal capacity to stand high inrush currents. These relays operate only in extreme conditions and serve as a warning to the operator that the motor or wiring requires attention.

## Disconnecting Switches

A line of high-tension reversible and interchangeable disconnecting switches has been placed on the market by the High Tension Company, 149 Broadway, New York City. All switch bases are of the channel type and all switches have double blade construction. Switches up to and including 22,000 volts have the U type blade; switches for 33,000 volts and above have the truss type.

The salient features pointed out by the manufacturer are: Reversible standard parts for inverted, upright or vertical mounting; interchangeable insulator units with cemented or adjustable non-cemented caps and pins; mounting holes symmetrical; offset pulling ring accessible at any angle; positive locking device; full-floating, self-aligning adjustable double pressure contacts; double switch blades; U-bolt type of clamp terminals; switch blade stops at 90 deg or 135 deg., and the elimination of tapped holes.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued April 17, 1928)

**16,935 (reissue).** ELECTRICAL STEAM GENERATION; T. H. Noll, Bronx, N. Y. App. filed Aug. 31, 1923.

**1,666,065.** MAGNETIC MOTOR; O. R. Anderson, Pasadena, Calif. App. filed April 1, 1924.

**1,666,089.** CONNECTER FOR ELECTRIC CIRCUITS; H. C. Foster, Connersville, Ind. App. filed July 25, 1927. Multiple circuit socket adapted to insure contact for three or more pairs of terminals.

**1,666,129.** TIME SWITCH; W. A. Frantz, Cleveland, Ohio. App. filed Jan. 21, 1924.

**1,666,223.** ELECTRIC-FIXTURE SUPPORT; W. Symmes, San Francisco, Calif. App. filed Oct. 23, 1922.

**1,666,247.** ELECTRIC CORD SWIVEL CONNECTER; C. Schuldt, Des Plaines, Ill. App. filed March 27, 1925.

**1,666,248.** THREE-WAY LAMP SOCKET; C. Schuldt, Des Plaines, Ill. App. filed July 22, 1925.

**1,666,281.** MAIL BOX; A. E. Deibert, Seattle, Wash. App. filed June 4, 1927. With an electric signal, as a bell.

**1,666,282.** PRESSURE-FLUCTUATING ALARM FOR MINES; R. C. Fagan, Spangler, Pa. App. filed Oct. 29, 1924.

**1,666,309.** MAGNOMETER; J. N. Ray, Newark, N. J. App. filed Nov. 26, 1924. Apparatus for testing the magnetism of electromagnetic sound reproducing devices.

**1,666,320.** LOCK-CONTROLLED ELECTRIC SWITCH; F. J. Watts, Bronson, Mich. App. filed Aug. 3, 1927.

**1,666,338.** ELECTRIC SWITCH; G. J. Meuer, Milwaukee, Wis. App. filed Jan. 18, 1926. Toggle type.

**1,666,339.** LUMINESCENT FUSE PLUG; L. F. Miller, Minneapolis, Min. App. filed Oct. 22, 1926.

**1,666,351.** ELECTRIC STRIKING MECHANISM; S. Rollin, Tulle, France. App. filed March 8, 1927.

**1,666,411.** ELECTRIC CONNECTER SOCKET; H. D'Olier, Jr., Bridgeport, Conn. App. filed Dec. 14, 1925.

**1,666,433.** SYSTEM OF ELECTRIC DISTRIBUTION; B. S. Weinfield, Schenectady, N. Y. App. filed June 28, 1926. For automatically controlling the connections and operation of a source of current whereby it is connected to a load circuit only under certain predetermined conditions, and whereby its output is limited to a safe value under abnormal load conditions.

**1,666,435.** SYSTEM OF ELECTRIC DISTRIBUTION; H. Bany, Scotia, N. Y. App. filed Jan. 8, 1926. An arrangement for controlling the operation of the interconnecting dynamo-electric units upon the occurrence of a reversal of energy flow.

**1,666,452.** GENERATOR FOR ELECTRIC-ARC WELDING; M. M. Irvine, Glasgow, Scotland. App. filed Feb. 15, 1927.

**1,666,457.** BRUSH LIFTER FOR ELECTRIC MOTORS OR THE LIKE; G. H. Leland, Dayton, Ohio. App. filed March 22, 1926.

**1,666,459.** BRUSH-LIFTING MECHANISM FOR ELECTRIC MOTORS OR THE LIKE; G. H. Leland, Dayton, Ohio. App. filed July 13, 1927.

**1,666,470.** ELECTRIC SWITCH; D. A. Sanford, Deceased, late of Washington, D. C. App. filed March 27, 1924. For attachment to the under surface of the floor of an elevator car and to be operated by the foot to energize an electro-magnet.

**1,666,471.** SYSTEM OF ELECTRIC DISTRIBUTION; H. T. Seeley, Schenectady, N. Y. App. filed Feb. 17, 1926. Comprising a supply circuit and a load circuit interconnected for controlling the operation of the inter-connecting units upon the occurrence of a reversal of energy flow.

**1,666,473.** HIGH-VOLTAGE DIRECT-CURRENT SYSTEM; J. Slepian, Swissvale, Pa. App. filed Feb. 26, 1921.

**1,666,498.** FLOAT-OPERATED ELECTRIC-SWITCH-ACTUATING MECHANISM; C. W. Lindemann, Chicago, Ill. App. filed April 9, 1926.

**1,666,546.** ELECTRIC LIGHTER FOR CIGARS, CIGARETTES, ETC.; S. L. Wolfson, Meriden, Conn. App. filed Feb. 18, 1928.

**1,666,588.** ELECTRIC MOTOR; M. Andis, Racine, Wis. App. filed June 26, 1926. Intended to develop light power under circumstances where considerations of size and weight are important.

**1,666,589.** ELEVATOR SIGNAL SYSTEM; C. W. Bassett, Montclair, N. J. App. filed April 17, 1926.

**1,666,639.** HOSPITAL SIGNAL SWITCH; J. O. Cadieux, Meriden, Conn. App. filed May 6, 1925.

**1,666,675.** CIRCUIT MAKING AND BREAKING DEVICE; T. Zweigsberck, London, England. App. filed Dec. 20, 1923. An electro-magnetically operated circuit breaker having an independently, mechanically operated mechanism adaptable for conjoint action with the electro-magnetic mechanism to close the circuit.

**1,666,680.** DYNAMOMETER; O. E. Buckley, Maplewood, N. J. App. filed Dec. 30, 1922.

**1,666,697.** DIATHERMIC APPARATUS; G. Grossmann, Berlin, Germany App. filed Oct. 7, 1927.

**1,666,724.** INCLOSED ELECTRIC SWITCH; D. T. Wadsworth, Cold Springs, Ky. App. filed Aug. 15, 1924. Meter service switch.

**1,666,729.** ELECTRIC FIXTURE; W. G. Biek and G. D. Rice, Dowagiac, Mich. App. filed July 20, 1927. Attachment plug adapted to be used in floors covered with rugs, the connection being made through the rug.

**1,666,762.** SEPARATOR FOR THE ELECTRODES OF ELECTROLYTIC CELLS; J. L. Woodbridge, Philadelphia, Pa. App. filed July 12, 1927.

**1,666,763.** SWITCH; G. A. Yanochowski, La Grange, Ill. App. filed May 31, 1924. Horn button.

**1,666,816.** AIR CIRCULATING AND HEATING APPARATUS; P. R. Falk, New York, N. Y. App. filed Nov. 22, 1926.

**1,666,831.** ELECTRIC HEATER; C. Pandolfo, Montevideo, Uruguay. App. filed Nov. 3, 1926.

**1,666,876.** LAMP FOR USE ON MOTOR VEHICLES AND FOR OTHER PURPOSES; S. L. Price, London, England. App. filed Jan. 17, 1923.

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Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

# New Trade Literature

FURNACE TYPE TERMINAL MOUNTINGS.—The Globar Corporation, Niagara Falls, N. Y., is distributing bulletin D, giving details of standard furnace type "Globar" terminal mountings. A drawing shows a typical cross-section through a furnace equipped with "Globar" electric heating elements, and detail drawings show the "Globar" terminal and mounting assembly, self-cooled and water-cooled. The bulletin also contains instructions for replacing "Globar" electric heating elements while the furnace is in operation.

LIGHTING UNITS AND FLOODLIGHTS.—Bulletin GEA-359A issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the "Novalux" ornamental lighting units for street lighting. The company also is distributing bulletin GEA-161B covering searchlight and airport lighting, including floodlighting projectors, incandescent searchlights and aviation beacons. The bulletin covers the application of floodlighting to buildings.

FEEDER EQUIPMENT FOR MINING SERVICE.—Leaflet No. L 20,115-A, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covers its automatic direct-current feeder equipment for mining service.

GROUNDS.—"Grounding Facts" is the title of a booklet issued by the Paragon Electric Company, 37 West Van Buren Street, Chicago. While the booklet gives information on Paragon grounds, directions for their installation etc., it is virtually a treatise on the general subject of grounding and contains information concerning the grounding of transformer secondaries, transformer neutrals, protection of station equipment, feeder circuits, arc-lighting circuits, trolley cirouits, railway signal installations, etc.

LIGHTNING ARRESTERS.—A booklet issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, entitled "The Preferred Lightning Arrester of Today—Why?" is the seventh of a series describing the technical features of the crystal valve lightning arresters as they apply to modern lightning protection.

STARTERS.—The Monitor Controller Company, Baltimore, is distributing bulletin No. 112, covering the Monitor "Thermaload" starter designed for any type of drive where single-phase or polyphase motors are connected across the line. It contains a table of ratings, dimensions and weights of the Monitor starters and a table of the ampere rating of the thermal units to be used with induction motors.

TRANSMISSION MACHINERY.—Catalog No. 22 issued by Winfield H. Smith, Inc., Springville, N. Y., describes and illustrates its line of speed reducers, hangers, pillow blocks and other light power transmission machinery.

MOTORS.—The General Electric Company, Schenectady, N. Y., has issued a bulletin describing its standardized type MD-400 mill motors. Illustrations are given showing a few standard arrangements and some of their many applications.

INSULATING MACHINES.—Bulletin No. 332 issued by John Royle & Sons, Paterson, N. J., describes and illustrates its perfected insulating machines patented for applying die-formed rubber or plastic coatings upon electric conductors and other materials. The bulletin covers the features of construction and contains specifications covering the various machines.

MOTORS.—Bulletins GEA-752 and GEA-894 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate its type BD constant and adjustable-speed direct-current motors and type CD adjustable-speed direct-current motors.

COMPRESSORS AND VACUUM PUMPS.—The Ingersoll-Rand Company, 11 Broadway, New York City, is distributing bulletin No. 3150, in which it describes and illustrates the class ER and FR compressors and vacuum pumps suitable for machine shop, factory, foundry, mine, quarry and power plants, also for air-lift pumping, liquid agitation and gas distribution. Various photographs show the detailed construction of the machines.

CONTROL EQUIPMENT AND BRUSHHOLDERS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-308A, describing and illustrating its arc suppressor plates for drum controllers. The company also is distributing the following bulletins GEA-934, covering the CR7896 automatic throw-over panels; GEA-835A, covering the CR4066, CR4068, CR4166 and CR4168 direct-current magnetic controllers for constant and adjustable-speed motors; GEA-948, describing the CR4065 direct-current magnetic controllers for constant-speed motors; GEA-950, covering the CR1028 alternating-current inclosed starting rheostats used in conjunction with primary switches for slip-ring induction motors, and GEA-760A and GEA-838A, covering its improved brush-holders and ventilated covers for GE-275 and GE-247 railway motors, respectively.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Melbourne, Australia (No. 30,912), of battery chargers.

Purchase is desired in Sheffield, England (No. 30,913), of battery-charging panels.

Purchase and agency are desired in Otanes, Spain (No. 30,895), for electric galvanizing apparatus.

An agency is desired in Munich, Germany (No. 30,908), for household electrical appliances, especially washing and ironing machines.

Purchase or agency is desired in Montreal, Canada (No. 30,909), for electric lamps, standards and shades and another (No. 30,935) for electric surfacing machines.

Purchase and agency are desired in Melbourne, Australia (No. 30,910), for electric hand vacuum brushes for automobile upholstery.

An agency is desired in Frankfort, Germany (No. 30,876), for electric washing machines.

Purchase is desired in Temuco, Chile (No. 30,931), of wiring supplies and fixtures.

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Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

# Business Facts for Electrical Men

**Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business**

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## South's Rapid Increase in Industrial Activity

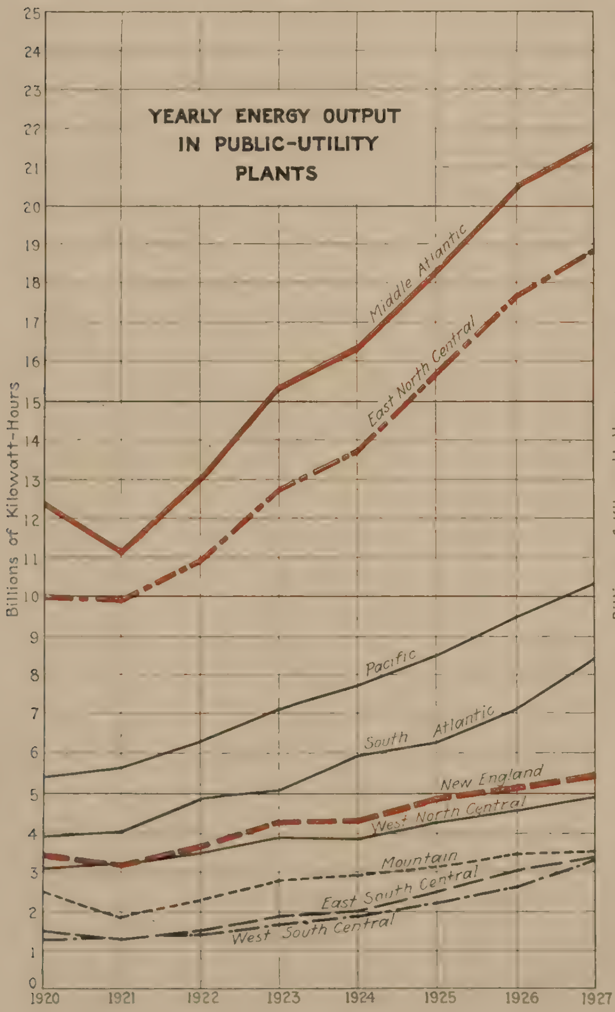
ELECTRICAL energy production is generally acknowledged to be a reliable indicator of industrial activity. Broadly speaking, those countries or regions which range high in this regard are conspicuous industrial regions; those in which the growth in energy output is relatively rapid are likely to be advancing at a corresponding rate industrially.

The accompanying curves of regional energy production in public utility plants of all kinds were plotted from statistics published by the United States Geological Survey. One is drawn to the ordinary uniform scale. It shows the three regions constituting the industrial belt along the northeastern portion of the country as comprising the great power-using section.

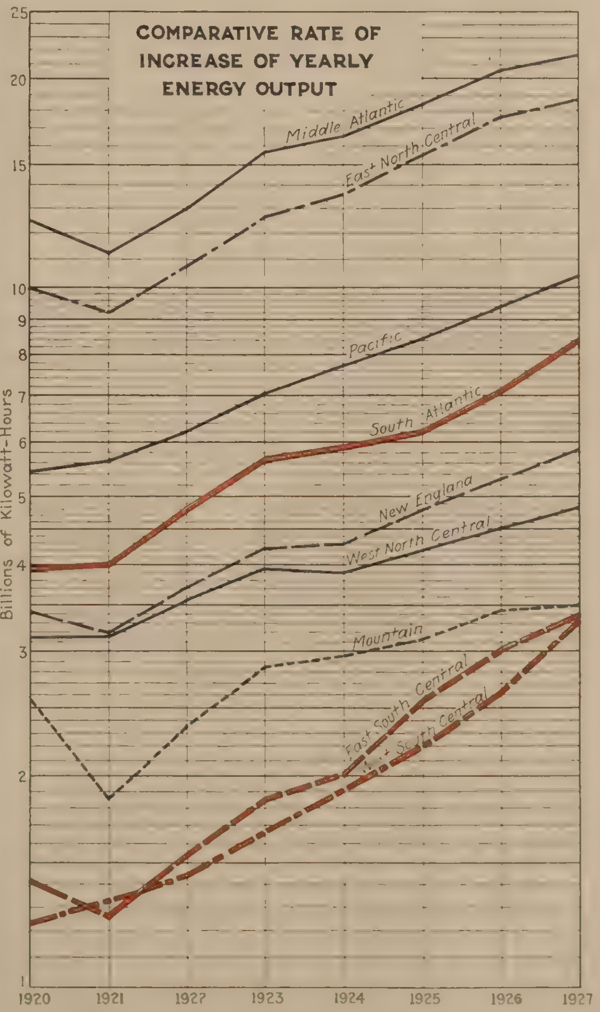
But the three Pacific States, with a smaller population than New England and about a quarter as populous as the Atlantic States, far exceeded these two regions in their relative use of electricity.

On the other chart the same figures are plotted, but to a scale that shows equal percentage growth by an equal slope of the curves, regardless of the actual amounts. The steepest slope indicates the fastest rate of increase.

A predominant position with respect to rate of growth is at once evident in the two South Central regions. The other Southern section, the South Atlantic, although much higher in absolute output, has had a slower rate of increase, but taken as a whole the South has been gaining in electrical output more rapidly than the rest of the country, with the Pacific States next in order.



*The industrial Northeast has the largest output*



*The "new South" has the most rapid growth*

# New England Production 2.7 per Cent Down During First Quarter

THE rate of general production in the New England States during the first quarter of 1928 was on an average about 2.7 per cent under that reported for the same period during 1927, as indicated by the consumption of electrical energy by some 400 large manufacturing plants scattered throughout the section. As has been the case during the last five years, the peak of operations in New England manufacturing plants as a whole this year was reached in February, the March rate of production, after correction is made for the number of working days, being about 6.2 per cent under February. The March activity was also 2.6 per cent under March, 1926.

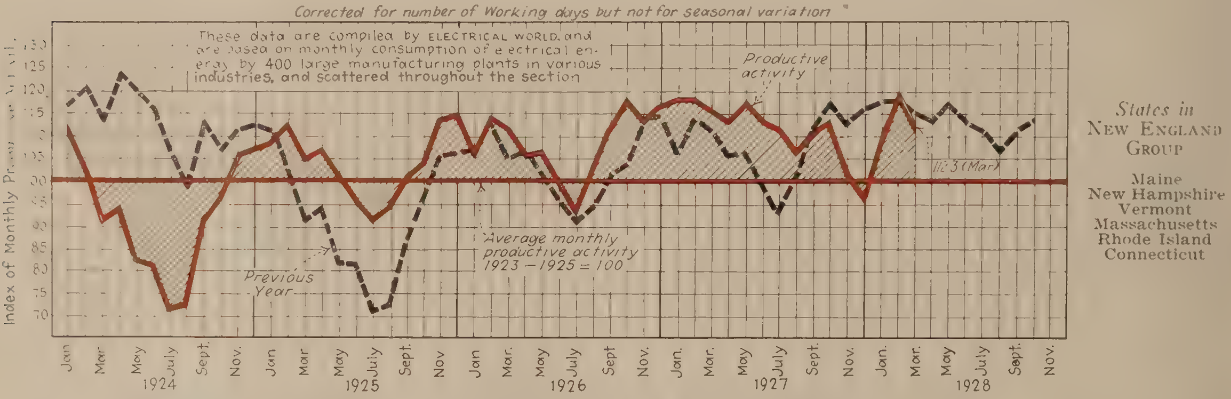
The favorable position of New England industry as a whole, however, is evidenced by the fact that all of the primary industries with the exception of textiles reported an average rate of production during the first quarter materially above that reported for the same period last year. Textile plants as a whole have been reporting a lower rate of production than the year previous ever since last September, the low point being reached in December, when the rate of operations was 22 per cent under December, 1926. The high weight given to the index of textiles activity serves to bring the index of general activity below that of the year previous.

*Indexes of Productive Activity in the New England States*

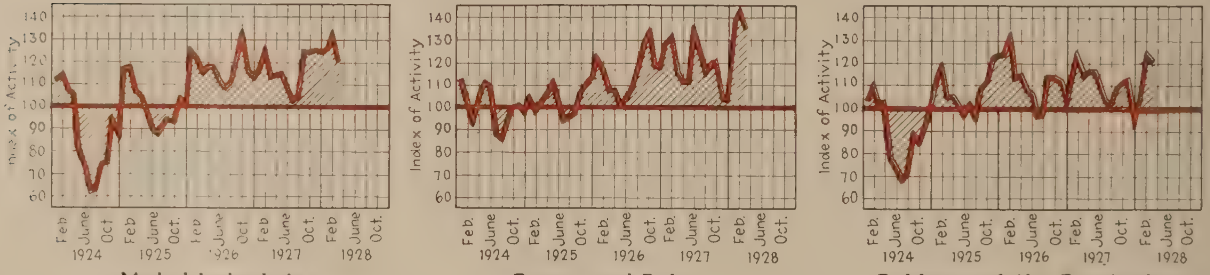
All Figures Adjusted for Number of Working Days

| | March, 1928 | Feb., 1928 | March, 1927 | Average for First Quarter, 1928 | Average for First Quarter, 1927 |
|---|---|---|---|---|---|
| All industry | 112.3 | 119.7 | 115.2 | 113.7 | 116.8 |
| Chemical and allied products | 134.8 | 135.8 | 102.5 | 130.2 | 113.7 |
| Leather and its products | 100.6 | 108.4 | 93.5 | 101.7 | 96.1 |
| Lumber and its products | 110.7 | 115.4 | ..... | 107.4 | ..... |
| Metal industries group | 120.6 | 133.1 | 113.7 | 126.5 | 118.7 |
| Paper and pulp | 136.2 | 143.0 | 116.0 | 139.4 | 125.0 |
| Rubber and its products | 120.4 | 126.0 | 114.8 | 117.8 | 116.5 |
| Textiles | 107.3 | 114.2 | 120.0 | 108.5 | 119.5 |

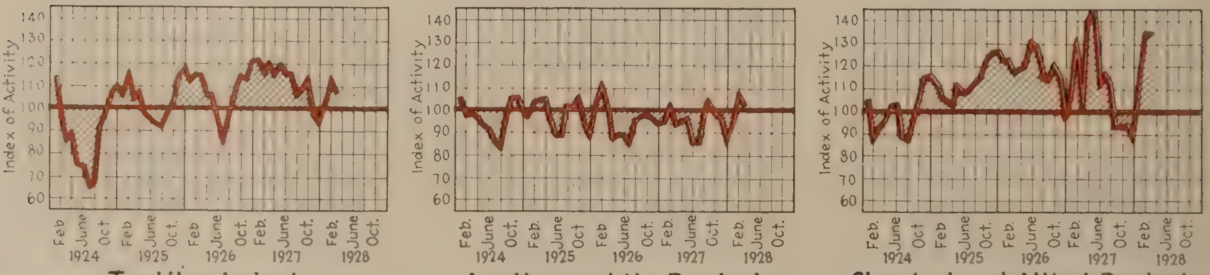
ELECTRICAL WORLD *Barometer of Industrial Activity in the New England States*



GENERAL INDUSTRIAL ACTIVITY IN THE NEW ENGLAND STATES



Metal Industries — Paper and Pulp — Rubber and its Products



Textiles Industry — Leather and its Products — Chemical and Allied Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NEW ENGLAND STATES

Electrical World

McGraw-Hill Publishing Company, Inc.
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*Editor*

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## *Social Values in Industrial Decentralization*

THE day of the single large production plant in an industrial center has passed. Both economic and social values have forced industrial decentralization. In a sense this trend is a by-product of technical progress, for electric power and electric machines make decentralization possible. Power can be delivered to a factory at a cost which is about the same in any part of the country. This power has been so used in machines and control mechanisms that any kind of labor can readily operate an industry after a very short period of training. Efficiency in production has come to mean a comparatively small plant wherein a single competent production executive has full scope to exercise his talent by direct control and scrutiny of all operations. Marketing efficiency dictates the use of multiple-production plants in local market areas tied together by a national sales and manufacturing policy. All these economic values are recognized and are being put to work in American industry.

But the social values are of equal importance, as pointed out by George M. Verity in this issue. The trend toward decentralization makes for better working conditions and a more equitable distribution of wages to workers. A factory in a small town raises all standards of living. The farmer on the outskirts can diversify his farming and better his load factor; the worker can have his garden and can walk to work; the factory payroll increases the prosperity of the community, and thus all inhabitants get an increment increase in wealth and consequently an increment increase in standards of living. As Mr. Verity points out, industry has an obligation to the utilities to use their power, because this use makes possible the extension of electric service to farms and small communities. In the ultimate balance sheet the mechanization of civilization will give equal value to social and economic assets.

* * * *

## *"Professionalizing" Public Relations Activities*

THIS is an age of extreme specialization and minute organization. The temptation to design complex mechanisms to attain results often within reach by simpler means is widely prevalent. It often assails those responsible for light and power company administration, for much of our modern thinking is based upon intricate systems of service. Little could be accomplished without proceeding from such a base, but mechanistic conceptions should not be followed slavishly. Public relations work, for example, is less a matter of machinery than of individual service and personal contact of employees and executives with customers and others. Good service at fair rates is basic, but, given this elementary requirement, the rest should follow without resorting to professionalized propaganda or building up a special organization to be the regular feature display of the company front window.

Organization for quiet, effective service within the company and the cultivation of friendly dealings with the public, yes; but no "ballyhooing" about "the fine department we have to build up good relations with customers" and no substitution of social welfare vernacular for simple business give and take. There should be no need of labeling the office doors of this department with anything but the names of those whose human understanding of their duties finds competent expression in their daily service in this important cause. Office machinery in its proper place, but in the long run the less the public thinks about the mechanism of corporate good will, the better. The ancient saying that Mark Hopkins on one end of a log and a student on the other created a university might well be paralleled by the statement that wherever a public utility employee and a customer meet on a plane of courtesy and fair intentions there is a public relations structure capable of being developed into an edifice of permanent worth and beauty.

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## *Resolutions Are Not Enough*

FOR a number of years the Natural Resources Production Department of the Chamber of Commerce of the United States has at the annual meeting of the chamber discussed natural resources with particular reference to electric public utilities. This year's meeting, held in Washington, again took up the subject, particularizing on group management and electric power and the investor, while the chairman of the department, M. S. Sloan of Brooklyn, stressed the water-power situation and legislation. The Natural Resources Production Department is, apparently, working hard, and yet, in spite of the airing of these vital public questions, business remains outwardly apathetic. Of what use are resolutions unless they are put in practice?

For example, the Chamber of Commerce of the United States is committed to the principle that government should not enter the realm of business to undertake that which can be successfully performed in the public interest by private enterprise. This principle it holds to be politically and economically sound. Nevertheless, the judgment of this organization, representing the collective business enterprise of the country, is apparently not regarded as of much weight by those who make the laws and those who administer them. Otherwise we should not have constantly thrust before us attempts to put the government into the electrochemical business, the fertilizer business, the coal business, the power business, the transportation business, etc. Would it not be proper at this time, considering the bent of Congress toward such legislation, for American industry to assert itself more vigorously on this question of government in business? We hold with the chamber that ruthless methods discredit all business and should not be tolerated. We believe that abuses should be checked and curbed in the public interest; but government ownership in any guise should not be sanctioned, however great the provocation. This, we feel sure, is the position of American business, and the Chamber of Commerce of the United States, without neglecting its other work, would render a great service to industry by arousing people to the danger which departure from this principle would bring upon the Republic and its institutions.

* * * *

## *Price Cutting— the Cause and Cure*

MANY men have been wrecked by living beyond their incomes. Many men live successfully within their incomes. The amount of the income has very little to do with it. It is a matter of principle, a practical matter of policy with a man whether or not he shall discipline himself and his household to the point where expenses shall be held within the family resources. It is, after all, a simple matter to understand, however hard it is to live up to the precept.

For all that men may say, it is precisely the same principle that is involved in price cutting. The only difference is that in business the sources and possibilities of the income and the character and diversity of the expenses are highly organized and much more complicated. But the control still lies in that same simple element of courage that enables men to pocket pride and face embarrassment and alter plans and win the loyal co-operation and support of the others who may be affected. In family life it entails the sacrifice of pleasure and comforts. In business life it entails the sacrifice of volume, the curtailment of production and sometimes the reduction of the organization. Either is hard to do and usually should not be done if by effort and ingenuity overhead costs can be cut or the income can be increased. Price cutting is like running up unpaid bills. It saves face temporarily and feeds false hope, but if carried too far leads to disaster.

At the present time American industry is volume-mad and electrical manufacturers have been afflicted with the epidemic. To get volume of sales too many of them are cutting prices and sacrificing profits in a struggle to maintain a condition of overproduction by striving to snatch the order away from the other fellow and keep the factory operating at full capacity. The trouble is that in industry it does not stop there. For cut prices lower market levels and demoralize values because other sellers feel obliged to cut, and soon profitless prices become established and are temporarily unescapable. And yet some manufacturers refuse to scramble for orders this way. They don't cut prices. If they cannot get business on a basis economically sound, they let somebody else take it. They reckon the prestige of their product to be worth more than their natural pride of volume. When they face a period of buyers' market they recognize that the only cure is limited production and they shoulder their responsibility. They live within their income.

Price cutting is primarily the false fruit of a state of mind. The seller indulges in it to save volume. The buyer sees in it an opportunity to save money. And in the end both lose.

## *Astral Analysis by Atomic Emissions*

IT IS known that the emission and absorption spectra of stars permit a chemical analysis of their constituents to be made. Not content with this knowledge, research workers have made recent advances in atomic physics and spectrum analysis that give promise of a knowledge of the physical conditions of the stars. Each star gives a continuous spectrum as well as absorption and emission line spectra, and these two facts are seized upon by research workers to find out whether these spectra come from solid, liquid or gaseous masses.

The method used in the application of atomic physics to the exploration of these stars consists in the correlation of the temperature and pressure of the fixed stars with definite excitation energies obtainable in laboratory experiments and, further, in the comparison of the spectra emitted in these laboratory experiments with those of the fixed stars. Results are not complete, but data are accumulating rapidly. These researches afford more proof of the basic nature of electricity and its importance as a research tool.

* * * *

## *The New-Old Idea in Industrial Lighting*

IT WOULD be absurd to liken present practice in industrial lighting of the best types to that of twenty years ago, when the present illuminating engineering movement was fairly getting under way. But the pendulum swings in engineering practice as in other things, and at the present time we are at the beginning of a new swing which to a certain extent is back in the direction of the localized lighting so common in days past. This localized lighting, however, is so different from the old as hardly to be recognizable as having points of similarity. The old practice in factory lighting of hanging a lamp on a drop cord over each place where work was to be done, supplemented in some of the better factories with arc lamps to give a background of general lighting, has changed in the last twenty years to general lighting of high enough intensity to do away to a large extent with the necessity of localized lighting. The cheapness of light and the desirability of doing away with troublesome drop cords have been important factors in bringing about this change, as well as the increased productivity and cheerfulness and the avoidance of accidents that go with a system of adequate general lighting.

General lighting by uniformly spaced luminaires with spacings and mounting heights according to the commonly accepted rules of good practice is giving excellent results as compared with the old methods, but the intensity of illumination by the general lighting method must be sufficient to meet the most exacting requirements to be found anywhere in the entire area. Our knowledge of the lighting intensities necessary for the best and most rapid work has now progressed to a point where it becomes evident that for operations on dark materials, under some circumstances, intensities of 30 to 100 foot-candles are economically desirable and are being used instead of intensities of about one-tenth those values, which were previously considered very excellent general illumination.

The attention of designers is again naturally led to producing these relatively high intensities at the points where such high intensities are needed without the expense of producing them over the entire working area. It may be cheaper and more satisfactory to produce a fairly uniform intensity of 10 foot-candles, for example, over an entire working space than to resort to the complications and inconvenience of providing luminaires for localized lighting to get 10 foot-candles at certain designated working points, with the general level at other places much lower. With the cost of artificial light as it is at present, the possible savings in operating and wiring costs by the latter method may easily be offset by the interference with production. With ten times as much illumination required at certain critical working points it is easy to see that the answer to the problem may be different as the cost of light becomes larger in proportion to the labor factor of the production cost.

Along with this trend to localized lighting has very properly come a more careful study of what lighting conditions produce the best vision in specific cases. Mass production operations are now carried on upon a scale that justifies much thought and attention being directed to just how to produce the best visibility for the worker at any given step in a process, rather than simply "smearing around the foot-candles" promiscuously and trusting to luck that the job will be really well lighted. Dr. Percy W. Cobb of Nela Park has repeatedly urged this from the laboratory scientist's point of view in Illuminating Engineering Society papers the past three years, and the practical importance of such studies of quality in industrial illumination was most strikingly brought out by the paper on "Quality Industrial Lighting," written by Arthur A. Brainerd and abstracted in the ELECTRICAL WORLD of February 4. In this paper, which won the McGraw award at the N.E.L.A. convention last year, various examples are given where the quality of illumination as to uniformity and shadows and the contrasts of the objects being worked upon with the background were very important factors and where increase of illumination intensities without looking to these factors would give disappointing results. From which it is apparent that, although illumination design methods have been remarkably simplified and standardized in the past few years, there is still plenty ahead for the advanced lighting expert to do in the way of helping the manufacturer to get the conditions which are best for visibility in various processes.

* * * *

## *An Uncompleted Job*

IN A STATE that shall be nameless and in a year that does not matter an electric light and power company decided to build a hydro plant in a certain valley. It was a partly wooded, farming country and, being free from "hot-dog" stands and gasoline filling stations, was easy to look upon. The utility, being community-minded, designed a dam and power house that would be a creditable addition, if not an improvement, to the countryside. As is so often the custom, the highway, formerly at a lower level upstream, was diverted to cross the dam, and when the project was completed it brought many motorists to the property of the power company and its well-planned hydro-electric project. During the process of construction barracks were erected on either side of the valley directly adjacent to the dam, and since certain fine old oaks and pines stood in the way they were cut down. Natural sand pits were at hand, and great yellow gashes on the hillsides told of the removal of construction material. When the job was completed the barracks were torn down, and the engineers, by industrious figuring, announced a cost of $185 per kilowatt and congratulated one another upon the completion of so fine a job, economically done.

What was the cost of that station? Should it not have included the planting of small trees to take the place of those removed? Did it not properly require provision for the filling in of the cellars and foundation areas of the dismantled structures? Should the raw, telltale pits remain as mute evidence of an uncompleted task that a few hundred bushes would have soon brought to a conclusion? Less than one per cent increase in cost would have accomplished wonders in skilled hands. It is, assuredly, a passing day when thoughtless, unconscionably poor economics permit the establishment of a final cost which omits an adequate cleaning-up process. It is an unfortunate day for the utility that neglects a magnificent public relations opportunity that shrieks, not knocks, at its door.

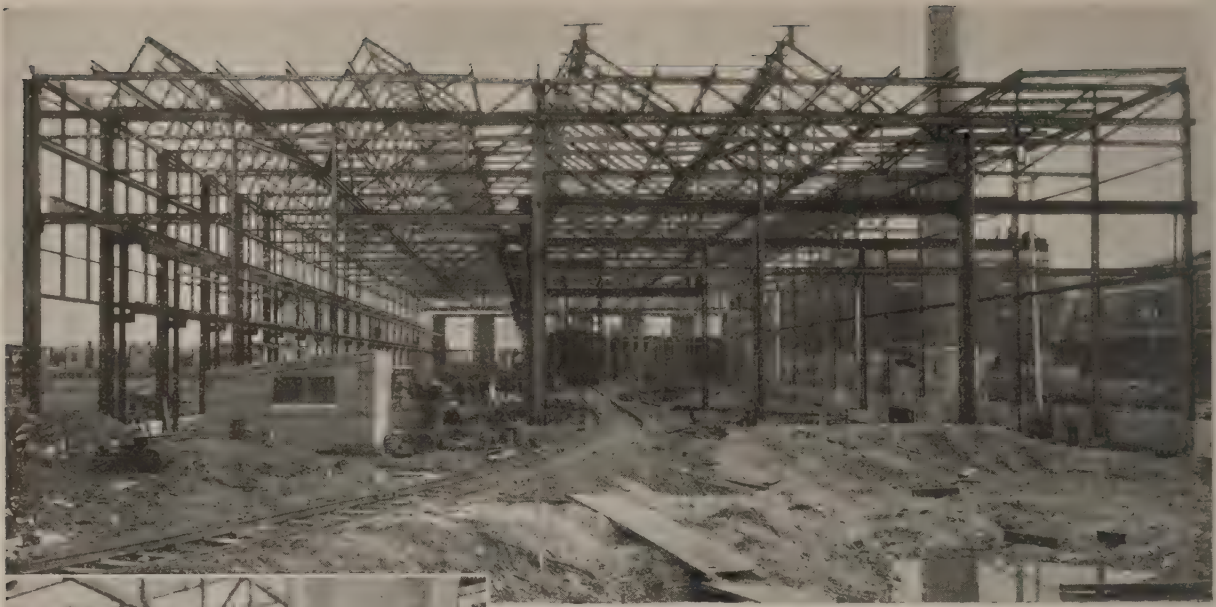
* * * *

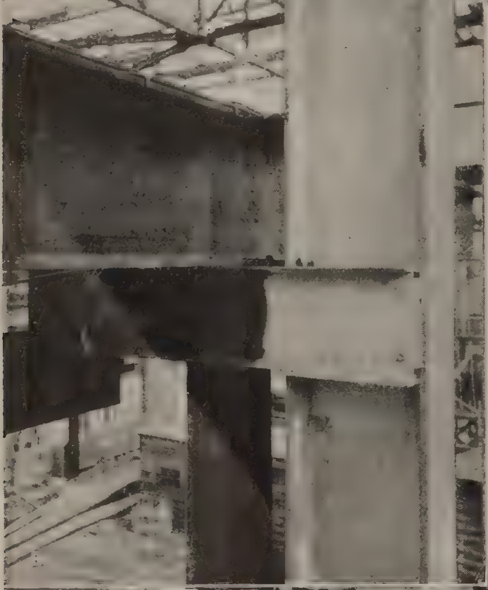
## *Modern Legerdemain*

THERE is always something fascinating about the sleight-of-hand performer and his amazing series of impossible tricks. Even the small boy, however, realizes that twenty pink rabbits cannot be contained simultaneously in the one silk hat from which they are apparently drawn, and that the bowl of goldfish has not vanished into the air when the mystic passes have been completed over the soft blue cloth. Why are some power-station engineers so ingenuously credulous about their ability to cause equally tangible materials to disappear without trace? It is apparent that the goldfish and the non-oxidizable content of the coal burned in pulverized-fuel plants have both disappeared from view, and it is equally certain that they still exist somewhere.

A steam generating station utilizing 500 tons of coal a day with a conservatively estimated ash content of 6 per cent has 30 tons of solid material to dispose of properly whether a stoker-fed boiler or pulverized-fuel equipment is used. Some of it will inevitably reach the open air; with stoker-fed furnaces this is relatively limited. It is amazing to hear engineers who have lived and worked through the era that has minimized the smoke nuisance state that they do not know where the ashes go and that there is an almost negligible quantity of which to dispose. The ashes, as any one on the leeside of the plant and possibly many miles away can tell you, are floating gently down on the countryside. Ten or twenty tons of impalpables per day constitute an amazing contribution to the community, however clean and sootless this powder deposit may be.

Official data of test runs in one pulverized-fuel installation where special precautions have been taken to control ash deposits indicate that while an average of 3.68 per cent of the dry coal is reclaimed as slag from the combustion chamber, the total flue refuse per pound of dry coal burned amounted to 0.0994 pound. Slowly indeed has industry learned that refuse is not disposed of when acids and dyes are poured into previously attractive streams, that smoke pollution of the air is a civic offense, in addition to being unprofitable, and that valleys were not made for refuse pits. The past points the way. Ashes must be disposed of, not blown into the air and forgotten by all but one's neighbors.





# *Arc-Welded Building*

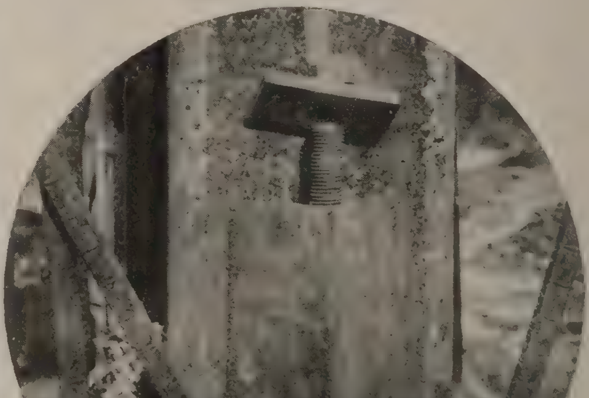
A SAVING of 125 tons of steel was made possible by arc welding the frame instead of riveting. A total of 989 tons of steel was used, of which 745 tons passed through the welding shop of the American Bridge Company at Trenton, N. J. The building is being erected by the U. G. I. Contracting Company of Philadelphia for the General Electric Company at its new plant at Philadelphia.

A—View from rear of building. It is joined by a transept to the existing building seen on the right.

B—Details of crane runway brackets. Bolts were used in some cases to hold the frame in place before welding.

C—Welding a crane column to its base.

D—Method of connecting column to anchor bolts, utilizing steel angle welded to column.



# Politics and the Colorado River

## Scheme to inject federal government into power business disguised as safeguard against Imperial Valley floods

By H. I. Harriman
*President New England Power Company, Boston, Mass.*

*H. I. Harriman*

UNDER the guise of a beneficent plan to protect the Imperial Valley of California against floods from the Colorado River by damming that stream at Boulder Canyon, developing hydro-electric power for transmission to the Los Angeles district and constructing a water supply from the Colorado Basin to serve a future population of 5,000,000 in southern California, it is proposed to launch the United States government into the power business at enormous cost and with all the uncertainties which beset vast political undertakings entered into without due regard to economic factors which should control action in such a situation.

A proper understanding of the problem of the Colorado River demands a brief explanation of the topography of its basin and the characteristics of its river flow. The Colorado Basin lies between the Continental Divide and the Coast Range. It includes southern Wyoming, parts of Utah and Colorado, the western half of New Mexico, substantially all of Arizona and slight areas in Nevada and California. Its area of more than 200,000 square miles is a territory larger than the German Empire and comprises about one-thirteenth of the entire area of the United States. It is a land of extreme variations in rainfall, in elevation and in the character of the country. The northerly part of the basin is highly mountainous and heavily timbered, a territory of warm summers and cold winters, a land of deep snowfall, a region that stores snows of winter and pours them forth in irresistible floods in the early summer.

The middle section of the Colorado Basin is a territory of low rainfall, six or seven inches; of high plateaus and of vast canyons. In no place in the world are there such deep, marvelously colored and wonderfully beautiful gorges and canyons.

The southern portion of the basin is a desert country, relatively low in elevation, with a rainfall varying from three to four inches, and of tremendous summer heat, 115 to 120 deg. being not unusual temperatures over much of this southern area in the months of June, July and August.

Irrigation is of tremendous importance in the arid West. The normal annual flow of the Colorado River is about 17,000,000 acre-feet, extreme years ranging from 9,000,000 to 25,000,000 acre-feet. Storage of water is vitally essential. The normal flow will irrigate about 5,000,000 acres, but in extremely dry years only half that area can be served. The Reclamation Service estimates that in the United States basin of the river about 7,000,000 acres could be irrigated if the water supply was sufficient. To this we must add about 1,000,000 acres in the delta region of Mexico. Already about 2,500,000 acres in the United States basin is irrigated, plus 200,000 in Mexico.

In 1921 representatives of the various states in the basin convened to draw a treaty which would definitely divide the waters of the river between the various states and permit the development of storage without fear that the states not benefited would be deprived of the future use of their just portion of the water.

The conference, while only partially successful, agreed that the four upper basin states should always so regulate their takings for irrigation that over a ten-year period an annual average of not less than 7,500,000 acre-feet should pass Lee's Ferry for use by the three lower basin states, and to this was added 1,000,000 acre-feet for the use of the lower basin states represented by the flow of the Gila River.

Unfortunately, the treaty did not attempt to divide the waters between the various states in the upper and lower basins, and so far Arizona has failed to ratify the treaty, fearing that without an agreement with California it would be unsafe for her (Arizona) to consent to a divi-

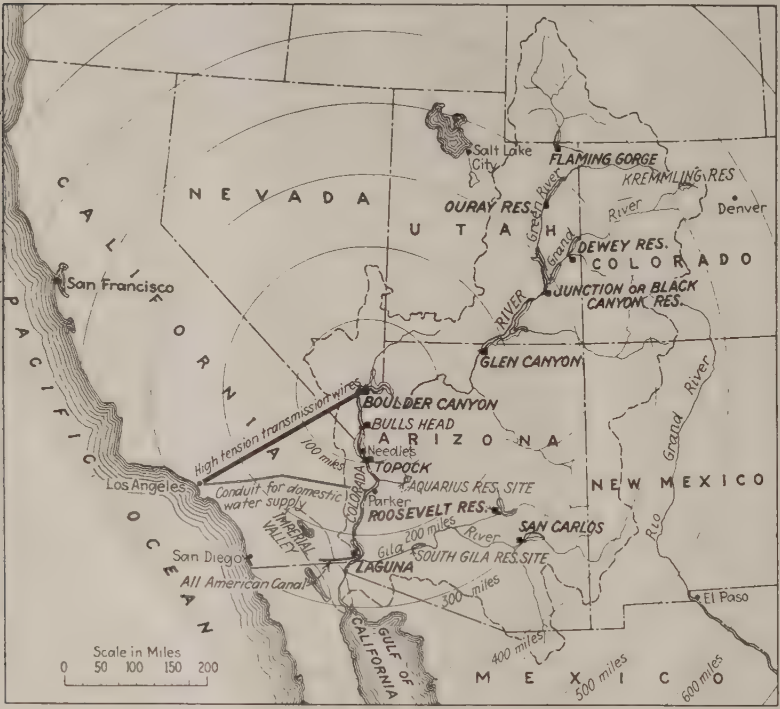
### Sound Expert Advice

*IMPRESSIVE because restrained and convincing because it offers a constructive program based on competent personal investigation on the ground, Mr. Harriman's analysis of the Boulder Dam project and the related political program for utilizing the Colorado River at the expense of the federal government deserves careful reading by every friend of individual initiative in the United States.*

*Mr. Harriman shows most effectively how protection against floods can be attained at a cost far below the anticipated outlay required to embark the federal government in the power business as a gigantic byproduct of an apparently innocent scheme to regulate and utilize stream flow in a basin occupying one-thirteenth of the area of the country.*

sion of the waters between the upper and the lower basins unless simultaneously a treaty were enacted between California and Arizona giving Arizona protection against the immediate appropriation by the Sunset State of more than her share of the flowage into the lower basin states. California's ratification is conditional only and is to be made effective if the United States creates a huge storage reservoir on the lower river.

The upper basin states demand ratification without reservations. The cost of placing water in the Imperial Valley of California is probably not over half the cost of delivery to the high table lands of Arizona, and until there is a division of the water to which the lower basin states are entitled Arizona will probably refuse to ratify the treaty. Both Arizona and the upper basin states fear that Mexico will put to prior use much of the water that otherwise might be used on United States land. Water is the lifeblood of these states and each state fears that Mexico or some other state will deprive it of a part of the water that it might otherwise use and doom a portion of its territory to perpetual desert.



*Colorado River basin center of political discussion*

In the canyon section of the river 6,000,000 hp. can be developed on a 60 per cent load factor. This exceeds the energy that can be developed on the St. Lawrence River or at Niagara Falls. Today there is little market for this potential power, as the territory is very sparsely settled with no industry and no local use. Only the lower section of the river lies within transmission distance of the large electrical market of southern California, but to any one who visualizes the phenomenal engineering and industrial progress of the last 50 years it is not difficult to imagine that the entire potential power of the stream may be used within the next half century.

The danger of a break of the river into the Imperial Valley is ever present and the homes of 60,000 people with a taxable value exceeding $100,000,000 will be in constant danger until the federal government takes adequate steps to open a new and proper channel for the sea. Storage on the main Colorado River would of course reduce the flood menace to this valley, but the threat of floods from the Gila will still exist and the valley will never be safe, storage or no storage, until a new and adequate channel is cut to the Gulf.

Competent engineers affirm that if the United States and Mexico execute a proper treaty a new channel can be cut at a cost not exceeding $5,000,000 substantially parallel to the original channel of the river, which will safely carry the floodwaters of the Colorado to the Gulf without menace to the Imperial Valley and without danger of undue silting.

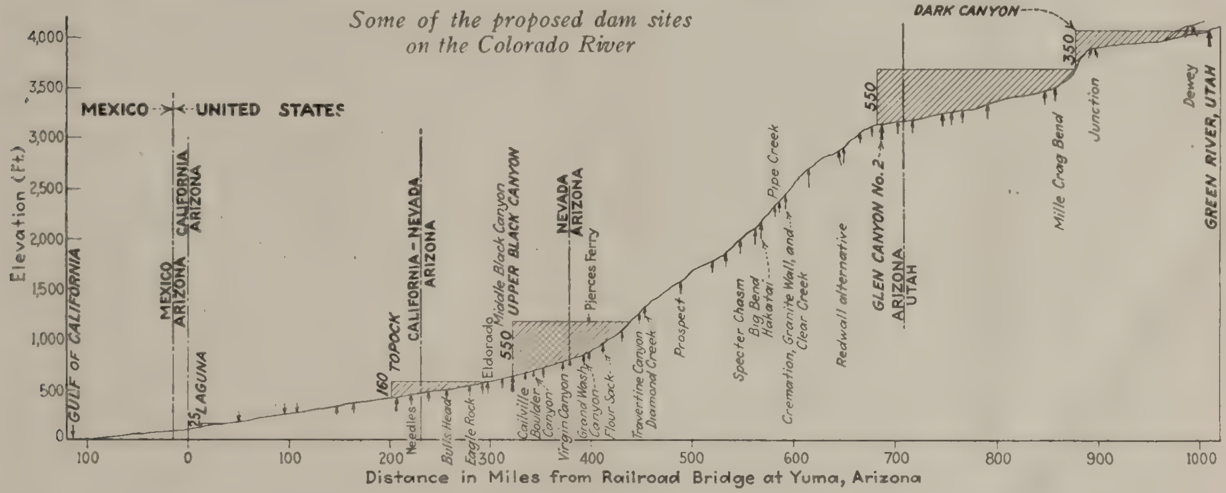
We turn now to consider measures pending in Congress for the construction by the federal government of a huge storage dam near Boulder Canyon, the creation of a 1,000,000-hp. plant and the digging of an all-American canal to turn the waters of the river into the Imperial Valley through a channel lying in the United States alone.

The Reclamation Service estimates the total cost of the above projects at $125,000,000. Others have estimated the cost at double that amount, but whatever the cost, it will be by all odds the largest business adventure within the boundaries of the United States which the federal government has ever attempted.

The merits and demerits of this proposed all-American canal involve a long story which will not be entered into here. Suffice it to say that a Board of Government Engineers has reported the canal to be feasible at a cost of approximately $31,000,000, but it also suggested that if the canal were to be built and a larger area of land watered storage would be necessary against the low water season.

The search for storage aroused the interest of Los Angeles. The managers of the municipal electric system there had for some time been perturbed over the necessity of buying from a private corporation a major portion of the electricity that it sold to its customers. The citizens were not, however, prepared to vote a huge bond issue that would enable the city to develop its own hydro-electric system and the suggestion of storage on the Colorado for the benefit of the Imperial Valley seemed to open the possibilities of federal aid. Astute politicians combined forces and one step has led to another until the early plan to irrigate a few thousand acres of mesa lands above the Imperial Valley has developed into a project to secure federal construction of an irrigation, storage and hydro-electric development of enormous proportions. This project is claimed to be the only sound method of protecting the Imperial Valley against floods, which have twice swept into it and which now threaten its existence.

It is universally conceded that the federal government should take adequate steps to protect the Imperial Valley from another disastrous flood. The valley is menaced, not primarily because of the size of the Colorado flood, but because the original stream bed of the river became clogged during the two years or thereabouts when it flowed into the valley. Recently American engineers, in consultation with Señor Mejorada, a distinguished Mexican engineer, have revived and improved the plan for an adequate channel protected by levees from the international border to the Gulf and they estimate its present cost at $5,000,000. If this plan is carried through the Imperial Valley will be adequately protected against all floods and a channel provided which will maintain itself by natural erosion and with little, if any, annual cost. It is a plan approved by Mexico and undoubtedly the United States government can secure the right for the construction and maintenance of this channel if proper representations are made at Mexico City. Yet we hear nothing of this project, though it is the least expensive and most adequate plan for protecting the Imperial Valley against floods.


*Some of the proposed dam sites on the Colorado River*

This channel is needed whether or not storage is constructed on the main Colorado River, for the Gila River and other streams entering below the proposed site of the Boulder Canyon dam produce short floods of as great height, but of less duration, as those of the main river. The Boulder Canyon project would in no way protect the Imperial Valley from the Gila River floods.

The most available site for storage is probably the Mojave Canyon site below Needles, sometimes known as the Topock site, where a dam of moderate height will impound 10,000,000 acre-feet at a cost estimated between $10,000,000 and $15,000,000. This project was seriously recommended some year ago by Secretaries Weeks, Works and Wallace, who then comprised the Federal Power Board. It did not meet with favor in southern California because it did not include a great power development or an all-American canal.

Storage should, of course, be created in the upper stretches of the river above its rapid drop so that the flow may be regulated and conserved for all the potential power plants of the stream. In the upper basin there are two or three sites at which large storage can be created, and on the main river there are three additional sites. Of these last, at the upper site, Lee's Ferry, where 20,000,000 acre-feet can be stored and the river regulated to an even flow of about 15,000 second-feet, the most desirable location appears to exist for a great storage reservoir. This is at the head of the canyon section of the main river and would make possible the development of the entire stream for power. A second site is at Boulder Canyon, or Black Canyon, where a storage of equal size can be created, and finally there is the Topock site below Needles, in the Mojave Canyon, where a reservoir of any size up to 20,000,000 acre-feet can be created. A storage of 6,000,000 acre-feet is more than sufficient to prevent destructive floods on the lower river.

With the floods of the main river regulated by a reservoir at Lee's Ferry the construction problem of all the lower dam sites on the river will be greatly simplified. Preliminary borings indicate rock of a suitable character, but much further detailed study should be given to this site before any work is started.

A dam at Boulder or Black Canyon, near the foot of the rapid water of the Colorado River, is also probably feasible, although the bedrock is so far below the water level as to make the problem of building the foundation under a torrent rushing through a box canyon quite unprecedented and some engineers say all but impossible.

The storage capacity of Boulder Canyon will be of value in regulating the stream for any power plant located at that dam, or for further irrigation in the Imperial Valley and in Mexico, but it will have no value for the great power plants which will eventually utilize the main power of the river. At some time in the future storage must be created either at Lee's Ferry or in the upper basin to regulate the flow of the Colorado for the thirteen or fourteen power plants which will ultimately be built to utilize the fall in the Grand Canyon. When this upper storage is created the storage at Boulder Canyon will be unnecessary and the Boulder Dam will become a power dam without other function.

At the Topock site a storage of from 6,000,000 to 10,000,000 acre-feet can be created at a cost of from $10,000,000 to $15,000,000, or a storage up to 24,000,000 acre-feet at a corresponding additional cost. A 6,000,000 acre-foot storage will be of ample size to reduce the floods on the main river to a point that will in no way threaten Imperial Valley and substantially to increase the low water flow of the Colorado during the irrigation season, but no great amount of power can be developed at Topock. For this reason this project has not appealed to the managers of the municipal plant of Los Angeles, who desire to have the federal government supply them with electrical energy, or to the promoters in the Imperial Valley who wish to have the carrying charges of the all-American canal met from the sale of power.

The Boulder Canyon project is a power project pure and simple and is an effort to inject the federal government into the business of generating electricity. Boulder Canyon is not the proper location for a storage dam for the regulation of the main river. A river should be regulated at the head of its rapids and not at the foot. Again, the Boulder Dam is entirely unnecessary for the protection of or for irrigation in the Imperial Valley because both of these objects can be attained at a small fraction of the cost of the Boulder Dam by the construction of a dam at Topock.

### Boulder Dam in Its True Light

Let us examine the Boulder project in its true light as a project to force the federal government into an investment of not less than $125,000,000 for the purpose of generating power for the cities of southern California and for the further purpose of building an all-American canal which the Imperial Valley cannot afford to carry.

If the project is carried out there will be developed at Boulder approximately 1,000,000 hp., or 750,000 kw., on a 55 per cent load factor. This means the annual production of about 3,500,000,000 kw.-hr.

The Federal Power Commission, which has carefully examined the market for Boulder energy, estimates that it will take southern California from nine to ten years to absorb this block of power after delivery is begun. It further estimates that the cost of Boulder power delivered at Los Angeles, including all transmission costs and losses, will be between 4¾ and 5 mills per kilowatt-hour. This is on the assumption that the Boulder project, including the all-American canal, will cost not exceeding $125,000,000. If the cost of the project should exceed that amount the cost of energy delivered in southern California would be increased proportionately.

### Steam Power Costs Decreasing

The cost of power from Boulder Dam in fairness should be compared to the cost of power generated in a modern steam plant near Los Angeles. The Southern California Edison Company is now producing power, all charges included, in its Long Beach plant at slightly less than 4½ mills per kilowatt-hour. In its new and improved plant now under construction it is expected that the cost will be reduced to 3⅞ mills per kilowatt-hour, and in view of the remarkable strides that are being made in increasing the efficiency of steam plants it is not fanciful to imagine that the cost of steam power in southern California, with oil at its present price, will be approximately 3 mills at the time when the Boulder Dam project can be completed. Even if the oil supply of southern California is exhausted and it is necessary to turn to Utah coal, energy cost should not exceed 4 mills per kilowatt-hour. Thus the power users of southern California will be paying a mill a kilowatt more for Boulder energy, with the uncertainties of long-distance transmission, than for steam energy generated at their door. This will mean an annual loss of $3,500,000 and it may be twice that amount.

Boulder power at 4¾ mills is based upon the assumption that the dam itself can be built for $40,000,000, yet it must be recognized that the project is one of great hazard, that a dam 550 ft. high has never as yet been constructed, that it is necessary to go 127 ft. below the channel of the river in order to find bedrock and to excavate perhaps 20 or 30 ft. into this bedrock, thus making the total height of the dam from bedrock to crest nearly 700 ft., and that the work of clearing and preparing the foundations must be done in a stream less than 300 ft. wide and carrying each year floods of half the volume of the water which passes over Niagara Falls, and in some years a flow equal to the flow of Niagara. Competent engineeers have estimated the cost of the Boulder Dam at from $90,000,000 to $100,000,000 and some say that the project is almost impossible of accomplishment because of the unsurpassed difficulties in building such a huge dam in such a narrow gorge carrying such enormous floods.

It is urged that stored water from the Colorado River is necessary in order that Los Angeles and the other cities of southern California may have adequate domestic water supply. Los Angeles now gets its water supply from local sources and from the Owens River, and the best engineering evidence would indicate that this supply can be doubled before it is necessary to turn to the Colorado. Obviously the water of the Colorado should not be used by Los Angeles until every other source has been exhausted because of the great distance which it must be carried and the fact that it must be pumped over a ridge of the coast range 1,500 ft. high. When the population of Los Angeles reaches 5,000,000 it may be necessary for her to secure a part of her water supply from the Colorado, but even Western optimism must admit that such a contingency will not arise for several decades.

It is further urged that the Boulder project is required in order to protect the Imperial Valley from floods, yet we have seen that this protection can be supplied in other ways at a fraction of the cost.

Again, it is stated that Boulder power is required by southern California. While admitting the great growth of the power demand of the Sunset State, we have seen that its power requirements can be furnished at a very much lower cost from steam.

Finally, the need of additional stored water for irrigation is stressed. Such additional supply can be had at moderate cost from the Topock Dam, and further engineering study will reveal where the main storage of the Colorado should be located.

### A Sane Program

What, then, is a sane program for the development of the Colorado River? The one pressing need is the protection of the Imperial Valley from floods. This protection can best be supplied by the construction of a suitable channel from the international border to the Gulf of California, and it is suggested that the first step should be the negotiation of a treaty with Mexico providing for the construction of such a channel.

As a second step the Topock Dam should be constructed both for flood protection and for irrigation. The construction of this dam requires no treaty with Mexico and work on it can be started at once.

The new channel and the Topock Dam can together be constructed at a cost of from $15,000,000 to $20,000,000 and together they will protect the Imperial Valley from floods and they will furnish it with such additional irrigation supply as may be required in the next decade.

With these two projects under way the Engineering Corps of the United States Army, assisted, possibly, by other engineering departments of the government, should be given an adequate appropriation with which to make a complete study of the entire river. Such a study should include borings at all possible dam sites, complete surveys and a comprehensive plan which will most efficiently provide for the future development of power and irrigation. Such a program is sane, constructive and relatively inexpensive and will avoid costly mistakes and a wasteful use of one of the greatest resources of the far West.

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## System Frequency Control

By C. P. Hubbard
*Chief System Operator Detroit Edison Company, Detroit, Mich.*

FREQUENCY regulation of the Detroit Edison system is controlled by the largest power house under orders from the load dispatcher. The ratio of system capacity held in reserve for regulating purposes to capacity in actual use is about one to eight. That is to say, the amount of idle capacity floating on the line and available for regulation is approximately one-eighth of the total load. Each power house carries a definite percentage of the total system load. This figure is given by the load dispatcher each half hour, or, in case of sudden load changes, every fifteen minutes. If the regulating power house should be subjected to a sudden rise in load between normal load instructions the switchboard operator in the power house informs the load dispatcher and a new allocation of the total load is made. In a case of this kind the controlling power house continues to regulate at the rise in load until the new allocation is made by the load dispatcher.

In order to restore system frequency to normal after emergency, such as switch trip-outs or loss of generators, the proportionate parts of the system load are put on reserve capacity, which is always available at all power houses. Reserve capacity is never allowed to get below a point at which the largest generator in the system might be lost and the frequency still maintained. Under certain emergency conditions the controlling power house relinquishes frequency control and it devolves upon one or more of the other power plants. Such an emergency would be a separation of the various system units by which a unit which may be in trouble is dropped out and the others continue to function as independent elements. In cases of extreme trouble a lower limit of 54 cycles has been set as the frequency at which a beginning should be made in dropping customers off the system in order to lighten the load.

In the control center, which is the system operator's office, a Westinghouse centrifugal recorder, type RF, is the master frequency control of the entire system. This meter gives a very accurate record of frequency variation on account of its sensitivity and the width and rate of travel of the chart. The company does not sell telechron or synchronous clocks to its customers, but these are used in the stations and power houses and on various types of demand meters on customers' premises. The master clock is corrected once each day by raising or lowering the system frequency very slightly. Adjustment is seldom necessary as the frequency is held practically constant. The Detroit Edison Company has at this time only one major interconnection, with the Consumers Power Company, made early in 1928. The Detroit company regulates the frequency of both systems.

## Unique Bridge for Locating Cable Faults

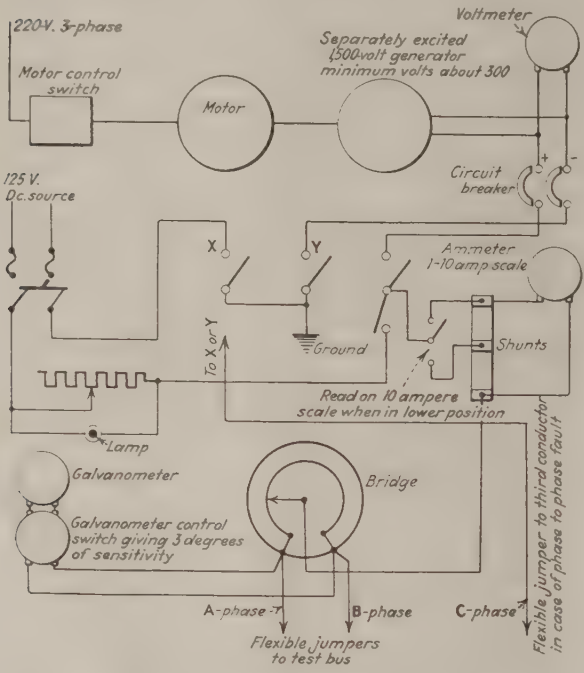
By Charles H. Smith
*Department of Standardizing and Testing*
*Edison Electric Illuminating Company of Boston*

THE Boston Edison Company has recently installed at its Edgar station a specially designed apparatus for locating cable faults by bridging. The outfit is composed principally of two main units, a very sensitive bridge with separately mounted galvanometer and an auxiliary motor-generator set for supplying direct current at 1,500 volts. For low-resistance faults a 125-volt direct-current source, provided with a series rheostat for current control, is used instead of the 1,500-volt source. The bridge and other parts of the equipment are insulated for 1,500 volts.

*Panel-mounted bridge and accessories for locating cable faults*

The bridge proper was furnished by the Rawson Electrical Instrument Company, Cambridge, Mass. It consists of a helically wound slide wire approximately 30 ft. long shrunk upon a bakelite drum. The operating lever makes ten complete revolutions as the slide moves from one end of the wire to the other, each revolution being indicated by a second arm geared to the operating lever. As the scale is divided into 1,000 divisions, each division represents one ten-thousandth of the cable length. As the length of the longest cable line from Edgar station is about 57,000 ft., each division represents not more than 11.5 ft. of cable.

In order to test the sensitivity of the bridge, a test was made on a line approximately 58,000 ft. long, with an artificial fault introduced at 10,000 ft. With a solid fault and 2 amp. flowing through the bridge a galvanometer deflection of one division represented less than 1 ft. of cable. With a fault of 1,500 ohms and only 0.075 amp. flowing a deflection of one division represented 10 ft. of cable. Thus it can be seen that very accurate bridging is possible with this type of bridge.


220-V. 3-phase
Motor control switch
Motor
Voltmeter
Separately excited 1,500-volt generator minimum volts about 300
Circuit breaker
+
-
125 V. Dc. source
X
Y
Ammeter 1-10 amp scale
Ground
To X or Y
Shunts
Read on 10 ampere scale when in lower position
Lamp
Galvanometer
Bridge
Galvanometer control switch giving 3 degrees of sensitivity
A-phase
B-phase
C-phase
Flexible jumpers to test bus
Flexible jumper to third conductor in case of phase to phase fault

*Power bridge simplifies locating of cable faults*

Its chief advantage over other bridges, however, lies in the fact that by the use of the 1,500-volt generator, even on very high resistance faults (i.e., faults of 100,000 ohms or more), the current can be brought into the range of the bridge. For example, at the time of the above tests, it was found that a fault as high as 500,000 ohms could be located within one cable section by the use of the 1,500-volt sources. This is a very great advantage when a joint blows open under water, resulting in a high-resistance water fault. Use of the bridge enables a troubleman to go to the approximate location and by inspection of a very few manholes locate the blown joint.

Another unusual feature in this installation lies in the fact that the connections are all made to the cable through a permanent test bus. The leads from the bridge terminals and from the ground, where one is needed as in the case of a phase-to-phase fault, are all rubber-insulated leads attached to long wooden operating rods. These have clamps which can be attached, from the floor below, to the bare test bus in the ceiling of the test room. Then by means of a gang-operated switch in the switch mechanism room the cable is connected to the test bus and when jumpers have been properly connected at the far end the cable is ready for bridging. At the Edgar station end it is not necessary for the operator to handle loose leads in the cable terminal room at all, which makes the operation of the test apparatus unusually safe.

The front view of the control panels shows the bridge dial on one panel and with it the galvanometer and low-voltage current control. On the other panel is the control equipment for the 1,500-volt motor-generator, with a double range ammeter (1 — 10 amp.) and a 1,500-volt voltmeter, both with protective cases. The bridge slider is inclosed in a dustproof case. The scheme of connections is shown in the accompanying diagram.

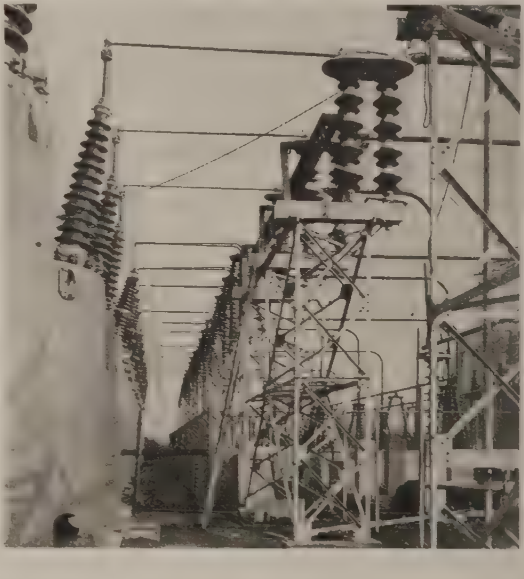
## *Performance of Coal Pulverizing Equipment*

For Year Nov. 1, 1926, to Nov. 1, 1927

New Orleans Public Service Company, Inc.

| | |
|---|---|
| **9-Ton Fuller Mills:** | |
| Total coal pulverized, tons | 92,620 |
| Total hours operation, hours | 12,840 |
| Average coal pulverized per set of balls (4), tons | 14,250 |
| Average coal discharged per set of exhaust fan blades, tons | 23,150 |
| Average coal pulverized per set of pushers (4), tons | 28,500 |
| Average coal pulverized per spider, tons | 30,870 |
| Average coal pulverized per ball race, tons | 46,310 |
| **2½-Ton Fuller Mills:** | |
| Number of hours operation, hours | 9,288 |
| Coal pulverized, tons | 17,500 |
| Coal pulverized per set of balls (4), tons | 14,000 |
| Coal pulverized per set of pushers (4), tons | 14,000 |
| **Aero Mills:** | |
| Number of hours operation, hours | 13,437 |
| Coal pulverized, tons | 32,450 |
| Coal pulverized per set of paddles, tons | 9,540 |
| Coal pulverized per set of liners, tons | 16,230 |

## Disconnecting Switch Contacts on Breaker Terminals



OWING to space limitations adjacent to the oil circuit breakers on the 220-kv. lines that link the Laguna Bell substation with the Long Beach steam plant of the Southern California Edison Company the disconnecting switches are mounted directly on the oil circuit breakers, as shown in the accompanying illustration. Six three-pole manually operated switches are used at this substation. The circuit breaker bushing serves as the third insulator column of a single-pole switch and supports the jaw contact. The disconnecting switches are type TTR "Hi-Pressure" units manufactured by the Railway & Industrial Engineering Company, Greensburg, Pa.

# Power from Pumped Water*

Water pumped to reservoir for later use in hydro plants. Rocky River development of the Connecticut Light & Power Company. River regulation controlled.

By E. J. Amberg
*Research Engineer Connecticut Light & Power Company*

THE Rocky River hydro-electric development of the Connecticut Light & Power Company has created considerable interest among technical as well as non-technical men as a project for regulating the flow of the Housatonic River below New Milford, Conn. Briefly, the development consists of a storage reservoir created on Rocky River, a tributary of the Housatonic, with a power and pumping plant on the Housatonic River, the power and pumping plant being connected by a single penstock with the reservoir.

The Rocky River basin is located north of Danbury and west of the Housatonic River and the site of the development is approximately 1½ miles by state highway from the nearest railroad station at New Milford. The basin has a drainage area of approximately 40 square miles, 8¼ miles of which is covered by the storage lake. The unusual features of this development lie in the fact that the drainage area of the reservoir basin will supply only about 1.5 billion cubic-feet of water in an average year, while the useful capacity of the reservoir is 5.9 billion cubic-feet. All water above the natural run-off required to fill the reservoir must be pumped from the Housatonic River against a head varying from 200 to 230 ft. While considerable excess hydro energy will be available for pumping, the studies and investigations for this development are all based on using secondary steam-generated electrical energy for pumping to be supplied over transmission lines from the Devon station of the Connecticut Light & Power Company.

### Acts as a Battery

The Rocky River reservoir may be likened to a large storage battery. Charging the battery is accomplished by secondary steam energy driving two electrically operated 8,100-hp. centrifugal pumps, delivering water to the reservoir. The battery is discharged by means of the 30,000-kva. generating unit at Rocky River delivering primary hydro energy. The efficiency of this storage battery for changing secondary steam energy into primary hydro energy is 61 per cent; this includes all losses from the 66,000-volt bus at the Devon steam station

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**Abstract of paper presented at the regional meeting of the American Institute of Electrical Engineers, New Haven, Conn., May 11, 1928.*

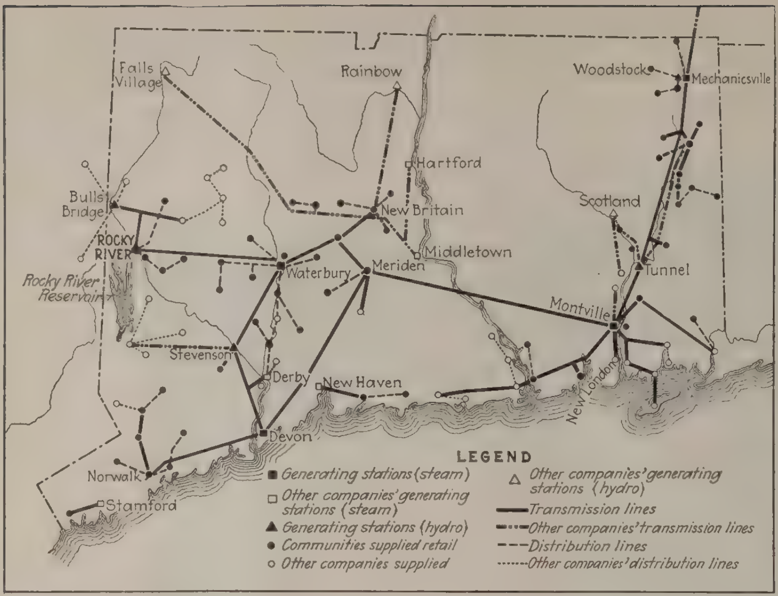
Falls Village
Rainbow
Woodstock
Mechanicsville
Hartford
Bulls Bridge
New Britain
Scotland
ROCKY RIVER
Middletown
Rocky River Reservoir
Waterbury
Meriden
Tunnel
Montville
Stevenson
Derby
New Haven
New London
Devon
Norwalk
Stamford
LEGEND
■ Generating stations (steam)
□ Other companies' generating stations (steam)
▲ Generating stations (hydro)
● Communities supplied retail
○ Other companies supplied
△ Other companies' generating stations (hydro)
Transmission lines
Other companies' transmission lines
Distribution lines
Other companies' distribution lines

*Fig. 1—Connecticut Light & Power system and Rocky River plant*

through the pumping units into the reservoir and back through the generating unit to the 66,000-volt Rocky River bus. In other words, for every 100 kw.-hr. supplied by the Devon steam station in filling the reservoir 61 kw.-hr. is delivered by the Rocky River generating unit when the water is drawn out again. We must not, however, overlook the fact that below the Rocky River plant there is an additional total average head of 191 ft. available, of which 71 ft. is efficiently developed at Stevenson. If the head at Stevenson is added, then for every 100 kw.-hr. of steam energy 79 kw.-hr. of hydro energy is returned. If the total head from Rocky River to tidewater is added, 111 kw.-hr. of hydro energy could be obtained from every 100 kw.-hr. of steam energy used in pumping.

The Housatonic River had no means of regulation and the stream flow shows very wide variations. The only period of the year when any reliance can be placed on the river flow is in the spring. With the river plants at Stevenson and Bulls Bridge operated in conjunction with the Rocky River storage plant the 24-hour firm power of the hydro system is 11,000 kw. The chart (Fig. 3) shows the unregulated power duration curves for a typical dry, wet and average year, limited by the installed capacities of the Stevenson and Bulls Bridge stations, which together total 26,000 kw. The regulated 24-hour firm power of 11,000 kw. obtained by the addition of Rocky River is also shown. The respective areas between the 11,000 kw. regulated firm power and the power duration curves represent the energy which has to be furnished from storage. The amount required in each year varies considerably, being 9,500,000 kw.-hr. in the wet year and 39,900,000 kw.-hr. in the dry year. Of these amounts, 78 per cent is produced by the Rocky River station and the balance at Stevenson, generated from the water released from the Rocky River station. By applying the 24-hour firm power of 11,000 kw. to the upper half of the load curve, as shown in Fig. 4, curve 1, the total installed hydro capacity of 50,000 kw. can be used as firm capacity. Before regulation by Rocky River the combined firm capacity of the Stevenson and Bulls Bridge stations was only 10,000 kw., although the installed capacity was 26,000 kw. Therefore, by installing a 24,000-kw. generating unit in the Rocky River station and by regulating the river the firm hydro capacity has been increased by 40,000 kw.

To obtain the maximum benefits from such a storage development it is necessary to apply it to that part of the load requiring the smallest number of kilowatt-hours. When plotting system loads in the form of an annual duration load curve we will find that there is a decided peak. The reasons for this pronounced peak on the duration load curves vary; on systems like the Connecticut company, where there are no short time peaks of any extent, the seasonal changes in load are responsible. What appears as a very short time peak on the duration load

*To the left are the concrete intake tower, the surge tank and penstock to power house below.*

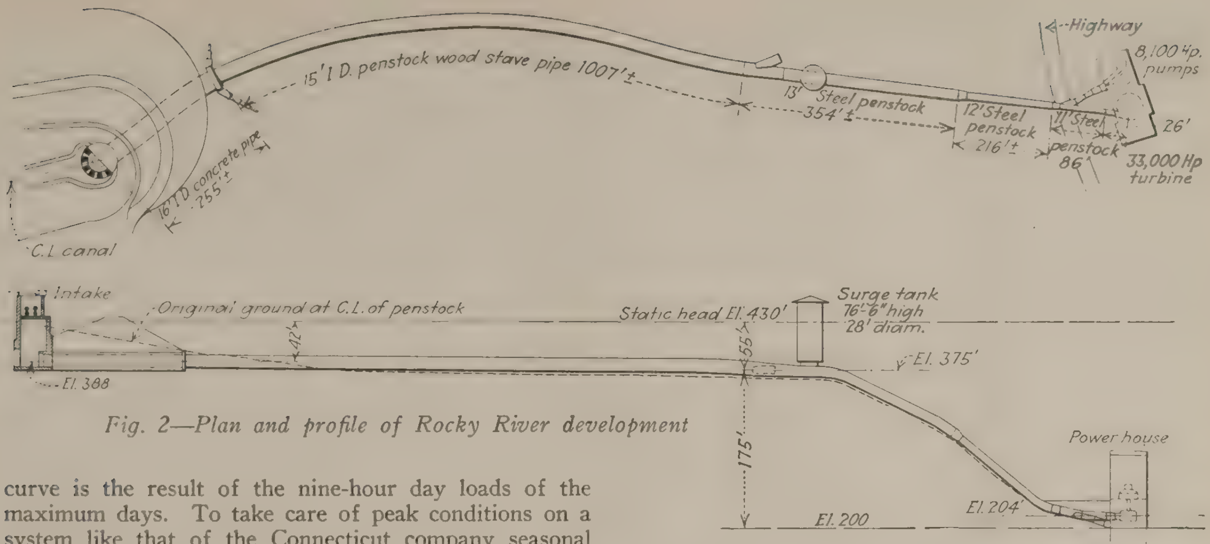

*Fig. 2—Plan and profile of Rocky River development*

curve is the result of the nine-hour day loads of the maximum days. To take care of peak conditions on a system like that of the Connecticut company seasonal storage in addition to weekly pondage is required. This seasonal storage is being provided by the construction of the Rocky River storage reservoir.

Two annual duration load curves are shown in Fig. 4; curve 1 represents the present approximate combined load of the Connecticut Light & Power Company and associated companies, while curve 2 shows the expected combined load for the year 1931. The upper half of load curve 1, and load curve 2 for that matter, contains only 18.2 per cent of the total kilowatt-hours; the load factor of this part of the load is 17.2 per cent. The advantage of applying the hydro generating capacity to the peak of the load and the steam generating capacity to the base of the load is quite evident from a study of this load curve. Assuming that the total load has increased 50 per cent, as indicated by curve 2 on Fig. 4, the same number of hydro kilowatt-hours represented by area *A2* would permit a firm hydro capacity of 65,000 kw., as against 50,000 kw. firm capacity of curve 1, or 15,000 kw. firm capacity could be installed without increasing the storage facilities. Additional capacity can often be installed at a low cost per kilowatt in existing plants, thus lowering the average unit cost per kilowatt of hydro capacity. Such storage development as Rocky River has, therefore, some inherent values which can be increasingly realized as the load increases.

Aside from the features discussed above, hydro plants have another great advantage in that they provide standby capacity which can be made available in a fraction of the time required at a steam station, because to get up steam and warm up a turbine requires time unless boilers are kept in service and excess turbine capacity is kept on the line to take care of sudden load demands. With the means of regulating the stream flow below Rocky River, it will be possible to develop the full head on this section of the river, which will then produce a total 24-hour firm power of approximately 23,000 kw.

The hydro capacity will again be applied to the upper half of the load curve, which from curve 1 on Fig. 4 shows a load factor of 17.2 per cent. In order to take care of possible changes in the load curve we will make an arbitrary increase in the load factor of one-third, which will change this load factor to 23 per cent. With a 23 per cent load factor and a 24-hour firm power of 23,000 kw. it will be possible to increase the total installed

*This dam diverts water into canal running to left and thence to intake tower* hydro capacity to 100,000 kw. by developing the full head of the river between tidewater and Rocky River.

The second 24,000-kw. unit at Rocky River is in addition to the 100,000 kw. capacity above referred to; its main function will be to act as a spare unit, which can be made instantly available. The second unit can be installed at a low unit cost, including the raising of the reservoir level, which will add approximately 1,000,000,000 cu.ft. to the useful storage capacity.

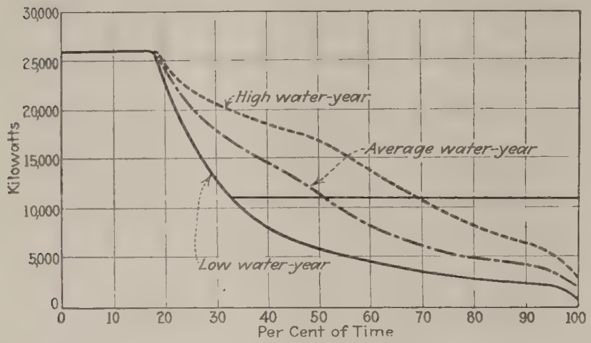

*Fig. 3—Power duration curves for combined output of Bulls Bridge and Stevenson*

The horizontal line on the chart represents Rocky River firm power

UNREGULATED

| | Square Miles | Head, Ft. | Kw. Per Sq. Ft. | Installed Capacity Kw. |
|---|---|---|---|---|
| Bulls Bridge | 782 | 104 | 6.27 | 7,200 |
| Stevenson | 1,510 | 71 | 4.40 | 18,700 |
| | | | | 26,000 |
| Rocky River | 35 | 214.2 | | 24,000 |
| Power | | | 15.55 | |
| Pumping | | | 25.35 | |

REGULATED BY ROCKY RIVER TO PRODUCE 11,000 KW. FIRM POWER

| | Low Water, Kw.-Hr. | High Water, Kw.-Hr. | Average Water, Kw.-Hr. |
|---|---|---|---|
| Rocky River output | 31,100,000 | 7,400,000 | 17,400,000 |
| *Stevenson | 8,800,000 | 2,100,000 | 4,900,000 |
| Total | 39,900,000 | 9,500,000 | 22,300,000 |

*Generated at Stevenson on water from Rocky River.

From the foregoing it can be seen that the Rocky River development has a considerable increased future value, by making it possible to develop the full head below Rocky River as the load of the system of the Connecticut Light & Power Company and associated companies increases. Without Rocky River further economic development of the river would have been impossible.

### Use of Water Illustrated

In concluding the first part of this paper an account of water utilization at Rocky River and Stevenson stations for a typical average year seems in order.

As stated before, with a full reservoir the water level will be at an elevation of 430 ft. The normal allowable draw-down is 30 ft., or to water level elevation at 400 ft. In this 30 ft. of draw-down, 5.9 billion cubic feet of water is taken from the reservoir. This amount of water in going through the Rocky River generator will produce 24,200,000 kw.-hr.

From the power-duration curve for an average year in Fig. 3 it will be seen that 22,300,000 kw.-hr. must be generated by water from Rocky River to maintain the 24-hour firm power of 11,000 kw. Of the total of 22,300,000 kw.-hr. the Rocky River station will furnish 17,400,000 kw.-hr., while the remaining 4,900,000 kw.-hr. is generated at the Stevenson station by the water discharged from Rocky River station. The amount of water that must be taken from the reservoir in order to produce 17,400,000 kw.-hr. at Rocky River station is approximately 4,030,000,000 cu.ft., based on an average figure of 15.55 kw. per second-foot.

The water used for refilling the reservoir falls into two classes, with two subdivisions in each class:

1. Run-off water from the Rocky River drainage area:
   (a) Water held back at a time when it would have spilled over the Stevenson dam.
   (b) Water held back at a time when it could have been used at the Stevenson station.
2. Water taken from the Housatonic River and pumped into the reservoir:
   (a) Water taken from the Housatonic River at a time when this water would have spilled over the dam at Stevenson.
   (b) Water taken from the river at a time when this water could have been used at the Stevenson station.

The following is a brief summary of the amount of water obtained from each subdivision for an average year:

1. The run-off from the Rocky River drainage area in an average year based on a net area of 35 square miles is 1.6 billion cubic-feet.

(a) The daily discharge records for the average year show that there are 58 days of the year when the flow of the river equals or exceeds 2.86 cu.ft. per second per square mile, the flow necessary to produce 24-hour full load at Stevenson. The run-off during the 58 days amounts to 0.84 billion cubic feet. This amount of water, when finally released from the reservoir, will utilize the additional head at Rocky River as well as at Stevenson.

(b) The difference, or 1.6 — 0.84 = 0.76 billion cubic-feet, is Rocky River run-off that is caught in the reservoir at a time when the river flow was less than 2.86 cu.ft. per second per square mile. This amount of water, when finally released, will utilize the additional head of the Rocky River station only.

2. The total amount of water to be pumped in an average year is 4.03 — 1.6 = 2.43 billion cubic-feet. The possible number of pump hours per week with two pumping units available is 336 hours. Load conditions, however, will normally limit the actual pump hours per week to 200 hours, which corresponds to an average pumping rate of 298 cu.ft. per second, as against the maximum possible rate of 500 cu.ft. per second, which is the capacity of the two pumps.

(a) The daily discharge records for the average year show that there are 58 days of the year when the flow of the river equals or exceeds 2.86 cu.ft. per second per square mile, the flow necessary to produce 24-hour full load at Stevenson, and 45 days when the river flow equals or exceeds 3.16 cu.ft. per second per square mile, the flow necessary to produce 24-hour full load at Stevenson after an average of 298 cu.ft. of water per second has been taken from the river at the Rocky River station. The amount of water pumped during this period is 1.32 billion cubic feet. This water when released from the reservoir will utilize the additional head at the Rocky River and Stevenson stations.

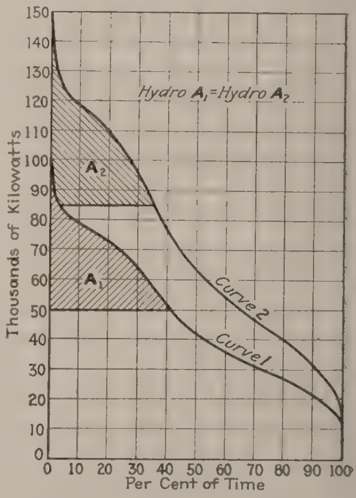

*Fig. 4—Present and 1931 Rocky River load duration curves*

| | Curve 1 | Curve 2 |
|---|---|---|
| Maximum hours, kilowatts | 100,000 | 150,000 |
| Load factor, per cent | 47.3 | 47.3 |
| Hydro, kilowatts | 50,000 | 65,000 |
| Increase | ........ | 15,000 |
| Hydro load factor, per cent | 17.2 | 13.2 |

(b) To fill the reservoir completely an additional amount of 2.430 — 1.325 = 1.105 billion cubic-feet of water must be pumped at a time when the river flow is less than 2.86 cu.ft. per second per square mile. This water when released from the reservoir will utilize the additional head of the Rocky River station only.

The storage reservoir or lake is about 10 miles long and 1¾ miles across at the widest part. It has a surface area of 8⅓ square miles and a shore line of approximately 60 miles. The main dam is located across Rocky River at a point about 1 mile above its junction with the Housatonic River. It is an earth-filled dam with a core wall. The lower part of this core wall consists of a 2-ft. concrete section which extends on the average 10 ft. above and an average of 5 ft. below the ground surface. On top of this concrete section was placed a 6-in. Wakefield core wall (timber) reaching up to an elevation of 435 ft. On the west end the concrete core wall was located in solid rock. This rock, however, dropped off rapidly below the surface at the location of the old river bed; from this point the core wall continued in earth. The material for the dam was obtained from the canal excavation and was placed in the dam by sluicing. The relative elevations were such that only a very small quantity could be sluiced directly, so practically all of the material was excavated with drag lines and placed in large piles. It was then sluiced from these piles down into the dam. However, after the dam had reached a certain height the slope in the sluicing line became insufficient; this was partly due, too, to the increased distance of the drag line from the dam. When this point was reached the material was sluiced to a pumping plant located at an elevation of 375 ft. Before being delivered to the pumps, the material was passed through a revolving screen which eliminated all stone over 6 in. in diameter.

On this dam itself a gasoline-driven drag line was utilized to throw up small dikes on each edge to hold the water within the dam and give the sluiced material a chance to settle. Near the center of the dam was a concrete chimney with openings which acted as overflows for the sluicing water. The chimney connected at the bottom with the concrete conduit under the dam. As the dam came up the openings were closed. The dike along the canal was constructed in a similar manner, as it constitutes practically an extension of the main dam.

The canal leading from the reservoir to the intake was excavated for about 3,300 ft. along the east bank of the valley. Terminating the dike in the side hill permitted the construction of a circular intake tower in the canal with only a short length of concrete conduit extending through the dike. Six equal intake openings are located in the half of the tower facing the canal. Each opening is protected by vertical trash racks provided with a compressed air rack raking device, and each opening can be closed by steel stop logs operated by means of manually operated hoists. A self-closing sliding Broome gate is located at the entrance to the concrete conduit in the tower and operated by electric hoist. Ample air vents to the penstock are provided in the intake structure back of the gate. Necessary by-pass pipe connections are provided to fill the penstock from the intake with the Broome gate closed and for filling the intake from the canal with the steel stop logs in position.

TABLE I—TABULATION SHOWING SUMMARY OF WATER USED FOR FILLING THE ROCKY RIVER RESERVOIR IN AN AVERAGE YEAR

| Classification | Water | Amount of Water, Billions of Cu.Ft. | Will Use "Additional" Head of Rocky River Station | Will Use "Additional" Head of Stevenson Station |
|---|---|---|---|---|
| 1 (a) | Run-off exceeding full load flow. | 0.840 | Yes | Yes |
| 1 (b) | Run-off below full load flow..... | 0.760 | Yes | No |
| 2 (a) | Pumped water exceeding full load flow.................. | 1.325 | Yes | Yes |
| 2 (b) | Pumped water below full load flow........................ | 1.105 | Yes | No |
|  | Total.................... | 4.030 |  |  |

The concrete conduit, having an inside diameter of 16 ft., extends only a short distance from the intake tower to the wood-stave pipe line. This wood pipe line has an inside diameter of 15 ft. and extends for approximately 1,007 ft. along the hillside. The average gradient is 0.5 ft. in 100 ft. The intake tower and wood pipe line are of sufficient capacity for the installation in the future of a second generating unit. The wood pipe line joins a steel penstock "Y" connection; one of the two branches is blanked off ready for a second penstock for the future unit, while the other extends a short distance to a Johnson differential surge tank. Freezing of the water in this surge tank is prevented by agitation with compressed air. From the surge tank the penstock drops down the hillside to the power house. The inside diameter varies from 13 ft. to 11 ft. just outside the power house, where there is another "Y" connection, one branch for the generating unit and the other for the two pumping units. Each branch has a Venturi section for measurement of flows.

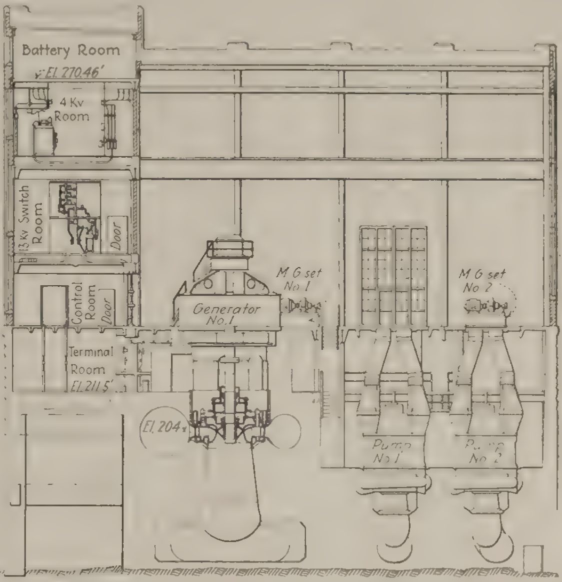

*Fig. 5—Cross-section of Rocky River plant*

### Power Station Building

Like most modern power house construction, the substructure of the Rocky River plant is built exclusively of concrete, with a small amount of steel work to support the lighter floors. The foundation rests on bedrock, which was so close to the elevation desired that little rock had to be taken out or extra concrete put in. The concrete barrel type of construction was used, wherein the entire weight of generator, shaft, runner and hydraulic thrust is carried through a concrete barrel and the turbine speed ring to the foundations. The south end of the building, referred to as the switch bay, is supported on reinforced concrete columns. All the surface of the concrete substructure was coated with a waterproofing compound.

The power house superstructure is of structural steel framework and brick. Precast gypsum slabs provide the foundation for an asphalt built-up roof. All exterior trim of the foundation is of precast cement blocks.

There are four floors in the switch bay with a control cable terminal room below the first floor. The first floor is the control room with the switchboard. The second floor contains the 13,200-volt pump motor bus and switching and the third and fourth floors are used for the 4,600-volt distribution bus and storage battery room.

### Hydraulic Equipment

The hydraulic equipment of the power station consists of one 33,300-hp. vertical shaft turbine and two 8,100-hp. vertical shaft centrifugal pumps. A noteworthy feature of the turbine is the cylinder gate, which replaces the more conventional butterfly or Johnson valves for directly shutting off the flow of water to the turbine. This cylinder gate is built in the turbine in the annular chamber between the pit liner and the speed ring. It is operated from a valve on the generator floor, which controls the admission of water under penstock pressure to the annular chambers above the valve. Positive mechanical locking devices hold the valve either in a completely open or fully closed position.

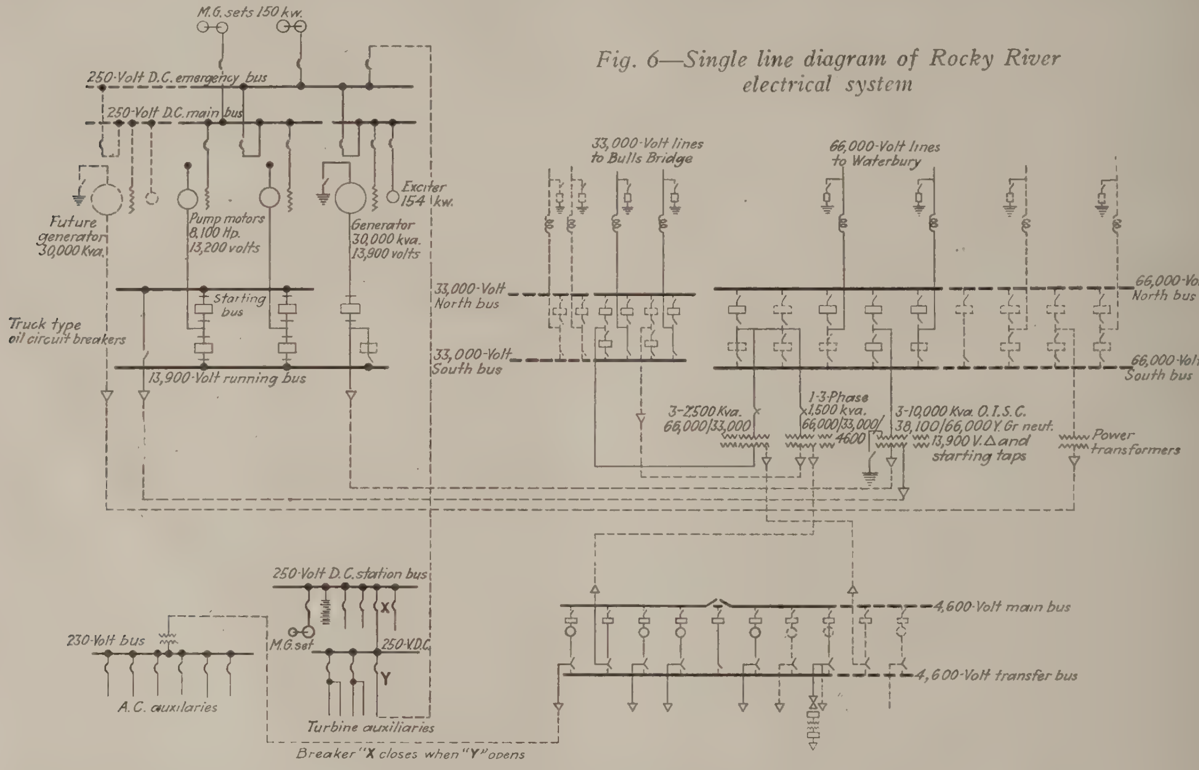
Fig. 6—Single line diagram of Rocky River electrical system

M.G. sets 150 kw.
250-Volt D.C. emergency bus
250-Volt D.C. main bus
Future generator 30,000 Kva.
Pump motors 8,100 Hp. 13,200 volts
Generator 30,000 kva. 13,900 volts
Exciter 154 kw.
Starting bus
Truck type oil circuit breakers
13,900-Volt running bus
33,000-Volt lines to Bulls Bridge
66,000-Volt lines to Waterbury
33,000-Volt North bus
33,000-Volt South bus
66,000-Volt North bus
66,000-Volt South bus
3-2500 Kva. 66,000/33,000
1-3-Phase 1,500 kva. 66,000/33,000/4600
3-10,000 Kva. O.I.S.C. 38,100/66,000 Y. Gr. neut. 13,900 V. Δ and starting taps
Power transformers
250-Volt D.C. station bus
X
M.G. set
250-V.D.C.
Y
230-Volt bus
A.C. auxiliaries
Turbine auxiliaries
Breaker "X closes when "Y" opens
4,600-Volt main bus
4,600-Volt transfer bus

The centrifugal pump specifications called for a rating of 112,500 gal. per minute (250 cu.ft. per second) delivered against a maximum head of 240 ft. In the discharge line of each pump is a hydraulic-cylinder-operated Dow pivot valve. The intake to each pumping unit can be shut off by a self-closing Treadwell gate, and each intake is equipped with vertical trash racks with air-raking device. Provision is made for the insertion of stop logs in each pump intake and in the two openings of the turbine draft tube.

The generator is of the standard vertical waterwheel type with shaft and exciter. It is rated at 30,000 kva., 80 per cent power factor, 13,900 volts, three phase, 60 cycle, 200 revolutions per minute, with direct-connected exciter rated at 154 kw., 250 volts, compound wound with interpoles. The pump prime movers are vertical synchronous motors rated at 7,900 kva., 80 per cent leading power factor, 13,200 volts (with voltage range of 5 per cent above or below), three phase, 60 cycle, 327 revolutions per minute. Pump motor and spare excitation is furnished by two motor-generator sets, each consisting of 150-kw., 1,200-r.p.m., 250-volt, compound-wound direct-current generator with interpoles direct connected to a 225-hp., 220-volt, three-phase, 60-cycle, squirrel-cage induction motor.

The shaft of the generating unit is of two sections, one for generator and one for turbine, with forged half-flanged sections bolted together upon installation. The turbine shaft has one guide bearing of the babbitted type mounted on the turbine crown plate. Lubrication is provided from a self-contained gear pump driven from the main shaft. For emergency operation a float-controlled rotary, direct-current motor-driven auxiliary oil pump is provided. The generator shaft has a Kingsbury thrust bearing with copper cooling coils and an upper and lower guide bearing of the babbitted type. The lubricating system for the generator shaft bearings consists of a gear pump, driven from the main shaft and located in the lower guide bearing oil pan.

The shaft of the pumping units is one-piece forged steel with a Kingsbury and combined upper guide and thrust bearing with copper cooling coils mounted on the upper spider designed to support the total weight and thrust and a guide bearing between motor and pump, supported in a cast-iron frame of heavy section bolted at the bottom to the upper head of the pump. Lubrication of all bearings on each unit is automatic from a motor-driven gear pump, with a similar pump for spare for each unit.

In the plant there are five distinct groups of electrical equipments:

(a) A 4,600-volt indoor local distribution bus.

(b) A 33,000-volt outdoor tie-in bus for Bulls Bridge station.

(c) A 66,000-volt outdoor main station bus.

(d) A 13,900-volt indoor bus for pumps.

(e) Station service buses.

The 4,600-volt bus is for distribution of power to the New Milford district. The 33,000-volt outdoor bus afforded the most economical arrangement for connecting the Bulls Bridge station (upstream from Rocky River about 8 miles) to the 66,000-volt main transmission system. The 66,000-volt outdoor substation consists of a main and a transfer bus with switching equipment for the two 66,000-volt, three-phase lines to Waterbury, the 30,000-kva. transformer bank stepping down to 13,900 volts and the connection to the transformer banks stepping down to 33,000 volts and 4,600 volts respectively. Space was left in the bus structure so that each of these two banks can be equipped with a separate circuit breaker. The 30,000-kva. main transformer bank has two oil circuit breakers, one of which acts as a transfer breaker. Although the generating voltage is 13,900, the main station voltage is 66,000. If it were not for the two pumping units there would be no bus and no switching equipment at 13,900 volts. The 66,000-volt side of the 30,000-kva. transformer bank is "Y" connected and solidly grounded. The 13,900-volt windings are provided with 40, 50 and 60 per cent taps to obtain with an open delta connection approximately half voltage for starting the pumps.

The 13,900-volt indoor substation is for the sole purpose of supplying power to the pumping units. There are two buses, a full-voltage running bus and a half-voltage starting bus. The connections from the transformer bank to the buses are made with single-conductor cables. The generator leads are connected to the running bus through a set of disconnecting switches, with provision for a future oil circuit breaker. On the generator side of this tap is a non-automatic oil circuit breaker to disconnect the generator from the transformer bank before it is used to supply power to the pumps from the 66,000-volt bus. The two oil circuit breakers connecting each pumping unit to the starting and running buses are interlocked.

### STATION SERVICE BUSES

A 230-volt, 60-cycle, three-phase bus supplies power primarily to the two motor-generator sets, the battery charging set, the sump pumps, air compressor, station lighting, etc. The main 250-volt, direct-current or exciter bus is at present divided into two sections, one for the generator, the other for the two pumps. The 250-volt direct-current emergency bus is supplied from one of the two motor-generator sets. The governor oil pump and the emergency turbine oil pump are normally connected to this bus; if power fails they are automatically switched over onto the 250-volt direct-current battery bus. All the control circuits and small direct-current motors in the plant are connected to the battery bus. The control battery was purchased large enough so that it can perform the double function of control battery and storage battery.

The Rocky River development was designed and built by the U.G.I. Contracting Company of Philadelphia for the Connecticut Light & Power Company in close collaboration with the latter's engineering staff.

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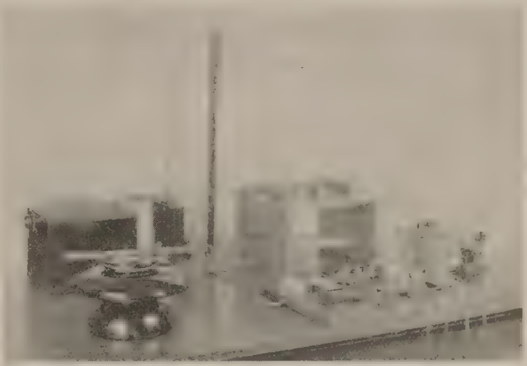
# Pin-Type Insulator Capacitance Tests

By Arthur L. Albert
*Instructor Electrical Engineering,*
*Oregon State College, Corvallis, Ore.*

STUDIES of the capacitance phenomena in suspension-type insulator strings have been of importance in power transmission and it is possible that a knowledge of the capacitance of pin-type insulators may also prove useful to electrical engineers. Very little information is available regarding this subject, and with a view to determining the relations between the capacitance and other test characteristics of pin-type insulators an investigation was undertaken at Oregon State College.

The capacitance of 180 insulators was measured and test values were correlated with certain other insulator test characteristics. A wave-meter and a vacuum tube oscillator as shown in the accompanying illustration were used to make the measurements. The capacitance values were obtained by holding the oscillator frequency constant and observing the difference between the wave-meter condenser settings necessary to produce resonance both with and without the insulator in parallel with this condenser. Capacitances were found to vary from about 8 to 15 micro-mfd. at 500,000 cycles. Large variations in frequency, however, did not materially affect the capacitance. Various factors, such as the size of tie wire, were found to influence results. Also it was found that a relation exists between the capacitance of an insulator and its other test characteristics, particularly the puncture voltage value. This, no doubt, is due to the fact that the puncture voltage and the capacitance are both largely determined by the thickness of the porcelain between the pin and the tie wire and conductor. It is not believed that capacitance is the determining factor in the puncture voltage value at low frequencies.



*Apparatus for measuring capacitance of pin-type insulators using a wave meter and oscillator*

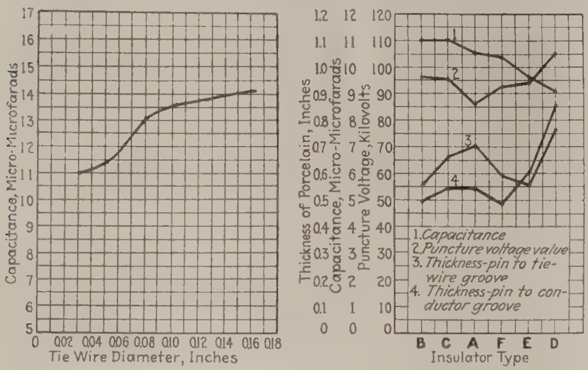
Tests were made on insulators submitted by six dif-

AVERAGE CAPACITANCE, MICRO-MICROFARADS, FOR TEN PIN-TYPE INSULATORS OF SIX MANUFACTURERS

| Manufacturer | 13-17 Kv. | 45-55 Kv. | 66 Kv. |
|---|---|---|---|
| A | 10.54 | 13.12 | 12.31 |
| B | 11.08 | 12.00 | 12.82 |
| C | 11.05 | 11.71 | 14.14 |
| D | 9.10 | 10.88 | 11.97 |
| E | 9.65 | 10.60 | 11.73 |
| F | 10.38 | 11.08 | 10.91 |

ferent manufacturers and will be referred to as A, B, C, D, E and F. These were of three general classes, 13-17 kv., 45-55 kv. and 66 kv. Ten insulators of each class were measured, making a total of 180 tests in all. Individual values of capacitance obtained for the different voltage classes varied between 8.4 and 14.5 m.mfd. For the 13-17 kv. class the range was 8.4-11.8 m.mfd.; 45-55 kv. class, 10.0-14.4 m.mfd., and for the 66-kv. class, 10.6-14.5 m.mfd. Average values for ten insulators in each class are given in the table which appears on page 965.

Tests were made on an "A" insulator of the 13-17-kv. class to determine the influence of tie wire size on measured capacitance. Results are shown in an accompanying illustration. While tests were made on only one insulator, it is evident that the size of tie wire very materially affects the capacitance.



*Effect of tie wire size on insulator capacitance and other characteristics of 13-17-kv. pin-type insulators*

The exact nature of dielectric losses due to an alternating field is not definitely known, and there is at present considerable research being conducted in this field. If there is an appreciable loss in insulators due to the alternating dielectric flux, this loss would probably vary with the capacitance. It was, therefore, thought possible that a relation would exist between the puncture voltage value and the capacitance, since the alternating dielectric flux would heat the porcelain and lower the dielectric strength. The values given in one of the accompanying curves, which were determined by test, show that as the capacitance decreases the puncture voltage value increases. This was what was expected from a consideration of the losses due to the dielectric flux. However, a study of the dimensions showed conclusively that the puncture voltage value at 60 cycles was not determined by the capacitance, but by the thickness of porcelain between the pin and the other electrode. A study was also made to determine the possible relation between the capacitance and corona formation voltage. No consistent relation was found to exist.

### Conclusions Reached

High-voltage pin-type insulators have an appreciable capacitance, varying from about 8 to 15 m.mfd., depending on the design and voltage class of the insulator. An increase in the diameter of the tie wire increases the insulator capacitance.

Frequency of the voltage used in making measurements does not materially affect the measured capacitance.

There seems to be no consistent relation between capacitance and corona formation voltage.

Thickness of the porcelain between the pin or thimble as one electrode and the tie wire and conductor as the other is a very important factor in determining both the capacitance and the puncture voltage value.

The author wishes to acknowledge the assistance of Prof. F. O. McMillan and students of Oregon State College in making this investigation.

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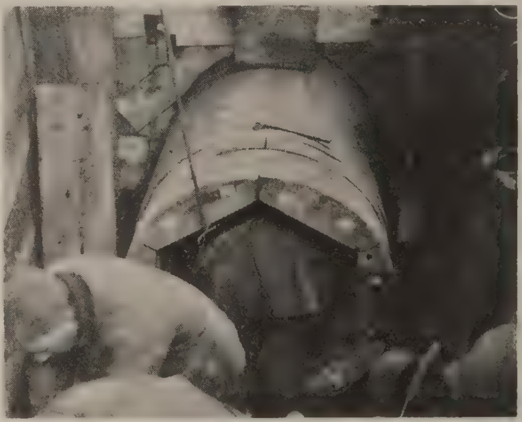
## Submarine Cable Approach Tunnel

By M. R. Sumner
*General Superintendent of Construction*
*Byllesby Engineering & Management Corporation, Pittsburgh, Pa.*

During 1927 the Duquesne Light Company installed six cables under the Ohio River at Pittsburgh, Pa. These cables extend from the generating plant on Brunot Island, across the back channel of the river, under the main line of the Pittsburgh & Lake Erie Railroad, to a manhole on West Carson Street, a distance of 1,285 ft. The six cables are each 350,000 circ.mil, 22 kv., lead covered and steel armored. Dredging across the back channel was done by the Equitable Towing & Transportation Company, a subsidiary of the Duquesne Light Company. A trench about 6 ft. deep was dredged in the river bed, the cables were laid in, inspected by a company diver and the trench backfilled by the dredge boat to complete the installation work.

On the mainland it was necessary to tunnel under the four main line tracks of the Pittsburgh & Lake Erie Railroad. A 42-in. outside diameter steel pipe was used for driving the tunnel. This pipe, in 4-ft. sections, had a 6-in. x $\frac{1}{4}$-in. collar on the inside of one end. The first section also had a collar on the outside of the front end, which acted as a driving edge. The pipe was driven through the earth by two 35-ton hydraulic jacks, pressing against an 18-in. driving frame of 6-in. x 6-in. oak, bolted together with staggered joints. A wooden cradle was set to line and grade to start the pipe in the right direction, which was checked twice daily with a transit as the work progressed. Driving was done continuously by three shifts of men and progressed about 1 ft. per hour. The cost of this tunnel was $235.20. Within the tunnel pipe were laid eight 6-in. sewer pipes as a duct line for the cables.



*Cradle and driving frame for steel pipe tunneling*

# Are Customer Sales Overdone?

This might be the interpretation placed upon the recent drastic
decline in the percentage borne by this type
of financing to the total

By H. M. Cameron
*Financial Editor* Electrical World

ATTENTION has been directed recently to an apparent decline in the sale of preferred stock direct to customers by power and light companies through what are popularly called customer campaigns. Total sales of such issues in 1927 fell off to 11 per cent of the year's total financing, against an average of 19 per cent for the seven-year period 1920 to 1926 inclusive. The question arises as to whether or not customer ownership has been overdone. Have the companies been satisfied with the results of campaigns already carried on?

*So much has been said and written on the theoretical advantages to public utilities of selling stock direct to customers that an attempt to secure first-hand evidence with regard to results actually achieved seemed warranted. A questionnaire was sent to representative companies in different parts of the country and several of the replies are presented herewith. The questions asked were:*

*1. To what extent has customer ownership really proved beneficial in improving public and political relations?*

*2. What does the customer-ownership campaign cost in relation to the cost of mortgage bonds or other financing?*

*3. Why is customer ownership declining, or at least standing still, while general financing has increased by leaps and bounds?*

There has been, in fact, no falling off in actual totals of customer-ownership sales, although the proportion has declined materially. The 1927 total was slightly above the revised 1926 total of $236,557,100, although considerably under the 1925 total, which is the highest on record. The 1925 figure was 23 per cent of the total financing for that year. The decline in percentages since that time is due to two factors: A slight reduction in the aggregate volume of customer sales and a sharp increase in senior financing due to declining money rates and to other factors. Public sales of mortgage bonds were more than $1,107,000,000 last year, against $813,860,000 the year before, and the total of debentures sold rose from $158,250,000 to $358,150,000. It is significant that much of this financing was for the purpose of revamping financial structures and retiring high-interest bearing securities, since such financing is better adapted to the purpose than other types. Furthermore, the well-balanced company structures of the industry as a whole permitted of large-scale additions to funded debt, and at the attractive money rates ruling the volume of senior financing naturally increased rapidly.

### Beneficial to Public Relations

Without exception each of a representative group of executives approached by the Electrical World in an attempt to evaluate the real worth of customer ownership agreed that such a policy has an exceedingly important bearing on public relations. P. S. Young, vice-president of the Public Service Corporation of New Jersey, said "it is not unreasonable to say that the adoption by this company of customer ownership of its securities and the consequent dissemination of facts pertaining to the operations of the various public utilities has resulted in improving public relations. Before the Public Service Corporation of New Jersey adopted the popular ownership plan of selling its securities to customers there was hardly a state or municipal election held but that Public Service was used as a talking point by some of the candidates seeking public office. This could have no other than a harmful effect on the Public Service Corporation of New Jersey and its securities. During recent political campaigns practically no mention was made of Public Service by candidates seeking office."

In answer to the same question Chester C. Smith, vice-president and secretary of the Kansas City Power & Light Company, said: "Customer ownership, in my opinion, has been of material benefit in improving the public relations of the utilities. I do believe, however, that the benefit which has been derived has in some instances been greatly overestimated. It has been the personal experience of our company that as soon as our customers have made a nice profit in their securities they immediately disposed of them and invested in other securities. This, of course, does not destroy the good will which has been created, but it did, in effect, minimize it because when the ownership was gone the interest in the company was not so pronounced."

Referring to the bearing of the question on relations, Herbert A. Wagner, president of the Consolidated Gas, Electric Light & Power Company of Baltimore, said: "Customer ownership has undoubtedly proved beneficial in improving public relations. Customer owners take far more interest in the utilities in their communities and their development and financing. Though these customers a better understanding is developed of the reality of stockholder ownership, of the soundness of financing methods, of the necessity for a fair rate of return and the mutual interdependence of the local utilities and local communities."

E. J. Beckett of the Pacific Gas & Electric Company states that there can be no reasonable doubt of the merit of customer ownership in respect to public and political relations. He said: "Out here in California a proposal to put the state in the water and power business has thrice been defeated upon submission to the voters and in each case the stockholders of the central-station companies, now numbering in the neighborhood of 200,000, were without question largely responsible for the active opposition to the measure. These elections afforded a pretty tangible basis for gaging the political value of customer ownership and I believe that its effect on public relations, while hardly susceptible of measurement, has been equally beneficial.

Another reference to the political aspect of the situation is made by F. H. Farnum, manager of the securities department of the Central Maine Power Company. Mr. Farnum says: "In Central Maine Power Company territory during the past ten years the company has been subjected to several severe political attacks. There has been a gradual change in state-wide public opinion from one of hostility to our proposed measures and politics to one of greater friendliness. We believe that this improving public opinion and public relation is in no small measure due to our customer-ownership stock distribution."

Another specific reference to the political aspects of the situation is made by the manager of the investment department of the Southern California Edison Company, who says: "While the primary purpose of customer-ownership financing is to raise money in the local field for capital expenditures, it has assumed an equally important mission as an instrumentality in the promotion of better political, public and employee relations. The defeat of the proposed and pernicious water and power act in California three times in succession by an increasingly large majority may be largely attributed to the hundreds of thousands of power company security holders in the state.

### Saving in Financing Costs

With respect to the cost of financing through the customer-ownership campaigns, a variety of opinions were given. The last-mentioned company states: "Speaking for the Southern California Edison Company only, the cost of selling securities through our customer-ownership campaign is, on an average over a ten-year period, about 60 per cent cheaper than the cost would have been for other modes of financing. The figures for costs are used in the underwriting sense and do not take into account the yield on the types of securities in question which would enter into a computation of real cost of money to the company."

Somewhat different has been the experience of the Potomac Electric Power Company. A. G. Neal, vice-president and comptroller, states: "There are many elements entering into the comparative costs of customer-ownership campaigning as compared to cost of financing through sale of bonds. It is undoubtedly most costly to finance through customer-ownership campaigns, but difficult to put the added value of the good will that flows to the company through this means as compared to that through the sale of bonds."

Referring to the question of costs, the Pacific Gas & Electric Company has had the following experience; "The average spread between the sale price of bonds to an underwriting syndicate and the price at which such bonds are offered to the public is probably from 3 to 5 per cent. Ordinarily, stock financing, on account of the relatively greater risk involved, might logically be expected to exceed this cost. In our own case, however, the cost of selling stock direct to the public has been very substantially below these figures. In the period from the middle of 1914, when this company initiated the customer-ownership plan, to the close of 1926 our average cost per $100 share of selling $64,700,000 par value of the stock direct to the investing public, without any underwriting, was 61 cents. I believe that this figure is, however, very considerably below the average stock selling costs of the industry as a whole.

It is obvious from what has been said that the cost of financing varies according to local conditions. A large company in the Middle West states: "It has been our experience that the cost of financing through customer ownership has been substantially the same as the cost of financing through investment bankers." A large Eastern company states: "Customer-ownership campaigns usually cost less than financing through underwriting or other methods of marketing junior securities." Still another large group with wide experience in customer ownership states: "The cost of money obtained through bankers varies between 3 per cent and 6 per cent, depending mainly on the class of security sold. Costs of the sale of the stock to customers varies principally with commissions paid to employees. In 1927 our costs amounted to slightly over 2 per cent."

### Alleged Decline in Customer Sales

Replies to the third question, dealing with the alleged falling off of customer ownership, also disclosed a difference of opinion. A large Pacific Coast company states: "I should say that this is due to the fact of a plentiful supply of money in the last several years, enabling large blocks of securities to be marketed in a short time by placing the issue through bond and brokerage offices. Many companies not having large construction programs no doubt sold their whole issues in the above manner in a comparatively short time and, therefore, felt no necessity of making any sales themselves locally to their customers during the balance of the year. Personally, I think this is rather a shortsighted policy as the maximum value of customer-ownership campaigns, I believe, is through continuous contact with one's customers in the sale of securities." Answering the same question Mr. Young, vice-president of the Public Service Corporation of New Jersey, states: "This question was anticipated by the 1927 customer-ownership committee of the National Electric Light Association and the statement on page 1 of its report, which is quoted below, practically answers the question: 'It is entirely natural, with the new capital requirements of electric power and light companies varying from year to year and with financial conditions changing from time to time, that the type of securities chosen by the companies shall also vary. It is, therefore, not surprising that occasionally the volume of customer-ownership securities sold in any one year by the electric light and power companies should be less than in some previous year.' "

A slightly different explanation is given by the Central Maine Power Company: "On the Central Maine Power Company system the number of customer owners is not increasing for two reasons: First, because those already owning the stock are increasing their holdings; second, because the tradeouts are almost equal to the number of new stockholders secured. With a limited amount of stock available the number of stockholders will not materially increase. In the case of the Public Service Corporation of New Hampshire there has been in 1927, and will be, a large increase in customer ownership during the present year.

A slightly different aspect of the situation is brought out by Chester C. Smith, vice-president of the Kansas City Power & Light Company, who says: "I am answering this question by saying that, in my opinion, this has been due to some extent to the low yield the securities offered. For example, in the period from 1920 to 1923 stocks and bonds were being freely offered to customer owners on a 7 and 8 per cent basis, whereas in 1927 this yield dropped to as low as 4½ per cent. In other words, customer owners as a general rule are not educated up to the investment quality of a security, but are more interested in the return or yield. This, in my opinion, accounts for the fact that the low-yield securities which were issued in 1927 had to be absorbed by discriminating investors such as insurance companies, trust companies and others investing funds in large amounts for private individuals."

The situation is concisely summed up by Herbert A. Wagner, president of the Consolidated Gas, Electric Light & Power Company of Baltimore, who said: "The sale of junior issues to customers was undertaken at a time when it became necessary and also possible to increase the ratio of junior securities. During and immediately following wartime borrowing had to be resorted to to an abnormal degree, and senior issues rose to unsound proportions. Financing almost entirely by the sale of junior securities followed this for several years. A large part of the more recent financing has been due to the refunding of bonds and preferred stock originally issued on high yield basis. When large issues are called it is necessary to have funds available promptly and surely and underwriting must be resorted to. A large part of the financing for plant improvements and extensions is still being done through customer-ownership distribution of junior securities and probably to a greater degree than heretofore."

### Viewpoint of Electric Bond & Share Company

The attitude of the Electric Bond & Share group toward the customer campaign is of special importance in view of the wide use of this policy resorted to by Electric Bond & Share companies. The following statement by E. B. Lee, statistician of the company, is of particular interest:

> We feel most strongly that public relations are greatly improved by having a large ownership of company stock in the territory served. It is never possible for a public utility company to have perfect public relations, human nature being what it is, but certainly a customer owner looks upon the company that serves him with more friendly eyes than if he did not have his own capital invested in the enterprise.
>
> Your second question has to do with the cost to the company of selling its stock in customer-ownership campaigns as contrasted with the cost of selling the stock in wholesale lots to dealers for distribution. The experience of our associated companies is that there is very little difference in the cost to the company of these two methods of disposing of its preferred stock. There is a direct benefit, however, in having the stock sold locally in that company employees learn more about their company and come into closer financial contact with the public through selling the stock than if the stock were sold by outside bankers.
>
> Your third question is why the percentage of preferred stock sold in customer-ownership campaigns in 1927 constitutes a smaller percentage of the total securities issued by public utility companies than in previous years. This reduction in the amount of preferred stock sold in customer-ownership campaigns in relation to the total securities issued is due to the fact that during 1927 the public utility companies, especially those engaged in the electric power and light business, did a large amount of refunding of securities. Of course, they also sold large amounts of securities for new construction and for additions to properties, but the proportion of securities sold for these purposes to the total sold was less than for previous years.
>
> In this connection it must be remembered that during the years 1917 to 1921, inclusive, it was practically impossible for public utility companies to finance their requirements except at heavy cost. During these years securities sold by these companies carried high interest or dividend rates and were sold at prices to make the cost of money very high. It was not until 1922 that the companies found themselves in a position to finance themselves on anything like favorable terms. The improvement in money conditions continued through the years 1923 to 1926, inclusive, and during this time the companies issued large amounts of securities for new construction and additions and to take care of short-term loans and other indebtedness created during the years when financing was difficult. By the close of 1926 the companies had practically caught up with their construction program and during 1927 the amount of new construction was more normal. During the year, the cost of money having been so greatly reduced, the companies took advantage of the opportunity to refund those issues placed during the years when interest rates were much higher.

### Investment Bankers Favor Plan

Turning from the attitude and experience of the companies to that of the bankers, one might possibly suppose that the investment banking fraternity would not be particularly friendly toward customer-ownership compaigns, since they naturally limit the volume of business available. Interviewed on this subject, Henry R. Hayes, vice-president of Stone & Webster and Blodget and president of the Investment Bankers' Association of America, said:

> The Investment Bankers' Association strongly favors the placement of securities among consumers. We have gone on record as favoring this policy so often that there is little to be added. However, it is of prime importance that only conservative securities be sold and, further, that they be sold at existing market prices. The part-payment policy is a sound method of installment selling and a happy way to encourage thrift. It is best for the consumer to become acquainted with the economics of his utility, but no consumer really should be enticed to buy utility stock unless he has a savings bank account, and perhaps liberty bonds and an insurance policy.

Another large banking house expressed the following opinion through one of its officers:

> As the trend toward customer ownership has become more pronounced, it has become increasingly apparent that the customer represents a consistent source of new money, and while the cost of money obtained through the sale of stock is higher than the cost of money derived from the sale of bonds, it is nevertheless necessary in order to maintain a well-balanced capital structure. Furthermore, if the stock is sold to the consumer (and to the employee) part of this increased money cost might be deemed chargeable to cost of maintaining good relations with customers and employees. The investment banker should have no objections to this method of financing, inasmuch as it is to his advantage for the company to maintain good public relations and a well-balanced capital structure. Furthermore, as it is impossible for most companies to care for their principal financial requirements in this manner, it will not in the long run seriously restrict the business of the investment banker.
>
> At the same time, as pointed out above, by maintaining a good balance of stocks to bonds, the issues handled by the investment banker should be backed by a stronger equity than might be the case if the company did not sell its stock locally. For the banker handling stocks as well as bonds, this might reduce the issues available, but the fact cannot be overlooked that much of the stock is sold to the small investor who, prior to his purchase of the stock of his local electric company, placed his surplus money in a savings bank, a local building and loan association or in local real estate mortgages. Thus it is possible that by selling stock to employees and customers the electric light companies are educating a new class of investor to the possibilities of investing in the securities of corporations. This cannot help but eventually redound to the benefit of the investment banker.

## Power-Driven Take-up Reel Mounted on Line Truck

FIVE trucks of the Northwestern Electric Company, Portland, Ore., are equipped with a line-wire take-up reel attached to the niggerhead of a power-driven winch near the front of the truck. The arms of the reel are mounted on a steel plate which is fastened to the niggerhead of the winch with cap screws, making the reel easily removable. By loosening the screws holding the outer arms of the coil-forming reel the arms may be swung in toward the center for removing the coil of wire.

## Substation Inspections

By O. M. Ward

*Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.*

INSPECTION REPORT forms used by the Milwaukee Electric Railway & Light Company for different types of equipment have been described from time to time in the Electrical World. In addition to those forms, there are a number of others of less complexity and detail and also certain summary forms by means of which the chief operator is kept continuously informed of the status of all inspection work undertaken in the various substations.

The shorter forms each cover a definite item. The one on oil switch inspections carries space for notations on the condition of the contacts, of the oil, of the operating mechanism, and of the control. Intervals between regular oil-switch inspections vary from one month to two years, depending upon the equipment or line to which the switch is connected. But inspections are made annually and this form reports the bus voltage, conditions of insulators and connections, cleanliness, and conditions of buses generally. The miscellaneous equipment inspection, which is made at intervals of from six months to two years, is reported on a form which, on account of the impossibility of its being made specific, is mostly taken up with space for remarks.

The operations of automatic switches and contactors are recorded by Veeder counters, the readings of which are taken once a month. These readings, together with identifying descriptions of the equipments and line-ammeter readings, are reported to the chief operator. His accumulated records show the total operations for each month and for the preceding twelve months, and also the monthly average for the particular class of equipment during those twelve months. If the number of operations at any time appears excessive in comparison with the average, a special investigation is made to determine the cause of the condition.

The summary inspection report form, which is kept by the chief operator, consists merely of a date-recording blank, in which he enters the inspection dates for all apparatus and equipment. With this record, he is enabled to keep informed of inspections completed and due, and can, at any time, tell pretty closely the condition of any equipment in any station.

## Revised Handling of Customers' Complaints

By J. W. Williams

*Director Public Relations*
*Binghamton Light, Heat & Power Company*

COMPLAINING customers are the ones who deserve the most attention. Previously all customers' complaints were handled through the meter department. Upon receipt of high-bill complaints the meter was generally tested, but many customers would come back dissatisfied. The customer is seldom interested in what the meter test shows and must be shown where the current actually was used, or must be convinced of the value of the service rendered for the rate charged.

It has been difficult to induce meter men to adopt a sympathetic attitude toward the customer. They are convinced before they start that the meter must be correct, because they have tested many meters and found only a very few fast. This attitude does not appease the customer.

Under our present method complaint men are used who have been trained in every department and who can test a meter if a customer insists. In most every instance they are able to find some cause for the increased consumption that satisfies the customer, so that it is not necessary for the customer to come back and discuss the same complaint all over again. If the increased consumption has been caused by some device that the customer just started using the customer is shown how slight the daily increase in cost is compared with the service given by the particular appliance. This encourages the customer to continue using the appliance rather than neglect its use to reduce the electric bill, as occurred when inexperienced complaint men were employed. The complaint man not only satisfies the complainant but also explains rates and bills, instructs customers how to read meters and shows them how to replace their fuses, etc.

When a complaint is received that cannot be satisfied at our complaint counters a complaint order is made out in triplicate. On this complaint order is shown meter data, last reading, twelve months' consumption and any remarks which the counter clerk has gathered from his conversation with the customer that will be helpful to the complaint man. The record of this complaint is entered on a log sheet, triplicate copy being filed numerically at the counter as a check on the prompt return of original by the complaint man, or in case of a line complaint to assure that the line department completes the work in a reasonable length of time. The original and duplicate of the complaint order go to the complaint man; he retains the duplicate for his records and returns the original to the counter when his work is completed. When the original is returned to the counter the triplicate copy is destroyed.

A comparison of results obtained under the old and new method of handling complaints is interesting:

*Old Method*—Report of meter tester:

"Could find no reason for high bill except that customer is using lights."

*New Method*—Report of a trained complaint man:

"Customer leaves a 25-watt lamp burn all night in bathroom. Children also leave back porch light on frequently all night. I found they had young pups in the cellar that would not eat without lights on, and customer admitted that they forgot these frequently. Satisfied."

This method of handling complaints has reduced special meter tests 75 per cent.

## Electric Trucks Charged at Outdoor Loading Platform

"THE fact that we are constantly purchasing additional electric truck equipment is proof positive that the service rendered has been satisfactory from every angle," said George Ford, superintendent American Railway Express Company, at the recent Electric Truck Conference in New York City. This organization operates a total of 1,528 electric vehicles in eighteen cities of the United States. Of this number 561 are operated in Greater New York. The kilowatt-hour consumption in Brooklyn, Long Island City, New York City and Jersey City totaled 5,401,900 in 1927.

At least 40 minutes per car per day is saved, according to Mr. Ford, by the charging of batteries while still in the truck and while the latter is in position at the loading platform. This practice obviates the necessity of the twice-daily run between the New York garage and the terminal in Long Island City. Weather conditions have, particularly in winter time, seriously complicated the plan, but experience over several years indicates the over-all value of the scheme. There are 125 charging outlets distributed around the outer edge of the platform.

In speaking of the difficulties of winter operation, Mr. Ford stated that the fact that actual failures on electric trucks or the number that were out of service during the winter did not cause the operating department any inconvenience is a fair indication of just what abuse an electric truck may be subjected to and still operate satisfactorily. "While we stored 125 electrics at the Long Island terminal and about 45 gas cars, it was always necessary in the morning to get an electric to tow the first gas car and get it started so that the remainder could be pulled around the platform and started up pending the driver's arrival.

"We at present are operating in New York City some 80 2-ton electric vehicles that are in their seventeenth year and also 120 that are in their twelfth year. It is particularly interesting to note that while years of service continue to accumulate on these vehicles, the repair and maintenance item remains about the same."

It is estimated that 28 per cent of the vehicles operated on an average of twenty hours daily and the remaining 72 per cent an average of fifteen hours.

## Sign Lighting Averages 85 Kw. a Block in Reading

SIGN lighting loads in the eight blocks of the main business section of Reading, Pa., total 680,000 watts, according to statistics of the industrial lighting department of the Metropolitan Edison Company, a subsidiary of the General Gas & Electric Corporation. This unusually high concentration of lighting for a community the size of Reading, approximately 114,000, has been secured largely through practical demonstrations by the company of the results that can be obtained with adequate illumination. Merchants have had proved to them, by installational examples, the sales and attention-arresting values of bright but unglaring effects in window lighting. The same plan has been applied to the improving of sign loads.

*Utility sign and comparative-letter-lighting demonstrate relative publicity values*

The new twelve-story office building of the Metropolitan Edison Company has been topped by a sign bearing the company's name in letters 10 ft. high. It is of a double-face type containing 2,600 25-watt lamps. The effectiveness of this display was such that other neighboring signs appeared dim in comparison. One illuminated-letter device, equipped with 810 10-watt lamps, was changed to 25-watt equipment after a comparative demonstration on one letter had indicated the relative publicity values. As a result of such work an increase of 47,000 watts was made on 21 signs with an appreciable gain in revenue.

Five advertising devices which had been allowed to fall into disuse were reconnected at 32,000 watts, and new signs and poster-board illumination last year amounted to 218,000 watts. In this work the commercial department of the utility obtains estimates for the fabrication and installation of new signs from several companies, leaving the conclusion of final negotiations to the buyer and seller. No signs are merchandised by the utility.

## Value of Campaigns Established

As a result of twelve major sales campaigns during the past year the Georgia Power Company has developed definite evidence regarding the value of such efforts. Out of the total sales, amounting to $1,600,000, more than $1,000,000 worth of goods were sold during the special campaigns. The annual quota was exceeded by $200,000. A comparison of campaign sales with total sales of some of the items is shown in the accompanying table.

SALES AND CAMPAIGN SALES

| Item | Total Sales | Campaign Sales | Percentage in Campaigns |
|---|---|---|---|
| Electric irons | 7,707 | 5,679 | 73.6 |
| Gas ranges | 3,971 | 1,693 | 42.6 |
| Waffle irons | 1,422 | 1,272 | 89.5 |
| Electric ranges | 1,163 | 1,003 | 86.2 |

VALUE OF SALES

| Item | Value | Item | Value |
|---|---|---|---|
| Electric refrigerators | $632,602 | Electric irons | $28,111 |
| Electric ranges | 147,456 | Electric waffle irons | 12,656 |
| Gas ranges | 87,114 | Gas water heaters | 5,763 |
| Radios | 55,720 | | |

Factors entering into the success of the Georgia Power Company's sales campaigns include the division of the state into sections, with a sales force in each; a special price to customers on the items offered during the campaign; free demonstration in the home of the customer, and terms on the articles extending from ten to twelve months. Extensive advertising also played an important part in putting over sales, advertisements being carried in a dozen daily and 40 weekly papers.

## Electric Dehydration of Oil

It happens frequently enough to constitute a problem that crude oil as it is pumped from the well is emulsified with water. Since the pipe line companies will accept nothing but pure crude for transportation through their pipes it is up to the producer to break down the emulsion and take the water out of the oil. The common practice is to apply heat to the oil in a series of cookers. This process of demulsification is now, to a growing extent, accomplished by electric dehydrators, states O. A. Jennings of the Oklahoma Gas & Electric Company.

The oil containing the emulsion is passed through an electrostatic field between two electrodes at a potential difference of about 11,000 volts. The discharge between the electrodes breaks down the emulsion and the water settles out. Aside from making the crude oil acceptable for transportation through pipe lines the Baumé gravity figure of the oil is raised and its market value thus increased. The increase in value is usually sufficient to pay for the treating equipment in nine months or less. The average power consumption of an electric dehydrator is in the neighborhood of 2,000 kw.-hr. per month, varying according to operating conditions between 1,200 and 5,000.

## *Notes on European Conditions*

*Result of Interview with*

Philip Torchio

*Vice-President New York Edison Company*

One visiting Italy and Switzerland is impressed by the remarkable development of railroad electrification. Switzerland has nearly completed her program of electrifying 60 per cent of her railroads. Italy is actively engaged in expanding her railroad electrification and in about a year one will be able to travel from France to Naples on a continuous electrified railroad.

In all the manufacturing plants I have visited in these two countries I have found considerable work in building apparatus for railroad electrifications.

The electric light and power industry in Italy is in a remarkably sound condition. While in the past years the rate adjustments to the depreciated value of the currency have lagged behind the movement of depreciation, with the returned appreciation of the lira of the last year the net returns have materially improved, notwithstanding a slight decrease in gross business during this year of economic readjustment.

One obstacle to the free development of the industry in domestic application is the heavy state and municipal taxes on all lighting bills. This does not apply to power. These taxes average about 60 per cent and are so worked that the electric undertakings are really made tax collectors of this 60 per cent extra for the state and the municipality. If a consumer desires to use any heating or power in his home, he usually demands that the supplying company furnish a separate meter service, so as to avoid the taxes that he would have to pay if he used only one meter for light and power.

The electrification of the industries has perhaps progressed to a greater degree than in any other country. The industrial rates are very reasonable and compare favorably with those of other countries. In the next two years more than 1,000,000 hp. of new hydro-electric plants will be placed in service, thereby making liberal provision for the expansion and growth of electric service in all lines of industrial and domestic activity.

The new telephone companies which, about three years ago, took over the local and interurban state telephone systems have made great improvements. In the large cities certain new, or almost new, details, such as taxi service calls, railroad information service, etc., have been introduced with great success. The state long-distance telephone lines are being entirely revamped, using underground armored cable buried in the ground. The use of overhead cables had to be abandoned on account of the hunters for birds shooting at the cables.

# Industrial Decentralization and Its Effect on Interconnected Systems

*An Interview with*
GEORGE M. VERITY
*President American Rolling Mill Company*
*Middletown, Ohio*

*George M. Verity*

SPREADING of industry over large areas and its effect on speeding up the growth of electric transmission and distribution networks over those areas is pointed out by George M. Verity, president of the American Rolling Mill Company, as an important factor in the wider application of electric power to the home and to the farm. He further said that it is incumbent as a social obligation of industry to promote the development of the electric light and power business if other considerations are equal or not too greatly diverse. In outlining the reason for his conclusions Mr. Verity said: "It is acknowledged that the key to all economic progress is power. It is agreed generally that the prosperity and progress of our country rest on the fact that the American workman is a director of the labor machines rather than a user of his own muscular force. The average utilization of power in American industries is now something more than 4 hp. per worker. This figure is more than double that of twenty years ago. Translated into terms of sweat of the brow, 1 hp. is equivalent to ten men. The American workman of today is the equal of more than 40 men working with their hands and backs. The mechanical power for the operation of machines is best supplied by electric motors. This is self-evident. Ease of control, variety and flexibility of application make electric power pre-eminent for industrial use.

"In addition to its direct service as a multiplier of production, electricity now makes another contribution to industrial progress, a contribution that in the future will increase. It is making more easily possible the locations of factories in small cities and towns. Industrial activity, so far as it is influenced by availability of power, may be removed from congested centers of population. An outworn argument for the locations of industries in so-called "industrial centers" has been that labor is plentiful in those centers. This is true. Labor, of a kind, is usually plentiful. But with that labor industry accepts the evils of a competitive labor market, of labor living in slums and less effective in consequence, of selfishly factional local governments and of labor's disinterest in everything except wages.

"Contrast with this the advantages of the small city. The plants of the American Rolling Mill Company are located in small cities. In these we know that the homes of our employees are brighter and more comfortable. We know that the eight hours of the day remaining after work and sleep are taken out are healthier and happier. We know that recreation is diversified and largely in the out-of-doors. We know that there is a closer contact with and a greater interest in religion than in the large city. We know that social life is at its best. We know that contact of our employees with community and municipal problems is closer and their participation in the administration of local government is on a broader and less sectarian basis. We know that the community of our employees is an important entity in the small city. We know these things because they are the reasons why our plants are located in small cities.

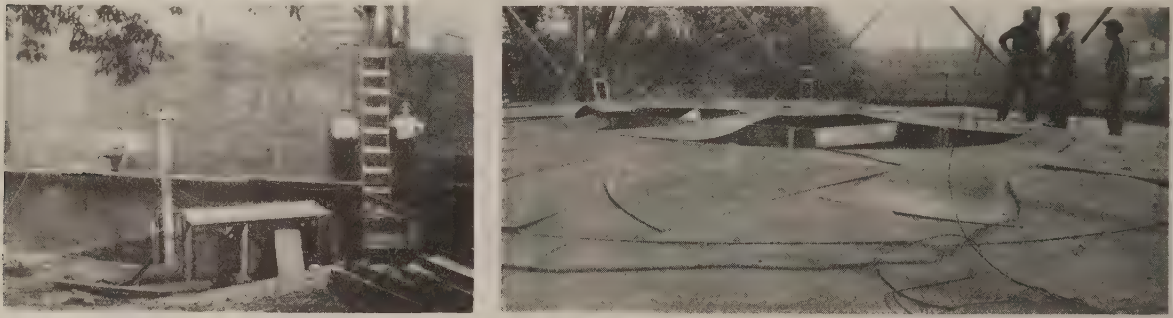
"There is more to the contract between labor and industry than the simple paying of dollars for a day's work, no matter whether the dollars paid are many or few. This is not to say that industry, with paternalistic gesture, should attempt to force on employees, or even offer to them, extra compensation in the shape of community benefits, which quite naturally may be received with resentment rather than thanks. It simply means that the industry is itself a part of the community to which the employees also belong. The industry has obligations to the community in proportion to its size. These obligations must be discharged understandingly and without the possibility of any suspicion that the industry is "running" things. The best way to escape that suspicion is to give no grounds for it, and grounds will not be given if the industry simply does its fair share in local government. The employees, too, have obligations to the community. Their obligations also must be discharged if the contract is to be lived up to. This all boils down to the statement that both employer and employed must develop an awareness of social duties, the performance of which will result in benefit to both. Nowhere but in the small town, where relative sizes are greater, can this condition be realized. This is why "Armco" is committed to the small town.

"I am told that electricity can be economically transmitted 200 or 300 miles. This means that power may be had within areas of such radius from generating plants. I am told also that improvements in steam plant efficiencies smash the idea, popularly held, that electricity must be cheaper in areas where water power is plentiful. This means that industries may be located without special regard to power supply, because power will be plentiful and low priced almost anywhere. In fact, we have gone quite a way on that road already.

"It seems to me that the spreading out of industry over large areas of country, which will be the effect of locating factories and plants in small towns, will greatly speed up the growth of electric transmission and distribution networks over these areas. This will help enormously in the job of bringing electricity to the 6,000,000 American farms that are waiting for it. The farmer now must pay a comparatively high price for electric service because the investment required to serve him is high. The cost to the farmer would be less if there were a few industrial plants taking their power from the same line that he takes his from, thus increasing the revenue factors of the line.

"The production and distribution of electricity is a distinct and separate economic function that, I think, can best be performed by organizations devoted to that work. It is not only true that, in the usual case, electricity can be supplied as economically, or more so, from a central system as it can be generated in a private plant, but from a social standpoint it is desirable for industries to take power from a supply system. This is on account of the fact that the prosperity of the individual rests on the prosperity of the nation. National prosperity, its continuance and enlargement, is in no small degree dependent on the more extensive application of electric power, not only to the industrial plant but to the home and to the farm. This widening application can be maintained and extended only through electricity supply systems. It is then, other considerations being equal or not too greatly diverse, incumbent as a social obligation on industry to promote the largest development of that agency—electricity supply systems—which has so important a rôle in the progress of the country.

"There is the picture. Capital is fast learning that it is a partner with labor on nothing more than an equal basis. The contentment and happiness of labor depend as much on conditions outside the factory as inside. The security of capital depends on the contentment of labor. Labor, respecting self and others, contented and interested in getting the most out of life, gains in respect, contentment and interest as it moves away from population congestion. Industry, for its own good, goes to the small towns. Electricity supply systems, already spread out over the United States in interconnected networks of enormous extent, grow larger and become closer woven on account of the spreading out of industry. The nation continues at accelerated pace toward her destiny of a happy, continuously prosperous and united people."



*Portable equipment speeds welding of gasholder.* *Assembly is simplified by the welding of rolled plates*

Tack welding follows the laying out of the plates upon a temporary structure and precedes the final welding work

## Electrically Welded Gasholder

AN ALL-ELECTRIC arc-welded low-pressure gasholder of 300,000 cu.ft. capacity has recently been completed at Albion, Mich. The construction and design are both the work of the Western Gas Construction Company of Fort Wayne, Ind. The holder, with all lifts elevated to their maximum height, stands 113 ft. 7 in. above the foundation. It has a diameter of 74 ft. and weighs 516,385 lb. plus the weight of the welding rod that was used. This is said to be the largest low-pressure gasholder built entirely by arc welding.

One of the great advantages of using electric welding on gasholders lies in the gas- and water-tight features of the construction, according to F. H. Beebe, vice-president of the Western Gas Construction Company. "Building a gasholder by electric arc welding has inherent practical advantages that recommend it strongly. It simplifies construction and reduces fabricating cost. When a gasholder is made of riveted plates it is necessary to employ the tank shop to lay out and punch all the members. When metallic arc welding is used it is only necessary to lay out and punch the members in the shop for fitting-up bolts. The plates are, of course, rolled to the proper radii in the shops. On this job the plates were assembled in position with bolts and tack welded with the exception of the cups and grips, which were fabricated in the shops and assembled in sections on the ground."

On this gasholder 4 tons of electrode welding rod were used. If a holder of the same size were made of riveted construction $7\frac{1}{2}$ tons of rivets would be necessary. Four "Stable-Arc" welders manufactured by the Lincoln Electric Company, Cleveland, Ohio, placed 21,414 lineal feet of welding. The entire job was carried through almost without a hitch and with much less difficulty than would naturally be expected with a new structural process.

## Wiring Practices Improved by British Organization

THE newly formed National Register of Electrical Installation Contractors has just recently held its first annual meeting at the Institution of Electrical Engineers in London. The chairman, P. V. Hunter, pointed out that the register was not a trade organization, but a body to protect the public from the irresponsible wireman and his shoddy and dangerous workmanship and to raise, by means of a national register, the efficiency and status of installation contractors in connection with the application and use of electricity for any purpose.

The register covers Great Britain, the Irish Free State and northern Ireland. Evidence of competence and responsibility and the occupation of suitable business premises are required as a condition of registration. The number of applications received so far is 1,378 and the number on the register is 1,086. Increasing interest in the advantages of registration is being shown by supply authorities and especially by those who have adopted assisted wiring schemes, many of whom have restricted installation work to registered contractors. No complaints of bad workmanship against registered contractors were lodged during the first year of the register's existence.

## Letters from Our Readers

### *Sales Policies—Not Electric Heat at Fault*

*To the Editor of the* ELECTRICAL WORLD:

Frank expressions of opinions, like T. P. Kindig presented in the April 28 issue on "What Is the Matter with Industrial Electric Heat?" are what the industry needs if it is going to progress. Too many discussions on timely topics are framed to avoid offense and they don't get anywhere. Whenever there is a lackadaisical attitude on a situation that requires action we need some straight-from-the-shoulder punches. Better to make some mistakes than conceal conditions that need correction.

Since Mr. Kindig indulged in expressing himself freely I am going to take the liberty of doing likewise.

First of all, there is nothing the matter with industrial electric heat. The slowness of progress in this development, which will eventually involve a load and energy consumption equaling or exceeding motor applications, is due to weak sales policies and selling methods.

The sooner manufacturers, or utilities, get over talking about who will benefit most by the acquisition of the new load and get down to joint participation, realizing that the benefits to either will justify all the work either can put into promotional work, the quicker will results come. Of course, utilities will get a yearly revenue from each installation, but these installations will also bring manufacturers repeat orders just as early motor installations did. "Passing the buck" never brought results.

The attitude of some combination gas and electric utilities or electric utilities affiliated with gas properties constitutes another major hindrance to the deserved growth of industrial applications of electric heat. It is natural for such companies to protect the investors in gas utilities by not stealing away gas applications and replacing by electric. For the combination companies the net immediate result would be zero. But should these situations put a stopper on all activity to secure applications of electric heat?

Surveys by any utility will show that there are plenty of heat applications to work on which are using neither gas nor electricity. If electric operation will be more beneficial to the customer than gas operation, he should be given electric operation, and vice versa. But the debate between the values of the two services should not be carried into the customer's office. It should be settled before customer approach by the gas and electric salesmen. If there is disagreement, then an executive in charge of both services should referee the decision. Debates between gas and electric salesmen in customers' offices have usually resulted in losing the business to oil.

What value will the existing sales policies of some gas-electric companies have if, a few years hence, customers decide for themselves that they want electric instead of gas operation? Better to sell them now what is best for them, so a lot of embarrassing explaining will not have to be done in the future when they voluntarily make a changeover.

Another reason why some utilities have put so little effort into developing electric-heat applications is because they think that such applications are available only in automobile centers, or where metallurgical furnaces are dominant. They haven't analyzed their market by listing every customer's applications which require heat and classifying the possibilities for electric heat as good, fair or remote. A few companies have or are making such surveys and other utilities will wish they had when they see the progress which will be made by the progressive companies which have had courage enough to appropriate money for a survey.

If utilities will analyze their possibilities for increasing motor loads above those which come from industrial expansion due to population growth many will see that they have to develop new markets.

Assuming a utility as interested in industrial electric heat, why the half-hearted sales efforts in acquiring it? Representation of utilities at manufacturers' sales schools on industrial electric heat would make it appear that there is only enough business to support two or three fair-sized utilities. Can the surveys which a few utilities and manufacturers have made of the potential market be so far astray as that?

As Mr. Kindig pointed out, the sales force that utilities have put on industrial-heat load acquisition is entirely out of proportion to the sales force working on motor applications. If the new business which can be acquired from industrial heat loads is equal to or greater than that from existing motor loads, what is the basis for devoting 10 per cent or less of the sales effort to the coming load and 90 per cent or more to a business which has already been developed. Sales forces should be based on the value of the reasonably obtainable market.

Finally, there should be more accumulation of selling-data ammunition, which will be facilitated by greater co-ordination of utility, oven manufacturer, and electrical manufacturer selling forces. As proof of the lack of fact-selling, I would wager that the ELECTRICAL WORLD'S editorial pages would not be burdened if all the factual data on which specific electric-heat applications have been sold during the last five years had to be published promptly.

GEORGE H. GETTER.

New York City.

### *Overbuilds Reading Railroad with 66-Kv. Lines*

*To the Editor of the* ELECTRICAL WORLD:

I note in the April 7 issue of the ELECTRICAL WORLD, on page 709, three cuts showing transmission structures over the Reading Railroad right-of-way in connection with the Conowingo lines. Unfortunately these are indicated incorrectly as being 220-kv. lines. They are actually the 66-kv. circuits from Plymouth Meeting substation, the 220/66-kv. transforming substation, to Westmoreland substation.

P. H. CHASE,
Engineer Transmission and Distribution Division.
Philadelphia Electric Company.

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Hydro Plant Achensee (Tyrol).*—P. Simon.—Last September the Achensee plant, the largest Austrian hydro-electric power station, was put into operation. Two natural Alpine lakes, located 6,500 ft. above sea level, were connected and provide the water supply and storage. From there a quadruple pentstock line, under an average inclination of 45 deg., leads to the power house in the valley, giving a useful hydraulic head of 1,200 ft. The station generates single-phase power at 16⅔ cycles for the Austrian Federal Railways and three-phase, 50-cycle for general power supply. There are installed four single-phase units of 8,000 hp., two three-phase sets of 15,250 hp. each and two more three-phase sets of 31,000 hp. each, totaling 124,500 hp., which will produce an average of 150,000,000 kw-hr. annually. The railway generators are driven by single-runner Pelton wheels, the three-phase machines by double wheel turbines of the same type. Transformers step the 16⅔-cycle potential up to the feeder voltage of 55 kv., the 50-cycle power to 115 kv. The outdoor switchgear is remotely controlled from a switching room.—*Zeitschrift des Vereines Deutscher Ingenieure,* March 24, 1928.

*New Extension to Shanghai's Electricity Plant.*—Upon the completion of the work now under construction at the plant of the Shanghai (China) Municipal Electricity Department the capacity of this station will be 120,000 kw. This addition, made necessary by the increase in the use of electrical energy in the territory served, involves the placement of two 20,000-kw. turbo-alternators. Boilers are provided with pulverized fuel equipment each having a steam generating capacity of 140,000 lb. per hour under normal load and 185,000 lb. per hour maximum at a pressure of 350 lb. per square inch and a temperature of 700 deg. F. The construction includes dust catchers fitted to the stacks to eliminate the dust nuisance often associated with the use of pulverized fuel.—*Far Eastern Review,* March, 1928.

## *Illumination*

*Photoelectric Photometers.*—In a series of three papers in this publication, the methods of photoelectric photometry, experiences and the progress that has been made in developing such devices in one laboratory are given. This method of photometry, which substitutes an electrical eye for a human eye, eliminates many of the former difficulties in photometric work. The general characteristics of the equipment and the possibilities involved in its use have been fully outlined. Four separate systems have been developed and a comparison of the practical application of these several devices has been made and the adaptability of the equipment to commercial photometry indicated.—*Transactions of the Illuminating Engineering Society,* April, 1928.

*Standardization of Methods of Heterochromatic Photometry.*—A. H. Taylor.—Experimental results of photometric tests of twelve colored filters, varying in color from saturated purplish-blue to saturated red, are given in this article. Measurements were made by flicker photometer, using a number of observers and by a spectro-photometer. Integral transmission factors computed from spectral transmission data were in satisfactory agreement with those obtained directly from flicker photometer observations for all but one filter. A proposed standardized method of procedure is suggested by the author for use in heterochromatic photometry.—*Transactions of the Iluminating Engineering Society,* April, 1928.

## *Transmission, Substations and Distribution*

*Horizontal Cooling Ducts on Transformers.*—F. Steckler.—On core type transformers with disk coils narrow oil ducts are provided between the disks to provide oil circulation. The size of these ducts is determined largely by mere assumptions, based on more or less reliable operating experiences. The article approaches this subject mathematically, pointing out how readily overheating, sludging of oil and carbonization of the insulation may occur when these ducts are too narrow. On wide coils oil circulation in a horizontal direction may only be expected at the right and left end of the disk section, while the middle part is stagnant and therefore endangered. The width of the duct should always be proportional to the width of the coil. A greatly improved cooling action could be obtained if the disks were wound with slightly rhombic cross-section copper instead of rectangular strips. This would give the disk coils a slight conical shape and would give all ducts an upward slant. A very small angle would increase circulation materially.—*Elektrotechnik und Maschinenbau,* March 25, 1928.

*Power-Factor Improvement.*—Considerable attention is being devoted by French engineers to the subject of power-factor improvement and the report of an investigation by one company is recorded in this article. As the result of several determinations L'Ouest Lumiere found that power-factor improvement in large plants was generally best effected by readjustment of the size of the motors, by the use of static condensers and by the adoption of synchronous or compensated induction motors. In the improvement of medium-sized plants it was generally found that users preferred to adopt an arrangement for the improvement of the whole plant, which obviated changing the distribution of motors or power transmissions. The arrangement most often employed in France is said to be the synchronous compensator, increased attention being given, it is stated, to the manufacture of smaller sizes. Improvements at the generating station and at different points of the system have been considered at some length and the subject of special tariffs allowing for corrected power factors is discussed.—*World Power,* April, 1928.

## *Units, Measurements and Instruments*

*The Dilatometric Study of Light Metals.*—Max Haas.—The dilatometric study of iron and its alloys by other investigators led the author to systematic dilatometric examinations of light metals and their technically important alloys. The apparatus used in this investigation was the Oberhoffer-Esser dilatometer with oil damping of the dilatometer housing and with the furnace dilatometer tubes and dilatometer casing stand at right angles to the camera. There are two means of optical registration, either in the direction of the furnace on a screen covered with a sensitive photographic paper or by reflection of the light rays on a protographic plate by means of a mirror set at an angle of 45 deg. Investigations were made of pure aluminum; silumin, a pure eutectic aluminum-silicon alloy; aluminum copper alloys and duralumin.—*Engineering* (*England*), March 16, 1928.

*A Method for Determining the Condition of Current Transformers While in Service.*—A method for determining the existence of short-circuited windings in current transformers while the transformers are in service and loaded has been devised and experimented with by one of the member companies of the N.E.L.A. When making this test no measurement need be made on the primary side of the current transformer. This test was devised primarily for installations where it is not possible to interrupt the customer's service and for installations where the voltage of the primary service is of such a high value that it is not possible, from a safety standpoint, to use the split core type of current transformer for a rough ratio measurement. It has been found experimentally that short circuits in current transformers are readily detected by this method, if errors of the order of 2 per cent or more occur at the wattmeter due to the short circuit. It is stated that the method proposed in this report is not advocated as a complete solution for all phases of the problem. The experience with this procedure has been limited to such an extent that it is only suggested that the method may, after exhaustive research, prove as practical as preliminary tests indicate.—*Serial Report National Electric Light Association*, March, 1928.

## *Motors and Control*

*Squirrel-Cage Induction Motors.*—D. B. Hoseason.—The principal features of an electric motor are discussed and the characteristics of the squirrel-cage machine are considered in relation to them. The disadvantages of the squirrel-cage motor are then examined and their importance on certain types of drive is considered. Various methods of overcoming the poor starting performance characteristics are dealt with. The characteristics of high-resistance rotors for both continuously rated and short-rated motors are discussed and the advantages of the double-squirrel cage rotor over many of the alternative proposals, are also considered. A close examination of the starting currents drawn by squirrel-cage motors under various conditions of starting is made and the subject is considered from the point of view of the utility engineer.—*Journal of the Institution of Electrical Engineers (England)*, April, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*New Insulating Compound.* — W. Meyer.—With the exception of porcelain, the best dielectric material obtainable today is rolled or laminated paper, impregnated with artificial resin. Its high puncture strength applies, however, only across the layers. It is neither weatherproof nor fireproof. A Swiss concern has developed a new material, called "Diel," made from a condensation product, which is claimed to be of homogeneous structure throughout, is waterproof, does not burn, is insoluble in hot oil and has a specific weight of 1.35. The new material is manufactured in rods, tubes and plates. Results of a large number of tests are given to show puncture, creepage, arc resistance, flashover and mechanical strength. If these claims are substantiated, which seems to be indicated by practical tests of long duration, this new compound should find a large field of applications for high-voltage outdoor insulation. *Bulletin de l'Association Suisse des Electriciens*, March 22, 1928.

*Electrolytic Iron.*—The production of electrolytic iron received little or no attention even after the successful application of refining copper by electrolysis because of the low intrinsic value of iron and the difficulties of obtaining it in a form suitable for commercial purposes. The electrodeposition of iron suitable for commercial use is stated to be a very difficult problem as compared with the electrodeposition of copper, zinc, lead, nickel and many other metals. Owing to the magnetic properties of the electrolytic iron it offers advantages in the construction of transformers, generators and motors. By using sheets of this material the weight efficiency of transformers may be increased about 35 to 45 per cent; in the case of alternating-current motors and generators an economy of about 16 per cent can be effected in the weight of the iron used. It is well known that the losses tend to increase with the time of service of a transformer and the deterioration of the plates takes place more rapidly as the temperature increases. Electrolytic iron gives no trouble from aging as its crystalline structure is very stable. The author has reviewed the various factors involved in the production of this material and offers an outline of the economic consideration.—*Engineering (England)*, March 23, 1928.

## *Traction*

*Action of High-Speed Breakers for Railway Protection.*—C. Begis.—Statistics indicate that there is one short circuit for every 310 train-miles on electrified main railroad lines. The most successful means of protecting the equipment against possible damages from such short circuits are the recently developed high-speed circuit breakers. With the co-operation of the French federal railway system the author has made an extensive study of this subject and gives a report of his work. More than 500 oscillograms were taken under various short-circuit conditions on the 1,500-volt direct-current system. It is claimed that never before have similar tests been made under actual railway operating conditions on such a large scale. The calibrated oscillograms give an excellent proof of the fast current interrupting action of high-speed breakers. Overvoltages as high as 2,500 and 10-ft. arcs were recorded.—*Revue Générale de l'Electricité*, March 17, 1928.

*French Railway Electrification.* — Chas. J. Webb. — The progress and practices involved in the electrification of the Midi Railway (France) are outlined both as to rolling stock and energy distributing equipment. The project involves a 150,000-volt transmission line for long-distance transmission of energy. Conversion to 60,000 volts is made for general distribution and transformed by means of rotary converters and mercury-arc rectifiers to 1,500 volts direct current for tractive-unit use. A special flexible driving coupling has been devised and is installed in many of the locomotives in connection with this development. Passenger trains are fitted with electric regenerative braking, while freight locomotives have rheostatic electric brakes controlled by varying the field of the motor.—*Electrical Review (England)*, April 20, 1928.

## *Heat Applications and Material Handling*

*Fundamental Principles in the Design of an Electric Furnace.*—Tsunezo Kawasakiya.—It is the contention of the author that the design of electric furnaces and other heat-treating apparatus is far behind that of other electrical equipment, and the object of the present investigation is to establish a technical foundation for this line of engineering. The analytical expression by geometrical quantities for conditions in the surrounding walls of an electric furnace is offered as a substitute for the usual algebraic solutions. Thermal equations have been derived to express the steady distribution of temperature, heat flow and stored energy in the walls through which an electric current passes. Simple relations derived by introducing equivalent physical constants for composite walls; an apparent thermal capacity which is denoted by the steady thermal energy stored in the furnace, divided by the temperature rise and corrected by means of an empirical expression; practical thermal equations applicable for a furnace operating intermittently; economical conditions to be kept in mind in the determination of the general contour of the furnace; resistance of the surrounding walls, and the resistive qualities of the material with the viewpoint of economy and application of the theories developed by means of specific numerical examples are given by the author. It is concluded that the principal value of the discussion rests upon the simplification of the mathematical calculations required through the introduction of a universal analytical expression of geometrical quantity for the surrounding walls.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1928.

## *Miscellaneous*

*Investigations of Lightning.* — L. Binder.—If the time of a lightning discharge is known, the current intensity can be calculated from calorific actions on wires or cables. Based upon past and recent observations, the author establishes a formula for the current to be $i = 9{,}500/\sqrt{t}$, giving values which check closely with Peek's latest observations on steel springs, melted by lightning. Measurements on the duration of discharge were made formerly with revolving cameras, while more recently oscillographic, cathode-ray and klydonograph records have afforded a much higher accuracy. Another method used by the author required a series of graduated spark gaps, finding in every case a total duration of more than 1/100 second. During these tests it was found that the distance of the thunder cloud not only affects the induced voltage but that it has also a decided influence upon the time character of the recorded phenemenon, which means that observations on the ground fail to indicate actual lightning conditions. — *Elektrotechnische Zeitschrift*, March 29, 1928.

# News of the Industry

## Transmission and Transportation

### Developments in These Departments of the World of Power Attract Main Attention at New Haven A.I.E.E. Meeting —Attractive Itinerary of Inspection Trips

NEW HAVEN gave a royal welcome this week to the fifth annual regional meeting and student convention of the Northeastern District of the American Institute of Electrical Engineers, which opened Wednesday morning at the Hotel Taft with a large and enthusiastic attendance. Nineteen papers composed the major business program, and through the courtesy of the New York, New Haven & Hartford Railroad a fine inspection itinerary was provided for delegates and guests, including the recently installed mercury-arc rectifier substations of the Connecticut Company at Bridgeport and Stratford, frequency-converter substations of that company and the Connecticut Light & Power Company at Devon and New Haven, the mercury boiler and turbine under erection for the Hartford Electric Light Company, the Hartford hump yard of the New Haven road, and the Rocky River hydro plant of the Connecticut Light & Power Company at New Milford. Yale University kept open house, and through the courtesy of the department of drama a party was scheduled for Friday evening in the Yale University Theater.

At the opening session on Wednesday morning four papers on transmission and four on measurements were presented. An active discussion of these papers was held in the afternoon. Commenting upon the paper of Philip Sporn, which dealt with the rationalization of system insulation, J. L. Montsinger urged that the 60-cycle flashover value of an insulator disk be used as a yardstick to specify the insulation strength of a transformer. C. L. Fortescue, in discussing this paper, stated that any lightning surge exceeding the 60-cycle flashover value for a fraction of a second would result in flashovers. In his opinion, high-impulse ratio values in line insulation did not indicate immunity from lightning flashovers. In endeavors to reduce line outages he urged the use of ground wires in preference to the brute-force method of adding insulation.

J. F. Peters said he was in favor of co-ordinating system insulation, but that the method advocated by Mr. Sporn was not feasible because insulation values are variable and, as designed, there was insufficient leeway in fixing insulation steps. He thought it would be better to fix one weak insulation point in the system, preferably near terminal equipment. In discussing a paper by W. W. Lewis, which also dealt with line insulation, Mr. Peters said that the ground-wire theory was based on induced strokes, but it was not yet proved that it would be effective on chopped waves resulting from direct strokes.

F. W. Peek discussed these papers and said that the maximum voltage that reaches terminal equipment is the arc-over voltage of the line insulators. When line insulation is increased it is therefore reasonable to increase the insulation strength of terminal apparatus to give the corresponding increased system service.

Closing the discussion, Mr. Sporn said that there was no reason for using insulator flashover values as yardsticks to measure transformer insulation strength. It would be better to specify test waves and use numerical values.

Instrumental measurements of surge effects were featured in papers by C. I. Hall, E. M. Tingley, J. W. Legg and A. F. Hamdi and H. D. Braley. Marked improvement in oscillographic technique was evidenced by these papers. At a technical session Wednesday afternoon papers were presented on railway motor selection, track-circuit shunting, the diverter-pole generator and electric conduction in hard rubber, pyrex glass and quartz.

Various aspects of the supply of power for heavy traction service were covered in five papers presented at a railroad power session Thursday morning. Friday was to be given to a student branch session, inspection trips and an afternoon session on power developments, with special emphasis upon the mercury boiler and Rocky River, by L. A. Sheldon and E. J. Amberg respectively. The annual regional banquet was scheduled for Thursday evening, and the convention was to close with a trip to Rocky River on Saturday. Attractive entertainment was provided.

## Chamber of Commerce for Teamwork

### Main Theme of the Washington Meeting, Where Special Attention Is Paid to Light and Power—Sloan and Pack Speak—R. E. Norton on Power and the Investor

THE sixteenth annual meeting of the Chamber of Commerce of the United States was held in Washington on May 7 to 11. "Teamwork for Prosperity" was the subject of the meeting, which focused attention on present and coming economic currents in the nation's business life and on organized efforts to interpret them.

Sounding the keynote at the opening session on Tuesday morning, Judge Edwin B. Parker, chairman of the chamber's board of directors, declared that unless business purge itself of those "whose acts stigmatize and bring business generally into disrepute," the public will turn loose "thunderbolts of wrath" which will inevitably bring legislative and governmental regulation of business and hamper freedom of initiative. Judge Parker's indictment of those who exploit the public for their private gain was the high light of the session. He reiterated the chamber's opposition to government in business, branded as "business outlaws" those who fail to observe the canons of decency and fair play, called for co-operation in the interest of agricultural prosperity, and warned against flaunting American prosperity before the rest of the world instead of dedicating such prosperity to service.

Three addresses of special interest to the electric light and power industry, because of their bearing on the present legislative situation and also because of their interpretation of the industry to business, were delivered at the session of the Natural Resources Division on Tuesday afternoon. M. S. Sloan of Brooklyn, chairman of the division, told of the conditions and trends in the development of forests, minerals and water, stressing some of the social aspects of natural resources.

Touching water-power development, he said in part:

> Government ownership and overregulation threaten all industries dealing directly with natural resources. Water resources, however, have received the bulk of legislative attention, both state and federal. Numerous attempts are being made to break down our national water-power policy through special legislation which would take major power projects out of the established federal water-power policy and treat them as special projects. Muscle Shoals establishes a precedent for the demand for special consideration in numerous instances. It is a demand for special consideration of the power features of the Colorado River and the Boulder Canyon project that has complicated the issues and delayed much-needed flood prevention measures. The settlement of power questions on the St. Lawrence River development is delaying the settlement of that great international question. The problem does not stop with any individual project. Attempts are being made to consider the whole Ten-

nessee River apart from our national water-power policy because of its relation to Muscle Shoals. And proposals are being made to inject into interstate compacts certain agreements that would bind the whole resources of the Colorado River to the special policy which it is proposed to set up for the Boulder Canyon project. Comparable situations have arisen in projects on the Columbia River. Over one-half of the nation's water resources are today bound hand and foot by legislative proposals and must await the final outcome of these proposals before any development can take place.

The practice of making political capital of this natural resource must end. No reason has become apparent for abandoning the water-power policy which was so laboriously created. In an industry such as the power industry where capital investment is great and where money turnover is slow nothing can be more prejudicial to success than the shifting sands of a changing national policy.

To stimulate a more careful use of natural resources it is not necessary for the American people to engage in business activities through government agencies. Neither is it advisable for them to adventure in government ownership for the purpose of demonstrating how development should be conducted and at what price the product should be marketed. The experiences in government operation give us no occasion for pride.

### GROUP MANAGEMENT

R. F. Pack, vice-president and general manager Northern States Power Company, Minneapolis, spoke on teamwork and group management. Part of his remarks follow:

A really thorough analysis of group management reveals that it is built primarily on its ability to select the best-qualified individuals from this great aggregation of human beings, organize them and put them to work for the benefit of all of us. To some "group management" suggests holding companies, and holding companies in turn suggest some remote organization of selfish financiers devoting their energies to pyramiding profits and enriching themselves at the expense of the public. While there are opportunities for abuse in the group management field as there are opportunities for abuse in every other form of business, the fact is that group management is fundamentally and economically sound in that it provides for organizing and utilizing the best available human ability to operate the best machinery ever devised in the industrial history of the world.

Group management is neither new nor peculiar to the electric light and power business. It exists in one form or another in the field of agriculture and related industries, mining and quarrying, manufacture of food products, of textiles, leather and leather products, rubber and rubber goods, metal and metal products, in the amusement business, the hotel business, retail merchandising and in other lines of business activities. In fact, it is being more and more recognized as the soundest and most logical means of rendering the best possible service to the public at the lowest possible cost.

The suggestion that group management is founded primarily on the organization and utilization of the best available human ability and that this method of operation accomplishes material benefits to the public can be amplified by a consideration of the public utility field.

Not many years ago there were numerous communities which had no electric service at all, and in others it was very inadequate. Good service was obtainable, for the most part, only in the large population centers. In that day each community was served by an individual generating plant built for that purpose. Then came advance in the art of transmitting electricity, with consequent interconnection of steam and hydro generating stations, and in the interconnection of groups of towns each drawing from a common power pool. That was the first step toward group management. It accomplished economies which are now too generally known to need further discussion.

The next step was the formation of holding and management companies which undertook to operate and direct a number of these interconnected systems, located often in widely separated parts of the country. Under this plan of organization hundreds of communities ranging in size from large cities to the smallest crossroad villages are given the benefit of the highest type of managerial skill. After all, isn't it good management which marks the line between success and failure in business? It is not the kind of business that makes that business a success. If that were true, everybody would enter that particular line of business with assurance of success. The thing that makes any business a success is its management. The group management plan of operation of public utilities not only furnishes the highest type of management which can be obtained, but the best available brains in each specialized field. For example, the highest obtainable type of hydraulic engineer is employed. It is his job with other duties to inspect and test waterwheels. The importance to the ultimate consumer of this work is quickly seen when we realize that a loss in waterwheel efficiency of 3 per cent may be equivalent to a loss of 2,500,000 kw.-hr. per year in a hydro-electric plant of 20,000-kw.-hr. capacity.

Group purchases mean concessions in prices. A group management company buying in volume for many properties is able to obtain prices fully 10 per cent lower than those which can be made available to an isolated plant. The significance of this may be appreciated when it is known that one large group company may purchase during the year as much as $30,000,000 worth of materials and supplies.

It is in the field of financing, however, that holding-management companies are able to render the most conspicuous service to the members of their respective family groups. Investment bankers and big and small individual investors scrutinize carefully the public utility seeking capital. They both insist that the company must be either one of considerable size or be associated with a larger group, that its earnings and expenses be about normal, that its property be well maintained, that the securities in which capital is to be invested be so adjusted that they are fairly protected by property and earnings, that the company be well managed and have good future prospects. The group properties come nearer to meeting these demands than do individual plant companies. This is evidenced by the fact that they are able to finance at a uniformly lower rate, which, after all, is the best evidence of their stability.

It will be seen, then, that group management not only accomplishes material saving in dollars and cents, which is being passed along to the ultimate consumer, but it makes available to the smallest community the best brains and the highest type of skill that can be obtained, to the material benefit of the public served.

Speaking of teamwork, Mr. Pack reviewed the work of the electric light and power industry with agricultural colleges and farmers on farm electrification and with the telephone companies on inductive co-ordination. He went on to say:

These examples of teamwork give us pleasurable thrills, but unfortunately we do not always get teamwork in business. There are many forces in this country which are busy night and day, stirring up suspicion and discontent and endeavoring to promote radicalism and indeed socialism in every form. Public ownership is a favorite medium. It happens just now that there are pending in Congress a number of measures which would put the government into the electric light and power business. We appreciate that it is our chestnuts which are in the fire. It is our industry which is immediately threatened, and we are doing the best we can to keep the government out of the electric business, because we consider it the legitimate field for private enterprise.

The United States government already is engaged in various lines of business which by no stretch of the imagination can be considered legitimate governmental functions. Some of our states are in the banking business, flour-milling business, cement business, insurance business and so forth. The municipalities own and operate gasoline stations, coal and wood yards and what not. There is a call here for team work. There is an opportunity for every business man who believes that government, whether national, state or municipal, should refrain from competition with legitimate business enterprise to consider the trend of the times, realizing that his business may come next and that here is a real and direct call for teamwork.

### FINANCING UTILITIES

R. E. Norton, vice-president C. H. Geist Securities Corporation of Philadelphia, discussed electric power and the investor. After a brief excursion into the history of electrical financing, he said:

Prior to 1920 the limited or "closed" mortgage was the only instrument considered conservative. On account of the immense growth of the electrical industry, large sums of money were required, and it soon became apparent that the limited mortgage restricted growth; hence the "open-end" mortgage. At first this mortgage was coolly and pessimistically received; but as time passed, owing first to the restrictions of the mortgage and second to the practice of electric companies, through customer ownership and otherwise, to sell their common and preferred stocks and preserve their junior equities, mortgages of this kind were accepted by the most conservative institutions.

For this reason I believe the mortgages protecting the electric utility securties are more conservative than those that protect either the industrial or the railroad issues in the United States. At first the investor cared and knew little about the mortgage restrictions; but now, as a general rule, the mortgages securing power and light securities are filed, inspected and studied by the large purchasers of bonds, as well as by the insurance companies.

And now consider the psychology of the investor. He has found a security regulated by the state public service commissions—a security in which the gross and net earnings of the properties continue to increase in a steady line, good times and bad; a security protected as a rule by sound mortgages and based on management that shows the highest sort of progressiveness and efficiency. These are the factors that have brought about his conversion.

I remember well the thrill that went through the banking world when, about 1923 or 1924, it was newsed about that the life insurance companies in New York were buying power and light bonds. Less than a month ago such bonds, under certain restrictions, were made legal for New York savings banks. Today electric utility bonds of proper character are being purchased at prices approximately on the same basis as you will find in railroads or other securities of the highest class. The markets are active, and many of the securities are listed on the New York Stock Exchange and other exchanges. There is a demand for the preferred stocks and a strong demand for the common stocks. The demand is based not only upon present earnings, but on future; and it is impossible to say that we have reached a point where the power and light properties, both in efficiency of operation and in popularity with the investor, have come into their own.

An interesting forecast of the probable future trend of taxes, and especially corporation taxes, in the next ten years was made at the Wednesday afternoon session of the Finance Department by Prof. Thomas S. Adams of Yale University. He contended that the burden of taxation on corporations is too high and should be reduced to the actual requirements of the sinking fund. Taxes in the aggregate, he believed, will increase, owing to increased governmental expenditures; but he said they should be more justly apportioned among corporations and individuals. A corporation tax of 10 per cent would in his estimation be more equable and not necessitate raids on the present sinking fund.

# Douglas Attacks Los Angeles Bureau

## Representative from Arizona Says that City Had up to 1925 Spent Nearly $130,000 for Boulder Dam Propaganda—Other Testimony Before Trade Commission

THAT the city of Los Angeles through its Bureau of Light and Power had expended more than $129,000 up to the year 1925 to influence public opinion and the Congress in favor of Boulder Dam was the accusation made before the Federal Trade Commission on Wednesday afternoon of this week by Congressman Douglas of Arizona. In Congressman Douglas' opinion the actual sum spent to date was four times that amount in addition to gifts of oranges and other fruit to members of Congress.

Congressman Douglas' testimony followed that of George F. Oxley of the National Electric Light Association, Judge Davis and Ira L. Grimshaw of the Joint Committee of National Utility Associations and Fred J. Bollmeyer of Cleveland, director of the Ohio State Committee on Public Utility Information. Following Congressman Douglas came Benjamin E. Ling, former director of the Ohio committee, and D. L. Gaskill, secretary-treasurer of the East Central Division of the N.E.L.A. The testimony of these witnesses was similar to that inserted in the record by the other state committees on public utility information.

Congressman Douglas' testimony created quite a sensation in an otherwise drab hearing; so much so that the full commission will consider it with a view to determining whether his testimony comes within the scope of the Senate resolution. Up to the present the Federal Trade Commission has been proceeding on the theory that the investigation was limited to privately owned electric light and power and gas corporations.

Congressman Douglas submitted that, in view of the activities of the city of Los Angeles, through the use of its great political power with relation to the inhabitants of the Owens and Santa Clara Valleys in California, and in view of its activites in expending huge sums of money to influence public opinion and members of Congress to support federal ownership of a tremendous power project, the conclusion is inevitable that the activities by political subdivisions to influence public opinion can be as insidious and as dangerous to the body politic as can be the activities of any other type of organization.

As a part of the record Congressman Douglas filed copies of resolutions passed by the Public Service Commissioners of Los Angeles calling for appropriations to the Boulder Dam Association. The Reclamation Service received $120,000 from Los Angeles and affiliated agencies for the investigation of the Boulder Dam site. More than $19,570 was received by the Boulder Dam Association up to July 19, 1924. Other contributions were read into the record, Congressman Douglas giving amounts and dates. He also called attention to the appropriations of the Imperial Valley Irrigation District, totaling $109,807. One item called for a fair-sized appropriation for the purpose of conducting a Congressional party through Imperial Valley. In addition, a special train came to Washington in 1927, carrying lobbyists for the Boulder Dam bill.

Speeches made throughout the country in favor of Boulder Dam were cited as evidence of propaganda by municipalities, and attention was directed to the great number of Californians now in Washington lobbying for the Boulder Dam bill. The Board of Supervisors of Los Angeles County also appropriated $20,000 in May 3, 1928, for that purpose. On the strength of the showing made Congressman Douglas suggested that the Federal Trade Commission investigate further into the activities of Los Angeles.

### Pennsylvania Activities

When Walter E. Long, who is treasurer of the public policy committee of the Pennsylvania Electric Association, took the stand at the Federal Trade Commission's inquiry into the public utilities on Thursday, May 3, he testified that the Pennsylvania Electric Association derived its revenues from the National Electric Light Association, which, he said, rebates part of the dues paid to it by Pennsylvania utilities. The public policy committee's funds come directly from member contributions. This committee was organized eight years ago to function in an advisory capacity on all matters dealing with general policies of the industry in Pennsylvania.

Mr. Long testified that in recent years there has been no active campaign against municipal ownership in Pennsylvania. The public policy committee, he said, was interested mostly in matters before the state departments and before the Legislature at Harrisburg. Its interest is explained by its obligations to its member companies. It had expended $113,000 since 1922.

Judge Healy, the examiner, asked Mr. Long to identify nine items totaling approximately $20,000 paid from September, 1922, to March, 1928, to the chairman of the committee, Walter H. Johnson. Mr. Long said he understood this money was used by Mr. Johnson for "attorneys and agents" but could not say for what particular purposes, preferring to have Mr. Johnson answer. He admitted the opposition of his committee to Governor Pinchot's "giant power" bills. Attorneys' bills of more than $14,000 each to two Philadelphia legal firms were shown, as well as the payment of $1,000 each to a former state legislator, W. T. Mamsey, and to J. H. Bigelow, chairman of the State Democratic Committee.

Governor Pinchot's attitude partly led to the determination of the Pennsylvania Electric Association to intensify its public relations campaign, Mr. Long admitted. He denied that the association or any of its member companies owned or held the obligations of any newspapers, and he replied in the negative to questions whether they had contributed to a presidential or senatorial campaign.

Mr. Johnson followed Mr. Long. He said he could not recollect what he had done with the $20,000 turned over to him by Mr. Long. "But I can say that not a penny of it was spent in connection with public or municipal ownership," he stated. "Every cent of it was spent honorably and lawfully." He thought some of it went to pay persons engaged to oppose bills at the state capital.

A. G. McKenzie of Philadelphia, director of the state utilities information bureaus of Pennsylvania and New Jersey, testified as to the publicity activities of these bureaus, and A. B. Millar, managing director of the Pennsylvania Electric Association and of the Eastern Division of the N.E.L.A., testified that he had held his present office for only about six months and had been spending most of his time studying the duties and functions of the association.

Documentary evidence, mostly relating to surveillance maintained by public utilities over textbooks on economics used in the schools and colleges of Pennsylvania, was introduced on Thursday. Most of the data were taken from files of the former director of the Pennsylvania Public Service Information Committee, Major Richardson, who is now director of information of the Joint Committee of National Utility Associations.

On Friday Senator Norris declared from his seat that the investigation is revealing "most startling things" as to the methods used by the utility interests to educate public opinion. He referred specifically to efforts to influence the adoption of public school textbooks and to defeat government power projects.

## Hunt Attacks Methods of Boulder Dam Boosters

*Governor of Arizona Wants Two-Sided Investigation, Asserting that Five Dollars Has Been Spent to Further Scheme for Every Dollar Spent Against It*

DEMANDING that the Federal Trade Commission shall investigate moneys expended and publicity methods followed by the friends as well as by the opponents of the Swing-Johnson bill, Governor G. W. P. Hunt of Arizona, whose stand against the bill and seven-state treaty has been repeatedly indorsed by re-election to the chief magistracy of his state, makes the charge in a letter to the commission under date of May 2 that "there is a conspiracy to rob the State of Arizona of valuable resources, to make them available to power companies in the State of California, and that enormous sums of money have been and are being expended to employ lobbyists, lawyers, engineers and newspaper men, and to pay for propaganda; that methods—both legitimate and questionable—have been employed to influence public opinion and to influence members of Congress in favor of the Boulder Dam legislation and to threaten, intimidate, harass and browbeat members of Congress into supporting the Boulder Dam legislation," and that "it could also probably be established that attempts have been made to influence the policy of candidates for the office of President of the United States."

Among other things the Governor says:

> Many of these newspapers articles, by inference and innuendo, charge that the State of Arizona in opposing the Swing-Johnson bill is acting in collusion with and under the influence of the representatives of private power companies. These allegations I challenge, denounce and deny. I am, of course, familiar in a general way with the "evidence" which has been offered to sustain the charges with reference to the alleged activities of the power companies. I am also familiar in a general way with some of the propaganda broadcast by those who are advocating this Boulder Dam legislation, and it is my belief that for every dollar the opponents of Boulder Canyon legislation have spent in opposing it those supporting the legislation have spent five dollars.

Governor Hunt appended to his letter a list of persons—not made public—whom he suggested that the Federal Trade Commission summon for examination on this phase of the matter.

## Power Board Considers Indian Power-Site Claims

The staff of the Federal Power Commission has recently completed a study of the amount, if any, that should be paid the Apache Indians of the San Carlos reservation in consideration of the development of power at the Coolidge Dam in Arizona. The dam is being built by the irrigation division of the Indian Service for the purpose of providing a dependable water supply for the Pima Indians and other users in the Gila Valley above the mouth of Salt River.

The Interior Department appropriation act provides for the generation of power at the dam as a by-product of the development. It also calls upon the Federal Power Commission to report to Congress whether any payment should be made to the Apaches as compensation for the power. Those who have been following the study are not surprised at the commission's report that the Indian lands had no power value independent of the irrigation development and that as the Apaches will benefit from the availability of power at low rates for their own pumping and domestic purposes no further compensation should be made.

A declaration of intention has been filed with the Federal Power Commission by the Fox River Paper Company in connection with its plan to reconstruct the dam across the Wisconsin River at Appleton.

## Middle West N.E.L.A. at St. Louis

More than three hundred delegates to the sixth annual convention of the Middle West Division, N.E.L.A., assembled at St. Louis on Wednesday for a three-day session. A notable address by President Don M. Sterns defending the merger movement, a plea of Chairman J. F. Owens of the Public Relations National Section for fuller appreciation of service on association committees, an able treatment of the rural service question by F. J. Hanlon of Mason City, Iowa, and a defense of utility organization and publicity by Carl D. Jackson were the outstanding events on the first day's program. The ELECTRICAL WORLD's report of the meeting will appear next week.

## Fighting Over Power Bills Goes on at Capitol

*Muscle Shoals Bill Warmly Debated in House, Which Adopts Radical Amendment—Boulder Dam Delay—Flood Prevention Bill Compromise*

CONSIDERATION of the Muscle Shoals bill on May 9 indicated that the House is almost equally divided on the measure. Despite a desperate effort on the part of the proponents of the bill to prevent it, the House voted by 169 to 159 to adjourn. The bill had been brought up on calendar Wednesday and was automatically displaced on the following day by the regular order of business. Unless a special rule be granted, it will not be brought before the House again before Wednesday of next week.

An amendment adopted in the course of the debate makes the bill more radical than ever. It provides that the Federal Power Commission is to determine the rate of any resale of power to the ultimate consumer. Thus, in addition to setting up the government in two lines of commercial business—fertilizer manufacture and the generation of electrical energy—a direct conflict between the rate-making bodies of the states and of the federal government is brought about.

The measure is regarded as one of the most radical ever brought to such an advanced legislative stage in the history of Congress. Representative Garrett, the minority leader, pointed out, in an impasstioned speech, that "for the first time in all the history of the country it is deliberately proposed that the federal government shall go into business for business' sake." The House, however, voted down by 125 to 46 Mr. Garrett's amendment that the government corporation be subject to local taxation and other laws of the states in which it operates to the same extent as would a private corporation engaged in such enterprises. Another important feature of the action taken by the House was the placing of a one-hour limit on all debate.

The National Fertilizer Association is protesting loudly against the failure of the military affairs committee to grant it a hearing.

No little encouraged by an indorsement from the White House and by the inclusion of their legislation on the tentative program of the House, advocates of the Boulder Dam bill conferred May 8 with Majority Leader Tilson in the hope of making arrangements for early consideration of the measure. Mr. Tilson took the position that the House should await the action of the Senate, where the Boulder Dam bill is the unfinished business. This is not satisfactory to the supporters of the bill.

Alterations in the flood prevention bill have been made to meet some of the President's objections to it in the form in which it was originally passed. As amended, it has been accepted by both houses and is expected to have Mr. Coolidge's approval. It appropriates $325,000,000.

## Purchases and Mergers

*Hodenpyl-Hardy and Stevens-Wood Interests Are Consolidated—Arkansas Power & Light Takes Over Southern Edison, Ending Litigation*

IT WAS announced on May 7 that the Allied Power & Light Company has been organized to consolidate the interests of Hodenpyl, Hardy & Company, Inc., and Stevens & Wood, Inc. The new company has contracted to acquire substantial stock interests in the Commonwealth Power Corporation, the Northern Ohio Power Company, the Penn-Ohio Edison Company and other companies. Hodenpyl, Hardy & Company were organized in 1914 and with their predecessors have for more than thirty years been interested in the organization, development and operation of public utility properties. Many of such properties—including the Consumers' Power Company, the Tennessee Electric Power Company, the Central Illinois Light Company, the Southern Indiana Gas & Electric Company, the Illinois Power Company, the Ohio Edison Company, the Illinois Electric Power Company and the Southern Michigan Light & Power Company—are now component parts of the Commonwealth Power Corporation system. Stevens & Wood have for many years engaged in the general engineering and construction business and the managing, supervising and financing activities of public utility corporations. They will continue business as a subsidiary company. Mr. Hodenpyl and Mr. Hardy will have substantial investment interests in the Allied company, but will not actively participate in its operations. B. C. Cobb is chairman and R. P. Stevens is president.

By a million-dollar deal completed April 30 the entire capital stock of the Southern Edison Company was transferred to the Arkansas Power & Light Company by the People's Light & Power Corporation of New York, of which the Southern Edison is a subsidiary. All plants and property of the Southern Edison in Arkansas and Mississippi pass into the control and management of the Arkansas Power & Light Company. The transaction will result in the dismissal of an appeal pending in the state Supreme Court, taken by the Southern Edison Company from the judgment of the Independence County Court at Batesville, Ark., regarding ownership of the electric light and water plants at that place and involving $425,000. (See ELECTRICAL WORLD, May 21, 1927, page 1081). The Southern Edison Company has withdrawn its bid for this property. Included in the transfer is the dam across Big Creek near Pangburn, 14 miles from Searcy, Ark., begun by predecessors of the Southern Edison, and which was almost destroyed by the floods last year.

Stockholders of the Harrisburg Light & Power Company will vote June 25 on whether to sell their holdings to the Pennsylvania Power & Light Company. Both companies are controlled by the Lehigh Power Securities Company.

The Harlem Valley Electric Corporation of Pawling, N. Y., has filed a certificate in the office of the Secretary of State of New York merging the Carmel Light & Power Company. The New York State Electric Corporation of Ithaca, N. Y., has filed a certificate merging the Tusten Light & Power Company. The New York Power & Light Corporation, Albany, N. Y., has filed a certificate merging the Blue Hill Light & Power Corporation. The Eastern New York Electric & Gas Company, Mechanicville, N. Y., has filed a certificate merging the Bouquet Electric Power Company.

The Ohio Public Utilities Commission on May 3 authorized the sale of the Union Gas & Electric Company to the Cincinnati Gas & Electric Company for a consideration of $9,695,778, to be paid with the issuance to the former of 185,000 shares of common capital stock at a declared value of $52.40 per share. The Cincinnati Gas & Electric Company, like the Union Gas & Electric, has been under lease to the Columbia Power Company, a subsidiary of the Columbia Gas & Electric Company. As previously announced, the subsidiary properties will be consolidated as the Cincinnati Gas & Electric Corporation.

The Commonwealth Telephone Company of Chicago has asked the Missouri Public Service Commission to approve its purchase of the Holt (Mo.) Electric Light Company.

Calera, Okla., voted April 30 to sell its city-owned lines and distribution system to the Oklahoma Gas & Electric Company.

After several elections in which proposals to sell the Westville (Okla.) municipal plant were voted down, that town on April 24 authorized sale of the plant for $45,000 to W. C. Tegtmeier and associates of Davenport, Iowa. The vote was 183 to 6.

The Town Council of Hooker, Okla., has accepted the bid of the Inland Utilities Company for its municipal light and power plant subject to confirmation at a special election.

Action taken by the City Council of Tahlequah, Okla., to hold an election on an offer to purchase the city lighting plant for $130,000 cash and "other considerations" has met with opposition from citizens who oppose the sale of the plant or favor another bid, stated at $175,000, and they have appealed to the Governor to interfere.

Oscar Nelson, who has owned and operated the Essex (Iowa) Light & Power Company 28 years, has sold the plant to the Nebraska-Iowa Power Company.

Purchase of the holdings of the Texas-Gulf Power Company by the Texas-Louisiana Power Company, which has its headquarters at Fort Worth, Tex., is announced by A. P. Barrett, president of the latter company. The transaction involves the electric light and power plants at Texas City, Friendswood, League City, Dickinson, Brazoria, West Columbia, Angleton and Strawn, as well as the Wichita Falls Traction Company and some waterworks, ice and gas plants. The consideration was not made public. The Texas-Louisiana Power operates in Texas, Louisiana, Oklahoma, New Mexico, Arizona and Kentucky.

The City Council of Summit, Miss., has voted to sell the local electric light plant and franchise to the Mississippi Light & Power Company for $22,500.

The Northern Electric Company has purchased the Whitewood Power & Light Company's plant at Whitewood, Saskatchewan. This firm has also purchased several other plants in eastern Saskatchewan and will operate them from a central producing plant. The town of Fillmore, Saskatchewan, has sold its municipal power plant to the Montreal Engineering Company.

## Prescott Host to Arizona Utilities Convention

*First Meeting of Newly Organized State Body Proves Highly Successful from Both Business and Entertainment Viewpoints*

THAT the Arizona Utilities Association's annual convention and joint meeting with the Pacific Coast Electrical Association and the Pacific Coast Gas Association, held at Prescott, Ariz., April 26, 27 and 28, in the Hassayampa Hotel, was the best all-around convention to meet in Arizona up to date was the way old convention heads expressed themselves regarding the gathering. With a record attendance of 125 delegates from Arizona, California, Colorado, New Mexico and Texas and an unusually good program, the success of the first convention of the newly organized association was called overwhelming.

On the opening morning President W. C. Hornberger outlined the history of the association, its work and its hopes. A talk on the development of the Salt River Valley by Jasper S. Connell of the Salt River Valley Water Users' Association, in which he outlined the program for irrigation and electrification of the valley, followed. Mayor E. C. Seale and M. A. Pooler of the Tucson Gas, Electric Light & Power Company spoke at the luncheon, and in the afternoon W. L. Frost, president Pacific Coast Electrical Association, made an enlightening talk on "The Commercial Era."

On Friday morning A. R. Baily, Los Angeles Gas & Electric Corporation, read a paper on "Practical Present-Day Distribution Methods" in which he outlined some experiments made by his company. S. R. Knight of the same company took as his topic "Some Applications of Recent Developments of Steam Power Generation" and described, using colored charts, modern methods of obtaining the most kilowatts per unit of fuel. P. G. Spilsbury, president of the Arizona Industrial Congress, spoke on "Public Relations," advising that the public be informed of all activities in easily understandable terms.

The four best essays selected from those submitted in a recent employees' essay contest were read. The winner was Mrs. Jean Roberts of the Tucson Gas, Electric Light & Power Company.

At the evening banquet on Friday a Smoki Indian snake dance provided a novel feature and was accompanied by other enjoyable performances. On Saturday morning the delegates were guests of the United Verde Copper Company at the Jerome-Clarkdale mines and smelter.

Officers elected for the ensuing year are: President, M. A. Pooler, Tucson Gas, Electric Light & Power Company; first vice-president, L. V. Seares, Arizona Power Company, Prescott; second vice-president, A. F. Moriarty, Central Arizona Light & Power Company, Phoenix; executive secretary, Milton G. Sanders, Phoenix.

## Ontario Hydro Rates Raised at Toronto

About eighty-six thousand users of electricity in Toronto have been called upon to pay more for their power and light by reason of an upward adjustment of rates announced by the Hydro-Electric Power Commission of Ontario. On houses of six or seven rooms the increase is about 14 per cent, while in the larger homes of ten or twelve rooms the boost is about 29 per cent.

The minimum rate is now 1½ cents per kilowatt-hour, with 10 per cent discount for prompt payment, compared with 1 per cent per kilowatt-hour, with the same discount, the rate which prevailed for some years. Moreover, consumption in excess of 9 kw. per 100 sq.ft. of floor area will cost 2 cents per kilowatt-hour for the excess consumption, except where consumers use electric cooking ranges, when an additional 200 kw. will be allowed at the 1½-cent rate.

The announcement intimates that the revision upward has been necessary because domestic consumption has passed beyond the limits of offpeak supply. The "object of the adjustment," continues the announcement, "is not so much to collect more revenue from the customers who are using an amount of power comparable with what they used in 1916 as to correct the tendency toward increasing loss which results from larger and larger consumption of excess power sold at a decreasing average rate with an increasing average cost."

The new rates are as follows:

Floor area charge, as at present, 3 cents per 100 sq.ft. per month.

First 3 kw.-hr. per 100 sq.ft. of floor area per month, as at present, 2 cents per kilowatt-hour.

Next 6 kw.-hr. per 100 sq.ft. of floor area per month, 1½ cents per kilowatt-hour.

Consumption in excess of 9 kw.-hr. per 100 sq.ft. of floor area per month at 2 cents per kilowatt-hour, subject to an allowance to customers having electric ranges of an additional 200 kw.-hr. per month at 1½ cents.

Prompt payment discount—One cent per 100 sq.ft. of floor area per month.

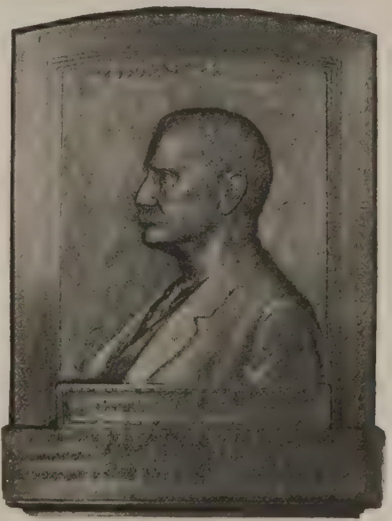
## Refrigerator Manufacturers Organize New Council

Commercial officials of the leading manufacturers of electric refrigerators held a meeting at the Detroit Athletic Club on Wednesday to discuss the advisability of perfecting an organization to promote their common interests. There were present representatives of the Kelvinator, General Electric, Servel, Copeland, Climax, Norge, Dole, Peerless, Zerozone, General Necessities, Cleveland Iceless Cooler and Ice Master companies. The meeting was held at the invitation of A. E. Waller, managing director of the National Electrical Manufacturers' Association, to consider the advisability of forming a refrigerator section of the Appliance Division of the N.E.M.A. rather than organizing a small independent association.

Interest in the discussion focused upon the immediate concern of the manufacturers to bring about more harmonious policies in the education of the public to the advantages of mechanical refrigeration by discouraging destructive practices in competition, and also upon the guidance of proper forms of local regulating ordinances governing the installation of refrigerating equipment. Organization was also seen to offer further opportunities in the field of standardization, industry statistics and similar group activities.

The conference finally voted to form a Refrigeration Manufacturers' Council and tentatively to indorse the N.E.M.A. proposal. The new organization will become effective when ten members sign the constitution and bylaws, which are slightly modified from those prepared after the Walden Woods conference of some time ago. Officers were elected as follows: President, C. K. Woodbridge, Kelvinator Corporation; vice-president, T. K. Quinn, General Electric Company; secretary, G. W. Mason, Copeland Products, Inc.; treasurer, H. E. Blood, Norge Corporation. The directors will be these officers and E. B. Mallory, Climax Electric Refrigerating Company.

## Tablet to Coffin Unveiled



IN THE presence of more than ten thousand employees, the board of directors and a few invited guests, a finely executed bronze tablet honoring the memory of Charles A. Coffin, founder of the General Electric Company, was unveiled at 12:35 p.m. on Tuesday, May 8, at the main gate of the Schenectady plant of that company. At that hour, after music by the General Electric band, Owen D. Young, chairman of the board of directors, called upon Miss Alice Coffin, daughter of the former president, to lift the curtain covering the tablet. E. W. Rice, Jr., honorary chairman of the board, then spoke, paying tribute to the genius, courage, public spirit, modesty and consideration for others that characterized Mr. Coffin.

## Southwestern Public Service Association at Dallas

May 2 to 5 was the date of the thirty-third annual convention of the Southwestern Public Service Association, held at Dallas, with general sessions each morning and meetings of the electric, railway, gas and accounting sections in the afternoons.

After the formal welcome and response on the first day, by E. H. Kifer, vice-president San Antonio Public Service Company, and President M. T. Walker of the association respectively, Secretary E. N. Willis gave an account of the year's accomplishments. Some of the speakers at the general sessions on the following days were John D. Liston of the General Electric Company, J. F. Owens, chairman Public Relations Section, N.E.L.A.; Managing Director Clapp of the N.E.L.A., and Miss Thelma Robinson of the Dallas Power & Light Company, Texas winner in the prize speaking competition, who took for her subject "The Electrocution of Drudgery."

The subjects considered at the meetings of the Electric Section comprised increasing the domestic load, refrigeration, organizing for service to large power customers, safety methods, rural electrification and the selection and training of employees.

More than five hundred men attended the convention. W. H. Burke, Fort Worth, Tex., Southwestern district manager for Stone & Webster, was elected president of the association for the ensuing term.

## Society of Arts and Sciences Awards Medal to Edison

The gold medal of the Society of Arts and Sciences has been awarded to Thomas A. Edison and will be presented to the distinguished inventor at a dinner to be held at the Hotel Astor, New York, on Thursday evening, May 24, at 7 o'clock. Helen Knox, executive secretary of the society, will preside, and the chief speeches will be made by Dr. John Campbell Merriam, president Carnegie Institution of Washington, and Dr. Elihu Thomson. Others who will be called upon are President James R. Angell of Yale, Dr. John H. Finley, Dr. Frank B. Jewett, Charles F. Kettering, Jesse L. Lasky, Secretary Howard McClenahan of the Franklin Institute, Dean William F. Russell of Teachers' College, Columbia University; Prof. Harlow Shapley of Harvard, President S. W. Stratton of the Massachusetts Institute of Technology, Dr. Willis R. Whitney and Arthur Williams. Reinald Werrenrath will sing, and "ether music" will be demonstrated by Prof. Leon Theremin.

Mr. Edison, in accepting the award, requested that should the state of his health at the time of the dinner make it impossible for him to come from Florida, the society permit his son, Charles Edison, president of the Edison Industries, to accept the medal for him.

## Storms Wreck Lines

*Penn Central Light & Power Company, Hard Hit by Belated Blizzard, Recovers Rapidly, Aided by Neighboring Utilities—Trouble in Nebraska*

AMONG light and power companies whose transmission systems were damaged by belated winter storms as April gave place to May the hardest hit was the Penn Central Light & Power Company of Altoona, Pa., whose entire network was put out of commission on the night of Friday, April 27, bringing a cessation of service in all the communities it serves. Through aid from the Pennsylvania Railroad and the Penn Public Service Company of Johnstown it was able to restore partial service, especially to Altoona, from 2 o'clock Saturday morning until Sunday evening, when two of the transmission lines connecting Altoona with the Williamsburg and Saxton plants were restored to service and power sufficient to carry the load was obtained. Forty-eight hours of continuous strenuous labor by a force of several hundred workers reestablished the transmission lines.

The company serves Altoona over a half dozen high-voltage lines. Two of these come from the east, two from the west and two from the south, and they are connected with four power plants. Every one of these lines went down under the weight of the snow, huge steel towers and hundreds of poles were flattened to the earth, and light and power service was cut off. There are 500 miles of transmission lines in the territory and not one was available to use.

Huntingdon, Lewistown, Mount Union and other places to the east were supplied with light and power from Warrior Ridge and Raystown. Martinsburg, Woodbury, Claysburg, Bedford and Everett were all cut off from service, but it was restored to Bedford and Everett Saturday night and to the other places not very long afterward.

The company on Saturday evening sent out a radio call requesting assistance to pull out of the wreckage and re-establish service. It brought a generous response from the Duquesne Light Company of Pittsburgh, which immediately recruited a force of 25 linemen and started them for Altoona, where they began work at 5 o'clock Sunday morning. The Pennsylvania Power & Light Company at Williamsport also picked up the message and sent five experienced men. Workman were handicapped by the deep snow, which in the mountain districts was up to their waists, but strenuous efforts overcame every obstacle, and in a very few days the discontinuance of service was an incident of the past.

A heavy wind and rain storm on May 2 damaged pole lines in central and eastern Nebraska, but prompt replacement was made possible by speedily improved weather conditions. The Nebraska Power Company had to cut out service for half of Omaha the greater part of the following day because river-carried refuse clogged the turbines. The little town of Clarks, in Merrick County, was almost wiped out by a wind of hurricane violence, and all wire companies in that neighborhood were put out of business for several days.

## San Francisco Votes Bonds for Water System

Voters of San Francisco declared themselves emphatically for municipal ownership of their water system when at the primary election on May 1 they voted a bond issue of $41,000,000 for purchase of the Spring Valley Water Company's system and $24,000,000 in bonds for completion of the Hetch Hetchy water supply. Complete returns showed the following vote on the two measures: Spring Valley purchase: yes, 81,302; no, 20,852; Hetch Hetchy bonds: yes, 93,396; no, 11,497. Approval of the Spring Valley purchase has followed four unsuccessful attempts at purchase since 1910, when the proposal was first placed before the voters. The valuation of the property at $41,000,000 was set by the California Railroad Commission.

## Briefer News

**Accounting Section of Empire State Association Meets at Briarcliff Lodge.**—Seven papers on accounting subjects were scheduled for the annual meeting of the Empire State Gas and Electric Association's Accounting Section at Briarcliff Lodge, N. Y., on Thursday and Friday of this week. On Friday President H. O. Palmer of the association was to make an address and Dean Dexter S. Kimball of Cornell was to speak on "The Engineer and the Accountant."

**Klamath Lake Permit of California-Oregon Power Company Opposed.**—A pending congressional measure which would authorize the United States government to be made a defendant in any suit started by the State of Oregon or by an irrigation district to set aside the permit of the California-Oregon Power Company to construct a dam across Klamath Lake at the Link River intake and to use the dam and impound waters for a period of 50 years will probably not be acted upon during this session of Congress, according to information obtained by State Attorney-General Van Winkle, who thinks the congested state of the congressional calendar will prevent. The state is an intervener in an action being taken by the Klamath Irrigation District to dissolve the contract and prevent the construction.

**New Rural Service Lines in Kentucky.**—The Kentucky Utilities Company has announced plans for construction of a new 12-mile, 2,300-volt transmission line from Greenville to serve 40 farms in Caldwell and Crittenden Counties. A 6,600-volt line, 20 miles long, from Cumberland Gap, Ky., to Rose Hill, Va., will serve customers along the route, as well as at Ewing and Rose Hill. A new line from Paducah to West Paducah will serve 36 customers, partly rural.

**New York Edison Rate Hearings to Be Resumed.**—Valuation hearings to determine whether lower rates shall be made for the New York Edison Company, which have been going on at intervals since they were instigated by Mayor Hylan nearly five years ago, are, at the company's own instance, to be continued throughout the summer, despite the city's request that they be postponed till fall. The city is preparing an inventory of property acquired by the company in 1901, maintaining that these figures will constitute the basis of its case. The company maintains that figures covering this property are already available.

**Rate Investigation Getting Under Way in St. Louis.**—The investigation into the rates of the Union Electric Light & Power Company in St. Louis already referred to is about to begin, and the company has filed a new schedule by which 27,303 industrial and commercial consumers will have their rates lowered to bring a total saving of $681,467. The company points out that residential rates were voluntarily reduced $600,000 in 1923, while power rates have been little reduced since 1919. However, the commissioners are also interested in lower rates for residential consumers, and it is believed that the new schedule will be a compromise between the views of the company and the commission.

**Three Guadalupe River Dams Finished, Six to Come.**—Extensions of six months from May 1 in which to carry out six projects for the construction of dams on the Guadalupe River in De Witt and Victoria Counties, Tex., have been granted the Texas Central Power Company by the State Board of Water Engineers. The Texas Central company, an Insull subsidiary, has just completed and placed in use three dams on the Guadalupe in Guadalupe County. The nine plants will comprise most of the desirable power sites on the middle Guadalupe. These are respectively 8 miles below New Braunfels, 5 miles west of Seguin and 5 miles south of Seguin.

**Putting Taxes on the Utilities.**—Light and power companies throughout Ontario County, N. Y., are in for higher taxation as the result of a resolution adopted by the Board of Supervisors at Canandaigua directing the employment of a firm of Buffalo assessment experts at a cost of $7,000 for the direct purpose of increasing tax burdens of public utility corporations. The resolution, adopted after a debate, purports to aim to increase public utility assessments as a forerunner to reducing burdens of smaller taxpayers. The Rochester Gas & Electric Corporation, the New York Central Electric Corporation and the Empire Gas & Electric Corporation are the largest light and power companies in the county.

Cincinnati to Experiment with Municipal Street Lighting.—The Cincinnati City Council has voted money from the public property fund of the city for the purpose of purchasing street-lighting equipment and standards owned by the Union Gas & Electric Company, figures compiled by Edgar Dow Gilman, public utilities director, purporting to show that this will effect a saving both for the municipality and for the property owners. At first only new installations on minor streets will be taken over, it being urged that later, upon expiration of the present lighting contract with the company, the method be extended to the limit of the city's available resources from suitable funds. Comparative estimates on the cost of lighting two actual streets are to be made.

Wisconsin Power & Light Company to Build Small Hydro Plant on Rock River and 132-Kv. Transmission Line.—The Wisconsin Power & Light Company has announced plans for a hydro-electric plant on Rock River at Rockton, Ill., to cost $250,000. A. P. Gale, southern district manager of the utility, announced the project following negotiations by which the Rockton Electric Company, a subsidiary of the Wisconsin Power & Light, acquired the water-power property for $50,000. The present dam will be raised two feet. The new plant will supply power to Rockton and will connect with power lines which are to be built for convenience of Winnebago County rural residents. The Wisconsin Power & Light also announces that it will build a 132-kv. transmission line from the state line at Beloit to Janesville, Wis., and from Beloit to Belvidere, Ill., to connect at the latter city with a similar line running to Waukegan, Ill.

Vermont and New Hampshire Commissions Still Wait Agreement on Connecticut River Jurisdiction.—Recent hearings before the Vermont Public Service Commission on the petition of the Bellows Falls Canal Company for condemnation of farm lands near Bellows Falls, Vt., and the assessment of damages to be caused by raising the company's dam in the Connecticut River 13 ft. resulted in a further adjournment until May 22. It was brought out that the New Hampshire commission has not advised the Bellows Falls company of any decision regarding the pending petition, which asks for a modification of an order giving New Hampshire power preference over Vermont on electricity generated through raising the dam. The Vermont commission intimated that unless a modified agreement can be reached it will decide that it has no jurisdiction in the matter.

New Unit at Zilwaukee Plant to Go in by June 1.—The new 30,000-kw. unit of the Consumers Power Company at its steam plant near Saginaw was turned over for drying-out purposes several weeks ago and will, it is expected, go on the lines by June 1. The plant has also been augmented by five stoker-fed boilers, a condenser and a new coal-handling system designed to care for an ultimate station capacity of 150,000 kw., of which 70,000 kw. is now installed.

Lamme Award for Achievement in Engineering.—At Ohio State University this spring a gold medal will be awarded for the first time from the Lamme foundation, of which the late Benjamin G. Lamme, long the chief engineer of the Westinghouse Electric & Manufacturing Company, an alumnus of the class of 1888, was the donor. The medal, which contains $100 worth of gold, is to be awarded every five years to a graduate in any branch of engineering at Ohio State. Together with a bas-relief of Mr. Lamme, with the dates of his birth and death, 1864 and 1924, it bears a quotation for which he became noted: "The engineer views hopefully the hitherto unattainable."

Threatened Break in a South Carolina Dam Averted.—Engineers succeeded by hard work in averting a threatened break in a waterworks dam 31 miles north of Greenville, S. C., which caused thousands of residents in the South Saluda River Valley to flee from their homes at the end of last week. The threatened structure is described as an earth dam 700 ft. long, 783 ft. thick at the base, tapering to 30 ft. at the top, and 140 ft. high, holding five billion gallons of water. For a time there was thought to be danger to other dams lower down the stream, should the Greenville dam break, and it is reported that the floodgates of a power dam at Piedmont were opened as a precautionary measure. A hundred miles southeast of the threatened dam the great hydro-electric project of the Lexington Water Power Company is under construction, with the fall of 1931 set for its completion. President W. S. Barstow of the General Gas & Electric Corporation, which is behind the Saluda Dam project, scouted the idea of danger to it from future floods or breaks, pointing out that the reservoir to be built and known as Lake Murray will be 33 miles long with an average width of 3½ miles and a maximum width of 14 miles.

Portland, Ore., Asks Rate Valuations of Its Electric Service Companies.—Rate valuations of the Portland Electric Power Company and the Northwestern Electric Company, the two Portland (Ore.) utilities which recently failed to obtain the approval of the city voters to merge their holdings, are asked by Portland authorities in a request to the Public Service Commission. According to Commissioner H. H. Corey, any reduction of rates of at least one of the utilities under consideration will not be confined to that city, nor, he states, will it be possible under the law to confine the investigation to Portland alone. To establish lower rates in the metropolis, he says, it will be necessary for the commission also to require that the Portland Electric Power Company equalize its tariff in respect to service rendered as far as 51 miles south to the city of Salem. The recent action of the commission upon its own motion will have precedence in the matter of the valuation probe of the two Portland utilities, but the commission has signified its willingness to co-operate with the municipal authorities.

Seattle Bill for Municipal Acquisition of Puget Sound Power & Light Plants Killed.—Opposed solidly by the majority group in the City Council, Councilman W. T. Campbell's bill designed to pave the way for acquisition by the city through condemnation proceedings of important properties of the Puget Sound Power & Light Company was killed at a recent Council session. The bill authorized a preliminary survey and appraisal of the company's Seattle distribution system and its Snoqualmie Falls and White River power plants and carried an appropriation of $25,000 to defray the cost of the appraisal. As originally drawn, the Mount Baker power plant was included in the property to be appraised, but the sponsors of the ordinance finally omitted it from the list. Those members of the council who supported the measure declared it necessary on the ground that sooner or later either the company or the city is bound to have a monopoly.

Plans Enlargement of Niobrara River Plant Under Increased Head.—The Northern Nebraska Power Company, which operates a hydro-electric plant on the Niobrara River, near Spencer, announces that it will construct a million-and-a-half-dollar plant at a point 10 miles south and 6 miles east of Spencer, which will increase its annual production from 15,000,000 kw.-hr. to 75,000,000 kw.-hr. The company, through E. A. Forbes, president, has contracted to sell the entire output to the Interstate Power Company, which operates in Nebraska, Minnesota, Iowa and South Dakota, covering a 300-mile-square territory. Mr. Forbes says that peculiar riverbed construction of the Niobrara makes possible the development at the point chosen of the largest hydro-electric plant in the state and the production of electrical energy at a cost below that of any steam plant in the state. The present plant has a 15-ft. drop. The new one will have a 50-ft. drop, thereby adding grreatly to the production possibilities of the site.

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Beauharnois Project Officially Authorized.—In so far as the Province of Quebec is concerned, the Beauharnois project (Electrical World, March 10, page 523) was officially authorized on April 28 by the signing of an order in Council granting the Beauharnois Light, Heat & Power Company the right to divert 40,000 cu.ft. of water per second between Lake St. Francis and Lake St. Louis on the St. Lawrence for the development of hydro-electric power, most of which will be absorbed by large industrial concerns in the immediate vicinity of Montreal. In addition to paying a yearly rental of $20,000 in advance for the first five years and $50,000 per year for the remaining period, the company has agreed to develop 100,000 hp. during the first five years, 200,000 hp. after the sixth, 300,000 hp. after the seventh and 500,000 hp. at the end of ten years. An announcement that the company would apply to the International Joint Waterways Commission for approval of its plans has called forth criticism in the Canadian Senate, on the ground that such sanction would encroach on provincial rights and that the question of jurisdiction should be settled by negotiation between Canada and the United States.

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]**

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

Indiana Electric Light Association (jointly with Indiana Public Utilities Association) — Columbia Club, Indianapolis, May 22-24. William Stokes, 1548 Consolidated Bldg., Indianapolis.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

American Institute of Electrical Engineers—Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

## Recent Court Decisions

Company Responsibility for Mishaps Alleged to Be Attendant on Right-of-Way Construction.—The Court of Civil Appeals of Texas has sustained a jury finding of company responsibility in Kleinstein vs. West Texas Utilities Company. This was a damage suit brought by a land owner against the owner of a transmission line built over his land. Alleged losses incurred included the escape of cattle through a gap in the owner's fence said to have been made by the company. This claim was properly submitted to the jury, the court held, as was the damage sustained by the alleged cutting of the right-of-way to an excessive width. (3 S. W. [2d] 882.)*

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Lack of Legal Evidence of Ownership of Pole Absolves Company Whose Stencil It Bore from Liability for Accident.—A pole alleged to belong to the Lowell Electric Light Corporation fell when a lineman employed by the city climbed it to repair wires belonging to the city, and he was injured, a damage suit (Lynch vs. Lowell Electric Light Corporation) resulting. The Supreme Judicial Court of Massachusetts has reversed a verdict for the plaintiff on the ground that since no permit for the erection of this pole, which had stood for twenty years, could be found in the city's records ownership was not proved, the existence of the pole was a nuisance and the city in attaching its own wires to it was a trespasser or at most a licensee to whom the company owed no duty. "Although the pole in question bore a number and a metal strip with the letters L.E.L. stenciled thereon, there is no claim that there were wires of the defendant on or attached to the pole at the time of the accident," the court said. "On the uncontradicted evidence that the defendant after the accident removed the fallen pole, cut off a section and destroyed the remainder of it, with other circumstantial evidence, the jury would have been warranted in finding that that pole was then owned by the defendant." (160 N. E. 413.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

## Commission Rulings

"Going-Concern" Value Not to Be Estimated on Percentage Basis.—In adjusting a complaint made by the city of Erie against the Mutual Telephone Company the Pennsylvania Public Service Commission found fault with the method of estimating "going-concern" value by percentages followed by both contestants, saying: "The commission will not accept such a method as the proper procedure for arriving at this value. The going-concern value of any public utility, when such value exists, must be determined from the circumstances of the particular case." The commission cut down the company's figure—$407,061—and the city's figure—$340,000—to $300,000, basing its own figure on a consideration of the character of the plant and a study of its operations, together with the advantages to the public derived from a recent consolidation.

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The Argument Against "Going-Concern" Value as a Factor in Rate Base.—In determining rates for an Indiana telephone company recently the Indiana Public Service Commission made a radical departure from usual methods by giving no consideration at all to "going-concern" value. "Going value and overhead costs have been the bone of contention in practically every big rate case that ever has come before this body during my years of service," Commissioner John W. McCardle, who wrote the order, declared: "Its elimination in this case marks a step forward in relieving the patron of an added burden and in reducing the actual costs incurred during rate proceedings. The patrons of a utility will be very slow to agree that any amount of going value should be added to capital account and a rate of return received on it; in fact, with the safeguards surrounding and protecting a utility from competition which are provided by the Indiana utility law, it is doubtful if going value ever should be added, for the reason that the law grants a monopoly, the consumers pay the cost of building up the business and an adequate return on the investment always is guaranteed the investor from the beginning. No two engineers agree as to what constitutes going value. Some say good will, some an opportunity to do business; some maintain that no expense is incurred to get new business after the business once is established." Continuing, the order says: "It is refreshing to note that the petitioner has not offered in evidence any appraisal of its property on the theory that its present fair value based on what it would cost to reproduce the property new is greatly in excess of what it really cost, as is usually done, but is content to rely on the book cost of the property as being a fair rate base in this case. This gives the commission an opportunity to allow a return upon the petitioner's investment, which is quite rare in present-day rate making. We wish to commend the attitude of the petitioner in this respect and to remark in passing that if more of the utilities would assume this attitude, a long step would be taken to promote harmony and a better public relationship between the patrons and the utility and reduce the rate-making process to a fairer and easier task." An increase designed to insure 7 per cent on the investment was granted by the commission.

# News About Men of the Industry

## *D. N. Lewis Assumes New Duties in Chicago*

Dwight N. Lewis, formerly commerce counsel of the Iowa Railroad Commission, is now vice-president of the United Public Service Company with offices in Chicago. Though a lawyer by profession, Mr. Lewis has long been prominently identified with the public utility industry. Mr. Lewis is a native of Iowa and a graduate of the Drake University Law School at Des Moines. For approximately 30 years he has been connected with the Iowa commission, at first being the whole office force, in charge of accounting, secretarial work, rate work and reporting. Gradually he advanced to be secretary and later counsel, which position he held for six years. Finally he became a member of the commission, and in 1927, after serving several terms, he was named commerce counsel. It was from this office that Mr. Lewis resigned to remove to Chicago. He has always devoted considerable time to the affairs of the National Association of Railroad and Utilities Commissioners and his successful committee work in that association culminated in his election to the presidency in 1922.

*D. N. Lewis*

**Dr. Felix Deutsch**, head of the Allgemeine Elektrizitäts - Gesellschaft, has just celebrated his 70th birthday. Dr. Deutsch paid his first visit to America last fall.

**L. L. Bailey**, commercial manager of the Keystone division of the West Penn Power Company with headquarters at Ridgway, has been promoted to the position of assistant to W. S. Finlay, Jr., president of the West Penn Electric Company, the parent company of the West Penn Power Company. He will make his headquarters in Pittsburgh. For the past 4½ years Mr. Bailey has been commercial manager of the Keystone division. He joined the company in August, 1923, as power engineer and on Jan. 1, 1924, was appointed to the position of commercial manager of the Keystone Power Corporation. On July 1, 1927, when the Keystone Power Corporation was merged with the West Penn Power Company, he assumed the duties he is now relinquishing.

**N. G. Harvey**, who recently resigned as president of the Illinois Electrical Supply Company and of the Electric Association of Chicago, was the guest of honor at a farewell luncheon given at the Union League Club, Chicago, April 30. The occasion marked the withdrawal of Mr. Harvey from the business life of Chicago to reside permanently in California. W. W. Low, president of the Electric Appliance Company, was the toastmaster. Twenty-three men attended, all of whom have been active in local electrical circles.

**M. L. Hibbard**, formerly chief operating engineer of the Northern States Power Company, who joined the Electric Bond & Share Company, New York, early this year, as announced in the Jan. 21 issue of the Electrical World, has been assigned to the Idaho Power Company, Boise, in the capacity of assistant general manager.

**C. P. Potter**, engineer in charge of large motor and transformer divisions of the Wagner Electric Corporation, St. Louis, Mo., has been elected chairman of the St. Louis Section of the American Institute of Electrical Engineers. Ever since he joined the Institute at the time he graduated from the University of Illinois, in June, 1909, he has been serving on various committees, and last year served as vice-chairman of the St. Louis Section.

**J. E. Aldred** of Aldred & Company, investment bankers of New York and chairman of the board of directors of the Consolidated Gas, Electric Light & Power Company of Baltimore, returned April 30 aboard the *Leviathan* from an inspection trip of the hydro-electric properties in France and in Italy in which the International Power Securities Corporation has invested. Mr. Aldred is president of the International.

**M. F. Simmons** has been appointed assistant to the vice-president in charge of General Electric manufacturing, according to an announcement made by C. C. Chesney, vice-president of that company. Mr. Simmons, who has been general supervisor of production, will continue in that capacity and will take over such other duties as may be assigned from time to time. He entered the service of the General Electric Company 25 years ago. For fifteen years he was in charge of the cost department at the Schenectady plant, and in 1921 was made assistant to the manager. Three years ago he was appointed general supervisor of production on the staff of the vice-president in charge of manufacturing.

## *F. S. Dewey General Sales Manager in Cincinnati*

Fred S. Dewey, vice-president in charge of lighting and power sales of the Kansas City Power & Light Company, has severed his connection with that utility to become general sales manager of the Union Gas & Electric Company, Cincinnati. Mr. Dewey has been identified with the Kansas City utility since 1918, when he became assistant general manager, and a few years ago, when the company was reorganized, he became a vice-president in charge of power and lighting sales. A native of Murray, Iowa, Mr. Dewey entered the public utility field immediately following graduation from the Iowa State College. His early experience was in the operation of the steam and gas plants of the Tri-City Electric Company, but he soon transferred his interests to the selling branch of the industry as power salesman.

*F. S. Dewey*

In 1915 he removed to Muscatine, Iowa, to affiliate himself with the local railway company and two years later he was appointed general manager of the Muscatine Light Company, the position he held until he became assistant general manager of the Kansas City property. Mr. Dewey has been active in the American Institute of Electrical Engineers, the Missouri Association of Public Utilities, the Kansas City Electric Club, the American Society of Mechanical Engineers, the Middle West Division of the National Electric Light Association and other societies.

**Samuel Insull**, president of the Commonwealth Edison Company, Chicago, arrived in New York May 8 aboard the White Star liner *Majestic* after a short trip abroad.

**Herbert A. Wagner**, president of the Consolidated Gas, Electric Light & Power Company of Baltimore, who recently was elected a director of the Baltimore Association of Commerce, has also been elected a vice-president.

## *Wentling Directs Research for Cedar Association*

John P. Wentling has been appointed director of the research division of the Western Red Cedar Association with headquarters at Minneapolis. Mr. Wentling, who has held a chair in the division of forestry, University of Minnesota, is recognized as one of the foremost authorities on wood technology. He received his professional training in forestry at Yale University, which was supplemented by practical experience obtained during a four-year connection with the United States Forest Service. After spending two years as instructor in wood technology at the Pennsylvania State Forest School, in 1908 he joined the teaching staff of the University of Minnesota in the division of forestry. During his affiliation with that institution he has organized and developed courses in wood technology and forest products as a major field of study in the division of forestry.

*J. P. Wentling*

In addition to his academic work, Mr. Wentling has frequently been called upon as consultant by outside interests. He is well known among the industries producing forest products, having addressed many state and national lumber organizations as well as various engineering societies.

A. Wainright, formerly operating vice-president of the Inland Power & Light Corporation, has resigned to affiliate himself with A. E. Fitkin, formerly owner of the Inland properties and now active in utility affairs in Los Angeles.

A. D. Babson, assistant manager of the central-station department of the New York district of the General Electric Company, retired May 1 after 37 years of active work with the General Electric Company and its predecessor, the Edison General Electric Company. He entered the employ of the Edison General Electric Company in New York as an estimator and after the consolidation of that company with the Thomson-Houston Company he became engineer of the Washington office. He subsequently was identified with the Baltimore office, the New England district and for a while he was assistant to the late Gen. Eugene Griffin, vice-president of the company. In 1903 he was appointed manager of the supply department of the New York district, which position he held until a few years ago, when he became assistant manager of the central-station department, the supply department having been divided into other company departments.

George W. Mason has been elected president of Copeland Products, Inc., manufacturer of electric refrigeration machines, Detroit, succeeding William Robert Wilson, who becomes chairman of the board. Mr. Mason became vice-president and general manager of Copeland Products, Inc., in March, 1926. He had previously established a reputation in production circles as works manager for the Chrysler Motor Corporation.

## *T. G. Nee Becomes President of Acme Wire*

Thomas G. Nee of New York has been elected president of the Acme Wire Company, New Haven, Conn., to succeed Victor M. Tyler, who retired. Mr. Nee is a graduate engineer of the University of Wisconsin. From 1905 to 1917 he was connected with the Mexican Telephone & Telegraph Company as vice-president and chief engineer in charge of all the company's operations in Mexico. Subsequently he spent ten years with the Allied Machinery Company of New York, which was owned by the American International Corporation of that city, as president of its most important subsidiary, the Horne Company, Limited, in Japan. He made a notable success of this undertaking, particularly during the trying years following the war.

Mr. Nee has had a broad business training in lines that make him thoroughly familiar with the products of the Acme Wire Company. His long connection with the telephone and telegraph industry familiarized him with coils, wire of all kinds, condensers and other electrical wire products. Mr. Nee was also elected a member of the board of directors of the Acme Wire Company to succeed James T. Moran, resigned. James W. Hook, president of the Geometric Tool Company, New Haven, was elected chairman of the executive committee of the Acme Wire Company and William G. Redfield, president of the New Haven Bank, was elected a member of the board of directors of the Acme organization to succeed James E. Wheeler, who has resigned.

*T. G. Nee*

# Obituary

George Offor, pioneer in the electrical industry in England, died recently at his home in Sydenham, London. Mr. Offor had celebrated his 101st birthday just a few days prior to his death.

Paul T. Brady, special representative in New York of the Westinghouse Electric & Manufacturing Company, with which he had been associated for 34 years, died suddenly May 3 at the home of his son in Portland, Ore. A graduate of Phillips Exeter Academy, Mr. Brady had been affiliated with various branches of the electrical industry since 1881. During his connection with the American Telephone & Telegraph Company he helped to extend the telephone system through the southeastern portion of New York State, and after joining the Thomson-Houston organization in 1890 he became its manager for the State of New York and the Middle West. In 1894 he was appointed New York State manager for the Westinghouse company with headquarters at Syracuse, but in 1907 he removed to New York as special representative. Among the public utilities which he helped to develop are the Rochester Gas & Electric Company, Niagara, Lockport & Ontario Power Company, Central Georgia Power Company, Virginia Power Company and the Southeastern Power & Light Company. In commenting on Mr. Brady's death, E. M. Herr, president of the Westinghouse company, said: "Mr. Brady was one of the pioneers of the electric light and power industry. Combining technical electrical knowledge with financial ability, he has left behind his as a monument more than a score of successful electrical systems." Mr. Brady was 71 years of age.

Hugh K. Prichitt, head of Prichitt & Company, investment bankers of New York, and a member of the board of directors of the Dubilier Condenser & Radio Corporation, died April 27 at his home in New York after a week's illness. At the time of his death Mr. Prichitt was an officer and director in several industrial enterprises.

# Financial and Statistical News

## *Markets Exceedingly Active*
## *Preferred Stocks Firm*

WITH further merger rumors and exceedingly heavy buying, the utilities securities markets have had one of the busiest weeks this year so far. Prices of several power and light common stocks have shown gains for the week of anywhere from five to twenty points. Among the most active issues were Columbia Gas & Electric, which advanced twelve points, and American Gas & Electric, which gained seventeen points and touched a new high of 167. Middle West Utilities took a further jump of seventeen points to a new high of 169, and Public Service of New Jersey continued its upward movement with a gain of about ten points to a high of 66⅜. Smaller gains are recorded in the case of several other issues, such as Commonwealth Edison, Edison of Boston, Philadelphia Electric, Southern California Edison, Electric Investors, etc.

Preferred stocks of the power and light companies continue to show strength, regardless of higher money rates, and prices are well maintained in the bond market with a marginal upward tendency, especially in the case of the higher grade issues.

## April Financing Reaches Total of $279,535,000

REACHING a total of $279,535,000, power and light company financing for April was more than double that for April of last year and accounted for almost one-half of the total volume of financing this year to date. This brings the total for the first four months up to $609,941,852, against an aggregate of $612,390,500 for the corresponding period of 1927. In other words, the volume of financing so far this year is keeping pace with the unprecedented record made last year.

Although it is impossible as yet to state accurately what proportion of the above financing constituted refunding operations, it may be assumed that at least $200,000,000 was for this purpose. Some of the largest issues of the month were almost entirely for refinancing, and the gain in interest charges exceeded 2 per cent in some instances.

A comparison of the totals by months this year and last follow:

| | 1928 | 1927 |
|---|---|---|
| January | $98,850,000 | $223,859,000 |
| February | 103,255,500 | 166,000,000 |
| March | 128,301,352 | 96,775,000 |
| April | 279,535,000 | 125,756,500 |
| | $609,941,852 | $612,390,500 |

## Allis-Chalmers Billings Up 6.4 per Cent

Billings for the first quarter of 1928 of the Allis-Chalmers Manufacturing Company show an increase of 6.4 per cent over the corresponding quarter of 1927. Earnings on a comparable basis also reflect an increase inasmuch as there was no fixed charge for debenture interest in the early months of 1927. Entire earnings were available for both preferred and common dividends. In the first quarter of 1928, the preferred stock having all been retired in July, 1927, earnings equivalent to $2.60 per share accrue wholly to common stock holders.

Bookings for the first quarter of 1928 were $8,370,537, against $7,833,622 for the first quarter of 1927. Unfilled orders as of March 31 were $9,973,862.

## *Security Issues of Electric Service Companies in April*

| Name of Company | Amount of Issue (Par Value) | Period Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| American Gas & Electric Co. | $50,000,000 | 100 | Gold debentures | To redeem bonds | 5 | 101 | 4.95 |
| New England Power Association | 25,000,000 | 20 | Gold debentures | To retire short-term bank loans and for the payment of other indebtedness | 5 | 100 | 5.00 |
| Gulf Power Co. | 2,500,000 | 40 | First and refunding mortgage gold bonds | Pay off notes | 5 | 99 | 5.06 |
| Central States Edison Co. | 1,350,000 | 15 | First lien gold bonds, series A | To retire existing funded debt, to defray cost of acquiring additional properties and for other corporate purposes | 5½ | 97½ | 5.75 |
| | 675,000 | 3 | Convertible gold notes | | 5½ | 98½ | 6.05 |
| North Continent Utilities Corp. | 1,250,000 | .. | Cumulative preferred stock | Extensions and betterments or for other corporate purposes | 7 | 100 | 7.00 |
| Minnesota Power & Light Co. | 14,000,000 | 50 | First and refunding mortgage gold bonds | To retire bonds | 4½ | 97½ | 4.64 |
| American Electric Power Corp. | 3,272,500 | .. | Preferred stock | To retire debentures | 6 | 93¾ | 6.40 |
| New England Public Service Co. | 4,387,500 | .. | Preferred stock | To refund short-term loans and for other corporate purposes | 6 | 97½ | 6.15 |
| Iowa Public Service Co. | 500,000 | .. | Cumulative first preferred stock | To reimburse for extensions and betterments and for the acquisition of properties | 6 | 100 | 6.00 |
| Cincinnati Gas & Electric Co. | 35,000,000 | 40 | First mortgage gold bonds, series A | Incident to consolidation | 4 | 92½ | 4.40 |
| Queens Borough Gas & Electric Co. | 4,000,000 | 30 | Refunding mortgage gold bonds | To reimburse for retirement of bonds and for additions and extensions | 4½ | 100 | 4.50 |
| Super-Power Co. of Illinois | 10,000,000 | 40 | First mortgage gold bonds | To defray cost of additions and extensions | 4½ | 98½ | 4.58 |
| Central States Electric Corp. | 10,000,000 | .. | Cumulative preferred stock | To acquire additional investments, to liquidate current indebtedness and for other corporate purposes | 6 | 101 | 5.94 |
| Associated Gas & Electric Co. | 63,000,000* | 20 | Convertible gold debentures | To retire debentures outstanding and securities of subsidiaries, for the acquisiting of property and for other corporate purposes | 4½ | 97 | 4.73 |
| Cities Service Co. | 50,000,000 | 30 | Gold debentures | To retire funded debt and for the retirement or acquisition of funded debt or preferred stocks of subsidiaries | 5 | 98 | 5.13 |
| Railway & Light Securities Co. | 3,000,000 | 25 | Collateral trust gold bonds | To retire securities and for the purchase of additional securities | 4½ | 94½ | 4.90 |
| Iowa Power & light Co. | 1,000,000 | .. | Cumulative preferred stock | To reimburse for additions and extensions, for acquisition of properties and of securities | 6 | 100 | 6.00 |
| Kentucky Power & Light Co. | 600,000 | 2 | Gold notes | To discharge obligations incurred in connection with acquisition of new properties | 5½ | 99½ | 5.75 |

| | | | |
|---|---|---|---|
| Total | $279,535,000 (par value) | Rights | $4,807,656 |
| Total amount actually realized | 273,518,225 | Total financing for April | $278,325,881 |

*Offered to stockholders at 97.

## American & Foreign Power Acquires Mexican Properties

A plan has been consummated whereby the American & Foreign Power Company, Inc., will acquire the collateral gold bonds, preferred stock and common stock of the Mexican Utilities Company by giving its 6 per cent preferred stock in exchange for the other company's securities on the following basis:

For each $100 principal amount of the collateral gold bonds of the Mexican Utilities Company, nine-tenths of a share of the $6 preferred stock of the American & Foreign Power Company, Inc., with a cash adjustment of accrued interest.

For each share of the preferred stock of the Mexican Utilities Company, 75-100ths of a share of the $6 preferred stock of the American & Foreign Power Company, Inc., with a cash adjustment of accrued dividends.

For each share of the common stock of the Mexican Utilities Co., 35-100ths of a share of the $6 preferred stock of the American & Foreign Power Company, Inc.

The privilege of exchange is extended to all holders of collateral gold bonds, preferred stock and common stock now outstanding of the Mexican Utilities Company who shall avail themselves thereof by depositing their holdings on or before June 1, 1928, or on or before any extended date. The American Exchange Irving Trust Company, 60 Broadway, New York, is depositary under the plan.

The Mexican Utilities Company is a holding company organized three years ago in Maine.

## General Gas & Electric System Net Income Up 8 per Cent

By a reduction of about 4 per cent in operating expenses, taxes and maintenance the officers of the General Gas & Electric group succeeded in showing an 8 per cent growth in net revenue, although gross revenue increased less than 2 per cent during 1927. Details of financial operations covering its large-scale hydro-electric development near Columbia, S. C., will be given in a later issue.

INTERNATIONAL POWER STOCK. — Shareholders of the International Power Securities Corporation at their recent annual meeting approved an increase in authorized common stock from 350,000 to 1,000,000 no-par shares.

## New Capital Issues

During the week ended May 10 the Southern Cities Utilities Company made an offering of 30-year 5 per cent first lien and collateral trust gold bonds, series A, to the amount of $10,500,000, the price being 94 and accrued interest, to yield 5.40 per cent.

The Rumford Falls Power Company (Maine) issued general mortgage 4½ per cent gold bonds to the amount of $2,000,000 at 98½ and accrued interest, to yield over 4.60 per cent. These bonds mature May 1, 1948.

The American Power & Light Company issued 200,000 shares of $5 preferred stock, series A, stamped certificates at $95 a share plus an amount equal to accrued dividends at the rate of $5 per share per annum from April 1, 1928, to yield 5.25 per cent.

With the purpose of retiring 7 per cent prior preference stock the Puget Sound Power & Light Company issued 110,000 shares of $5 dividend prior preference stock at 96 and accrued dividend, to yield 5.20 per cent.

One foreign offering was made—a three-and-a-half-million-dollar issue of

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday May 8 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 81 | 72 | 85 |
| Ala. Pwr., $7 cum. pf.—no par | k114¾ | 114¼ | 115½ |
| Allis Chalmers Mfg.,6% com.,ex.div. | 129⅛ | 115¼ | 129⅞ |
| Aluminum Co. of Amer., com. | 166 | 120 | 166 |
| Aluminum Co. of Amer., 6% pf | 109½ | 105½ | 109½ |
| Amer. & Foreign Pwr., 7% pf.—no par | 109½ | 105½ | 109⅞ |
| Amer. & Foreign Pwr., com.—no par | 37½ | 22¼ | 38⅞ |
| Amer. Bosch Magneto, com.—no par | 34½ | 15⅛ | 34½ |
| Amer. Brown Boveri Elec.† | 18¾ | 10⅛ | 18¾ |
| Amer. Brown Boveri Elec., pf. $7 | 63 | 40¼ | 65 |
| Amer. Gas & Elec., 6% pf.—no par | 110 | 106¾ | 111 |
| Amer. Gas & Elec., com. †—no par | 166½ | 117½ | 167 |
| Amer. Lt. & Trac., 6% pf | 115 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 219½ | 170 | 220 |
| Amer. Pwr. & Lt., 6% pf | 107¾ | 104 | 109½ |
| Amer. Pwr. & Lt., com. †—no par | 88¼ | 62¼ | 89½ |
| Amer. Pub. Serv., 7% pf. | a101 | 97½ | 101 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | a 96½ | 87½ | 97 |
| Amer. Pub. Utilities, 7% pr. pf. | a102½ | 95¾ | 102½ |
| Amer. Pub. Utilities, com. | k 60 | 60 | 65 |
| Amer. States Sec., A | a 12½ | 4 | 13 |
| Amer. States Sec., B | a 16½ | 4⅛ | 16½ |
| Amer. Superpwr., 6% 1st pf. | l 104½ | .... | .... |
| Amer Super pwr., Class A†—no par | 43¼ | 26¾ | 56 |
| Amer.Super pwr., Class B†—no par | 48¼ | 37 | 56¾ |
| Amer Wtr. Wks. & Elec., 6% pf | k104½ | 101½ | 106 |
| Amer W. W. & E., com. new—no par ex div | 68 | 52½ | 70⅛ |
| Anaconda Copper cap. $3 | 72 | 53¾ | 72⅞ |
| Appalachian Electric Pwr, 7% pf | 109 | 108½ | 110 |
| Arkansas Pwr., & Lt. 7% pf | 107½ | 107½ | 111 |
| Assoc Gas & Elec, $3.50—50 | 54½ | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 95 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par | 50⅛ | 47 | 51½ |
| BABCOCK & WILCOX, 7% com. | 122 | 117½ | 124¾ |
| Binghamton L., H. & P., $6 pf | 108 | 102 | 109½ |
| Birmingham Elec., pf. $6—no par. | 107 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf | k106 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k165 | 135 | 170 |
| Blaw-Knox, com.† | i101 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., $7 com | m246 | .... | .... |
| Brazilian Trac., Lt. & Pwr.,com.,new | f 63 | .... | .... |
| Broad River Pwr., 7% pf | 105 | 105 | 108⅛ |
| Brooklyn Edison, 8% com | 263½ | 206⅛ | 268½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | i 26⅛ | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | i 41 | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf | 99 | 98 | 101 |
| California Ry. & Pwr., 7% pf | 135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l108 | 109 | 110⅛ |
| Central & S. W. Util., $7 pf—no par | a104 | 99⅛ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a110½ | 103½ | 110 |
| Central Ark. Ry. & Lt., 7% pf | 106 | 105 | 107⅛ |
| Central Ill. Pub. Serv., $6 pf | a 99½ | 97½ | 100⅛ |
| Central Ind. Pwr., 7% pf | a100½ | 95 | 100½ |
| Central Maine Power, 6% pf | 98 | 96 | 98⅛ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf | 109⅛ | 104¼ | 110 |
| Central States Elec., 7% pf | 117½ | 104½ | 119¾ |
| Cincinnati Gas & Elec., 5% com. | g100⅛ | .... | .... |
| Cities Service, $6 pf.—no par | l 103⅛ | 94½ | 103½ |
| Cities Service, pf. B—no par | l 9⅛ | 8⅞ | 9⅛ |
| Cities Service, pf. BB—no par | l 97 | 88⅛ | 97 |
| Cities Service com.—20 | l 66½ | 54 | 67¾ |
| Cities Service, Bks. Shrs.—10 | l 32½ | 26⅛ | 33½ |
| Cities Service Pwr. & Lt., 7% pf | k108 | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf | 102 | 95⅛ | 102 |
| Cleveland Elec. Illg., 6% pf | 113 | 113 | 115⅛ |
| Cleveland Elec. Illg., 10% com. | 415 | 350 | 425 |
| Columbia Gas & Elec., 6% pf | 109 | 107⅛ | 110⅛ |
| Columbia G. & E. com. $5—no par | 117½ | 89½ | 117⅞ |
| Columbus Elec. & Pwr., $2 com.—no par | 79½ | 64 | 79¾ |
| Columbus Elec. & Pwr., 7% | 113 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 109½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 109½ | .... | .... |
| Columbus Ry., P. & Lt. com. no par | 120 | 120 | 125 |
| Commonwealth Edison, 8% com. | a189 | 165 | 189 |
| Commonwealth Pwr., 6% pf | 103¾ | 102⅛ | 104⅞ |
| Commonw'th Pwr., $2, com.—no par | 87½ | 62¼ | 87½ |
| Conn. Lt. & Pwr., 8% pf | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf | 117 | 118 | 121 |
| Cons. Gas of N. Y., pf | 104 | 101¼ | 105 |
| Cons. Gas of N. Y., com. $5—no par. ex.div | 168½ | 119⅛ | 170½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf | e111½ | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf | e105 | 100½ | 105¾ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 89⅛ | 67½ | 93 |
| Consolidated Pwr. & Lt., 7% pf | 105 | .... | .... |
| Consumers Pwr., 6% pf | 104¾ | 106 | 107 |
| Consumers Pwr., 6.6% pf | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108¼ | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par | k230 | 240 | 265 |
| Crocker Wheeler, com.† | 44 | ... | ... |
| Crocker Wheeler, 7% pf | 93 | ... | ... |
| DALLAS PWR. & LT., 7% pf | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf | 109 | 108⅛ | 110½ |
| Derby Gas & Elec., 7% pf | 102 | 96 | 100½ |
| Detroit Edison, 8% com | 191 | 166½ | 194¾ |
| Dubilier Condenser, com.—no par | 4⅛ | 2½ | 5⅛ |
| Duke Pwr., cap | k138 | 130 | 145 |
| Duquesne Lt., 5% pf | 105½ | 104⅛ | 105¾ |
| EASTERN NEW YORK UTIL., $7 pf | k110½ | 111 | 112½ |
| Eastern States Pwr. B | 24½ | 11½ | 25⅜ |
| Eastern States Pwr., pf | k 99½ | 98 | 100½ |
| East. Tex. Elec., 7% pf | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com | d284½ | 252 | 284½ |
| El Paso Elec. 7% pf | 113 | 110 | 112½ |
| Elec. Bond & Share, 6% pf | l110½ | 108¾ | 111⅞ |
| Elec. Bd. & Sh. Sec., com. $1—no par ex. rights | l119⅛ | 76 | 127½ |
| Electric Household Util.† | a 24½ | 13½ | 25 |
| Elec. Investors, 6% pf.—no par | 103½ | 101 | 104½ |
| Elec. Investors, com.†—no par | 69 | 40⅛ | 69 |
| Elec. Pwr. & Lt., ctfs. pf | 110 | 106½ | 110⅛ |
| Elec. Pwr. & Lt., ctfs., 40% pd | m127 | 120⅛ | 129½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 44½ | 28¾ | 44⅛ |
| Elec. Ry. Securities, com.—no par | 6¼ | ... | .. |
| Elec. St. Battery com. $5.25—no par | 81½ | 69 | 83⅛ |
| Elmira Wtr., Lt. & R.R., 7% pf | 105 | 104 | 107 |
| Empire Pwr., ptc.† | 37¾ | 27½ | 37¾ |
| Engr. Pub. Serv. $7, pf.—no par | 110¾ | 107 | 110¾ |
| Engr. Pub. Serv., com.—no par | 45½ | 33 | 46½ |
| Eureka Vacuum Cleaner, com. $4—no par | 75¾ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf | 111¾ | 104 | 111¾ |
| F.-M., com.—$3—no par | 48 | 32½ | 54 |
| Federal Lt. & Trac.,com $1.40 | 55½ | 42 | 56⅞ |
| Federal Lt. & Trac., $6 pf.—no par | 107¾ | 98 | 109 |
| Florida Pwr. & Lt., 7% pf | k108 | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf | l114½ | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf | 82 | 75 | 85 |
| Galveston-Houston Elec., com | 36 | 31 | 34 |
| General Cable, Cl.A | 75 | 56 | 84½ |
| Gen. Elec. $3 com.—no par | 174 | 124 | 174½ |
| Gen. Elec., special—6% | 11¾ | 11½ | 11¾ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par | 47½ | 35¼ | 48¾ |
| Gen. G. & E. (Del.) pf. A.$8—no par | 135 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par. | 118 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 | 114½ | 105⅛ | 114¾ |
| Gen. Pub. Serv., $7 pf. | 117 | 110 | 120 |
| Gen. Pub. Serv., com., no par | 29 | 16⅞ | 29 |
| General Public Utilities, $7 pf | k103 | 98 | 101 |
| Ga. Lt., Pwr. & Rys., com | k 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf | h105 | .... | .... |
| IDAHO PWR., 7% pf | 110 | 109 | 111½ |
| Ill. No. Utilities, 6% pf | k 99 | 96 | 100 |
| Ill. Pwr. & Lt., 7% pf | 105 | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf | 105½ | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf | 102 | 100 | 105 |
| Ingersoll Rand com | 97½ | 90 | 98 |
| Int. Combus. Engr., com. $2—no par | 65 | 45½ | 65 |
| Int. Combustion Engr.,7% pf | 105⅛ | 103 | 105⅛ |
| Int. Util., Class A—$3.50—no par | 51⅛ | 44⅛ | 52 |
| Int. Utilities, Class B—no par | 14⅛ | 6⅛ | 16⅛ |
| Interstate Pwr., pf.—$7—no par | 103 | 99 | 103½ |
| Interstate Pub. Serv., 7% pf | 106 | 103 | 106⅛ |
| Iowa Ry. & Lt., 7% pf | 101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 108 | 105 | 107 |
| Johns-Manville, com †—no par | [illegible] | 111 | 133½ |
| Johns-Manville, 7% pf | m122½ | 119½ | 121½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, May 5. *l*Bid price Wednesday, May 9. *m*Latest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday May 8 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY POWER & LIGHT pf. $7 | *l*113½ | 111½ | 114 |
| Kansas Gas & Elec. 7% pf. | *l*110 | 107 | 110 |
| Kelvinator Corp. | 20½ | 11¼ | 22¾ |
| Kentucky Hydro-Elec., 7% pf. | *k*104 | 100 | 105 |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 105 | 100 | 105 |
| LACLEDE GAS LT., 10% com. | *k*215 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 37½ | 19¾ | 40 |
| Long Island Ltg., 7% pf. | *k*111 | 110¾ | 112½ |
| Long Island Ltg., 6% pf. | *k*109 | 107 | 109 |
| Long Island Ltg., com.†—no par | 229 | 175 | 250 |
| Los Angeles Gas & Elec., 6% pf. | *h*112 | 105¼ | 112¼ |
| Louisville Gas & Elec., cl. A. $1.75 | 30¾ | 28 | 37¾ |
| MAN. ELEC. SUPPLY, cap. $5—no par | 53½ | 50 | 61 |
| Maytag Co., com. 50—no par | 38¾ | 30 | 40¼ |
| Memphis P. & L., pf.—$7—no par | 110 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 100 | 103 | 109½ |
| Metropolitan Ed., pf.—$7—no par | 109½ | 109 | 111 |
| Metropolitan Ed., com. $5—no par | *k*165 | 125 | 155 |
| Middle West Utilities, 6% pf. | *a*100¼ | 93½ | 100½ |
| Middle West Util., 6% pr. lien | *a*106½ | 99 | 108 |
| Middle West Util., com. $6—no par | *a*169 | 123¾ | 169 |
| Midland Utilities, pr. ln. 6% pf. | *a* 95½ | 94½ | 97 |
| Midland Utilities, 6% pf. A | *a* 90¾ | 89½ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 100 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | *l*108¼ | 107 | 109 |
| Miss. River Pwr., 6% pf. | *k*112 | 94 | 112½ |
| Miss. River Pwr., 3% com. | 112 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | 109½ | 107½ | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | 107½ | 105 | 108½ |
| Mohawk Hudson Pwr., com.—no par | 53 | 29½ | 53 |
| Montana Pwr., 5% com. | 175 | 102½ | 175 |
| Montreal Pwr., 7½% com. | *f*112 | .... | .... |
| Mountain States Pwr., 7% pf. | *k*104 | 97 | 105 |
| Mountain States Pwr., com.† | 18 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110½ | 98 | 110½ |
| National Carbon, 8% pf. | *a*136½ | 136½ | 139¾ |
| National Elec. Pwr., A† | *a* 38 | 27½ | 32¾ |
| National Lt., Ht. & Pwr., com | *k* 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | 72 | 70 | 80 |
| National Pwr. & Lt., pf.—$6—no par | 109 | 102 | 106 |
| National Pwr. & Lt., com.†—no par. | 36¼ | 21¾ | 36¾ |
| National Pub. Serv., 7% pf. | 102½ | 99 | 103 |
| National Pub. Serv., 7% ptc., pf. | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 26¾ | 22 | 27½ |
| National Pub. Serv., B com.—no par | *m* 27½ | 24½ | 30 |
| Nebraska Pwr., 7% pf. | *l*110½ | 110 | 111½ |
| Nevada-Calif. Elec., com. | *k* 33 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | 64 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 110 | 98½ | 110½ |
| New Eng. Pub. Serv., pf. $7 | 98 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 107½ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 102 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | 105 | 101 | 105½ |
| New York Power & Light 7% pf. | 114¼ | .... | .... |
| Niagara Falls Pwr., 7% pf.—25 | 28¼ | 27½ | 28½ |
| No. Amer., 6% pf.—50 | 55 | 53¼ | 55¾ |
| No. Amer., com.—10 | 77¾ | 58¾ | 77¾ |
| No. Amer. Edison, $6 pf.—no par | 104 | 102½ | 105¾ |
| Northeastern Pwr., com. | 27¼ | 19¾ | 30 |
| No. N. Y. Utilities, 7% pf. | 109 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 29½ | 18 | 29½ |
| Northern Ohio Pwr. & Lt., 6% pf. | 99 | 90 | 99 |
| No. Ont. Lt. & Pr. 6% pf. | *k* 99½ | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | *k* 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 110 | 108¼ | 110¾ |
| No. States Pwr. (Del.), 8% com. | 152 | 123 | 152 |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par. | 95¾ | 89 | 100½ |
| Ohio Brass, 6% pf. | *k*105 | 106 | 111 |
| Ohio Pwr., 6% pf. | 109 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | 104 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 112½ | 107 | 112 |
| Ohio River Edison, 7% pf. | 109 | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 114¾ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 29½ | 26¾ | 30 |
| Pacific Gas & Elec., 8% new com. | 52¾ | 43½ | 53¾ |
| Pacific Pwr. & Lt., 7% pf. | *l*111 | 106 | 110 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | *c* 82 | 79½ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 99½ | 93¾ | 100 |
| Penn-Ohio Edison, 7% pf. | 108 | 97½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 111 | .... | .... |
| Penn Pwr. & Lt.—$7—no par | *l*109¾ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | *e* 89 | 68 | 90 |
| Phila. Co., 5% pf.–50 | 48½ | 45½ | 48½ |
| Phila. Co., 6% pf.—50 | 56 | 52 | 57 |
| Phila. Co., com.—50 | *k*174¾ | 145 | 174¾ |
| Phila. Elec., 8% com.—25 | *c* 74¾ | 55½ | 74¾ |
| Portland Elec. Pwr., 7% pf. | 103½ | 100 | 104¾ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 43 | .... | .... |
| Potomac Elec. Power, 6% pf. | *j*113½ | .... | .... |
| Pwr. Sec., pf.—no par | 60 | 50 | 68 |
| Pwr. Sec., com.—no par | 14 | 11 | 14½ |
| Public Serv. of Colorado, 7% pf. | 105 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 113¼ | 103½ | 115 |
| Pub. Serv. of N. J., 7% pf. | *k*127 | 118 | 127 |
| Pub. Serv. of N. J., $2 com.—no par | 65¼ | 41½ | 66¾ |
| Pub. Serv. of No. Ill., 6% pf. | *a*113 | 110 | 115 |
| P. S. of No. Ill., com. $8—no par | *a*183 | 159¼ | 183 |
| Pub. Serv. of No. Ill., $8 com. | *a*181½ | 159¾ | 181½ |
| Pub. Serv. of Okla., 7% pr. ln. | 109 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 110 | 108 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | *k*110 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | *k*103 | 93½ | 105½ |
| Puget Sound Pwr. & Lt., com. | 77 | 34¾ | 84¾ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 57½ | 54½ | 57½ |
| Radio Corp. of Amer., com.—no par. | 209 | 85¼ | 209 |
| Rochester Gas & Elec. 6% pf. D | 105½ | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107½ | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105½ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 117 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | *k* 75 | 70 | 75 |
| Servel, Inc. | 14½ | 4½ | 14½ |
| Sierra Pacific Elec., 2% com. | 40 | 29 | 40 |
| Sioux City Gas & Elec., 7% pf. | 106 | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | *l* 109 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | *l* 91¼ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 58¾ | 40½ | 61 |
| So. Calif. Edison, 8% pf. | 49 | 38¾ | 41 |
| So. Calif. Edison, 7% pf. | 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 27½ | 25¾ | 27¾ |
| So. Calif. Edison, 8% com. | 51¾ | 43½ | 53¼ |
| Southern Cities Utilities, 7% pf. | 85 | 75 | 87 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 94½ | 88 | 96½ |
| Southwestern Pwr. & Lt., 7% pf. | 114 | 110 | 114½ |
| Standard Gas & Elec., 8% pf. | 70¾ | 65 | 71 |
| Standard Gas & Elec., 7% pr. pf. | 114½ | 108 | 115 |
| Standard G. & E., com. $3.50 | 74¾ | 57¾ | 74¾ |
| Standard Power & Light, com. | 46 | 29¾ | 49¾ |
| Standard Pwr. & Lt., 7% pf. | 106¾ | 103¾ | 107¾ |
| Staten Island Edison, pf.—$6—no par | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | 155 | 155 | 178 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 112½ |
| Syracuse Lighting, 8% pf. | *k*117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | 69½ | 62 | 71 |
| Tenn. Elec. Pwr., 6% pf. | 103 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109½ | 107 | 110 |
| Terre Haute, Ind. & East. Trac., 5% pf. | *k* 10 | .... | .... |
| Terre Haute, Ind. & East. Trac., com. | *k* 1 | 1 | 3 |
| Tex. Pwr. & Lt., 7% pf. | *i*114½ | 113½ | 115 |
| Tide Water Pwr., 8% pf. | 111 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 128½ | 112½ | 134 |
| Toledo Edison, 7% pf. | 109½ | 108 | 111 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | *k*145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 95 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | *c*149½ | 114½ | 149½ |
| United Lt. & Pwr., pf.—$4—no par | *a* 57 | 53 | 58 |
| United Lt. & Pwr., pf.—$6.50—no par | 101 | 94½ | 103½ |
| United L. & P., com. A .48—no par | *a* 25 | 14 | 25¾ |
| United L. & P., com. B .48—no par | *k* 29½ | 20 | 29½ |
| Utah Pwr. & Lt., 7% pf. | *i*112½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105½ | 105 | 106½ |
| Utica Gas & Elec., 8% com. | *k*200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101 | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 38½ | 28½ | 39½ |
| Utilities Pwr. & Lt., com. B $1—no par | 29½ | 18½ | 30½ |
| VERMONT HYDRO-ELEC., 7% pf. | 100 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | *k*110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102½ | 97 | 103½ |
| WAGNER ELEC., 7% pf. | *b*104 | 96½ | 105 |
| Wagner Elec., com.—no par | *b* 87½ | 37 | 87½ |
| Washington Ry. & Elec., 7% com. | *j*450 | .... | .... |
| Washington Ry. & Elec., 7% pf. | *j*102 | .... | .... |
| Washington Wtr. Pwr., 8% com. | 227 | 175 | 235 |
| West Penn Elec., 7% pf. | 114 | 109½ | 115 |
| West Penn Elec., Cl. A $7 | *k*110½ | 106½ | 112 |
| West Penn Pwr., 7% pf. | 115¾ | 114¾ | 117 |
| West Penn Pwr., 6% pf. | 110 | 108¾ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | *k* 95 | 94 | 100 |
| Western Pwr., 7% pf. | 103 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | *k*104 | 100 | 106 |
| Western States Gas & Elec., com. | *m* 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 110 | 88½ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | *k* 33½ | 30¼ | 34¼ |
| Weston Elec. Instrument, com.—no par | 17¾ | 12½ | 18¾ |
| Wheeling Elec., 6% pf. | 108 | 95 | 109 |
| Worthington Pump, 7% pf. A | *k* 56½ | 46½ | 58¼ |
| Worthington Pump, 6% B | *k* 49 | 41 | 51 |
| Worthington Pump, com. | 33¼ | 28 | 35¼ |
| YALE & TOWNE com. $5—25. | 78 | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, May 5. *l*Bid price Wednesday, May 9. *m*Latest quotations available. †Dividend rate variable.

sinking fund mortgage gold bonds of the Pomerania Electric Company, which serves the Prussian Province of Pomerania as well as portions of adjoining provinces. The bonds, dated May 1, 1928, and maturing May 1, 1953, were priced at 92½ and interest, yielding over 6.60 per cent.

## Customer-Ownership Sales

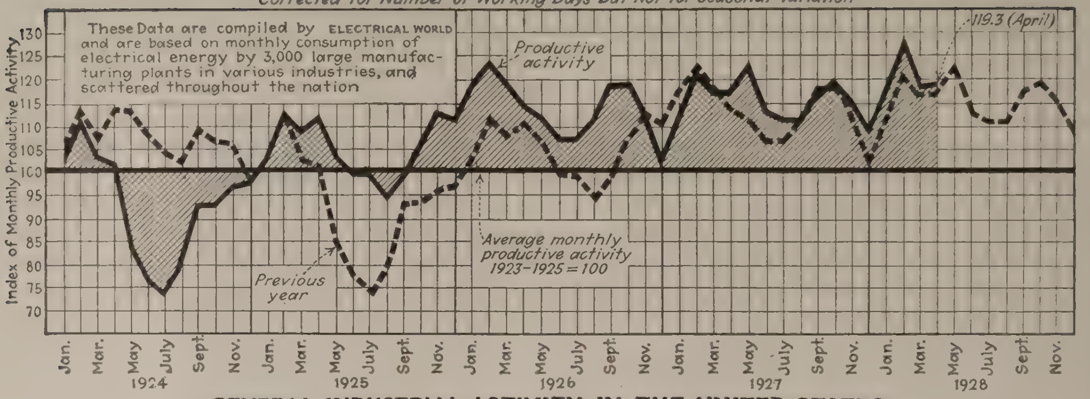
Somewhat less than average activity in customer-ownership campaigns is reflected in the reports of sales for January, and a further reduction occurred in February. In the former month the total value amounted to $16,171,029, the number of shares sold was 281,167 and the transactions 21,351. February sales of 154,306 shares, valued at $8,856,012, were made in 15,930 transactions.

January sales were virtually equal in value to those of December, and exceeded those of the four lowest months in the second half of 1927, but were in turn exceeded in October and November. February sales were somewhat below those of August, the last previous low month. The average amount per transaction was $760 in January and $555 in February. Neither of these figures is exceptional. These sales, in the nature of the case, fluctuate widely from month to month. It is of interest, though, that in January nine companies reported sales aggregating $500,000; in February there were only four.

LOUISVILLE GAS STOCK CHANGES.—Louisville Gas & Electric shareholders will consider at their annual meeting, May 18, a recommendation that class A stock be made non-callable and classes A and B share equally in any dividends declared after the payment of quarterly dividends at the rate of $1.50 a share on both stocks.

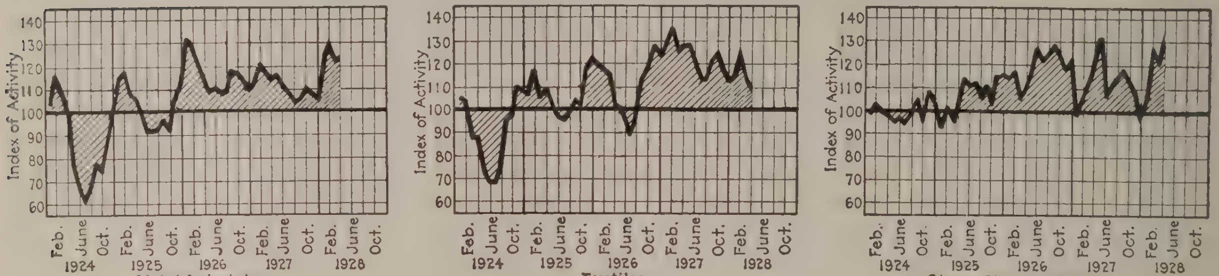
GENERAL ELECTRIC ELECTS NEW DIRECTOR.—Henry C. McEldowney, president of the Union Savings Bank and Union Trust Company, both of Pittsburgh, was elected a director of the General Electric Company at the organization meeting of the board held May 8 at Schenectady. The stockholders of the company at their annual meeting authorized the additional director, increasing the total from twenty to twenty-one. Other directors were reelected. Mr. McEldowney is a director of the Mellon National Bank of Pittsburgh and of the Pittsburgh Chamber of Commerce.

Corrected for Number of Working Days But Not for Seasonal Variation



These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,000 large manufacturing plants in various industries, and scattered throughout the nation

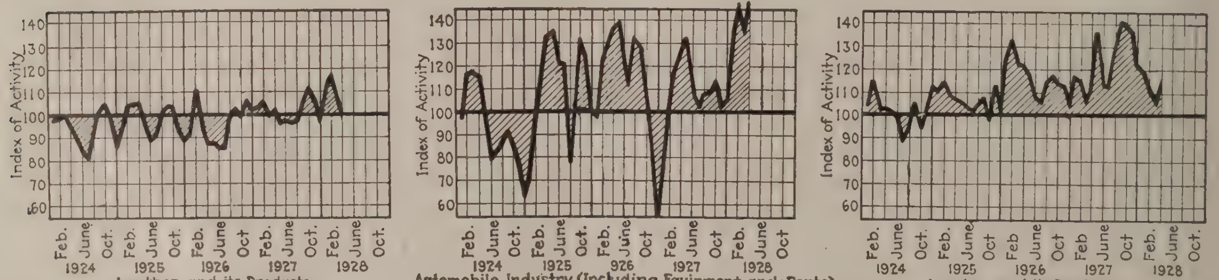
GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES



Metal Industries

Textiles

Stone, Clay, and Glass



Leather and its Products

Automobile Industry (Including Equipment and Parts)

Lumber and its Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

# Increased Productive Activity in April

THAT the present general optimism in business and industry which is prevalent in most sections of the nation is but a reflection of the individual operations is indicated by the consumption of electrical energy. Reports of energy consumption in April made to ELECTRICAL WORLD by some 3,000 large manufacturing companies reveal that the rate of industrial production in the first month of the second quarter of the year was close to 1 per cent greater than that witnessed in March and about 2.2 per cent over April of last year. Industrial operations are being well sustained, some of the outstanding industrial groups recording increased operations, when a slight seasonal decrease would be expected normally. The favorable industrial situation is reflected by the fact that during the first four months of the current year the average rate of activity of general industry was about 3.7 per cent above that during the same period in 1927.

The index of activity in general industry based on consumption of electrical energy stands at 119.3 for April, as compared with 118.2 in March. Comparative indexes of productive activity referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days are as follows:

| | |
|---|---|
| April, 1928 | 119.3 |
| March, 1928 | 118.2 |
| April, 1927 | 116.9 |
| Average first four months 1928 | 120.9 |
| Average first four months 1927 | 116.5 |

The most favorable aspects of the general industrial situation are to be found in the operations of the metal-working plants, the automobile manufacturing industry, which is but a branch of the metal-working industry, and in the stone, clay and glass industrial group. The ferrous and non-ferrous metal working plants reported a 3.5 per cent increase in operations during April and are operating on a plane about 14 per cent above last year. The automobile manufacturing plants, including replacement parts production, reported a 9 per cent increase during April over March, or at a rate 17 per cent above April last year. The stone, clay and glass group was up 10.3 per cent over March, or 14 per cent above April, 1927. On the unfavorable side must be placed the textiles industry, which reported a material drop in rate of operations during April, to a rate almost 15 per cent under April last year. The paper and pulp mills reported operations about 3 per cent under those of the month of April, 1927.

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HYDRO-ELECTRIC SECURITIES OFFICERS.—New officials of this corporation include Sir Herbert Holt, chairman of the board, and Alfred Loewenstein, president. The board will include as new members J. H. Gundy, S. Godin, Jr., and Prentiss N. Gray. According to Mr. Loewenstein the corporation will shortly have a capital of about $57,000,000, as well as $30,000,000 of unsold preference A stock and about 500,000 common shares, which may be issued when the opportunity arises.

# Business News and Market Conditions

## Electric Truck Industry Holds Conference in Chicago

The electric truck industry, composed of representatives of the transportation committee, Commercial National Section, N.E.L.A., its truck operation subcommittee, the electric street and industrial truck manufacturers' committees of the Society for Electrical Development, and the Electric Transportation Club of Chicago, met in a successful conference in Chicago recently. One all-day session was devoted to market development possibilities and sales programs were discussed. The purpose of the conference, which was to bring the truck manufacturers and the power companies more closely together in the common problem of promoting electric transportation, was outlined by John F. Gilchrist, vice-president of the Commonwealth Edison Company. Reports on the status of the use of electric street and industrial trucks and plans for market broadening were presented by the following committee chairmen: L. M. Branch, Commonwealth Edison Company; F. H. Tinsley, Walker Vehicle Company; C. B. Cook, Ellwell Parker Electric Company, and G. E. Stringfellow, Edison Storage Battery Company.

A practical plan for central-station co-operation in the promotion of electric transportation was described by L. J. Lamberger, Duquesne Light Company, Pittsburgh, Pa., which company has recently created a special division in its sales department for this work. The central station and its relation to electric truck promotion in other cities was

## *Value and Destination of Electrical Exports for February, 1928, Compared with Corresponding Month in 1927*

(Issued by Bureau of Foreign and Domestic Commerce)

| Article | February 1927 | February 1928 |
|---|---|---|
| Generators: | | |
| Direct-current: | | |
| Under 500 kw. | $37,923 | $50,469 |
| 500 kw. and over | 38,671 | 130,092 |
| Alternating current: | | |
| Under 2,000 kva. | 13,624 | 29,297 |
| 2,000 kva. and over | 175,258 | 23,450 |
| Steam turbine generator sets | 30,100 | 81,822 |
| Accessories and parts for generators | 48,165 | 79,327 |
| Self-contained lighting outfits | 114,548 | 90,664 |
| Batteries: | | |
| Flashlight batteries | 169,796 | 229,906 |
| Other dry and wet cell primary batteries | 161,617 | 218,613 |
| Storage batteries | 242,931 | 212,793 |
| Transforming or converting apparatus: | | |
| Power transformers | 114,816 | * |
| Power transformers, 500 kva. and over | * | 118,452 |
| Distribution transformers, less than 500 kva. | * | 52,036 |
| Other transformers | 138,317 | * |
| Instrument transformers | * | 42,737 |
| Other transformers, not elsewhere stated | * | 38,474 |
| Battery chargers under 15 amp. | * | 17,418 |
| Rectifiers, double current and motor generators, dynamotors, synchronous and other converters | 75,104 | 65,335 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephone | 49,880 | 142,250 |
| Switches and circuit breakers over 10 amp | 117,990 | 162,443 |
| Fuses and fuse blocks | 18,714 | 30,988 |
| Watt-hour and other measuring meters | 16,149 | 74,637 |
| Volt, watt, and ampere meters, and other recording indicating, and testing apparatus | 174,482 | * |
| Electrical indicating instruments | * | 26,058 |
| Electrical recording instruments | * | 10,189 |
| Other electrical testing apparatus | * | 70,408 |
| Lightning arresters, choke coils, reactors, and other protective devices | 61,167 | 67,460 |
| Motors, starters and controllers: | | |
| Motors, under 1 hp. | $161,886 | * |
| Motors ½ hp. and under | * | $153,020 |
| Motors over ½ hp and under 1 hp. | * | 61,970 |
| Stationary motors: | | |
| 1 to 200 hp. | 204,576 | 188,870 |
| Over 200 hp. | 14,639 | 5,049 |
| Railway motors | 84,642 | 10,193 |
| Electric locomotives: | | |
| Railway | 20,920 | 11,852 |
| Mining and industrial | 29,130 | 102,465 |
| Station and warehouse electric motor trucks | 2,438 | 16,647 |
| Starting and controlling equipment: | | |
| For industrial motors | 92,534 | 181,062 |
| For electric railway and vehicle motors | 4,180 | 2,497 |
| Portable electric tools | 70,188 | 88,728 |
| Accessories and parts for motors | 157,910 | 165,524 |
| Electric appliances: | | |
| Electric fans | 74,515 | 83,556 |
| Electric lamps: | | |
| Metal filament | 95,615 | 123,424 |
| Other electric lamps | 23,793 | 36,759 |
| Flashlights | 202,606 | 167,707 |
| Searchlights and projectors | 23,397 | 28,261 |
| Motor-driven household devices | 153,003 | * |
| Electric vacuum cleaners | * | 68,785 |
| Other motor-driven devices except tools | * | 71,349 |
| Electric flatirons | * | 14,822 |
| Domestic heating and cooking devices | 113,956 | * |
| Electric cooking ranges | * | 21,015 |
| Other domestic heating and cooking devices | * | 76,924 |
| Industrial electric furnaces and ovens | 28,675 | 14,300 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc. | 139,569 | 115,441 |
| Signal and communication devices: | | |
| Radio apparatus: | | |
| Transmitting sets and parts | 17,039 | 23,134 |
| Receiving sets | 203,367 | 189,877 |
| Tubes | 67,718 | 78,106 |
| Receiving-set components | 150,817 | 148,168 |
| Receiving-set accessories | 129,295 | 124,067 |
| Telegraph apparatus | $87,785 | $35,937 |
| Telephone apparatus: | | |
| Telephone instruments | 28,702 | 21,030 |
| Telephone switchboards | 127,870 | 17,903 |
| Other telephone equipment | 183,091 | 393,623 |
| Railway signals, switches and attachments | 60,846 | 30,418 |
| Bells, buzzers, annunciators and alarms | 18,347 | 27,719 |
| Other electric apparatus: | | |
| Spark plugs, magnetos, and other ignition apparatus | 126,646 | * |
| Spark plugs | * | 76,082 |
| Other starting, lighting, and ignition equipment | * | 49,350 |
| Insulating material | 96,455 | 112,976 |
| Metal conduit, outlet, and switch boxes | 85,068 | 120,009 |
| Sockets, receptacles and lighting switches | 149,354 | 145,539 |
| Electric lighting fixtures, interior and street | 119,322 | * |
| Electric interior lighting fixtures | * | 143,002 |
| Electric street lighting fixtures | * | 32,495 |
| Other wiring supplies and line material | 81,822 | 85,046 |
| Other electrical apparatus, not elsewhere stated | 624,639 | 557,970 |
| Rubber and friction tape | 30,507 | 25,264 |
| Globes and shades for lighting fixtures | 50,456 | 48,156 |
| Electrical glassware except for lighting | 24,012 | 40,467 |
| Electrical porcelain: | | |
| For less than 6,600 volts | 58,200 | 42,832 |
| For 6,600 volts and over | 30,393 | 33,485 |
| Carbons, carbon brushes and electrodes: | | |
| Electrodes for electric furnaces | 93,415 | 231,316 |
| Other carbon products | 140,888 | 82,183 |
| Insulated wire and cable (iron or steel) | 10,718 | 13,692 |
| Copper, bare wire | 202,321 | 190,753 |
| Copper, insulated wire and cable | 346,540 | 369,218 |
| Refrigeration sets up to 1 ton capacity | 161,515 | 368,513 |
| Domestic washing machines | 99,353 | 133,274 |
| Totals | $7,103,934 | $7,867,142 |

*Changes made in the classification.

### DESTINATION OF ELECTRICAL EXPORTS

| Country of Destination | February, 1928 |
|---|---|
| EUROPE: | $1,764,912 |
| Belgium | 107,935 |
| France | 161,501 |
| Germany | 126,369 |
| Italy | 105,266 |
| Netherlands | 79,431 |
| Spain | 325,709 |
| Sweden | 27,241 |
| United Kingdom | 511,968 |
| Other countries | 319,492 |
| WESTERN HEMISPHERE: | $4,330,290 |
| Canada | 1,729,690 |
| Mexico | 439,968 |
| Cuba | 240,678 |
| Argentina | 467,663 |
| Brazil | 475,674 |
| Chile | 244,589 |
| Colombia | 215,974 |
| Peru | 56,556 |
| Venezuela | 98,393 |
| Other countries | 361,105 |
| ASIA, AFRICA AND OCEANIA: | $171,940 |
| British India | 139,643 |
| China | 109,662 |
| Japan | 353,899 |
| Philippine Islands | 134,217 |
| Australia | 443,167 |
| New Zealand | 146,306 |
| Union of South Africa | 91,457 |
| Other countries | 353,589 |

outlined by C. R. Skinner, New York Edison Company; F. E. Nelson, Indianapolis Power & Light Company; H. S. Greiner, Minneapolis General Electric Company; F. S. Dewey, Kansas City Power & Light Company; E. L. Huston, Union Gas & Electric Company, Cincinnati, and D. F. Estes, Commonwealth Edison Company, Chicago.

Use and application of electric trucks for utility transportation problems were discussed by A. H. Gossard, Middle West Utilities Company; Secor Cunningham, Commonwealth Edison Company; H. P. Sedwick, Public Service Company of Northern Illinois, and J. R. Coxen, Consolidated Gas Company. On Friday the conference was given over to inspection of the use of electric trucks by the Commonwealth Edison Company and various industrial installations in Chicago. Sixty-eight representatives of the electric truck industry and utility companies attended the conference and it was felt that through the conference a new impetus had been given to the promotion of electric street and industrial truck transportation.

# Market Conditions

MATERIAL for extending service lines makes up an important part of the business in New England. Orders are mainly in small lots with the activity general. Industrial equipment buying is limited to small motor orders, of which a fair volume is maintained. In the Eastern district there is an increasing demand for industrial equipment. Transportation companies are looming up as an important factor in the electrical business. A New York utility company has ordered $70,000 worth of paper-insulated cable and $30,000 worth of substation apparatus. A company in northern New York also purchased $30,000 worth of switching equipment.

Continued rains have delayed construction work and crop planting in the Southeast, but business is satisfactory, although there is some pessimism in the rural sections. A slight improvement is recorded in the St. Louis district and there has been a marked improvement in the demand for medium-sized motors. A great deal of underground construction work is under way in the Middle West as well as a considerable amount of building, particularly larger structures. On the Pacific Coast varied machinery orders were placed. Lumber mills in the Puget Sound district are working on a five-day week.

## *Copper Price Strengthens—Sales Excellent*

Copper sellers did an excellent business with virtually all of it being done on the basis of 14.25 cents Connecticut. Zinc, though not particularly active, has commanded better prices and 6 cents has been realized on several sales for future delivery. Lead and tin have both been quiet and occasional shading of the prices for lead that have prevailed for some weeks is reported. Tin sagged slightly but was a little firmer on Wednesday.

NEW YORK METAL MARKET PRICES

| | May 2, 1928 Cents per Pound | May 9, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic.... | 14.025 | 14.025–14.05 |
| Lead, Am. S. & R. price | 6.10 | 6.10 |
| Antimony............ | 10.375 | 11¼ |
| Nickel, ingot.......... | 35.00 | 35 |
| Zinc spots............ | 6.225 | 6.325 |
| Tin, Straits........... | 51⅜ | 51.875 |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price May 9, 1928, 16 cents.

## *Service Expansion Promotes New England Sales*

Extension of service lines throughout New England is promoting sales. Buying of poles, wire, disconnecting switches and control equipment is recorded. Orders for small lots dominate the tone, among which are noted material for southern New Hampshire amounting to about $2,000. An order for disconnecting switches and accessories, amounting to $3,000, for a prominent power company and a number of insulator orders ranging from 200 to 1,000 lots were reported. A distributor reports that the general tone of business is steady and last month's sales were encouraging. New work centers about a number of line extensions planned for central and northern Maine, bids for which will be received soon.

Industrial equipment buying is limited to small motor orders, of which a fair volume is maintained. A few of the larger ratings up to 50 hp. are in demand and a number of loom motors were recently purchased. Heavy equipment buying is lagging, and negotiations are quiet. Special equipment is attracting attention. One company recently placed twelve motor-driven woodworking machines in a well-known institute. Small heating furnaces also are receiving attention. Appliance sales are steady and outdoor electric lighting and display signs are being promoted through special campaigns. Construction projects are as follows:

The Connecticut Light & Power Company, Waterbury, Conn., plans a repair and distributing plant to cost $200,000. The Baird Machine Company, Stratford, Conn., plans an addition to cost $85,000. The Boston Elevated Railway, Boston, plans a substation on Warren Street to cost $40,000. The Boston & Maine Railroad will make improvements in the car repair shops at Keene, N. H., to cost $175,000. Chicopee Center, Williamsett and Aldenville, Mass., plan ornamental lighting systems.

## *Industrial Business Better in Middle West*

Reports from agricultural districts in the Middle West are encouraging and industrial activity has accelerated somewhat. A considerable amount of building is under way, particularly larger structures. The utility companies are extremely busy, and a great deal of underground construction work is being done. Interesting orders include one for 250 distribution transformers in assorted sizes, one 55,000-kw. reheat turbine generator complete with appurtenances, 50,000 lb. copper bus bar, a quantity of disconnecting switches, circuit breakers and relays, and several construction orders totaling $50,000. Jobbers' sales are somewhat spotty. Considerable business is being obtained from railroad and municipal sources. Construction plans are as follows:

The Container Corporation of America, Chicago, plans a paper board mill to cost $300,000. The Chevrolet Motor Company plans an addition to its power plant at Detroit, Mich., to cost $100,000. The Patterson Foundry & Machine Company, East Liverpool, Ohio, plans an addition to cost $100,000. The Wisconsin Power & Light Company, Madison, Wis., plans a power plant on Yellow River, near Necedah, Wis., to cost $250,000. Emmetsburg and Indianola, Iowa, and Marquette, Mich., plan ornamental lighting systems.

## *Rains Delay Construction in Southeast—Sales Fair*

Despite continued rains which have delayed construction and considerably delayed the planting of crops, which latter fact is causing some pessimism in the rural sections, conditions in the Southeast are healthy and the volume of electrical business is satisfactory. A Tennessee company ordered copper wire and cable amounting to $5,000 and another company in the same state purchased power transformers aggregating $5,000. Another order for small power transformers came from a Georgia company and amounted to $4,000. Some other central-station orders included $5,000 worth of insulators and $3,300 worth of small switching equipment.

A silk mill under construction in Tennessee ordered copper wire and cable amounting to $15,000, and substation equipment amounting to approximately $10,000 for a rock quarry in Georgia will be ordered in the very near future. A new cement mill will be constructed in Georgia and material contracts will soon be let. Approximately $90,000 of motors, switchboard, transformers and wiring materials will go into that job. Construction projects are as follows:

The South Georgia Power Company, Albany, Ga., has purchased the municipal system in Rochelle and will connect with a transmission line. The Marianna Lime Products Company, Marianna, Fla., plans a cement mill at White Cliffs, Ark., to cost $500,000. The Shellabarger Mill & Elevator Company, Salina, Kan., will build a grain elevator to cost $350,000. The Kemper Military School, Boonville, Mo., plans an addition to its power plant. Swift & Company, Chicago, will install a cold storage plant at St. Louis to cost $400,000. Frederick E. Kern, Syndicate Trust Building, St. Louis, and associates, plan a fire brick and refractory plant, to cost $350,000.

The Laclede Power & Light Company, St. Louis, plans a switching station at Mound Street to cost $40,000. Anheuser-Busch, Inc., St. Louis, plans extensions in its power plant to cost $200,000. The Union Electric Light & Power Company, St. Louis, plans a substation on Clark Street to cost $45,000. The Dry Kold Products Company, 69 Neron Place, New Orleans, La., plans plants at Dallas and other points in Texas and Louisiana to cost $1,000,000. The Hahn Packing Company, Dallas, Tex., plans a rendering and packing plant to cost $100,000. Vernon, Tex., will build a power plant to cost $25,000. Brownsville, Tex., will build a substation, to cost $22,000. Houston, Tex., plans an improved lighting system on a number of streets.

## *Industrial Plants Buying in Eastern District*

Increasing demand for electrical equipment for industrial service is a feature of the market in the Eastern district. A recently organized rayon company will soon place orders for a considerable quantity of equipment for a $4,000,000 mill in Georgia. A nitrogen company in northern New York has contracted for industrial heating equipment to cost about $25,000. A steel chain manufacturing plant at Albany will make purchases for a new mill unit to cost close to $500,000.

Transportation account looms as an important consumer within a short time; New York will soon ask bids for equipment for two specimen subway trains of improved type, and a steam railroad has placed an order for parts, for reconditioning electric locomotives, to cost $40,000, and a contract for air compressors to cost $30,000. The electrification of the New York west side lines of the New York Central Railroad is scheduled to proceed at an early date, the cost to aggregate several million dollars and other New York Central plans are being rumored; plans for electrification of suburban lines of the Lackawanna Railroad, to cost $15,000,000, will soon be issued, and manufacturers are awaiting an opportunity to quote on requirements. The Reading Company, Philadelphia, also will make purchases for its $20,000,000 electrification program.

Central-station account is growing inactive in the Eastern district and the bulk of present business centers in miscellaneous and auxiliary apparatus. A New York utility has contracted for paper-insulated cable to cost $70,000, also for switches and protectors for substation service to cost about $30,000. A power company in Northern New York has placed a commitment for switching and accessory equipment to cost about $30,000. A new Jersey central station has been making purchases of transformers and other substation apparatus for several sizable projects and is expected to give additional contracts at an early date. A leading manufacturer of waterwheels states that current business for impulse type units is lower than that of a year ago at this time, owing largely to the falling off in demand on the Pacific Coast. Export sales of waterwheels are improving, with South American utilities prominent in the market. Construction activities in the Eastern district are as follows:

The New York Edison Company plans a substation to cost $450,000. The Ramsey Chain Company, Albany, N. Y., plans a plant to cost $500,000. The Liberty Construction Stone Company, New York, will build a plant to cost $100,000. The Eastern States Milling Corporation, Buffalo, N. Y., plans a grain mill to cost $200,000. The Oswego Candy Company, Oswego, N. Y., plans a factory addition to cost $100,000. The American Chatillon Company, New York, plans a new rayon mill at Rome, Ga., to cost $4,000,000.

The Gates-Day Aircraft Corporation, Paterson, N. J., will build a plant to cost $100,000. The Public Service Electric & Gas Company, Newark, N. J., plans a substation at Camden, N. J., to cost $500,000. The Anti-Hydro Waterproofing Company, Newark, N. J., will build an addition to cost about $100,000. The Philadelphia Rapid Transit Company, Philadelphia, plans a motor bus repair shop to cost $250,000. E. H. Reuss, Jr., Philadelphia, plans a pipe-bending and manufacturing plant to cost $200,000. The Bethlehem Shipbuilding Corporation, Baltimore, Md., will build a second unit to cost $500,000.

## *Varied Machinery Orders Placed on Pacific Coast*

Many interesting and varied machinery orders are reported on the Pacific Coast. They include 96 distribution transformers and a lot of lightning arresters and insulators having a total value of $15,000 for the Truckee Carson irrigation project, six 100-kva. subway transformers, valued at $5,000, for Pantages theatre, Fresno, thirteen assorted induction motors, valued at $2,500, for a Hawaiian sugar plantation, one carload assorted pin-type insulators, valued at $6,000, for a manufacturer of outdoor switches, one carload 11,000-volt pin-type insulators, valued at $6,500, for San Joaquin Valley extensions, 20 assorted motors, valued at $6,000, for a Bay district industrial plant and 200 transformers for power company stocks.

Lumber mills in the Puget Sound country, affiliated with the West Coast Lumbermen's Association, have agreed upon a curtailment program providing for a five-day week operation for an indefinite period. Previous to this action, several large mills in the Grays Harbor district closed down voluntarily and large mills in Tacoma abolished night shifts. The Weyerhaeuser Timber Company, Longview, Wash., is expected to award contracts in a few days for turbines and other equipment. Sales reported include about $10,000 worth of switchgear to a central-station company in Thurston county, ten 25-hp. motors for a Seattle can company and about fifty motors to lumber mills and allied industrials. Construction plans in the district are:

The San Francisco Produce & Provision Terminals, Inc., San Francisco, plans a warehouse and cold storage plant to cost $2,500,000. The Security Warehouse & Cold Storage Company, Santa Clara, Calif., plans a cold storage plant, to cost $150,000. The Empire Zinc Company, Belden, Colo., plans a milling plant to cost $250,000. The Black Hawk Consolidated Mines Company, Silver City, N. M., will build a milling plant to cost $100,000. The Oregon-Washington Railroad & Navigation Company, Portland, Ore., will make additions in its car and locomotive shops to cost $133,000.

The Wyoming Carbonizing & Briquetting Company, Kemmerer, Wyo., plans a new plant at Conroy, Wyo., to cost $150,000. The Western Public Service Company, Colorado Springs, Colo., plans additions to its power plant at Laramie, Wyo., to cost $76,000. The Public Service Company of Colorado, Denver, plans extension in transmission lines and distributing system at Alamosa, Colo., and vicinity. The Bureau of Reclamation, Denver, Colo., will receive bids until May 25 for construction of 19.1 miles, 66,000-volt, single-circuit wood pole, transmission line, and 13 miles single-circuit telephone line, near Adrian and Nyssa, Ore. Madera, San Jose, North Hollywood, Berkeley, San Diego, Santa Paula, Long Beach and Los Angeles, Calif., plan ornamental lighting systems.

## *Slight Improvement Recorded in St. Louis District*

Conditions show a slight improvement in the St. Louis district. There has been a marked increase in the demand for medium-sized motors and transformers, also meters and lightning arresters. One order, including 2,000 kva. of transformers with substation equipment amounted to $16,000 and was for use in the Southwest. Manufacturers report a good volume of business in domestic and heavy-duty ranges. One contract for a baking oven to cost $2,000 was placed. An order for a bank of transformers was placed by an industrial company at a cost of $2,500. The southern part of the district has shown the greatest activity of late. Construction activities are as follows:

The Bemis Brothers Bag Company, St. Louis, plans a cotton mill near Talladega, Ala., to cost $1,500,000. The Florida Power Corporation, Ocala, Fla., plans a Diesel engine power plant at Mayo, Fla., to cost $100,000. The Inland Utilities Company, Kansas City, Mo., plans a power plant at Blue Mountain, Miss., to cost $75,000. The Southern Fruit Company, Inc., Charlotte, N. C., plans a cold storage plant to cost $100,000. The Airial Mill, Easley, S. C., will build a cotton mill to cost $150,000. The Gaffney Manufacturing Company, Gaffney, S. C., will build an addition to its textile mill to cost $200,000.

The Sani-Fold Corporation, Athens, Tenn., plans a furniture plant to cost $200,000. Cookeville, Tenn., plans extensions in its power plant to cost $150,000. The Arrington Cold Storage Corporation, Arrington, Va., will build a cold storage plant to cost $100,000. The Mississippi Power Company, Gulfport, Miss., is negotiating for the purchase of the municipal plant at Flora, Miss. The Mississippi Power & Light Company, Pine Bluffs, Ark., has acquired the municipal plant at Summit, Miss. Palmetto, Fla., and Richmond, Va., plan improved street lighting systems.

# Activities of the Trade

## Landers, Frary & Clark Celebrate 75th Anniversary

To celebrate its 75th anniversary in its corporate form Landers, Frary & Clark of New Britain, Conn., manufacturer of electric appliances, household hardware, etc., are offering to dealers during the month of May a special 10 per cent price reduction on all urns and percolators. The company, in a letter to its dealers, states: "In preparation for this May sale your regular source of supply will ship you one order of nickeled or silver 'Universal' electric urns or percolators separately or in sets with accessories at 10 per cent below your usual cost. This is in expectation that these specially priced goods will be offered to consumers at 10 per cent savings during the month of May only."

The Wagner Electric Corporation, St. Louis, announces the removal of its New York City branch sales office from 50 Church Street to 30 Church Street, Suite 1110. The New York City service station remains at 321 West 54th Street.

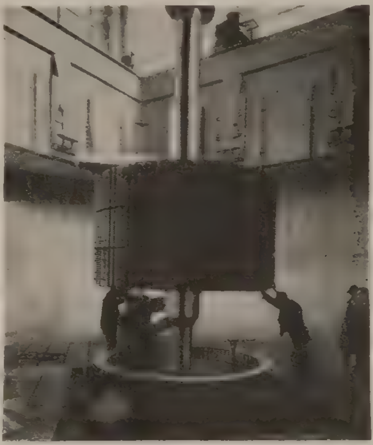
The General Electric Company announces the appointment of A. L. Jones as district manager in the Rocky Mountain region, with headquarters at Denver. Mr. Jones will supervise the sales in the nine states of the region with sub-offices at Butte, Mont., and Salt Lake City, Utah.

The Perfection Appliance Company, Detroit, manufacturer of the Perfection electric ironer, a division of the Splitdorf-Bethlehem Electrical Company of Newark, N. J., announces that A. H. Graham, formerly campaign manager for the Servel Corporation in the Southeastern division, has joined its sales organization as special sales representative working out of the head office in Detroit.

The Dampney Company of America, Hyde Park, Boston, Mass., announces that the sale of its "Apexior" protective coatings for power plant equipment will be handled in Colorado, western Nebraska, eastern Wyoming and northern New Mexico by Joy & Cox Inc., 314 Tramway Building, Denver.

The Lincoln Electric Company, Cleveland, manufacturer of "Linc-Weld" motors and "Stable-Arc" welders, announces the following changes and additions to its sales and welder service divisions. H. A. Stamper has been placed in charge of consumer motor sales and D. F. Titus in charge of welder service in the New York district under the direction of G. N. Gull, district sales manager; A. H. Kirkpatrick replaces D. W. Carver as manager of welder service in the Cincinnati district under M. R. Simpson, Mr. Carver having been transferred to the Cleveland district; H. E. Nelson will take charge of the consumer motor sales in the Cincinnati district; P. A. Ludwig has assumed charge of the welder service in Philadelphia and vicinity; Forrest Kessler has been transferred to the welder service division in the Cleveland district and J. R. Rothermel is in charge of welder service at Chicago under R. D. Malm, district manager, while W. Weaver has been placed in charge of the consumer motor sales in the Chicago district.

## Overspeed Tests Made Safely in General Electric Test Pit



Lowering a 30,000-kw. waterwheel generator rotor into the new General Electric test pit.

The Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, manufacturer of railway and power electrical material, announces the removal of its Chicago offices and warehouses to larger quarters at 111 North Canal Street, between Washington and Randolph Streets, directly opposite the Chicago & Northwestern depot.

The Cutler-Hammer Manufacturing Company, Milwaukee, manufacturer of electric controlling devices, announces a new toggle auto switch, designed to meet the severe requirements of truck and bus service.

The Crawford Oven Company, New Haven, Conn., announces that Robert M. Gantert, formerly associated with the Philadelphia Electric Company in developing bakery applications of electric ovens, has joined its sales organization. He will devote his time helping bakeries and food-products manufacturers in southeastern New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia solve their oven problems. The Crawford Oven Company manufactures a complete line of traveling ovens for baking and industrial applications. The company, at an early date, intends to open an office in New York City in charge of Mr. Gantert.

The Trico Fuse Manufacturing Company, Milwaukee, announces the removal of its Pittsburgh office to new and larger quarters at 405 Penn Avenue, in charge of W. A. Bittner.

The Oliver Iron & Steel Corporation, Pittsburgh, announces the appointment of Nelson G. Craig as district manager at 1420 Walnut Street, Philadelphia. Mr. Craig will have charge of the bolt, nut, rivet and pole line material sales in the Philadelphia territory.

The Electric Furniture Corporation and affiliated associated companies announce the opening of new showrooms in the St. Clair Building, Chicago, centrally located near the furniture mart. The Electric Furniture division has developed several distinct types of furniture equipped with a patented "Utilitap," a three-outlet tap mounted flush with the surface of the woodwork.

The General Electric Company, merchandise department, Bridgeport, Conn., announces that it is now marketing a line of "Textolite" attachment plugs.

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., has placed on the market an intermediate base line of sockets and receptacles.

The Oliver Iron & Steel Company, Pittsburgh, announces that Bertram Quarrie has been elected president of the company to succeed Henry Oliver, who has become chairman of the board of directors. Mr. Quarrie was formerly connected with the American Steel & Wire Company and the Otis Steel Company at Cleveland. This corrects an item appearing in the April 21 issue of the Electrical World in which it was stated that Mr. Oliver had resigned from the company.

The Yale Electric Corporation, Pearl and Tillary Streets, Brooklyn, N. Y., manufacturer of flashlights and dry batteries, announces that the company is now established in its new million-dollar building at 257 Cornelison Avenue, Jersey City, N. J.

The American Electric Switch Corporation, Minerva, Ohio, announces that it has added another building to its factory. The new building comprises two floors and a basement and has a floor space of 26,000 sq.ft. The switchboard, panelboard, knife switch and shipping departments will occupy the new addition.

The Hynes & Cox Electric Corporation, 406 North Pearl Street, Albany, N. Y., manufacturer of "Red Crown" water heaters, announces that it is now manufacturing the "Duostat" automatic electric water heater. This is a low wattage storage type heater using two heating elements, each of which is controlled by its own thermostat.

The Timken Roller Bearing Company, Canton Ohio, announces that W. H. Post has been appointed manager of the Pittsburgh branch of the service and sales divisions.

The Erie Malleable Iron Company, Erie, Pa., announces that since May 1 C. E. Collier has been in charge of its Western office, with headquarters at 911 Peoples Gas Building, Chicago, succeeding C. E. Callender, who has resigned.

The G-Q Electric Company, 208 Broadway, Milwaukee, jobber, announces the opening of a branch office at 531 West College Avenue, Appleton, Wis., which will serve the Fox River Valley.

# New Equipment Available

## High-Voltage Disconnect Switches

A line of group-operated disconnect switches for outdoor service in capacities of 600 and 800 amp. and voltages from 132,000 to 220,000 has been developed by the General Electric Company. These switches, which are intended for isolating oil circuit breakers on high-voltage, super-power systems, have short, fixed blades on insulators suspended from trucks. The trucks are moved backward or forward on ship channel frames. The stationary contacts are assembled on insulators suspended at the extreme ends of the frames. The contacts are of the spring-pressure line-contact type.

The manufacturer claims that this design permits a considerable saving in space over other types of switches using long swing blades. These switches are built in six-pole, single-throw and three-pole, single-throw types and carry the designations HD-1 and HD-2, respectively. Either manual or motor operation may be provided.

## Fractional-Horsepower Direct-Current Motors

A line of fractional-horsepower direct-current motors in standard sizes from 1/6 hp. to $\frac{1}{2}$ hp. at speeds corresponding to standard speeds of alternating-current motors has been placed on the market by the Century Electric Company, St. Louis. The field is a two-pole laminated steel structure. The compound-wound field coils are wound on forms, well insulated and taped. The armature slots are insulated with alternate layers of fish paper and varnished cambric. Hardwood wedges are used to retain the coils. Both field and armature coils are wound with cotton-enamel wire and thoroughly treated with insulating paints to withstand the dampness frequently surrounding installations in basements and humid tropical climates.

The bearings are made of cast phosphor bronze. The Century wool-yarn system of lubrication is used. The commutator, which is said to be of liberal size, is made from rolled copper bars and insulated with mica. The brushes are carried in a box-type brush-holder attached to the field frame and do not require adjustment during the life of the brushes.

## Lift-Truck for Heavy Reels

A storage battery lift-truck designed especially for handling reels of wire or cable has been developed by the Lakewood Engineering Company, Cleveland. The truck has a capacity of 6,000 lb. and will handle reels up to 60 in. in diameter and 42 in. wide. The winches, which operate on a bar placed in the center of the cable reel, slide upward on the trunnions and wind in at the same time thus securing a double action.

Guide Clamp.—A guide clamp which will prevent a conductor breaking as the result of crystallization close to the point where it is rigidly held to the connection member of an oil circuit breaker, transformer, or disconnecting switch has been placed on the market by the General Electric Company. The new guide clamp consists of a cast arm 4 to 6 in. long, provided with holes at each extremity for bolting to the conductor and terminal. Its function is to distribute the point of flexure over an appreciable length of conductor and thus to relieve the metal adjacent to the connecting stud of the full effect of vibration and swinging which often results in crystallization and ultimate failure. The clamp is made in a variety of sizes suitable for attachment to conductors in sizes from No. 2 up to $2\frac{1}{2}$-in. iron pipe size copper tubing.

Tension Indicator.—A tension indicator for determining tension in guy wires, messengers and line conductors has been placed on the market by the Martin-Loomis Corporation, Long Beach, Calif. The device is designed for use on wire from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. in diameter. It is not a dead-end instrument and can be installed on any line, either before or after tension is applied. Two rigid clamps on the main body 9 in. apart, through which the wire passes, are so made that the clamps swing to allow attachment to a line under tension. The tendency of the wire to resist being deflected between the two clamps exerts a pressure on a diaphram which is registered on a pressure gage. The instrument weighs only 12 lb.

## Automatic Telemetering Device

An automatic telemetering device, recently placed on the market by the General Electric Company, covers the readings of meters and instruments in all parts of the power system, and indicates or records them on a single receiving apparatus located at some central point, such as the load dispatcher's office. The telemetering system operates over a single pair of wires, the receiver being actuated by impulses sent out by relays associated with the outlying meters. Since the readings are transmitted by impulses, ordinary variations in line wire resistance or battery voltages have no effect on the accuracy of the telemetering. Carrier current channels may be used to transmit the readings, and in cases telephone circuits may be employed, without imparing communication in any way. Where a large number of intermittent readings from a particular station are required, standard supervisory equipment is utilized.

The telemeter proper, located at the load dispatcher's headquarters, is an accurate speedometer calibrated in terms of the speed of the rotating meters at the sending end. It consists essentially of a motor connected by a spring coupling and gearing to a permanent magnet. The motor is allowed to make one revolution for each impulse received. This is transferred to the permanent magnet by means of a flexible spring coupling and gearing. Hence the magnet also makes a definite portion of a revolution for each impulse received. The dragging effect of the revolving magnet upon a disc, to which the dial hand or recording pen is attached, translates the impulses into readings proportional to the indication of the outlying meter.

Important readings such as voltage, amperes, kilowatts, reactive kilovolt-amperes, and frequency, may be transmitted in this manner from all parts of the system. The dispatcher may have either visual or recording equipment for receiving them. When kilowatts are transmitted, each impulse represents a definite number of kilowatt-hours. The telemetering device may therefore operate a demand meter or register kilowatt-hours on a dial. Kilowatts from several remote points may be totalized on one receiving meter.

Device for Locating Defects in Machinery.—The "Transmit-o-phone" for locating defects in power plant machinery, motors, etc., and for locating leaks in pipe lines, hidden conduits or pipes, etc., has been placed on the market by the International Metal & Specialty Company, Berlin, N. J. The instrument has a variety of applications. It has been used to locate flooded conduits as well as to determine the exact cause and origin of the flooded conditions. The instrument is essentially a sensitive sound detecting device. The manufacturer also claims that the instrument can be used to locate defective electric meters.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued April 24, 1928)

16,940 (reissue). Thermostat; R. F. Massa, New York, N. Y. App. filed Nov. 11, 1913.

1,666,889. Transformer; J. Desloge, St. Louis, Mo. App. filed March 30, 1925. Bell-ringing type.

1,666,897. Ship-Guidance System; J. H. Hammond, Jr., Gloucester, Mass. App. filed April 27, 1922. For indicating the relative positions of movable bodies whereby desired relative positions may be maintained.

1,666,904. Time Switch; R. D. Mailey, East Orange, N. J. App. filed Oct. 30, 1923. Mercury type.

1,666,916. Electrically-Operated Door; H. Rowntree, Scarsdale, N. Y. App. filed Oct. 4, 1924.

1,666,923. Protective Device; W. W. Woodruff, Swarthmore, Pa. App. filed Nov. 3, 1922. Fusible cutout.

1,666,925. Switch Construction; R. B. Benjamin, Chicago, and C. E. Warner, Berwyn, Ill. App. filed Nov. 5, 1923. Toggle type.

1,666,970. Electromagnet; C. L. Jauss, Mexico, Mex. App. filed Sept. 23, 1925. Especially designed for the operation of locks.

1,666,973, 1,666,974. Double-Contact Socket for Electric Lamps; F. J. Miles and D. C. Thompson, Newark, N. J. Apps. filed Nov. 14, 1924. For use with small incandescent electric lamps.

1,666,978. Terminal Contact Clip; J. Sachs, Hartford, Conn. App. filed Dec. 12, 1921.

1,666,979. Fusible Switch; J. Sachs, Hartford, Conn. App. filed Jan. 25, 1923.

1,666,980. Cable Head; J. E. Sharp, Wheeling, W. Va. App. filed April 1, 1927. Head to be fastened over the eye in a steel snake with a view to enabling electricians to push the snake with facility through long stretches of conduit.

1,666,991. Electrical Connecter; S. Cohen, Neponsit, N. Y. App. filed Aug. 25, 1925.

1,667,018. Burglar-Alarm Mounting; P. V. Vandevelde, Corona, N. Y. App. filed April 13, 1926.

1,667,020. Pressure-Responsive Device; O. G. Wendel, Buffalo, N. Y. App. filed Sept. 21, 1921.

1,667,021. Translator of Electrical Energy; H. M. Williamson, Chicago, Ill. App. filed Dec. 8, 1923. Wherein electrical impulses are translated into audible sound waves or into physical vibrations.

1,667,025. Outlet-Box Hanger; C. E. Bowers, Los Angeles, Calif. App. filed Oct. 21, 1925.

1,667,035. Insulating Tube; P. A. Hünermann, Berlin-Weissensee, Germany. App. filed Sept. 28, 1926.

1,667,037. Electric-Circuit Closer; E. M. Kyle and E. F. Hurley, Lakeport, N. H. App. filed Dec. 1, 1924. For automatically closing a firm-alarm circuit.

1,667,056. Mercury-Contact Switch; I. E. Smith, Stockton, Calif. App. filed May 4, 1927.

1,667,070. Armature-Winding Machine; R. G. Jones, London, England, and C. Zwiebel, Dayton, Ohio. App. filed Jan. 23, 1925.

1,667,087. System of Electrical Transmission and Transformation; P. H. Thomas, Upper Montclair, N. J. App. filed Aug. 7, 1925.

1,667,142. Thermocouple; W. A. Darrah, Chicago, Ill. App. filed Feb. 24, 1925.

1,667,158. Electric Switch; C. E. Ives, Chicago, Ill. App. filed April 28, 1924. Hand operated switch embodied in a pistol grip or handle.

1,667,174. Oscillating Signal; R. R. Thompson, Los Angeles, Calif. App. filed Nov. 22, 1919. Railway signal.

1,667,178. Electrical Welding Apparatus; I. J. Van Huffel, Warren, Ohio. App. filed April 14, 1926.

1,667,242. Electric Converting Apparatus; J. E. Calverley, Preston, and W. E. Highfield, London, England. App. filed Nov. 12, 1925.

1,667,244. Electric-Welding Apparatus; A. Churchward, New York, N. Y. App. filed Nov. 8, 1926.

1,667,247. Electric Switch; J. J. Egan, Boston, Mass. App. filed March 25, 1926. For automatically cutting out an electrically heated flat-iron when the iron is turned upon its heel.

1,667,250. Electric Soldering Iron; W. Ensdorf, New York, N. Y., and J. Sandberg, Elizabeth, N. J. App. filed March 23, 1927.

1,667,257. Electric Heater; W. W. Hicks, San Francisco, and A. J. Kercher, Berkeley, Calif. App. filed Nov. 27, 1926. Adapted to prove a large area of contact between it and the medium to be heated.

1,667,293. Electric Switch; J. R. Marshall, McKean, Pa. App. filed June 5, 1925. Out-door switch.

1,667,297. Train-Line Coupler; H. E. Van Dorn, Chicago, Ill. App. filed May 9, 1921. For connecting together the electrical circuits on two adjacent railway cars.

1,667,308. Silent Secondary Clock; T. S. Casner, Plainfield, N. J. App. filed May 29, 1926. Electro-magnetically operated clock.

1,667,317. Dry Cell; G. W. Heise, Bayside, and H. H. Thompson, Flushing, N. Y. App. filed Nov. 18, 1922.

1,667,356. Time-Controlled Apparatus; C. M. Peacock, Oak Park, Ill. App. filed Aug. 29, 1925.

1,667,410. Speed-Responsive System; C. R. Beall, Swissvale, Pa. App. filed Sept. 5, 1923. Railway traffic-controlling apparatus.

1,667,418. Subaqueous Sound-Signaling Apparatus; W. Hahnemann, Kitseberg, near Kiel, and A. du Bois-Reymond, Plon, near Kiel, Germany. App. filed Feb. 4, 1921.

1,667,422. Demagnetizer; Toledo, Ohio. App. filed Nov. 13, 1920.

1,667,435. Lead Accumulator; R. Oppenheim, Levallois-Perret, France. App. filed April 18, 1925.

1,667,451. Apparatus for the Treatment of Organisms with Electrical Currents; W. T. Arnberg, Liljeholmen, Sweden. App. filed June 28, 1926.

1,667,452. Fishplate Bond; G. Barnes, Princeton, Ind. App. filed June 17, 1926.

1,667,469. Light Signal; P. E. Carter, Bronxville, N. Y. App. filed Nov. 9, 1921. Color light signals for railway signaling purposes.

1,667,485. Connecter; R. R. MacDonald, New York, N. Y. App. filed Aug. 25, 1927. For insulated stranded copper conductor cables.

1,667,487. Butt Welding; T. E. Murray, Jr., Brooklyn, N. Y. App. filed July 21, 1926.

1,667,510. Electric Conductor; J. R. Coe, Watertown, N. Y. App. filed July 30, 1924. A cable constituting an electrical conductor for high tension transmission lines having, in combination, a core comprising a plurality of short rigid members arranged end to end, and contacting wires of high electrical conductivity arranged spirally and side by side about the rigid members.

1,667,514. Synchronous Motor; V. A. Fynn, St. Louis, Mo. App. filed Nov. 26, 1923. Possessing mechanical features of induction motors and capable of carrying variable load at synchronous speed.

1,667,515. Plating Apparatus; F. P. Green, St. Louis, Mo. App. filed March 28, 1927.

1,667,521. Combined Gas and Electric Cook Stove or Range; F. C. Alber, Cleveland, Ohio. App. filed Nov. 26, 1924.

1,667,540. Method and Apparatus for Measuring Distance; H. G. Dorsey, Gloucester, Mass. App. filed Dec. 22, 1923.

1,667,555. Parkway-Cable Terminal; W. H. B. Lavarack, Pinebush, N. Y., and D. W. Richards, Roanoke, Va. App filed Sept. 28, 1926.

1,667,581. Battery-Terminal Clip; E. M. Bailey, Woodsdale, N. C. App. filed March 5, 1926.

1,667,585. Automatic Arc Welding; V. J. Chapman, Schenectady, N. Y. App. filed May 22, 1926. With means for oscillating the source of heat across the work.

1,667,586, 1,667,587. Apparatus for Fusion Welding; V. J. Chapman, Schenectady, N. Y. Apps. filed Aug. 2 and 30, 1926.

1,667,595. Temperature-Control Means; S. Halle, Colorado Springs, Colo. App. filed April 5, 1921.

1,667,612. Flow Meter and the Like; L. W. Thompson, Schenectady, N. Y. App. filed Sept. 22, 1922.

1,667,617. Terminal Block for Current Transformers; E. J. Zelt, Fort Wayne, Ind. App. filed Aug. 29, 1927.

1,667,624. Electrical Measuring Instrument; A. J. Corson and S. C. Hoare, Lynn, Mass. App. filed Oct. 17, 1924. With a temperature compensating arrangement.

1,667,633. Power System; C. MacMillan, Schenectady, N. Y. App. filed July 26, 1923. As applied to driving a ship.

1,667,636. Cable Grip; A. H. Nero, New Britain, Conn. App. filed June 8, 1923. Pendent fitting.

# New Trade Literature

MOTOR MAINTENANCE EQUIPMENT.—The Martindale Electric Company, 1260 West Fourth Street, Cleveland, has issued catalog No. 10, covering its motor maintenance equipment. This catalog contains twelve new products since the issue of previous catalogs and also mentions five improved products.

RECORDING LIQUID LEVEL GAGES.—Catalog No. 1800, issued by the Bristol Company, Waterbury, Conn., covers the Bristol recording liquid level gages. The various types are described and illustrated. Reproductions of the different types of charts employed are included. It contains a few methods of installing and attention is called to the electric motor-operated clock furnished with Bristol's recorders.

AIR COMPRESSORS AND TRANSFORMERS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-233B, describing its single-stage centrifugal air compressors. It contains an illustration giving the construction details as well as a curve showing the operating characteristics. The company also has issued bulletin GEA-912, covering its type YU-1140 transformers for oil burners for both ignition and control.

ELECTRIC APPLIANCES. — Landers, Frary & Clark, New Britain, Conn., are distributing a new catalog covering "Universal" electrical household appliances, table appliances, table stoves, heating devices, curling irons, heating pads, etc.

AUTOMATIC CONTROL.—"Speeding Up Production with Automatic Control" is the title of bulletin No. 110 issued by the Monitor Controller Company, Baltimore, Md., in which it covers the importance of automatic control. It also contains illustrations showing the application of automatic control to machine tools, also some specific applications of Monitor control and Monitor master stations.

SWITCHBOARD DEVICES AND RECORDING INSTRUMENTS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-940 and GEA-584A, covering its switchboard devices, such as panel and benchboard pipe fittings, and its totalizing recording instruments and remote indicators.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Berlin, Germany (No. 30,961), for cloth cutters and sewing machine motors.

An agency is desired in Medan, Sumatra (No. 31,010), for flash-light cases and batteries.

Purchase is desired in Dresden, Germany (No. 30,956), of electric heating appliances and ventilators.

An agency is desired in Santo Domingo, Dominican Republic (No. 30,947), for household electrical appliances and wiring supplies.

An agency is desired in Montevideo, Uruguay (No. 30,970), for household electrical appliances, wiring supplies, shades, globes, ranges, etc.

Purchase is desired in Copenhagen, Denmark (No. 31,005), of insulating material, ebonite parts, and signal boxes.

An agency is desired in Stockholm, Sweden (No. 31,009), for electric machinery and instruments and X-ray equipment.

Purchase and agency are desired in Sydney, Australia (No. 31,006), for fractional horsepower motors.

Copies of specifications for a 50 kilovolt switchgear and steelwork required for the Arapuni Scheme in New Zealand have been received from trade commissioner Julian B. Foster, Wellington. A copy of this specification is available in the Chicago district office and also in Washington. The closing date for tenders is July 10, 1928.

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## *Business Called Into Action*

ITS sixteenth annual meeting in Washington last week showed the Chamber of Commerce of the United States to be stronger and more representative of American business than ever. In a country that tops the world, so to speak, it is to be expected that a democratic body like the chamber will acquire with years inspiration for greater and better endeavors and also increase in moral stamina; otherwise it could neither wield much influence nor impart any of that motivating force which emanates from leadership and which American business must have to encourage and sustain it.

Outwardly all these qualities were visible at Washington only because the inner organization, containing the hewers of wood and drawers of water, was functioning. It is in the thoroughness of its detail work that the Chamber of Commerce of the United States makes its appeal, and its machinery of organization is geared to serve American business effectively and economically. This year the chamber seems to have struck a high note, and although the sound may not have been heard or heeded in the halls of Congress, the business world and the local chambers of commerce will carry out the program and make it effective.

* * * *

## *Keep the Escutcheon Clean!*

AS THE time approaches for Congress to adjourn—and for obvious reasons many Senators and Congressmen are anxious to get away early—the legislative outlook is promising. That is to say, little affecting the electrical industry will be enacted into law. On the Boulder Canyon bill are beginning to appear the dew and clammy coldness of death. The Muscle Shoals measures may succeed in getting before a hostile conference committee, but any conference report now appears hardly likely of passage. No other major legislation affecting the industry is pending.

Of course, it is to be expected that the Federal Trade Commission will continue its hearings and report monthly. It has already uncovered unsavory material which is being interpreted and played up in a way not complimentary to the electric public utilities. Viewed with even friendly eyes, the exhibition is not attractive, and wisdom and prudence dictate some heroic action on the part of the industry to thwart growing congressional unfriendliness and possible undermining of general public relations. The picture, however, is not so bad as it is painted.

Financially, the investors show greater faith in the industry than ever, and reports of operating companies more than justify that faith. Neither the Federal Trade Commission nor the Senate can nullify the economic laws upon which the continued growth of the electrical industry is predicated. None the less, the industry must not on that account permit the public to gain the impression that electric public utilities have been recreant to the trust reposed in them. The industry is obligated to render the very best service at the lowest possible rates. That motto is emblazoned on its shield, and when mud, no matter how much, is thrown at it, the mud should be quickly washed off and the shield reburnished, so that the message may never be lost to public view.

* * * *

## *Radio and Regulation*

RADIO sets using alternating current should be equipped with a voltage-regulating device. Light and power companies are expected to regulate voltage at generating stations and substations to a degree which will give satisfactory service to all devices attached to outlets in the homes, but they cannot be expected to provide voltage regulation which will always give the best possible service to radio sets. The wiring in the homes, the use of many household devices and other factors inherent in a large utility system introduce cost and jurisdiction items beyond the control of utility executives.

Radio reception is a precision service, and, for a minimum of cost, the best place to adjust for precision service is in the radio set. Tap-changing transformers, a rheostat or other means can be used to tune a set for the home voltage when the radio equipment is first installed. Once adjusted for voltage conditions in each home, the set will give satisfactory service. Radio manufacturers and utility executives should agree on a joint policy while alternating-current radio is in its infancy. Both will suffer unless the voltage problem is solved as a co-operative task.

* * * *

## *System Insulation Improved*

BETTER standards of service demand standards in system insulation that are rational and in advance of past practices. Hit-or-miss changes in insulation in the several parts of a system should give way to a co-ordinated plan that evaluates all system factors at each insulation point. This logical policy was stated by Philip Sporn at the New Haven meeting of the American Institute of Electrical Engineers last week; but the carrying out of the principle is difficult.

Insulation is a composite substance whose strength varies greatly with the materials used and with the physical test that can be had to give quantitative data on insulation strength, and as yet insufficient knowledge of lighting exists to permit the specification of tests which will duplicate the possible service experiences of insulation. And, finally, either grading a system or making a system have uniform insulation introduces economic values and different service conditions which are not conducive to standardization. System engineers, however, can use part of the principle to advantage. If, as at present, money is spent to raise line insulation, then money should be spent to raise terminal equipment insulation so as to maintain relative values at least, and it may pay to raise the insulation of the terminal equipment to a higher level than that of the line.

The goal in insulation is continuous service for all the system. Any grading which makes weak spots in insulation may protect physical apparatus at the expense of system service; but such a policy is unsound except as a temporary expedient, and in this event the relief valve should be simple, inexpensive and least hazardous to continuous service. Until the actual phenomena that may occur on a system are known quantitatively there is little need for hard-and-fast rules for system insulation. Awaiting such knowledge, insulation must be the outcome of a mixture of experience, money, guesswork and good judgment.

* * * *

## *Indirection Pays Poorly*

ONE lesson of the Federal Trade Commission's investigation of the electric power industry is this: Indirection does not pay. The utilities organized a wide-flung and apparently efficient bureau of information for the purpose of supplying the press and public with facts regarding electric, gas, telephone and electric railway service. Basic facts were printed in booklet form for use in schools, and other material was distributed to the press. The articles were cleanly labeled by the organizations that issued them; there was no anonymity, no attempt to evade responsibility, nothing to justify the adjective "insidious." Those to whom the reading matter was sent knew its source, and they were free to accept or reject it as their informed judgment should dictate. Many of them accepted it.

Now comes the wind from Washington to uncover what every one already knew. The information is condemned in the public prints as propaganda. The authors are pilloried as "the power trust"—which, of course, they are not. The industry gets blasted with column upon column of hypocritical criticism from many of the very papers which had published its material. It gets singed and crisped with the hot alibis of the very authorities who accepted its booklets as school texts. From which we cull the lesson that indirection hardly pays.

Now, there are many methods a business organization can employ in presenting its case to the public, and one of them is advertising. The forthrightness of paid advertising appeals to our American sense of square dealing. We figure that normally the advertiser must have faith in his business or he would not pay out good money to talk about it. The electric light and power industry should adopt this method of talking to its public more than heretofore, not alone because the method is more acceptable and effective than others, but because the industry cannot afford to neglect this avenue of publicity. The public information bureau proved somewhat of a boomerang. Much of the good it accomplished was wiped out by the denunciations which burst forth as a result of Washington inquiries. What the industry should now use is straight advertising—and plenty of it.

The National Electric Light Association should advertise liberally in telling the country about the merits of electric service. Every individual company should consider it a matter of course to use space in local papers. And the advertisements should be aggressive and not defensive. The industry should seek business, not sympathy, and it should do it soon.

* * * *

## *Railroad Power Contracts and Use of Utility Service*

PROSPECTS are brightening for the increased use of purchased power by electrified steam railroads. Central-station men must rejoice at such expressions of hospitality toward their product as were heard last week at the New Haven regional meeting of the American Institute of Electrical Engineers from men like Vandersluis, Withington and Hill. It is highly gratifying to learn that the use of purchased power tends to increase service reliability in a field where interruptions are simply intolerable and that such insurance is worth a premium over the cost of producing energy in an isolated station owned and operated by the railroad interests themselves. Apparently the most advanced opinion in railroad circles recognizes the importance of being free to perform the specialized task of moving commodities and living freight from place to place with maximum economy.

Railroad power business, however, does not come to the modern utility on a silver platter. The discussion at New Haven brought out very clearly the importance of negotiating contracts on a liberal basis as regards the customer's operating situation. The problem of demand charges is at the forefront of current railroad thinking, and it is significant that most painstaking specification of this element is embodied in the recent Illinois Central and Pennsylvania Railroad contracts with the power companies serving them. In the former case the transportation company is allowed to exclude from billing abnormal peaks due to stated recognized emergencies. In the latter a clear-cut expression of how demands are to be determined provides for service capable of being expanded over a long period of years. The speakers made the point that the advantages of interconnection should be availed of in fixing demand charges and intimated that the modern railroad's inside position in the fuel and capital markets should also be recognized in the negotiation of power sales, cost of production being thereby made the base of energy rates.

Power companies are under no obligation to sell energy to railroads at a loss, and we do not believe this class of customers desires them to do so, if, indeed, the regulating commissions concerned would permit such discrimination. Obviously a power contract, whether made with a railroad or with a manufacturer of neckties for the Zulus, must be profitable to each party in the long run if it is to endure in good relations. The railroads seek to obtain the best service at the lowest prices available, just like any discriminating buyer. Per contra, well-run power companies desire a fair profit on the business which they handle after all costs are met. All that the situation requires is a thorough study of the possibilities and equities of each particular situation, which then should find expression in a contract just to both sides and one designed to encourage the use of the service to the utmost desirable extent. The fine indorsement of purchased power at the New Haven meeting of the Institute should not be allowed to blind central-station men to the railroads' suggestion that various aspects of the economic problem deserve more thorough analysis in dealing with specific cases. The test of a good contract is its successful application, and no better evidence of this can be had than the satisfaction of both parties with an instrument which encourages the growth of business transacted with each other as the total volume of service rises.

* * * *

## *Fixed-Par Versus No-Par Stock*

THERE is an unwarranted misunderstanding in many minds regarding the relative merits of par and no-par stock. It is less a question of merit than of significance. The price paid for a share of stock by the original shareholder is not important. Invested capital appreciates as earnings are turned back into the company or as the market or replacement value of corporate properties increases. Invested dollars depreciate with profitless operation and adverse economic conditions affecting real estate or replacement costs. The equity of the stockholder is always his per-share interest in a hypothetically liquidated concern. This amount may, and in fact must, at any conceivable instant after organization be either more or less than the sum paid in by him in assuming partial proprietorship.

The establishment of a par value represents an effort of historical interest to stabilize artificially a thing which very evidently cannot be stabilized in this way, however satisfying arbitrary assumptions may be. Par value is a term possessing no significance whatever, and, rather than affecting the rights of either stockholders or the public, it has no possible influence upon them—other than to render confused that which is amazingly simple. A fairly-arrived-at book value, per share, at the instant under consideration is the only proper par. Nothing may be added to or taken away from the equity of the stockholder or the value of the property by arbitrary statements or assumptions of value.

* * * *

## *Economic Balance in the Electrical Industry*

A THOUGHT for electrical men as well as those connected with other industries came out of the convention of the United States Chamber of Commerce in Washington last week. There was naturally much said about the "new competition," the overproduction of commodities and the need for an intelligent attack upon the organizing of distribution in this country—the need for setting about the task and not just talking about it. More than one eminent speaker contributed to the crystallizing of this sensible conception. American industry is not suffering, they said, from too much production, but from production that is not in balance with consumption. We are not producing more things than people can use, but too often the wrong things, and the problem of the future will be to organize, regulate and correlate the supply and the demand. In a word, we must stop manufacturing more buttons than there are buttonholes, so to speak, and laying off for lack of market textile hands who are ready to work, when their own children need shirts that they are able to produce. Clearly this is neither logical, humane nor economic.

What does this mean in the electrical industry? For one thing, we have not in the past thought ahead and prepared the way for expanding markets in the home, store and factory by seeing that installations were made adequate for future needs when the wiring was put in. And so we see today power companies needing load and jobbers and manufacturers needing market that is blocked for lack of outlets. Meanwhile there are too many contractors suffering for lack of jobs, yet able and eager to install this wanted wiring—all owing to a lack of balanced preparation for future growth. Lack of industry statistics has prevented men forecasting the trends of growth and sensing the changing conditions, and factories have forged ahead, increasing capacity and intensifying competition, when often what were needed were goods quite different.

The future will demand more intelligent thought and unselfish planning, more market knowledge, more preparation and preadjustment for balanced development and growth. In the past there has been co-operation only when it was necessary to meet present and immediate embarrassment and need, but in the years ahead electrical men will have to learn to co-operate and organize to provide in advance for coming conditions and prevent the economic evils that inevitably follow the unbalancing of production, distribution and consumption in any market.

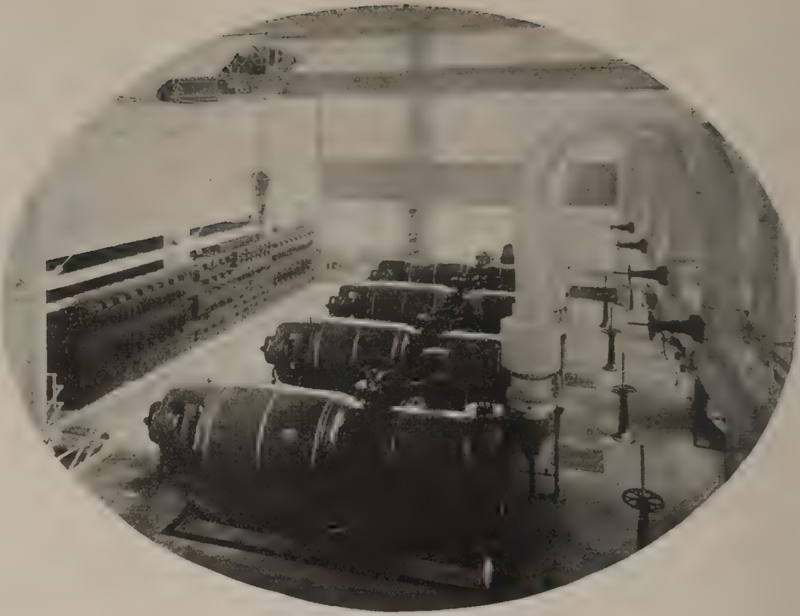
* * * *

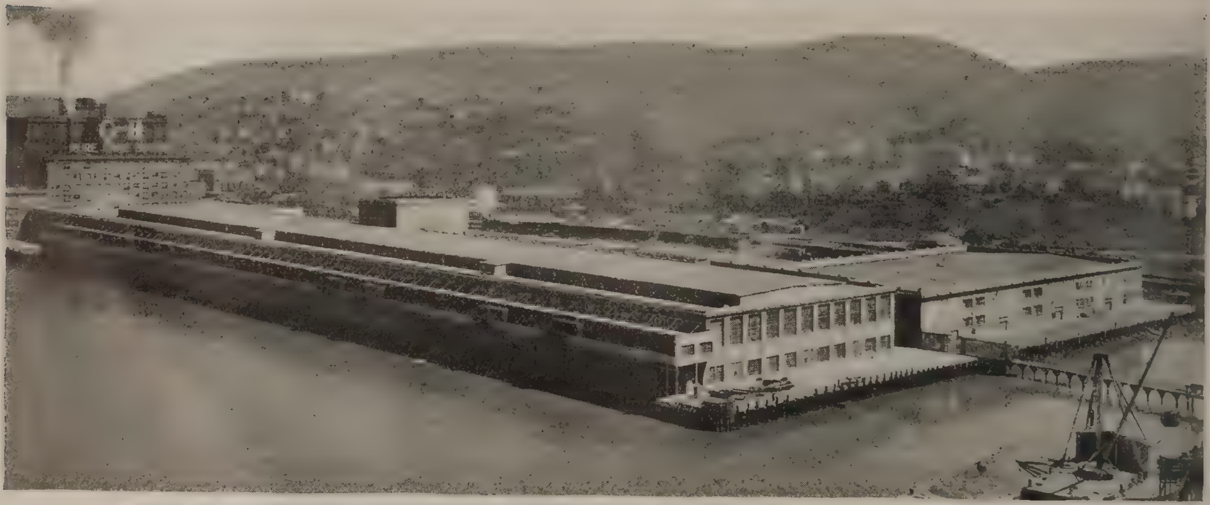
## *Code Work and Industry Progress*

CODE work and the progress of the industry are so intertwined that there can be no separation if the code is to serve the best interests of the electrical art. At the meeting of the electrical committee of the National Fire Protection Association held this month, and later at the N.F.P.A. meeting, the 1928 code was accepted, subject to a letter ballot of the electrical committee, after which it will be sent to the executive committee of the N.F.P.A. and later to the American Engineering Standards Committee. While the correlating committee, which was appointed by the electrical committee at its last meeting to whip the code and the mass of new rules into shape, was not in a position to do as complete a job as might have been done prior to the February meeting, yet many rules were covered in the 1928 code that should prove valuable to the industry.

There are three major problems on which the attention of the article committees and the electrical committee must be focused in the future. They are: (1) To get into the code such rules as should have been incorporated prior to the 1928 code; (2) to add rules to cover the industry's current needs; (3) to bring the code up to date and to keep it in step with the progress in the art. The responsibility for the solution of these problems lies not with any one branch of the industry. It is a joint co-operative task. The code is a national institution, and a great deal of effort has been expended in the last three years to make it so. Any further growth of local regulations will tend to denationalize the code. Such regulations, regrettable as they may be, are invited if the code fails not only to catch up with the progress in the art but to keep constantly in step with it.

# *Production Processes in This Mill Co-ordinated by Electricity*





ELECTRICAL applications in the plant of the California & Hawaiian Sugar Refinery at Crockett, Calif., have been an important factor in synchronizing production units and have made possible an uninterrupted flow of product from the receipt of raw sugar to delivery at the shipping platform. Automatic and semi-automatic control at key stations has reduced labor costs and removed the human element in co-ordinating production units. Hundreds of thousands of bags must be transported by conveyors. The applications are discussed in the following pages.

# Electricity in Sugar Refining

### Engineers of California & Hawaiian Sugar Refining Corporation produce electrical designs which speed up production and synchronize plant operations

By Louis F. Leurey
*Consulting Engineer, San Francisco, Cal.*

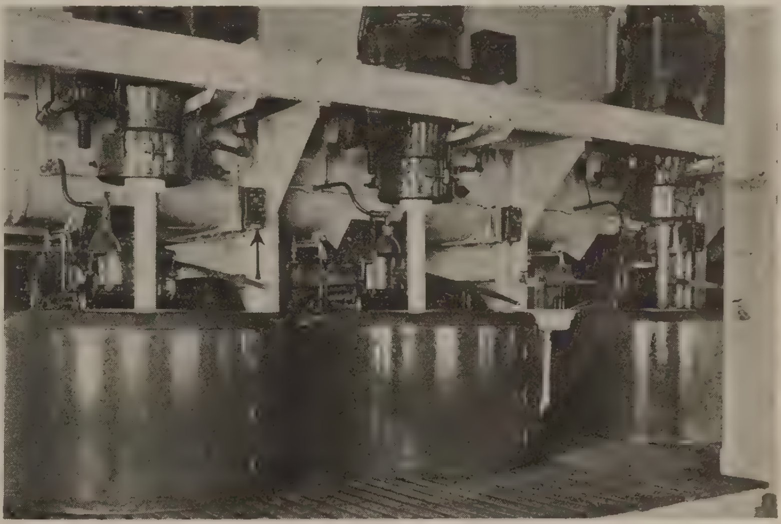
IN THE development of electrical usage at the plant of the California & Hawaiian Sugar Refining Corporation the engineering department has not been satisfied in applying all of the well-known methods of electrical drive and control but, being notably "electrically minded," it has gone extensively into the application of electricity as a medium in the accomplishment of industrial processes.

These engineers, in common with all engineers experienced in the manufacturing field, know that the greatest obstacle to synchronizing the various factors of production is the human element. Attacking the problem from this angle, they have made a special study of the salient factors which impede the uninterrupted flow of their product from the receipt of raw sugar to delivery at the shipping platform. They have found that the use of automatic and semi-automatic electrical control at certain key stations has not only reduced labor costs but has been a vital factor in co-ordinating the control of production units. Some of these applications are of consequence only in the sugar-refining process, but a number of important installations will be described where a similar application could be made to other products and are therefore of general interest in the manufacturing field. Before taking up the electrical applications in the plant it will be well to describe briefly the methods used in the process of refining sugar.

The plant of the California & Hawaiian Sugar Refining Corporation is situated at Crockett, Calif., on the shores of San Francisco Bay, and has a deep water frontage of 3,000 ft. It is served by ocean steamers, river craft and by connections to three transcontinental rail systems. The raw sugar is received in cargoes up to 14,000 tons from the Hawaiian Islands, and the Matson Navigation Company maintains a fleet of modern sugar-carrying vessels which transport up to 90,000 tons of raw sugar per month. The plant has a melting capacity of 2,500 tons of sugar per day, which is converted from the raw state into the various forms of refined product demanded by the American market.

Raw sugar comes from the Hawaiian Islands in 125-lb. bags, of approximately 98 deg. purity, which is landed from the ship's side in slings and conveyed directly to the refinery or to warehouse storage. The general refining process consists of the following operations:

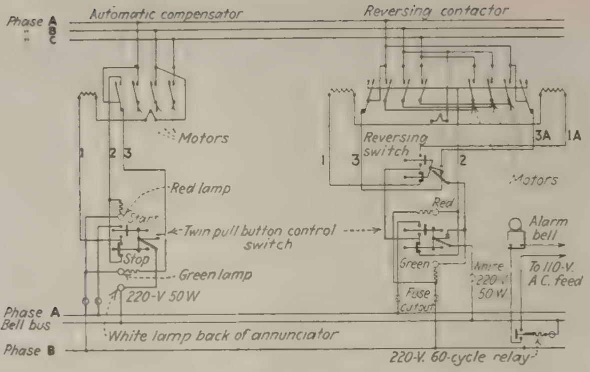
(a) *Washing* (Removal of External Impurities)—At the end of the main conveyor belts is a raw sugar bin, of 1,500 tons capacity, from the bottom of which the sugar is lifted in bucket elevators to a "mingler," where it is thoroughly mixed with syrup to give it "flow." The resultant mixture, called "magma," is allowed to flow into motor-driven centrifugals, where it is automatically washed by spray nozzles, thus raising its purity from approximately 98 to approximately 99.4 deg. Twenty-two raw sugar centrifugal machines, each one of which is driven by a 30-hp. motor, are required for this operation.



*Raw sugar centrifugal station, consisting of 22-30-hp. motors driving centrifugal baskets*

(b) *Melting* (Changing the Solid Raw Sugar into Liquid Form)—From the centrifugals the washed sugar drops into a cylindrical tank, where it is partially dissolved with hot water and stirred by revolving paddles until it reaches a concentration of 66 per cent of solid matter.

(c) *Filtration* (Removal of Insoluble and Soluble Impurities)—From the melting tank the solution is pumped to the top floor of the "char house," a nine-story building, where it is delivered to tanks and heated by steam coils to a temperature of 176 deg. F. At this point lime and kieselguhr (diatomaceous earth) are added. The kieselguhr absorbs some of the impurities

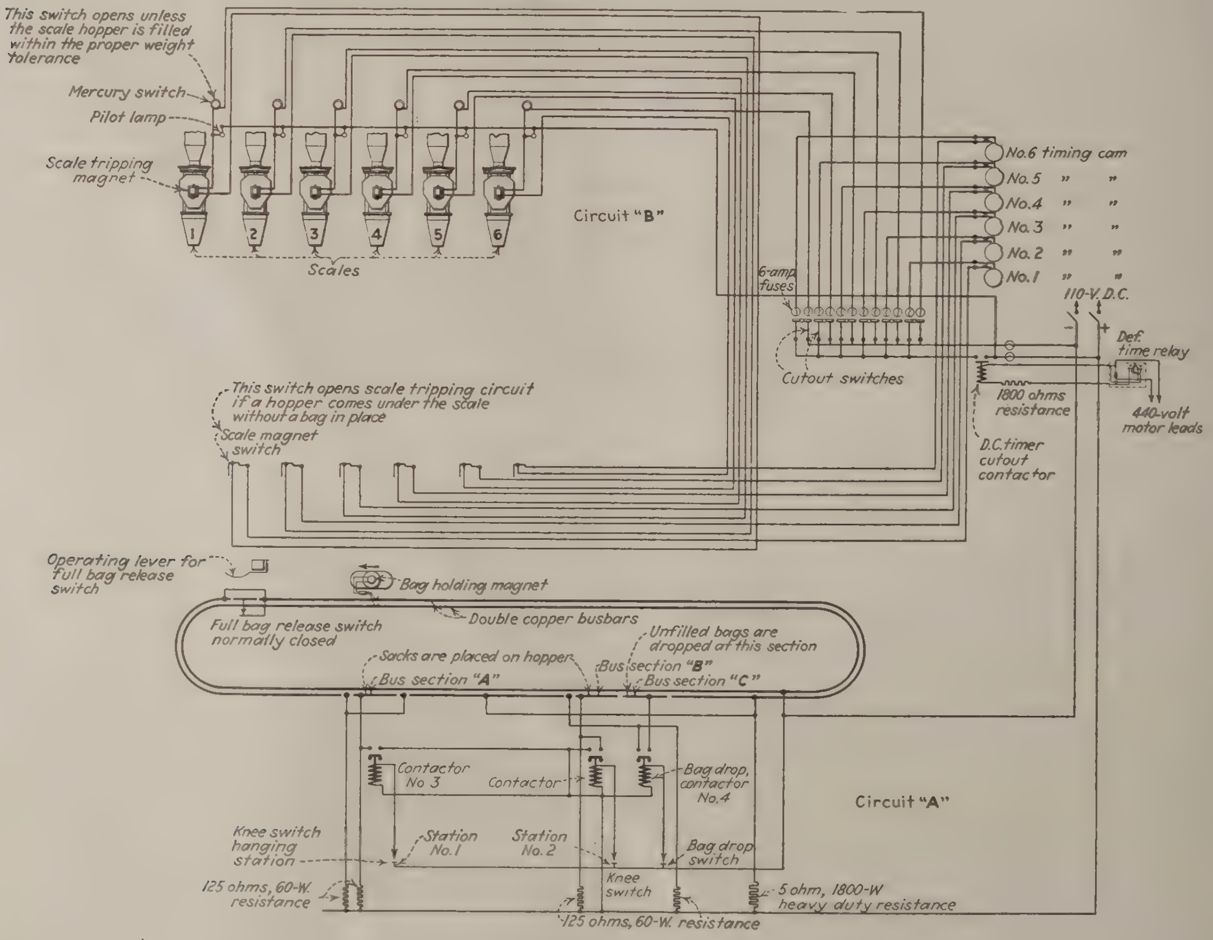


*Wiring for remote control of warehouse conveyor motors*

and in addition forms a porous coating against the filter cloths through which the sugar liquor passes. These filter cloths are contained in modern filter presses which remove from the liquor the insoluble impurities. From the filter presses the liquor is delivered to 108 char-filters. These char-filters each consist of heavy cast-iron tanks 10 ft. in diameter and 25 ft. in height, each containing 50 tons of "bone char," which is an animal charcoal ground to size between a 10- and a 30-mesh screen and calcined at a temperature of 1,200 deg. F. This filtration removes practically all of the coloring matter and considerable portions of the organic and mineral impurities present.

(d) *Crystallization* (Conversion of the Liquor into Sugar Crystals)—The sugar liquor now being pure white, with the greater part of the impurities removed, is then boiled under vacuum at low temperature in vacuum pans approximately 14 ft. in diameter and 17 ft. high. In approximately 1½ hours 38 tons of granulated sugar is delivered from these pans.

(e) *Drying*—Crystals from the vacuum pans are then spun in white sugar centrifugals, equipped with an automatic electrically controlled water spray, which washes and partially dries the sugar crystals. Final and complete drying is effected in an apparatus consisting of two large cylindrical drums, 6 ft. in diameter and 30 ft. long, each revolving with a slight downward pitch from the receiving to the discharging end. The first, or upper, "granulator" revolves slowly and carries on its inner edges narrow sawtooth shelves which cause the sugar to fall in a shower throughout the entire length of the drum. A strong current of air heated by steam coils and driven by a powerful fan is drawn through this "granulator" and dries the sugar to 0.1 of 1 per cent of moisture. The final drying is done in the lower drum or granulator carrying an internal steam heated drum about 24 in. in diameter, which revolves with the granulator. The sugar crystals fall in a shower from the shelves onto


This switch opens unless the scale hopper is filled within the proper weight tolerance
Mercury switch
Pilot lamp
Scale tripping magnet
1
2
3
4
5
6
Scales
Circuit "B"
No. 6 timing cam
No. 5 " "
No. 4 " "
No. 3 " "
No. 2 " "
No. 1 " "
6-amp fuses
110-V. D.C.
Def. time relay
Cutout switches
1800 ohms resistance
440-volt motor leads
D.C. timer cutout contactor
This switch opens scale tripping circuit if a hopper comes under the scale without a bag in place
Scale magnet switch
Operating lever for full bag release switch
Bag holding magnet
Full bag release switch normally closed
Double copper busbars
Unfilled bags are dropped at this section
Sacks are placed on hopper
Bus section "A"
Bus section "B"
Bus section "C"
Contactor No 3
Contactor
Bag drop, contactor No. 4
Circuit "A"
Knee switch hanging station
Station No. 1
Station No. 2
Bag drop switch
Knee switch
125 ohms, 60-W. resistance
5 ohm, 1800-W heavy duty resistance
125 ohms, 60-W. resistance

*Control of automatic bag-filling and weighing machine* this hot inner drum and are dried to a moisture content of about 0.05 of 1 per cent.

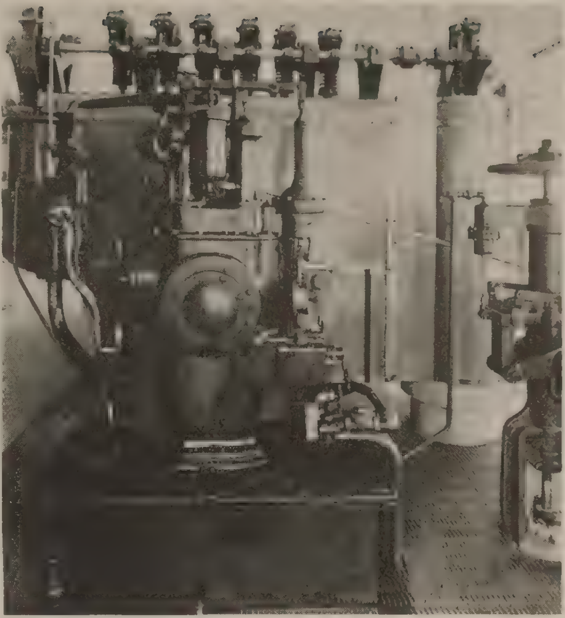
(f) *Sorting and Packing*—From the granulator the sugar is passed over separators which screen the crystals and sort the grains into coarse, medium and fine sizes. The sugar is then conveyed to the packing room. As many as fourteen grades of refined sugar are produced and packed in more than twenty various types of containers. The final product is of extreme purity, each grade being absolutely uniform as to color and granular structure, and in the entire process from raw sugar bin to final packed product it is at no time touched by the hands of the operators.

In addition to the main process described above, there are many intricate problems connected with the extraction of sugar from sweet waters and low-grade syrups, all requiring labor, machinery and fuel. It is sufficient to say here that these recovery operations are carried out to the limit of commercial economy.

### CENTRAL POWER PLANT

As great quantities of steam at low pressure are required in the process of sugar refining and as all of this steam must necessarily be generated at standard boiler pressures a steam turbo-generator plant was designed to act as a pressure reducer between the boiler room and the low pressure mains. In this way all electrical power required for the refinery is recovered as a byproduct of this pressure-reducing process. The cost of electrical energy consists of the sum of the fixed charges on the turbo-generators and the turbine building, plus the annual operating costs of the turbines and the thermal loss between the throttle and the discharge pipe. The sum of all of these charges is much lower than the cost of purchased energy even under the favorable load factor of sugar refinery operation.

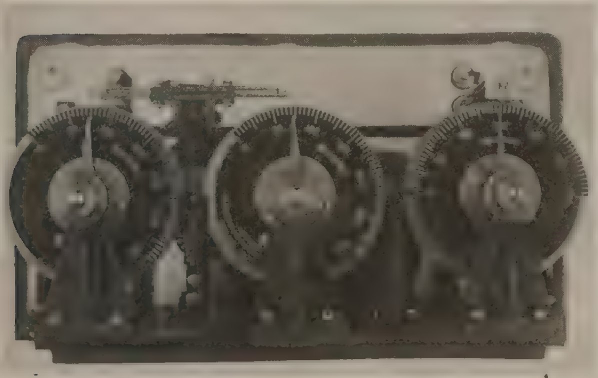
When it is considered that this power plant operates eleven months in the year, generating approximately 100,000 kw.-hr. per day, with an average load of 4,000 kw. and a maximum load of 4,500 kw., it can be readily appreciated that the power plant makes a very substantial return upon its investment. Three 1,500-kw., 440-volt, three-phase turbo-generator units exhaust directly into the 10-lb. low-pressure steam mains and do the regulating necessary for the electrical system. A fourth 1,500-kw. unit of single-stage design exhausts directly into the 70-lb. mains that supply the refinery vacuum pans.



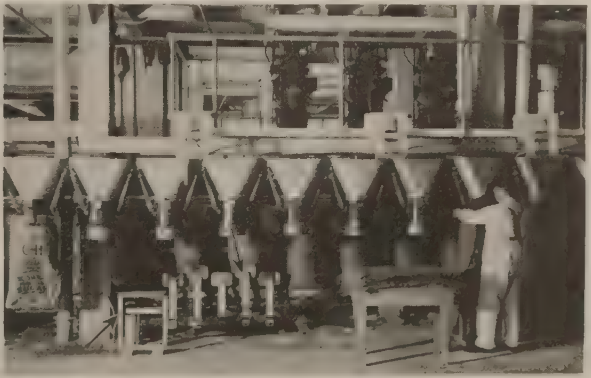
*Close-up view of speed governor, pressure governor and valve gear, high back-pressure turbine*

This high back-pressure turbine is of considerable interest due to several unique features incident to its operation. Requirements of the vacuum pan are such that a steady pressure is demanded, so that it was necessary to develop a pressure governor which would maintain a constant pressure over an adjustable range of from 55- to 70-lb. gage. The second requirement was that in maintaining this pressure the safe electrical output of the generator must not be exceeded, and the third requirement was that this machine must operate in parallel with the machines on the 10-lb. system.

The turbine, which is of General Electric manufacture, has met all of these requirements through a very ingenious design by the manufacturer. A mechanical pressure governor, as illustrated, has been incorporated with the hydraulic speed governor in such fashion as to maintain very steady pressure over a wide range of steam demands, and a contact-making ammeter acting on the pilot control motor of the speed governor oper-



*Close-up view of motor-driven supervising relay for controlling raw sugar station*



*Automatic electrically controlled bag-filling and weighing machine* ates successfully as a load-limiting device whenever the turbine's electrical output exceeds a predetermined limit.

The vacuum pans often require more steam than can be handled by the high back-pressure turbine, and a Shield regulating valve, designed by the master mechanic of the sugar company, supplies the make-up steam directly from the boiler room mains. Two of the accompanying charts, taken from flow meters, indicate the steam passing through the turbine and the make-up steam supplied by the Shield regulating valve during a typical operating day.

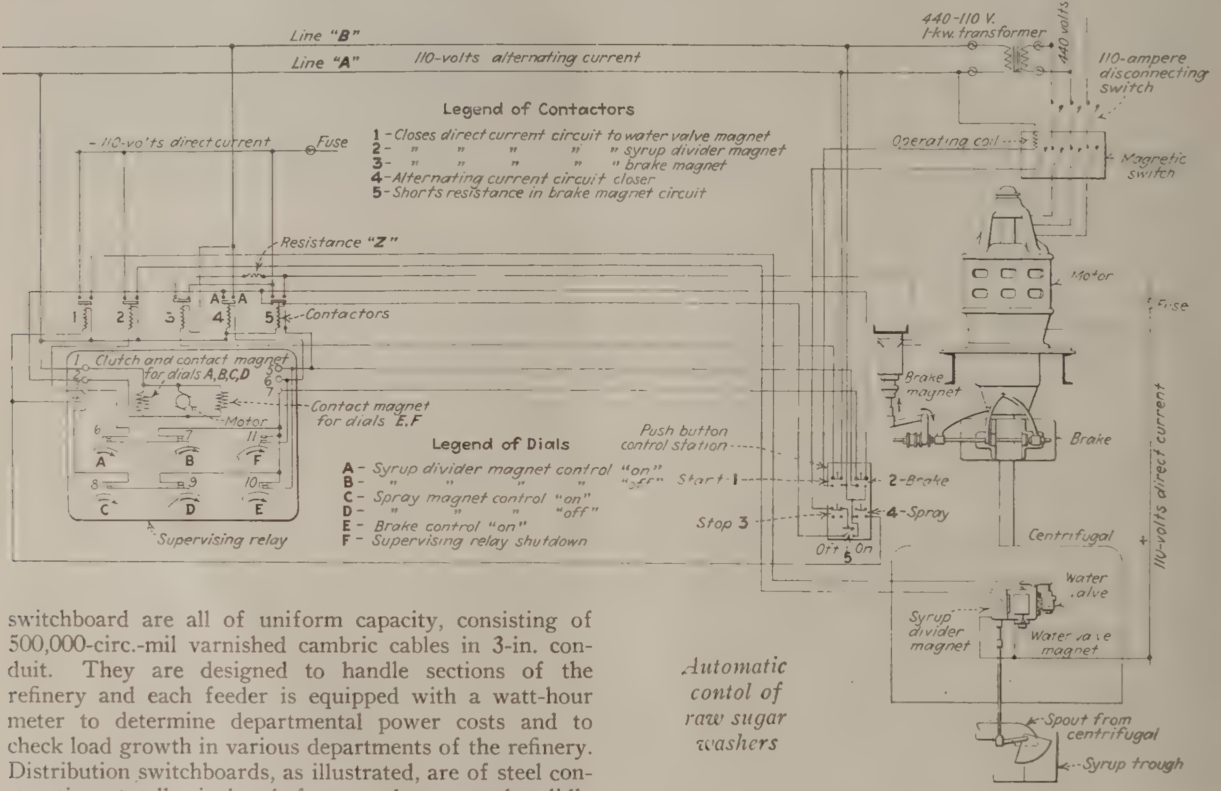
### Switchboards and Feeders

The main switchboard is of very simple design and controls four 3,000-amp. generator breakers and 21 500-amp., 440-volt feeder breakers. The feeders from this switchboard are all of uniform capacity, consisting of 500,000-circ.-mil varnished cambric cables in 3-in. conduit. They are designed to handle sections of the refinery and each feeder is equipped with a watt-hour meter to determine departmental power costs and to check load growth in various departments of the refinery. Distribution switchboards, as illustrated, are of steel construction, totally inclosed front and rear and solidly grounded. All switches are equipped with a corporation lock, and painters are permitted to paint switchboards unattended in the same manner that they would paint tanks or building columns.

All sub-feeders in the refinery, with the exception of those controlling motors of more than 50 hp., have a uniform capacity of 100 amp. each and are so routed in the refinery areas as to accumulate a load equal to their wire capacity. Feeders of this "busbar" type connect to two or more motors until they are fully loaded to wire capacity, and the size of the feeder remains unchanged from the switchboard to the last motor. By the use of this system of sub-feeders and of fully loaded main feeders all copper in the entire refinery is operating near its full efficiency, the only exception being the copper in the individual motor circuit, where size is governed by the requirements of the National Electrical Code.

There are approximately 200 fractional horsepower motors in the refinery and 800 motors of the three-phase, 440-volt type in sizes from 1 to 350 hp., totaling approximately 12,000 connected horsepower. The average size motor in the refinery is only 15 hp., but in spite of this small average size it has been possible to maintain a station power factor of from 83 to 84 per cent This has been accomplished by the judicious loading of induction motors and the use of synchronous motors of 150 to 350 hp. in driving pumps and air compressors, and by the further use of a static condenser at the terminal of a main feeder of especially low power factor.

Motor controls are grouped wherever possible at conveniently accessible locations and the various starters and disconnecting switches are all of the "ironclad," fully protected type, mounted on steel panels fabricated at the refinery to standard dimensions. This grouping of controls has resulted in more frequent inspections, lower maintenance costs and fewer interruptions to machine operation. All motor starters now purchased are of the automatic type, but old manual starters are being retained as long as they prove useful.


Line "B"
Line "A"
110-volts alternating current
440-110 V. 1-kw. transformer
440 volts
110-ampere disconnecting switch
Legend of Contactors
1 - Closes direct current circuit to water valve magnet
2 - " " " " " syrup divider magnet
3 - " " " " " brake magnet
4 - Alternating current circuit closer
5 - Shorts resistance in brake magnet circuit
- 110-volts direct current
Fuse
Operating coil
Magnetic switch
Resistance "Z"
Motor
Fuse
1 2 3 4 5
A A
Contactors
Clutch and contact magnet for dials A,B,C,D
1 2 5 6 7
Motor
Contact magnet for dials E.F
6 7 11
A B F
8 9 10
C D E
Supervising relay
Legend of Dials
A - Syrup divider magnet control "on"
B - " " " " "off"
C - Spray magnet control "on"
D - " " " "off"
E - Brake control "on"
F - Supervising relay shutdown
Push button control station
Start - 1
2 - Brake
Stop 3
4 - Spray
Off 5 On
Brake magnet
Brake
Centrifugal
110-volts direct current
Water valve
Syrup divider magnet
Water valve magnet
Spout from centrifugal
Syrup trough

*Automatic contol of raw sugar washers*

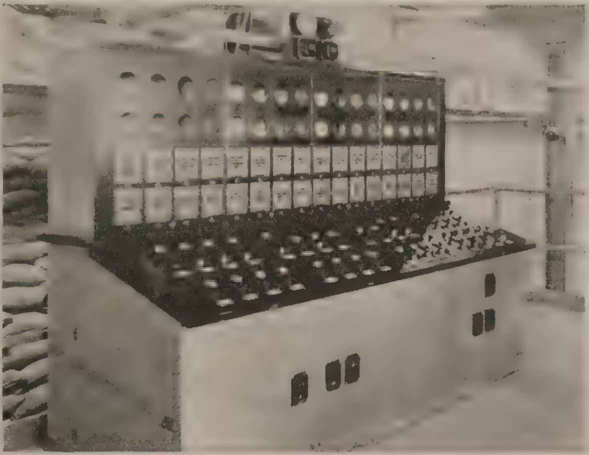
### Special Applications and Controls

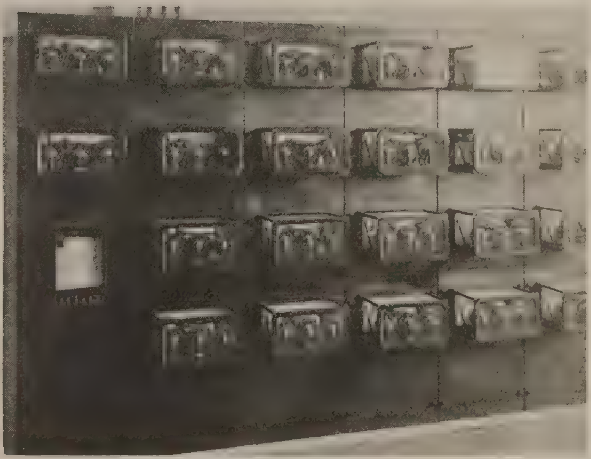
The raw sugar washing station, as shown by one of the accompanying illustrations, consists of a group of 22 centrifugal sugar washers, each driven by a Westinghouse 30-hp. high-torque motor. The motors are directly connected to centrifugal baskets by centrifugal clutches that engage after the motor has partly come up to speed, the motor itself being thrown directly across the line by means of a magnetic contactor. Each centrifugal is automatically controlled by a three-dial, motor-driven supervising relay (illustrated) which is energized by the same push-button that is used to control the starting contactor of the 30-hp. motor. Each timing dial of this supervising relay can be independently adjusted and automatically set to:

First—Control the time of admission and duration of the water spray applied to each centrifugal.

Second—Control syrup stream by which first washings of low purity are separated from final washings.

Third—Open the magnetic contactor to the 30-hp. motor and apply the brakes to the centrifugal basket.





*At right—Benchboard with visual annunciator for remote control of warehouse motors*

*Below, left—Fabricated steel switchboards controlling distribution circuits*

*Below, right—Switchboard with automatic supervising relays for controlling raw sugar washers*

In addition to these automatic operations there are five push buttons, as indicated on the accompanying control diagram of the automatic sugar washer. Each of these push buttons gives independent manual control without in any way interfering with the operation of the supervising relay, as follows:

Push Button No. 1—Releases the brake, closes the magnetic switch controlling the centrifugal motor and energizes the supervising relay.

Push Button No. 4—Operates the water spray independent of the supervising relay in order to wet the centrifugal basket preparatory to filling with "magma."

Push Button No. 3—Opens the magnetic contactor to the main motor without disturbing the time cycle of the supervising relay. This feature is necessary in order that the centrifugal basket may be slowed down when loaded too rapidly.

Push Button No. 1—Must be pushed again to reconnect the main motor.

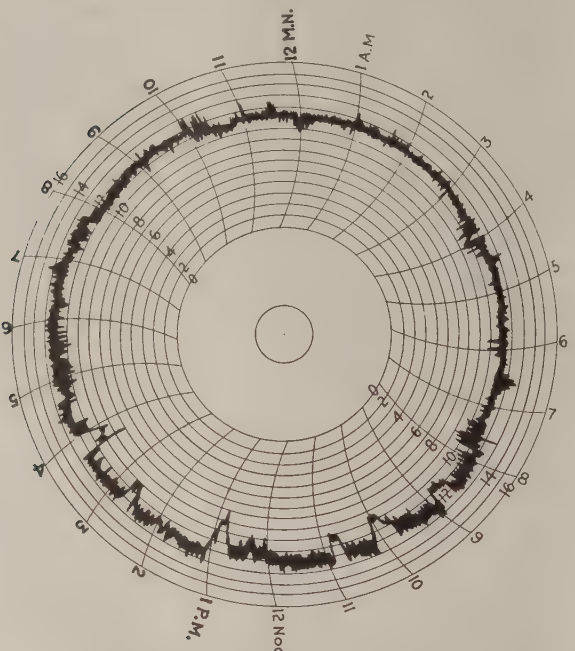
Push Button No. 2—Disconnects the main motor and applies the brake independent of the supervising relay.

Key Switch No. 5—Is for the purpose of by-passing the supervising relay and permits the operation of the centrifugals by hand control. This is necessary in making mechanical adjustment and for washing down the equipment.

The equipment described above was all designed by the engineering department of the California & Hawaiian Sugar Refining Corporation and gives an extremely flexible control of the raw sugar station. Labor charges have been reduced, a more uniform product secured and, through a better timing of operations, higher load factor has resulted at this important refinery station. It is obvious that such a control system could be applied to the washing of salt or any other product that is centrifugally separated.

One of two automatic bag-filling and weighing machines designed and built by the engineering department of the sugar company during the past season is shown in one of the accompanying illustrations. The application consists essentially of two conveyors. One, commonly called the "merry-go-round," has been in use for several years and consists merely of a succession of small platforms upon which filled bags of sugar are conveyed from the automatic weighing scales, past the sewing machine heads, to the warehouse conveyor chute. The other conveyor is suspended directly over a part of the "merry-go-round" and operates in synchronism. This second conveyor comprises a series of special hoppers, to which empty bags are attached, and which carry the bags under the automatic weighing scales. Here the weight of sugar depresses a given bag until it rests upon one step of the "merry-go-round"; the bag is released automatically from its hopper and is carried on, as indicated above.

The automatic electric control of this station, as shown in an accompanying diagram, consists of two separate circuits. Circuit "A," or the bag-holding circuit, consists of two copper bus bars mounted concentrically on the hopper conveyor framework, Within each hopper is mounted an electromagnet which operates holding arms, as shown in one of the illustrations, and clasps the bag to the hopper. These magnets are connected to the busbars by sliding copper brushes. The busbar is divided into sections, so that when an empty bag is slipped over the hopper spout by the operator the magnet is energized at 110 volts by means of a momentary contact switch closed by the knee of the operator. As soon as the bag has moved past this "loading section" of the busbar it is held in place by reduced voltage to minimize heating of the magnets, which are necessarily small so as not to interfere with the flow of sugar from the scale to the sack within the predetermined time.



*Steam input to high back-pressure turbine*

The second circuit, "B," consists of an electromagnet control on the dumping valve of the automatic weighing scales. This circuit is equipped with a timing commutator mechanically driven by the "merry-go-round" and so arranged that the automatic scales discharge at the exact moment the proper bag is beneath them.

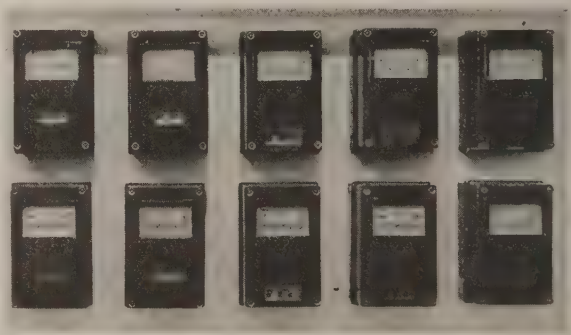
From this point the bag rests on one step of the "merry-go-round," where it first passes a tapping device to settle the sugar, and then contacts with a mechanical arm which de-energizes the bag-holding magnet and permits the bag to continue past the sewing machine heads. The installation has now been in operation for a period of six months and has not only operated with high economy but has been of still greater value in synchronizing refinery operations to a finer degree of accuracy.

As this refinery handles over its main conveying system approximately 40,000 bags of raw sugar per day from the warehouse to the refinery, and about the same number of bags of refined sugar from refinery to warehouse, it became highly important that a dependable counter be developed which would accurately tabulate this product so that the warehouse operation and the refining processes could be successfully synchronized. To accomplish this purpose it was essential that the measuring must be done at a number of points throughout the refinery and warehouse,, some of them over 1,000 ft. distant from the control station, corresponding to the load dispatcher's desk in an electric utility. Failing to find a satisfactory counting device on the market, the refinery engineers painstakingly experimented with various methods and finally developed a device which is an adaptation of the principle of an electrical demand indicator and records bags of sugar instead of kilowatts of demand. It has a recording capacity up to 10,000,000 bags of sugar before reverting to zero. A battery of fourteen of these counters is shown in one of the accompanying illustrations.

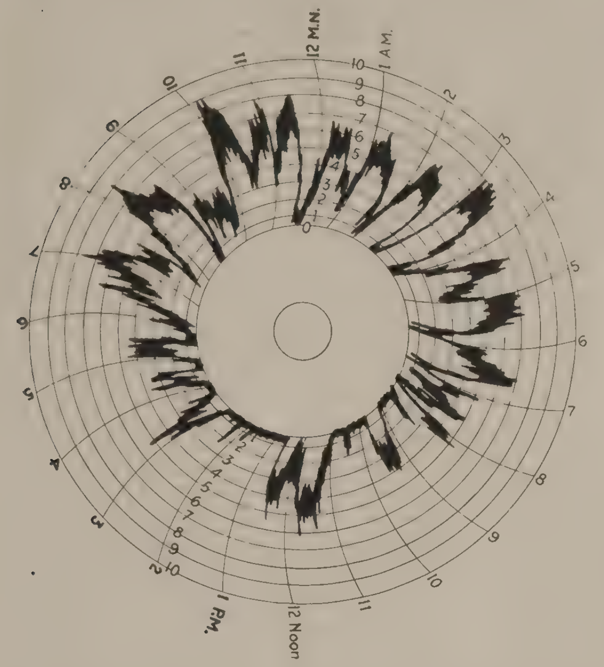
Specially designed mechanical contacting switches were developed by the refinery engineers and located at various points in the conveying system where the sugar goes down an incline, thus securing a very rapid operation of the contact. The contactor had to be made very rugged and with exceptionally high speed action in order to catch bags traveling in various positions and at various rates of speed. This contactor opens against the action of a small magnet which is installed to prevent chattering due to mechanical rebound at the time the trigger resets. These contactors have been in operation for about four years with an extremely creditable record of reliability.

### REMOTE-CONTROL WAREHOUSE SWITCHBOARD

The sugar comes to the refinery in ship cargoes as large as 14,000 tons, and a very intricate and complete conveying system has been installed so that ships might be unloaded with the least delay. In addition to taking care of the unloading of the ships, 2,500 tons of the product must be delivered to, and almost as much again received from, the refinery each working day. Some 30-odd motors are employed in driving these various conveyors, a number of which are reversing and many of which are interconnected for various transfers of product to and from storage. As the warehouses are more than 1,000 ft. long and 250 ft. wide, divided by fire wall sections, it became highly important that all conveyor operations be synchronized from a single point. This point was selected at the end of the main conveyors which lead from the warehouse to the refinery. The first design developed was a fully automatic type, using plugs and receptacles so that any train of conveyors could be



*Remotely controlled bag counters located at central control point* electrically interlocked. This design was rejected for two reasons: (1) Due to the excessive number of combinations needed to satisfy all of the requirements in transferring product. (2) Due to the fact that it would introduce too much special equipment and thus complicate the maintenance problem. It was deemed wiser to design a remote-control board, giving individual control of motor circuits without interlocking, and to use types of control equipment familiar to the operating department.



*Input of make-up steam to refinery vacuum pans as delivered from boiler room to "Shield" regulating valve*

A benchboard was designed, as illustrated, to give rapid remote control over all of these motors in order that jams on the conveyor systems could be prevented and that transfers of product could be quickly and accurately carried out. The benchboard, which is of General Electric manufacture, is designed along central-station lines, except that 440-volt control equipment is used instead of the conventional 110-volt. Multi-conductor No. 14 B. & S. gage wire is used between the benchboard and the automatic motor starters and contactors in various sections of the warehouse. Three wires are used to control an ordinary operation and five wires are used to control a reversing operation.

Conventional red and green bull's-eye lamps with red and green mechanical indicators are used on each control switch, the lamps having a 440-volt resistor between them and the source of energy. In addition to these lamps on the benchboard, there is a ground glass visual annunciator mounted on the vertical section of the switchboard. If a motor stops, due to overload, no voltage or from any accidental cause, a white light flashes behind the ground glass annunciator and illuminates the painted name or number of the conveyor, and at the same time an auxiliary gong in parallel with the white light is sounded. The operator then manually disconnects all motors that are driving conveyors in train with the conveyor in trouble. A pull on the green or stop button of the troubled conveyor clears the white light and bell by means of an auxiliary finger.

Operated in conjunction with this system of control is a 12-volt direct-current signal system with return call push buttons and bell. The bell on this system is connected in parallel with a red lamp mounted back of the ground glass visual annunciator which flashes the name of the conveyor whenever a signal comes in. Reset buttons are mounted on the switchboard for clearing this light after the operator has heard the signal and identified the conveyor.

All motors are normally started and stopped on bell signal from the motor station, and emergency stops are made at the benchboard whenever a motor kicks out in a conveyor train. Safety buttons are also installed at convenient points near the motors and conveyors so that emergency stops can be made when necessary.

This switchboard has proved highly satisfactory in expediting warehouse operations and in cutting down the losses incidental to jams that previously occurred when a single conveyor, operated in train, fell out of step. It is planned, as will be seen from the accompanying illustration, to install ammeters in each motor circuit so that the operator on the benchboard will have continuous knowledge of the loading and operating condition of each conveyor in the system.

In conclusion, it is only fair to point out that the achievements of the engineering department of the California & Hawaiian refinery in these advanced applications of electricity were all made in the face of many discouraging circumstances, among which may be cited the tremendous pressure required by the routine operation of such a large plant, and, secondly, due to the fact that very little, if any, standard equipment could be applied to the work in hand, especially as the refinery is situated several thousand miles from the great manufacturing centers of the electrical industry. Under these circumstances the important and successful applications made could only have been carried out by engineers of an enthusiastic type, and above all by engineers who were "electrically minded."

## Cost of Steam Plant Equipment

FROM the data sheets of a large steam-driven central station the following field installed costs, excluding general job and contractor's compensation and overhead, are taken as of 1927:

STEAM PLANT EQUIPMENT COSTS, 1927

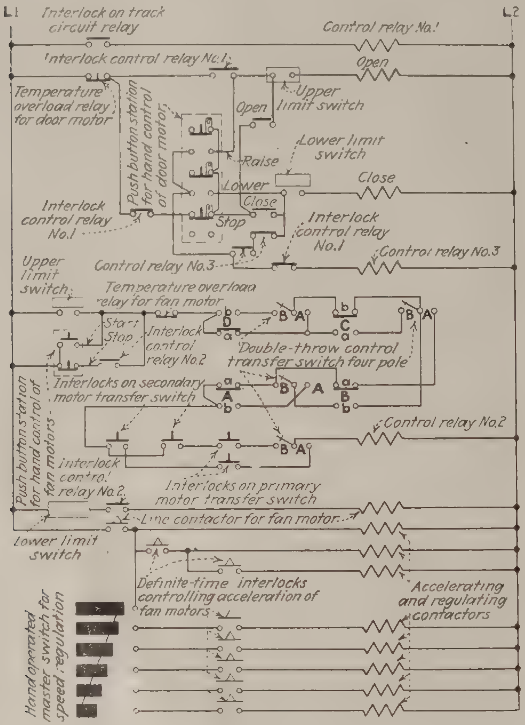
| | |
|---|---|
| One Ingersoll-Rand two-stage, horizontal type 10, water-cooled, 12x12-in. air compressor, 60-in. flywheel, 10x⅜-in.x15-ft. long leather belt and 50-hp. motor, 2,200-volt, three-phase motor | $4,512 |
| One air compressor, Kellogg self-contained, chain-driven model 42-250, 1-hp. motor, 110 volts | 358 |
| One air compressor, Westinghouse air brake locomotive type, 6x12x10-in.; steam end, 8x12x10-in.; air end, 2-in. steam outlet, 1½-in. steam inlet | 522 |
| One 1,000-gal.-per-minute centrifugal fire pump. 1,650 r.p.m., 8-in. suction, 6-in. discharge, direct-connected to Westinghouse turbine, single-stage impulse, 200-lb. gage, 100 deg. superheat | 4,342 |
| One 3,500-kw., 100 per cent power factor turbo-generator unit, 1,800 r.p.m., 180 lb. steam pressure, 20 deg. superheat; generator 2,300 volts, three phase, 60 cycles, with oil pumps for turbine | 71,886 |
| One jet condenser, Westinghouse LeBlanc, turbine driven, handling 2,380,000 lb. of water condensing 58,450 lb. steam per hour to 28-in. vacuum with cooling water at 40 deg. to 70 deg. F.; one centrifugal pump driven by 15-hp. motor, and one 5,240 gal.-per-minute centrifugal condensate ejector pump, one vacuum air pump and one 143-hp. turbine (non-condensing), 1,000 r.p.m. | 12,333 |
| Pedestal and foundation | 2,951 |

# Ventilation Control in the Moffat Tunnel

By H. C. Glaze and M. P. Bailey

*General Electric Company*

FAN ventilation is used by the Denver & Salt Lake Railroad in removing smoke and gases from the recently completed Moffat Tunnel through the Continental Divide in Colorado. All ventilation is accomplished at the east portal through the use of two fans located in separate compartments of a specially designed structure. Control equipment is installed in this building.


L1
Interlock on track circuit relay
L2
Control relay No.1
Interlock control relay No.1
Open
Temperature overload relay for door motor
Push button station for hand control of door motor
Upper limit switch
Open
Lower limit switch
Raise
Close
Lower
Close
Stop
Interlock control relay No.1
Interlock control relay No.1
Control relay No.3
Upper limit switch
Control relay No.3
Temperature overload relay for fan motor
Start
Stop
Interlock control relay No.2
Double-throw control transfer switch four pole
Interlocks on secondary motor transfer switch
Push button station for hand control of fan motors
Control relay No.2
Interlock control relay No.2
Interlocks on primary motor transfer switch
Line contactor for fan motor
Lower limit switch
Definite-time interlocks controlling acceleration of fan motors
Accelerating and regulating contactors
Hand operated master switch for speed regulation

*Control plan for ventilating fans and dampers*

Each fan is driven by a 2,200-volt, slip-ring, induction motor. As the barometric pressure varies considerably between the two portals during different seasons of the year, motors of different capacities are used, one of 750 and the other of 500-hp. Only one fan is operated at a time, the selection depending on the traffic and the barometric pressure. The speed of each motor may be reduced 20 to 25 per cent by means of a resistor.

A door installed in the tunnel at the east portal confines and directs the air in the tunnel. This door in opening slides upward and is actuated by a 10-hp., high-resistance, squirrel-cage motor.

Under certain conditions fresh air is forced through the tunnel from east to west, while under other conditions the smoke and gases are exhausted from the tunnel from west to east. The fan rotates in but one direction, dampers being provided to change the direction of air flow and to control the several openings. By suitably adjusting these dampers the air can be forced into or discharged from the tunnel.

As a train approaches the tunnel from the east it closes a track circuit, thus causing a track relay to energize a reversing magnetic starting switch. This switch opens the tunnel door by means of the 10-hp., squirrel-cage motor previously mentioned, and allows the train to enter the tunnel. As the last car leaves the track circuit the relays drop out, energizing the "close" contactor of the magnetic starting switch. When the door reaches the closed position a limit switch trips, completing a circuit for a contactor, which in turn closes a triple-pole, 300-amp., high-voltage, oil-immersed line contactor governing the fan motor. The latter automatically accelerates through suitable contactors to 80 per cent speed by means of definite-time control. Any increase in speed above 80 per cent is obtained by means of a master switch. When a westbound train passes out of the west portal the conductor telephones the station attendant at the east portal, who, if traffic conditions permit, can shut down the fan by means of a push-button station.

A train approaching from the west makes contact with the track circuit inside the tunnel at some distance from the door, causing the track relay to complete the circuit to the reversing magnetic switch. The various devices then function in a manner similar to that for the westbound train. The door may be opened at any time, from a push-button station.

As the railroad company intends to operate but one motor at a time, only one control equipment has been installed. This may be used for either motor and includes one three-phase, 2,200-volt, incoming line and feeder panel with the usual instruments and circuit breaker with overload and undervoltage trip; a speed regulating starter panel, containing the necessary secondary accelerating contactors, regulating contactors, accelerating and control relays, as well as the necessary push-button stations, limit switches for the tunnel door, and a master switch. On the secondary panel there is a reversing magnetic switch for controlling the 10-hp., 220-volt, squirrel-cage motor operating the door at the east portal.

Each of the dampers is controlled by a 3-hp., 220-volt motor operating a suitable mechanism. They are interlocked in such a way that the fan motors cannot operate until proper dampers are completely opened or closed, as the case may be.

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# 40,000-Kw. Frequency Changer Ties 25- and 60-Cycle Systems in New York

40,000-kw., 25/60-cycle frequency changer set tying the East River generating station of the New York Edison Company with the Brooklyn Edison Company and the United Electric Light & Power Company.

# Engineering for Economy*

### Objectives for action outlined. Planned development. More research. Better personnel. Broader perspectives. Economic approach

By E. C. Stone
*Chairman Engineering National Section, N.E.L.A.*

Until a very few years ago the leaders of our industry were primarily concerned with reducing the cost of energy. Much success has been attained in this line, and the cost of energy has now become such a small part of the total cost that it is necessary to look elsewhere in the future for major economies. On the other hand, the tendency to build large power plants at points more and more remote from the load centers, involving more extensive transmission systems, and the insistent demands for greater and greater reliability of service, as well as other less important influences, are giving the unit cost of system investment an upward trend. This fact and the vast reductions that have been made in unit fuel cost are making the fixed charges on system investment an element of constantly increasing importance in the overall cost of electric energy delivered to the user. The system investment is therefore the most logical place to look for further cost reductions.

The first objective, to obtain "more kilowatt-hours per kilowatt of system capacity," is primarily a sales job, but the engineer can and should make a definite and valuable contribution. Getting more kilowatt-hours per kilowatt of system capacity means an intensive development, requiring that power be furnished at lower than average prices for new uses and under conditions different from those we are familiar with. Attainment of maximum results will necessitate a thorough and accurate knowledge of the cost of service in each case. It is clearly the engineer's problem to determine cost of service, involving, as it does, an analysis of load factors and diversity of demand, investment required to serve, and so on, and he should make a careful study of the cost of serving each new class of business that comes up for consideration.

It is the function of the engineer to set up the engineering features of the service extension and installation rules. In many cases these have become very complicated and cumbersome and include requirements entirely unnecessary under conditions now existing. At this time the engineer can very properly review this entire situation with the purpose of simplifying the physical conditions under which service is rendered and thereby improving our relations with our customers.

*The executive committee of the Engineering National Section has adopted the following major objectives toward which the work of the section should be directed:*

*More kilowatt-hours per kilowatt of system capacity.*

*More system capacity per dollar of investment*

*Definite advance planning of system development, and co-ordination of adjacent systems.*

*Comprehensive research in fundamental engineering problems of the industry, co-ordinated through the committees.*

*Better content and wider distribution of serial reports.*

*Study of, and when desirable, reports on national engineering issues affecting our industry.*

*Constructive co-operation in the national movement for standardization.*

*Greater engineering service to the industry through closer co-operation with the other national sections of the N.E.L.A.*

*Recruiting and training of adequate engineering personnel.*

The second objective, "more system capacity per dollar of investment," is the engineer's own problem. There appear to be particularly three methods of approach to this objective, as follows: Development of best practices in engineering through the activities of the engineering committees of the N.E.L.A.; definite planning of system development; research both in system designing and operation and in apparatus and equipment.

The advantages in planning system development where growth is as rapid as in our industry are self-evident, but have not been fully appreciated until quite recently. Comprehensive planning will include a study of the probable future load conditions in the territory served and an analysis of the earning power of the different parts of the system; it will determine the economic steps by which to increase capacity and the proper time at which to make additions to the system; it will determine proper proportioning of steam and hydro-electric generating capacity, useful interconnections and co-ordinated development of adjacent systems; it will bring out new operating problems to be encountered in future conditions of load and system capacity, thus permitting a thorough study and solution before they become acute, and it will make it possible for the engineer to keep his executives fully informed in advance as to financial requirements for system development and probable engineering and operating difficulties to be encountered as the load grows.

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**Abstract of address presented at the annual convention of the Southwestern Division, N.E.L.A., Biloxi, Miss., April 3, 1928.*

Research in apparatus and equipment is of course primarily the job of the manufacturer. Nevertheless, the manufacturer cannot furnish adequate equipment unless the power engineer defines the conditions which must be met in operation, and the power engineer must co-operate in testing and trying out under operating conditions new developments in equipment which give promise. For example, circuit-breaker tests on actual power systems have been an invaluable aid in improving circuit breakers. Similarly, recent tests of transient conditions on transmission systems have furnished data most vital to efficient design of systems and equipment.

### Economy in Expenditures

The power industry will undoubtedly spend more money both for operations and for additions to plant during the next ten years than it has spent in any previous like period of time. In capital improvements alone it is quite reasonable to suppose that as much as ten billion dollars will be spent. The engineers will be responsible for specifying how these huge sums are to be expended. Furthermore, the exacting demands for the highest possible grade of service and the economic pressure to get the greatest possible value out of every dollar spent, as well as the more intricate engineering problems coming from the enormous amounts of energy to be handled and the vast networks of transmission and distribution required to handle it, will make the engineering problems of the future more complex than those of the past, so that both the magnitude and intricacies of the situation will make it necessary that particular attention be given to the recruiting and training of an adequate engineering personnel to handle them.

The knowledge now available on the engineering problems of the power industry, if utilized by engineering talent of high grade, should make possible a future development far more consistent than that of the past, with a correspondingly lower unit cost of plant and of replacements for obsolescence. A more systematic development, based on better understanding of the problems of the future, will prove adequate to meet the conditions imposed by more exacting service requirements, greater economic pressure and larger volumes of energy to be handled.

### New Type of Engineer Needed

I believe it is fair to say that at the moment there is considerable opportunity for improvement in the organization of the engineering forces of member companies and in the quality of engineering achievement. In the past many engineers of above the average in ability have been diverted to executive positions because of the greater necessity of filling such positions effectively, with the result that there is a shortage of high grade engineering talent in our industry. This means that more attention should be given to bringing the best engineering graduates into the industry and more interest should be taken in the courses given in the engineering schools, in order that the graduates may be better fitted for the work they are to perform.

The development of the huge power systems now in operation and growing at a rapid pace have changed the character of engineering talent required. Whereas not so many years ago the power system engineer was confronted mainly with the details of making the different pieces of apparatus work, he now faces the far broader problems of developing a co-ordinated system that will deliver an even higher quality of service than has been accomplished in the past and will show the greatest possible return for every dollar spent.

The job of the power system engineer today starts, of course, with getting solutions to his physical problems, but it by no means ends there. Following the solution of the physical problem there must be an economic analysis of each situation, including comparison of the present and future capital requirements, annual over-all costs, both in operating expense and fixed charges on investment over a period of years; extent of replacement of existing equipment in each case and justification therefor, accuracy of the assumptions made and possible effect on results as actual conditions develop that are at variance with them. The situation must be studied from the executive, commercial and public relations viewpoints, so that the engineer must go beyond the realm of the scientific into that of the business man. And just to the extent that he is able to understand and anticipate the executive's judgment as drawn from all of these viewpoints, to exactly that extent does he become a more valuable man and put himself in line for bigger things.

### Conclusion

In conclusion, it is desired to leave two thoughts for consideration:

1. The industry will spend more money in the next ten years than in any past like period. It will be called upon to meet more exacting service requirements than ever before, and will be under greater economic pressure so that more careful attention will have to be given to every dollar spent. These are the engineer's problems and they are more difficult than those which have confronted him in the past. There is, therefore, an important executive problem to be worked out in recruiting and training the necessary engineering talent and in providing an organization to enable it to function adequately.

2. To meet these more exacting requirements the engineer must be developed into a "scientific business man." His job starts with getting solutions to physical problems, but it by no means ends there. He must be a good business man, a salesman, a diplomat and "must play with the teams" if he is to deal successfully with those men with whom he must deal if his plans are to materialize. Just to the extent to which the engineer understands and anticipates the executive judgment, which must be based on organization, commercial and public relations viewpoints, as well as on engineering, to exactly that extent does he become a more valuable man to his company.

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## Ovens Found Best for Drying Electrical Apparatus

By T. A. Converse
*Local Manager American Electric Service & Maintenance Company, Troy, N. Y.*

EXPERIENCE indicates that in drying out water-soaked motors, control apparatus, etc., the work should be done by baking and redipping in preference to drying out by electric current circulated through the windings, except where emergencies preclude the oven method. Our tests show that when dried out internally by heating up the windings through current application there is a tendency to char the insulation and to cause deterioration of the external insulation on the coils. We have also found it necessary to redip the winding in insulation varnish to bring it back to the standards that existed before the winding was damaged.

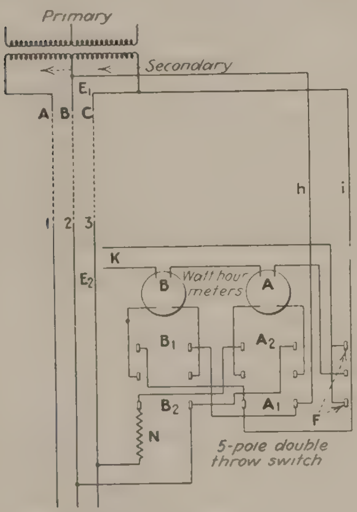
In the late Vermont flood we had a variety of apparatus to dry out, including both alternating and direct-current motors, transformers and other equipment. Our method was the same in all cases, that is, the apparatus was disassembled and the windings were placed in an oven and baked for 72 hours at 250 deg. F. The apparatus was then tested for breakdown and resistance, and if in good condition the coils were dipped in varnish and the apparatus rebaked at the same temperature for 48 hours. This method was entirely satisfactory and we believe that if the apparatus to be dried is not too large it pays to follow this plan rather than to dry out by excess currents and finish with surface coats of varnish.

# Errors from Potential Transformer Leads

By G. A. Collins

*San Joaquin Light & Power Corporation, Fresno, Calif.*

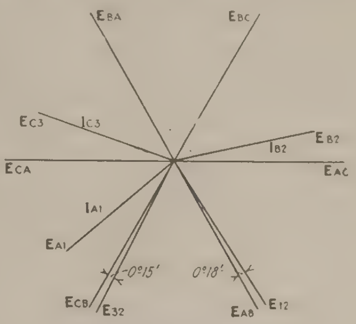
Long leads in the secondaries of potential transformers, unless the size of conductor is larger than ordinarily used, introduce appreciable errors in the registration of watt-hour meters. With a secondary burden consisting of two watt-hour meters and a directional relay potential coil a 300-ft. run of 19-25 stranded cable will introduce a phase shift of between fifteen and twenty minutes. This phase angle, in the case of an inductive secondary burden on the potential transformer, is in the same direction as the phase angle of the potential transformer and the two add in their effect on the accuracy of the watt-hour meters. If in addition to the two watt-hour meters and relay potential coil a non-inductive burden of the order of 200 volt-amperes is added to one of the phases its potential will be lowered about 2 per cent and that of the other phase raised somewhat. In this case considerable error is introduced by the voltage drop and there is also an appreciable phase shift.



*Wiring arrangements for measuring potential drop and phase angle of leads*

*N* is a resistance equal to that of the leads *h* and *i* from the potential transformers to the switchboard. *K* is a source of current for the series elements of the two watt-hour meters.

The watt-hour meter method of testing instrument transformers can readily be adapted to measuring the phase angle and potential drop in the secondary leads of potential transformers. The accompanying wiring diagram indicates the connections for measuring the potential drop and phase angle of leads *B*-2 and *C*-3 for phase *BC*. The resistance and reactance of the leads *h* and *i* should be kept low by using a good-sized conductor, about No. 10, and twisting or tying the two together. The two jaws, *F*, of the double-throw switch are shorter than the others, so that the current circuit, *K*, is opened in advance of the two potential circuits. This eliminates any error that would result if the two potential circuits did not open or close at exactly the same instant owing to slight differences in the lengths of the potential switch jaws.



*Phase-angle relationships as determined in test*

With the current in the series coils of the watt-hour meters in phase with the potential *BC*, two sets of readings are taken; first, with the switch in the position $A_1\ B_2$, the revolutions of the meters *A* and *B* being designated $A_1$ and $B_2$, respectively, and, second, with the switch in the position $A_2\ B_1$, the revolutions of *A* and *B* being designated $A_2$ and $B_1$. Then

$$\frac{E_1}{E_2} = \sqrt{\frac{A_1\ B_1}{A_2\ B_2}}$$

which is the ratio of the voltage at the transformer terminals to that at the switchboard.

To get the phase difference of $E_1$ and $E_2$, the current in the series coils of the watt-hour meters is made to lag behind the potential *BC* and another set of readings is taken, from which

$$\cos\ (\theta + \alpha) = \cos\ \theta\ \frac{E_1}{E_2} \sqrt{\frac{A_2\ B_2}{A_1\ B_1}}$$

$\theta$ is the angle by which the current in the series coils of the meters lags behind the potential *BC*, $\frac{E_1}{E_2}$ is the ratio, found in the first test, of the voltage at the transformer terminals to that at the switchboard, $A_1$, $A_2$, $B_1$, $B_2$ are the readings of the two watt-hour meters and $\alpha$ is the difference in phase between $E_1$ and $E_2$. This form of the phase angle formula is convenient for logarithmic calculation and leaves no question as to the sign of $\alpha$, or need of further tests to determine it. $E_2$ leads $E_1$ if the sign of $\alpha$ is positive.

To check the accuracy of the method a set-up was made, $\frac{E_1}{E_2}$ and $\alpha$ determined by the watt-hour meter method of test and the results checked by calculation. The burden across each of the two phases (1-2 and 2-3) consisted of two watt-hour meters and a directional relay potential coil. The resistance of the lead *A*-1 was 0.479 ohm; *B*-2, 0.492 ohm, and *C*-3, 0.472 ohm. The current in leg *C*-3 was 0.463 amp. and lagged 79 deg. 45 minutes behind potential $E_{CB}$. The current in leg A-1 was 0.518 amp. and lagged 79 deg. and 17 minutes behind potential

COMPARISON OF RESULTS OBTAINED BY TEST AND CALCULATION

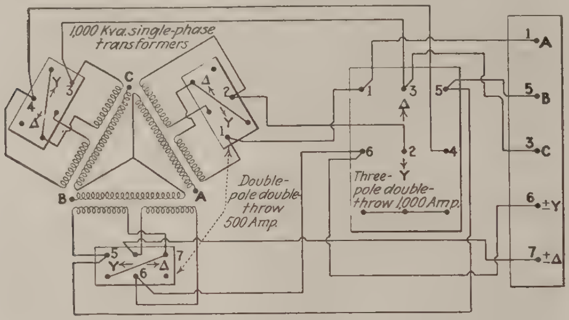
| | Phase Angle | | $\frac{E_1}{E_2}$ | |
|---|---|---|---|---|
| | Phase *AB*, Minutes | Phase *CB*, Minutes | Phase *AB* | Phase *CB* |
| By test | +19 | +18 | 0.9990 | 1.0023 |
| By calculation | +18 | +15 | 0.9993 | 1.0026 |

$E_{AB}$. The phase sequence was $CBA$, potential $AB$ leading potential $CA$ 120 deg., and potential $CA$ leading $BC$ 120 deg. Both phase voltages $AB$ and $BC$ were 120.5.

## Portable Transformer Bank Aids System Changeover

By Maurice D. Smith

DURING a recent system changeover from delta to Y secondaries it was often found necessary to install a bank of transformers temporarily in order to boost the voltage at certain points. The transformers were installed either on a pole or in an inclosure and were in service for only a short time, the period of operation varying from three days to a week, depending upon the amount of related work to be done on the distribution circuits and at the customer's premises.


1,000 Kva. single-phase transformers
C
B
A
Y
Δ
1
2
3
4
5
6
7
Double-pole double-throw 500 Amp.
Three-pole double-throw 1,000 Amp.
1 A
5 B
3 C
6 ±Y
7 ±Δ

*Transformer bank permits rapid shift from delta to Y secondary distribution system*

In order to provide continuous and adequate service, it was felt that the expenditure was justified, but that the time required to install, dismantle and shift it to a new location had a tendency to retard the changeover progress. The possibility of using a bank of transformers permanently installed on a trailer was then studied and it was found to be the most economical and convenient means of supplying emergency and temporary service.

A 2-ton, completely inclosed electric truck which had been in service for many years and was to be retired was converted into a trailer at a small expense. It was equipped with three 100-kva., single-phase transformers connected as shown in the accompanying illustration and offered a flexible outfit. The primary cables enter the trailer through the roof, going first to a set of primary cutouts, which are fused for 100 amp. each, and then to the transformers. A pothead is installed in the primary neutral so that the neutral may be opened for the closed delta connection and closed for the Y connection. By throwing three two-pole and one three-pole, double-throw switches either a delta or a Y connection can be made. Conductors of 800,000-circ.mil cable are brought from the transformers to the switches and from the switches to a terminal board. Here the cables to the network, which enter the trailer through the floor, may be shifted either to the delta or to the Y connection in a short time. A color scheme is used to mark the delta and Y connections in order to prevent the operator from making a false connection. This arrangement so speeded up the work that it enabled the completion of a large project ahead of schedule.

## Computing Compensator Settings for Automatic Regulators

FIRST ARTICLE

By V. W. Palen

IT IS the author's purpose to outline quite completely in this series of papers, of which there are five, the steps in the method used by an Eastern electric company for obtaining compensator settings for its voltage regulators. The engineering division of this particular company supplies the operating division with such computed settings in advance of all major feeder changes. In relatively few cases has it been necessary to substitute experimental settings for the theoretical ones computed beforehand.

Take the case of a single feed. The load center is located quite definitely through a careful study of the maps showing all of the transformers supplied from the primary in question. Once the load center location is determined, the resistance, reactance and impedance of the primary from substation to load center must be computed.

CHARACTERISTICS OF UNIT LENGTHS OF CONDUCTORS

| Type of Primary | Ohms Resistance | Ohms Reactance | Ohms Impedance |
|---|---|---|---|
| 1,000 ft. of 350,000-circ.mil underground cable | 0.0345 | 0.0369 | 0.0580 |
| 1,000 ft. of 250,000-circ.mil underground cable | 0.0431 | 0.0379 | 0.0570 |
| 1,000 ft. of No. 2/0 overhead wire.......... | 0.0790 | 0.1320 | 0.1540 |

In the case given in the accompanying illustration the load center is 4,000 ft. from the substation. Using the data in the accompanying table the resistance, reactance and impedance from substation to the load center are as follows:

| | | Ohms Resistance | Ohms Reactance | Ohms Impedance |
|---|---|---|---|---|
| (AB) | 1,000 ft. of 250,000-circ.mil. underground cable.................... | 0.0431 | 0.0379 | 0.0570 |
| (BC) | 3,000 ft. of No. 2/0 overhead wire..... | 0.2370 | 0.3960 | 0.4620 |
| (AC) | Total........................... | 0.2801 | 0.4339 | 0.5190 |

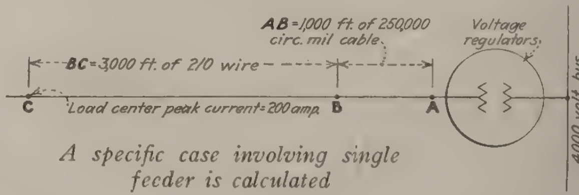
Since the primary current at peak load is 200 amp. and since the ratio of the current transformer is usually 20 to 1:

$$\text{Resistance Drop (AC)} = \frac{0.2801 \times 200}{20} = 2.801 \text{ volts}$$

$$\text{Reactance Drop (AC)} = \frac{0.4339 \times 200}{20} = 4.339 \text{ volts}$$

$$\text{Impedance Drop (AC)} = \frac{0.5190 \times 200}{20} = 5.190 \text{ volts}$$

The compensator on this feeder, therefore, is set as nearly to the values above as is possible.


AB=1,000 ft. of 250,000 circ. mil cable
Voltage regulators
BC=3,000 ft. of 2/0 wire
C
Load center peak current=200 amp.
B
A
4,000 volt bus

*A specific case involving single feeder is calculated*

In the papers to follow the author will take up the computations for single-loop, double-loop and triple-loop circuits. In the last paper of the series various types of compensators and methods of applying definite settings to each will be described.

# Low-Cost Rural Construction

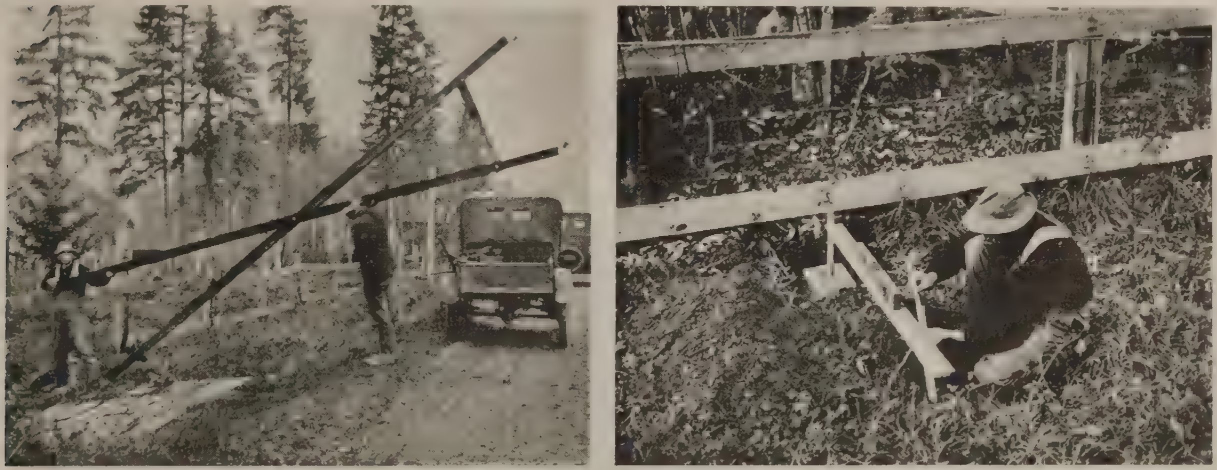
### Lightweight X-frames, utilized to provide service at minimum cost, prove practical. Single-phase rural lines constructed for $333 per mile

By George W. Kable
*Agricultural Engineer*

A FLEXIBLE, scissors-like frame made of 2x4-in. timbers and hinged at the base to 1-in. iron pipes set in concrete blocks replaces the customary pole in an unusual type of 2,200-volt rural line construction used by the Young Electric Company near Sherwood, Ore. This type of support makes possible the construction of a single-phase rural line at a cost of $333 per mile. It was evolved by D. S. Young five or six years ago and is not entirely an untried experiment, one such line having been in service for more than four years. Some of the advantages claimed for the line are: 50 per cent reduction in farm line construction and maintenance cost; a safe line complying with regulations; no pole climbing; a two-man line crew at farm wages; no rotting off of poles, and no guy wires crossing roads.

The owner and manager of the Young Electric Company is a farmer. Six years ago he purchased about 6 miles of rural distribution line having a bad financial reputation and threatened with paralysis. In endeavoring to maintain and extend his lines and give reasonably good service, the owner was forced to measures of economy that have stimulated originality. For instance, he reads meters once every three months, presents the bill on the spot, discusses any difficulties or contemplated equipment the user may have in mind, and in 90 per cent of the cases collects the bill. The meter book, including detachable bill form, comprises the entire bookkeeping system. These economy measures, including the flexible frame line construction, have resulted in reductions in first cost and overhead sufficient to permit service in territory which under a more costly system would probably be without electricity for many years.

All of the distribution lines of the company are single-phase, 2,200 volts. The system at present consists of two separate units embracing 8 miles of pole line and 11½ miles of flexible frame construction. Power is purchased from two different companies and distributed to a total of 90 customers, mostly farmers. Sixty per cent of the load is lighting.

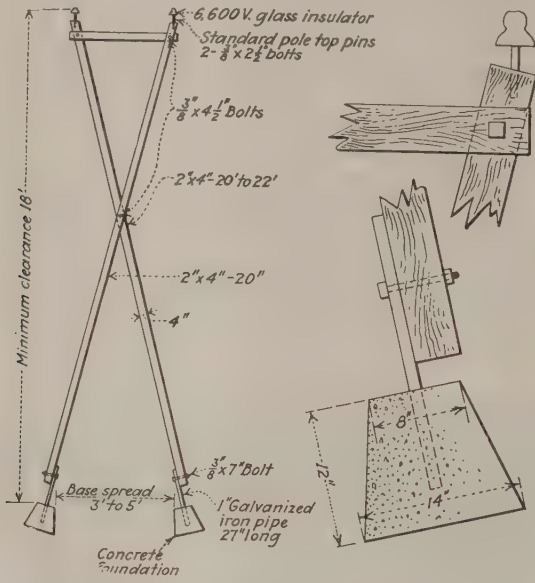


*Erecting one of the X-frames after wires are tied in and installing the pre-cast concrete footings*

The distinguishing feature of the flexible line is the frame. Intermediate frames are made up of two 2x4's, and anchor frames of 3x4's bolted together near their centers with ⅜-in. bolts. A cross-member is bolted near the top as shown in the accompanying illustrations. The frame is bolted to two 1-in. iron pipes embedded in pre-cast pyramidal concrete blocks. Anchor frames are placed at intervals of about one-quarter mile, at road or line crossings, where transformers are hung and at points where the line changes direction. Frames are anchored to concrete dead-men through anchor rods, strain insulators and ¼-in. guy cable attached to the frame cross-member near the top.

There are no lateral guys on the frames. On slight curves the frames are stiffened by vertical tension members which carry the side pull to the foundation blocks. On sharper curves a third anchor block is used, causing the resultant forces to still fall within the base of the frame and make it self-supporting. Where service leads run from a frame, the transformer is hung to one side of the center of the cross-member to balance the pull of the service wires. No attempt is made to place anchor blocks on the same level. On hillsides one leg of the frame may be 6 or 8 ft. longer than the other.

In erecting the line the cross-members are bolted together on the ground, the wires tied in and the frame raised in the manner shown in one of the accompanying illustrations. In this way two men will erect one-half mile of straight line completely in one day after the precast concrete base blocks have been placed and the material delivered to the job. Costs for building 9 miles of line in 1925 are given in the accompanying table.



*Dimensional details of X-frames for supporting 2,200-volt rural line*

COST DATA FOR X-FRAME RURAL LINE CONSTRUCTION

| | |
|---|---|
| Anchor rods | $51.50 |
| Bolts | 68.08 |
| Cable | 29.85 |
| Cement | 119.00 |
| Copper (Nos. 6, 8 and 10) | 887.24 |
| Cutouts | 20.00 |
| Clevises | 22.20 |
| Gravel and sand at $2.75 per yd | 75.00 |
| Guy clamps | 41.26 |
| Glass insulators | 50.52 |
| Eye bolts | 17.15 |
| Strain insulators | 53.70 |
| Lumber at $18, $20 and $22 per thousand | 262.45 |
| Pole top pins | 120.50 |
| Anchor pipe | 169.16 |
| Washers | 16.74 |
| Reinforcing for anchor blocks | 10.00 |
| Total | $2,014.35 |
| Plus 10 per cent | 201.43 |
| Total material cost | $2,215.78 |
| Total labor cost | $713.30 |
| (Including clearing right-of-way, assembling materials, cement work at 60 cents per hour, digging anchor holes at 20 cents each, and two men erecting line at $5 and $4 per day) | |
| Insurance | $39.81 |
| Freight | 35.00 |
| Total cost of line | $3,003.89 |
| **Total cost per mile of line** | 333.76 |
| **Material cost per mile** | 246.20 |
| **Labor, insurance, freight, etc., per mile** | 87.56 |
| Following are total costs for individual frames erected in place and including all labor and material except that for clearing right-of-way and for copper: | |
| Intermediate frames | $6.00 |
| Light turn and service drop frames | 6.90 |
| Heavy turn frames | 9.00 |
| Transformer and intermediate anchored frames | 10.05 |
| Dead-end frames | 12.45 |
| Transformer and heavy turn frames | 12.75 |

Mr. Young has not constructed his flexible line without criticism. At first thought the 2x4-in. frames seem dangerously flimsy and the hinged base a travesty on the creosoted pole. Such a radical change must also offend the eye of many who have grown up with pole lines. The seeming unsightliness of the frame line diminishes, however, as the novelty wears off.

The Oregon Public Service Commission, while not having passed formally upon this type of construction, has the following to say regarding it: "This type of construction was called to our attention previously through an informal complaint, and a field inspection was made by our engineering department. . . . Sections of line using this class of construction were found to be giving satisfactory service after many years. Will further advise that additional study of this matter indicates that in so far as construction requirements prescribed by this commission and contained in the Na-

*Inexpensive rural line construction used in a farming section*

*Transformer structure with offset to balance service wire pull*

*Self-supporting angle structure using simplified design* tional Safety Code are concerned, this type of supporting structure meets all rules and regulations prescribed for rural line construction."

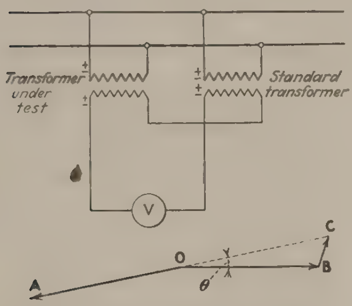
Obviously, the greatest use which the frame construction might be expected to serve would be for the secondary distribution lines and perhaps for private farm extensions where low first cost is desirable and unskilled workmen are available. At least it offers a possibility worth considering in rural line extension programs.

## Measuring Instrument Transformer Characteristics

By Carl W. Evans
*University Station, Tex.*

IN THE cases of utilities in which the number of necessary instrument transformer tests is small it is not generally economical to purchase elaborate testing equipments for this work. To such companies the following method of checking the ratio and phase-angle characteristics of current and potential transformers will be of interest inasmuch as the only special equipment required consists of standard potential and current transformers and low-reading voltmeter and ammeter.

For testing a potential transformer the connection shown in the accompanying illustration is used. It will be observed that the voltage of one transformer is in opposition to the voltage of the other. The voltmeter, $V$, indicates the vectorial difference between the two voltages. Because all alternating - current voltmeters are of the electro-dynamometer type, the voltmeter will not indicate which of the two is the higher voltage, but this can be determined by measuring the voltage of each separately. If the voltage of each transformer and the voltage indicated by the voltmeter are plotted to scale vectorially, the result will be a closed triangle, as shown. The vector $OA$ is the voltage of the standard transformer; the vector $OB$ is the voltage of the unknown transformer, and $CB$ is the vectorial difference of the two, which is the voltage indicated by the voltmeter. From this information it is possible to determine the characteristics of the transformer under test. If $R_s$ is the ratio of the standard transformer, then the ratio of the transformer under test is given by the formula:



*Simple ratio and phase-angle test for instrument transformers*

$$R_x - R_s \frac{OB}{OA}$$

where $OB$ and $OA$ are the voltages, respectively, of the unknown and the standard transformer secondaries.

The phase angle of the transformer under test, as compared to the standard, is the angle between $OB$ and $OA$ reversed; that is, between $OB$ and $OC$. Since the values of $OA$, $OB$, $OC$, and $BC$ are all known, the angle may be determined very easily from the trigonometric formula:

$$\phi = \cos^{-1} \frac{OB^2 + OC^2 - CB^2}{2 \times OB \times OC}$$

In the testing of current transformers the procedure is exactly the same, the current transformer under test and the standard transformer, excited from the same primary source, being connected in such a manner that their secondary currents are in opposition and the resultant current of the two being measured by a low-reading ammeter. The same formula may be used, the only difference being that the values substituted are currents instead of voltages.

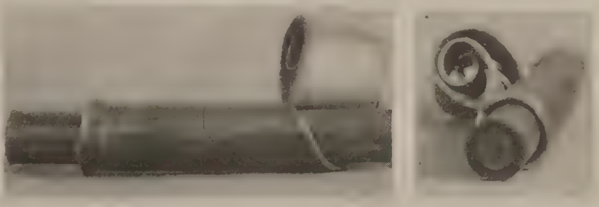
The phase angle determined by this method is the angle between the secondary voltages of the standard and the unknown transformer. It is impossible by this method to determine whether the voltage of the transformer under test lags or leads the voltage of the standard transformer, hence it is not possible to correct the values found with the correction curves usually furnished with the standard transformers. When the characteristics of the standards are very nearly ideal, as they usually are, the error introduced by not correcting the readings with the correction curves is very slight. Only where a very high degree of accuracy is required, as in laboratory measurements, will the accuracy, obtained by the expensive equipment available, justify the additional investment.

## Proper Cutting of Lead Sheath Improves Cable Splicing

By John A. McHugh
*Assistant Engineer New York Edison Company*

IT HAS been found that in the preparation of paper-insulated, lead-covered cable for splicing two troubles arise which can easily be prevented: First, the lead is not always uniformly belled around the cable; second, the outer papers of the mill insulation are sometimes damaged, either in making the usual lateral cut through the sheath or in attempting to bell out the lead.

Both of these difficulties can be overcome by following an improved procedure for the preparation of the cable ends. A sharp knife or specially designed tool is used to scribe around the cable at the location where the lead is to be removed. A helix is then scribed from this point to the end of the cable. The lead is pierced at the outer end of the helix and grasped with pliers. By rotating the pliers in a manner similar to the operation of a can opener the lead is easily removed, as is shown in the accompanying illustrations. The radial tension applied to the lead in the operation produces an appreciable belling-out of the lead, sufficient to relieve electrostatic stresses in cables for moderate transmission voltages and to permit the easy introduction of metal foil for reducing the stresses in higher voltage cables. This feature can be noted in the illustration. It may also be observed that the marker tape under the cable sheath is not disturbed.



*Helical cutting back bells cable and protects insulation*

# Transmission by Cables

## High-voltage cables considered as commercial possibilities in power transmission. Costs and performances compared

By Dr. Richard Apt
*Director V. L. G. Cable Company, Berlin*

*That aviation will necessitate some change in American high-tension transmission practice is the opinion of Dr. Richard Apt, director of the V. L. G. Cable Company of Berlin, who is at present visiting this country, to study our cable system.*

*When asked by the* Electrical World *to comment on the outlook for high-tension cables suitable for American electric light and power conditions Dr. Apt made the following remarks:*

JOINTLY with friends in the German cable industry, Messrs. E. Hartmann, Duisburg; A. Geissler, Mannheim, and R. Halbreiter, Rheydt, I came to America for the purpose of personally familiarizing myself with the status of American cable technology and discussing with American engineers the problems which exist in cable technology and power transmission by cables.

Overhead circuits are exposed to a great extent to the influence of the weather, particularly storms and rain. It is true that it has been possible greatly to increase the mechanical and electrical strength of the insulators; nevertheless, to the open-air circuit there always adheres the disadvantage that it is subject to all influences, even to intentional interference. Industries in which continuous power supply is a prerequisite may therefore hesitate to permit their plants to be fed by an overhead feeder. To this must be added that it is practically impossible to run overhead circuits of high voltage in cities.

For exactly the same reason that satisfactory telephone communication only became possible when the telephone wires were in cables, development of high-voltage power transmission will also aim at underground distribution. An important factor leading to such a decision is the development of aviation. There can be no doubt that aviation will in a few years increase many times beyond its present status and that regular air lines, similar to our present railways, will run through the country. In Germany regular aviation service has already reached noteworthy proportions, and the development in this country, with its disproportionately greater distances, will undoubtedly be similar to that abroad. For aviation, however, high-voltage lines represent a great danger, and there will hardly be any means, for instance in the event of sudden fog, to render the existence of overhead lines noticeable to the flier.

The cable industry of the old world and the new has, on the strength of these considerations, most zealously promoted in the last few years investigations in high-voltage cable technology and in the manufacture of the cables themselves. Extremely careful examination and testing of the material, particularly of the paper and the impregnating substances, has led to great improvements and has rendered it possible materially to increase the specific disruptive strength of the insulation. The realization that punctures in cables are as a rule attributable to gas inclusions has led to special precautions in the manufacture of the cable and of the saturating substances in order to prevent the formation of gas bubbles within the active insulating material.

Hand in hand with the perfection of the manufacture went scientific researches. Cable works of even moderate size today possess laboratories equipped with transformers for voltages of from 500,000 to 600,000, so that all problems of high-voltage cable technology can be looked into and investigated.

An important step in advance was the building up of the so-called ionizationless cable by wrapping around the insulation a thin metal band or metalized paper according to Höchstätter. The idea that it is of primary importance to keep the insulating cover impregnated with oil has led to the interesting development of the Pirelli cable, in which a hollow conductor is kept constantly under oil pressure, and the New York Edison Company and the Commonwealth Edison Company of Chicago have installations of such cables rated at 132,000 volts.

In Germany cables for voltages of 100,000 have likewise been installed, and these with those in America leave no doubt, so far as the experts in problems of cable technology are concerned, that it is safe to carry out power transmissions for interconnected systems at 100 kv. with cables, and even an increase in the voltage to 200 kv. will hardly present insurmountable obstacles.

For these high voltages, of course, only single-conductor cables can be considered, even for alternating-current systems. Three-conductor cables would be too heavy. Moreover, the manufacture of the joints presents substantially greater difficulties than do joints for single-conductor cables. Moreover, the losses in the lead jacket of the single-conductor cables is not serious, especially if large quantities of energy are transmitted. The capacity of the cable network may also serve to improve the load factor. When the leading current becomes too great a compensation can be carried out by means of reactors.

### Cost No Handicap

Now, as regards the question of cost, undoubtedly a long-distance circuit made of cables will always cost more than an overhead line of the same voltage. It must be considered, however, that cables can be used with much larger cross-section for the single conductor than is possible with overhead lines, so that it will not always be necessary to raise the voltage in cables as high as in overhead circuits. It is evident, however, that the expenditure for the maintenance of the cable network and the supervising service will be much smaller than with an exposed overhead circuit. Likewise, the life of the cables, according to the experiences so far gathered, is much longer than that of overhead lines where it is necessary to replace the insulators after a lapse of years. If, therefore, the annual cost of the overhead line is compared with that of cables for each kilowatt transmitted, figures will be arrived at in many instances which render the use of cables thoroughly economical for large energy transmissions with high voltages.

My conviction, therefore, is that in the technology of the transmission of power the same development will take place as in telephony. It is true great problems have still to be solved, and to that end the experts in cable research in the various countries should co-operate with each other through a joint interchange of experiences and experimental results. Perhaps it would be a worth-while move if within the International Electrotechnical Commission a special committee were formed for studying these questions.

# Manufacturers Talk of Price Cutting

A group of selected letters from executives in different fields of electrical manufacture discussing who is to blame for the trouble in this buyer's market and commenting on the possibilities for reform

THE series of articles, editorials and letters from our readers which have been published in these pages since the appearance on Feb. 18 of the article by Earl Whitehorne entitled "Who Pays the Cost of Price Cutting?" have brought forth many letters of comment and opinion. Many manufacturers have related in detail experiences with buyers in which undoubted pressure has been applied to incite the salesmen to a competition in paring profits. They have been depressing both in number and in similarity because they evidence how far has gone this epidemic of profiteering by purchasers, through the gentle art of pitting one salesman against the other, taking advantage of the present mad competitive struggle for volume. Many, however, have testified to the price cowardice of sellers as the chief course of demoralization in the market place.

Also, many constructive ideas have been advanced. Some purchasing agents have stoutly contested the innocence of the buyer. Others have frankly argued for a broader recognition of the economics of purchasing and more ethical practices, as in the case of the article by the president of the National Association of Purchasing Agents printed in the ELECTRICAL WORLD on April 21. The following series of extracts from letters from the executives of manufacturing companies have been selected from the pile to present a cross-section of the sellers' viewpoint, as it has been reflected by readers of these articles:

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## Destroying Price Levels for Allied Lines

*By a Manufacturer of Control Apparatus*

The present price-cutting situation in the electrical industry is serious. Unfortunately it appears that a good percentage of the manufacturers in the electrical industry, through necessity for more business, have more or less lost sight of their backbone. The average buyer, not taking into consideration the eventual effect, works on the manufacturer's pliant backbone and molds the same to his own desire. The result is an additional cut in price. In my estimation the manufacturer does not deserve any sympathy, but at the same time the situation is decidedly unfortunate.

A contributing factor to the bad price situation also lies in the lack of loyalty among the allied industries. The control manufacturer at the present time is up against a very serious situation imposed upon him by the motor manufacturer. While the motor manufacturer may maintain price on his motors, because of the longer discount which he is receiving from the control manufacturer, he has quite a bit of leeway in discount to play with, and does not hesitate at all to turn a good portion of this discount over to the buyer. Time and again the customer can buy our control cheaper through a motor manufacturer than he can buy from us direct and, this being the case, it naturally gives the control buyer a considerable leverage with which to lower the control manufacturer's price. We have known of some instances where the motor manufacturer was so hungry for business, or so anxious to do the buyer a favor, that he included the control apparatus in his motor bid at the exact cost of the control equipment to the motor manufacturer. Nor will the motor manufacturer listen to reason when this very bad situation is called to his attention, and it is his argument that since he buys the control apparatus, and pays for it, it is his privilege to do with it whatever he wants to. Technically he is correct, but practically he is making life miserable for the control manufacturer.

## One-Price Policy a Cure

*By a Bearing Manufacturer*

In my opinion the only practical solution is to encourage both purchasing agent and seller to submit closed quotations which shall not be subject to further change. If the manufacturer would stick by his first price the purchasing agent would be unable to gain anything by quasi-crooked purchasing methods. If the purchasing agent would at the outset state that he would not lend himself to such practices and insist upon the best price once and for all, then many of the complaints of which you very properly write would be avoided.

## Price Squeezing Impairing Quality

*By a High-Tension Equipment Manufacturer*

At the present time the situation is very bad from the viewpoint of the manufacturer, due to the fact that it is a buyer's market. The buyer is undoubtedly convinced of this fact and is taking undue advantage of this condition by telling the manufacturer just how much he will pay for the manufacturer's product. This condition is certainly a most unhealthy one because in the end it must result in disaster to the manufacturer who allows the purchaser to name his price for the equipment to be bought.

In consequence of this unfortunate situation manufacturers of all types of equipment of a certainty must be offering material of an inferior quality to that purchased during 1925-26, and in all probability, unless conditions change in 1928, this practice will be continued. In other words, this ceaseless sparring between the purchaser and the manufacturer is doing a lot of harm to both parties and in the end is going to result in more operating troubles, less responsibility on the part of the manufacturer and, what is worse, a decided inclination on the part of the manufacturer to slip out of his responsibilities whenever possible, due to the natural feeling that he was compelled to take the order at an abnormally low figure and he could not, of course, give the same service as would be possible if he secured normal profits.

## Temptation to Sell Low to Carry Overhead

*By a Pole Manufacturer*

There can be no question but what the interests of a buyer and a seller are exactly mutual. So far it has seemed impossible to find this common ground on which to meet. Nearly all buyers will declare themselves favorable to paying a price which includes a fair margin of profit, but their idea of arriving at that price seems to be to take the lowest bid.

We have noticed a decided tendency on the part of a great many purchasing agents to avoid making any investigation of producing, handling and grading methods and suspect very strongly that the reason for this is that they do not want to be forced to recognize that the commodity of one supplier may be superior to that of another for fear that it might handicap them in trying to hammer the price of the superior article down to the quotation made on the inferior.

The temptation to cut a price is, of course, always present. Volume has such a tremendous control of costs. When volume is slightly below the standard, then any orders secured at a price above primary cost help pay expense. It is very easy for one to argue himself into a position of preferring to have an order which helps pay expense, even though it does not pay its proportionate cost, than to refuse the order and not have that slight assistance toward operating cost and expense.

So far as I can see about the only thing to do is to continue to lay these problems before the buying public, hoping that in time it will have a favorable effect on those who feel that price is the only measure of value.

## Price Hammering on Special Jobs

*By a Power Equipment Manufacturer*

Realizing that it is hopeless to get the regular price after a price has once been cut on standard equipment, our policy is very fixed and definite; that is—maintain standard prices on standard equipment, and most of our responsible competitors do the same. Let me say that our standard prices show a very small margin between cost and selling price. What is recognized as sound business policy might recommend a greater margin, and this would indicate that an error was made in establishing the standard prices.

The jobs involving special equipment are usually large jobs. This prompts the purchaser to call in a number of manufacturers. They do not know what each one is quoting on, which creates an ideal situation for the purchasing agent, and he has not failed to take advantage of it. This hammering down in price has been gradual, but the seller is responsible for carrying it to its present extreme. If every manufacturer would quote prices that include a profit that he knows is necessary for a healthy condition of his business and refuse to take orders that only help to pay the factory overhead expense the business would divide itself among those who contribute most to their particular division of the industry or in proportion to the extent to which they contribute. This, I believe, will be brought about when both buyer and seller understand the present situation and see where it is leading.

## Most Purchasing Agents Absolutely Square

*By a Lighting Equipment Manufacturer*

Our experience has been that not much of the temptation for price cutting is due to any desire of the purchasing agents of large buyers to keep us from a legitimate profit. The purchasing agent is more concerned in a fair price, coupled with quality of goods and prompt deliveries.

We find that the purchasing agents of large buyers are absolutely "square" and willing to see us make a legitimate profit. They study their jobs and know what is a fair price and investigate the ability of their source of supply to serve promptly. There are still a few of the "old school" who feel a day's work well done only when they have lied to a bunch of salesmen, thereby keeping their companies from earning a legitimate profit, but that type is fast dying out or being placed in other positions where they are not so harmful to their employers. In the selling field the word soon gets around of such unethical purchasing agents and many good stories could be told of how they were cured.

Most of the trouble we have with price cutting in our own line is among the manufacturers' and distributors' salesmen. This practice is more and more becoming a thing of the past and will only be cured when all of us finally sell every one of our salesmen and distributors' salesmen on the fallacy of such a thing.

## Lump Sum Bid Unethical

*By an Instrument Manufacturer*

For many years it has been my opinion that one of the greatest impediments to the general building up of the industry has been the policy of the public utilities to resort to the "lump sum bid."

A large part of our sales activity has been directed toward breaking down this unfair method of purchasing, and I am glad to say that we have had considerable success. In my opinion it is a plan that cannot successfully withstand publicity, not only because of the ethics implied but because the policy tends to throttle development by stifling incentive on the part of the so-called independent manufacturers to develop and continually better devices they now manufacture. I think it is demonstrable that most of the development to which I refer has been contributed by aggressive independent manufacturers who are specialists operating under healthy and normal competitive conditions.

## Sliding Scale and Reciprocity

*By a Controller Manufacturer*

We suffer from the evil that you refer to, although perhaps to a lesser degree than the majority of electrical manufacturers, as we sell on a rigid policy of adhering, without deviation, to our established prices.

There are two other phases of merchandising electrical apparatus that have crept in during the last few years that I feel are detrimental to the business. One is the practice of establishing a sliding scale of discounts, a system of giving large purchasers preferential discounts on account of the potential buying power of these big customers, and additional quantity discounts worked out on a sliding scale, paid in the form of rebates at the end of the year. Any manufacturer, of course, expects to make a certain over-all profit on his products, and in order to give big discounts his list prices must be based accordingly. The customer of small purchasing power consequently pays an excessive price for the apparatus that he buys and the additional profit made on these sales helps the large and powerful purchaser to obtain his goods at a discount.

The other condition that we refer to is the use of reciprocity to coerce purchasers to buy electrical equipment. This is a method of commercial warfare against which the small manufacturer has practically no defense, and the ultimate outcome, if the buyers of electrical equipment do not offer strenuous resistance, would be to eliminate the small electrical manufacturer who does not have big tonnages of steel and other commodities to place. The business of this company has suffered to a considerable extent from the reciprocity pressure, as a number of good-sized orders which were about to be placed with us have been diverted to the large manufacturers due to threats on their part to cease buying from the customer unless the orders were placed with them.

## Too Much Salesmen's Gossip

*By a Pole Line Hardware Manufacturer*

Most manufacturers are hard losers and are more or less jealous of their competitors and will take the business at less than their cost merely to keep their competitor from receiving it.

We do not believe that the manufacturers who are selling a competitive line are close enough that they can sit down and talk over their difficulties without the conversation being broadcast.

The manufacturer pays too much attention to salesmen's gossip about his competitor cutting prices, but if the competitive manufacturers were so lined up that they could discuss costs with each other, I believe a lot of the trouble would be eliminated.

## Untrained Salesmen a Weakness

*By a Manufacturer of Fans and Blowers*

The tendency today in our own industry is to have untrained men and place them out in the field. The result is their lack of real engineering ability, their lack of ingenuity in meeting the unusual situation, causing them to waver in their determination to sell at the right price, and consequently they phone the factory for a reduction in price, making their case as strong as possible with the factory that the competitors are cutting prices. Invariably, from investigations which the writer has made, the salesman either deliberately misrepresented conditions or he merely took the word of the buyer.

We feel that not much progress will be made until manufacturers take the pains and effort to train their men thoroughly so that when the buyer reports that the price is high they are in a position to analyze why their price is high and incidentally show the buyer that they should receive more money because they are furnishing more and better goods, or that they be permitted to omit items which will bring their price on the same basis. Until the manufacturers develop that critical attitude of mind in their salesmen very little progress will be made in any field where engineering is as much a part of the sale as the product.

## Fair Play Pays the Purchaser

*By a Line Equipment Manufacturer*

I have learned both directly and indirectly that when the purchasing department plays absolutely square with any manufacturer the buyer's interests, in the end, will be better taken care of than where the purchasing department resorts to the practice of always taking unfair advantage of the seller.

For example, a certain commodity has been sold for several months at a uniform price, but owing to reduction in price of raw material (and after the manufacturers' present stock is exhausted) this commodity will take a lower price. If, in the meantime, the manufacturer is asked for a quotation on this product by the purchasing department for a customer and this customer has always played fair with the manufacturer he will be "tipped off" that it will be policy for him to delay his purchase on account of reduction in price shortly to take effect. On the other hand, if the purchasing department has used sharp tactics in its buying, to the detriment of the manufacturer, it will be only too glad to "load him up" at the present high figure.

There is no question but that both parties are in a measure to blame, and I have contended all along that it is absolutely wrong for the purchasing department of the buyer to dictate to the manufacturer or seller at what price his goods should be sold. Unfortunately, the manufacturers are handicapped by present laws, while the purchasing agents can have as many conferences and discuss the buying end, with the sole idea of bringing down prices and playing one manufacturer against the other to accomplish this end, but in no way incriminating themselves.

## Product Prestige Proof Against Price

*By an Insulator Manufacturer*

Graybeards do not endeavor to use reason with the boy in love nor with the man at war—both actuated so highly by emotion or desperation—nor is one to be censured, under the modern code, if he burns up the parlor furniture to keep the kids warm if no other fuel is available. Thus, with tonnage (buying) off, say, 20 per cent and the Overhead boys appearing regularly at table for every meal, what have you except cut prices?

Tell me not in idle patter that business is not emotional largely—especially big business—when an Insull, a Morgan, a Mellon, continue domination because "I like the game." Did not Napoleon and does not Mussolini also like the same game?

If this thesis rings reasonably true, business is not different or better; it is simply surrounded with different trappings—check protectors, efficiency experts, units of millions instead of thousands, and, as of yore, the purchasing agent is simply a salesman on the other side of the fence or a salesman a purchasing agent with change of residence and both aping the Dutch and Indians on the Manhattan purchase, where both thought they had, and wondered if they had, put over a good deal.

Remember, the purchasing agent, in a seller's market, doesn't dare ask, "Is this your best price?"—the sales gent insults easily. So, in a buyer's market, the purchasing agent dares and does ask, and by the time this reaches the sales end it is amplified orally into a demand and visually into an ogre across the desk.

Constructively, I will say that I don't blame either side; that the most salutary movement among the large central-station buyers is the selection of engineers of purchase instead of purchasing machines (clerks). To an engineering mind, one need not get blue in the face trying to explain that the reason "Your price is high" on 60,000 bolts (insulators?) is that there are 50 different kinds of steel and methods of making bolts and a nickel steel heat-treated bolt put in bed with an O.H. mal-born bolt is an insult to bolts in general—and even hard on the nuts!

Finally, you may quietly confide to your friends that all this dilemma may be avoided by making and selling a product so blessed good that buying and using it is a pleasure not to be contaminated by "an extra 10 and two 5's."

Maxfield Parrish does it; Franklin Booth does it; Teague does it; Johannsen does it! Tarnation to the school or system that tends to squeeze all the poetry out of business as the present trend and régime does, with big syndicate headquarters on Broadway or LaSalle Street and robots screwing up nuts or turning handles in Texas, Oklahoma and Vermont!

## A General Code of Ethics Needed

*By a Wire and Cable Manufacturer*

What this industry needs is a code of business ethics—a list of rules applying to all branches of the industry in their relation to each other—a code drawn up by representatives of all branches and subscribed to by all of the members of all branches.

Salesmen and purchasing agents should have copies of this code so that when a salesmen calls on a P. A. he can ask and expect to receive from the P. A. treatment exactly in accordance with the rules and regulations of the code. And, conversely, the P. A. can refuse the salesman certain information by mentioning the fact that the giving out of such information would be at variance with the code.

In other words, we would all know how to conduct ourselves without fear of doing what is really right, as we have now.

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# Galvanizing with Electric Heat at Gary

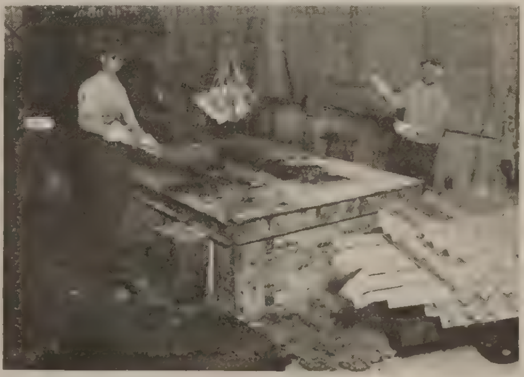
By Eugene A. Longgood

*Industrial Power Sales Engineer*
*Northern Indiana Public Service Company, Hammond, Ind.*

What is believed to be the largest electrically heated galvanizing tank in the world is installed in the Gary plant of the Walter Bates Steel Corporation, which fabricates steel for transmission line towers, substation structures, floor gratings and various other purposes. The tank is 30.5 ft. long, 48 in. deep and 22 in. wide and holds approximately 45 tons of spelter. Around it was built a furnace having three 135-kw. heating zones of equal length. Each zone contains three horizontal rows of heating elements, one above the other, on both sides of the kettle. The heating element—a continuous ribbon—is laced over the insulating supports, which form an integral part of the brick lining. Each zone is on one phase of a three-phase transformer bank and is controlled through a high-low switch. The temperature is automatically held at 820 deg. F. by pyrometers. The General Electric Company designed the furnace and furnished the electrical equipment.

The installation has a rated capacity of four tons per hour and a guaranteed consumption of 210 kw.-hr. per hour when galvanizing one ton per hour, 275 kw.-hr. per hour at two tons per hour, 345 kw.-hr. per hour at three tons per hour and 405 kw.-hr. per hour at four tons per hour. The standby losses were guaranteed not to exceed 90 kw.-hr. per hour when the kettle is covered and 140 kw.-hr. per hour when it is uncovered. The performance is about 15 per cent better than guaranteed. The minimum cost for electricity, which was obtained at the maximum production rate, was $1.50 per ton of steel galvanized; the average cost is $2. These figures are inclusive of energy used for maintaining the spelter temperature throughout the 24 hours of the day.

Power is supplied by the Northern Indiana Public Service Company under its demand schedule, with an off-peak clause. As the off-peak clause allows the use of 20 per cent of maximum demand during the peak, the fabricating part of the plant can work its regular hours.



*Electrically heated galvanizing kettle in plant of Walter Bates Steel Corporation*

Practically the entire output of this plant is galvanized and since this kettle was put in operation on May 10, 1927, production has run as high as 50 tons in twelve hours.

Automatic temperature control assures that the zinc is applied within the ideal heat range, resulting in a uniformity of coat that is highly desirable. This also saves spelter. Longer tank life is obtained because of the absence of oxidizing flames and due to the fact that the average temperature gradient in the wall of the pot is from 1,100 deg. to 820 deg. with electric heat, whereas it is about 1,600 deg. to 820 deg. with flame heating. The quality of the product and the cost per ton have been so satisfactory that this company has planned a second kettle, of double the width and longer, to take care of the increased tonnage requirements of its fabricated tower and pole business.

## Extending Investment List Strengthens the Markets

### Effect of recent New York legislation already evident in behavior of power and light securities

THAT recent legislation in New York State which widens the market for public utility securities has been effective and is likely to be still more so is indicated by the behavior of the security markets for these issues subsequent to the passing of the new legislation. Although not specifically designated, an examination of the securities coming within the provisions of the act indicates that a number of preferred issues and debentures of electric power and light companies, both operating and holding companies, have been legalized. Naturally this will influence the yield rate at which securities coming under the new legislation will be issued.

Much has been said of the rapid expansion in available investment funds of financial institutions. The number of individual trusts also has grown rapidly, and the funds available for investment in the assets of insurance companies have grown by leaps and bounds. As a consequence, there has been no little agitation for a widening of the legal investment lists of these institutions. Among the laws recently enacted relating to investments in New York savings banks one act makes provision that a savings bank under certain stipulated conditions may invest its assets in first or refunding mortgage bonds of designated electric, gas and telephone companies within the United States. It is added that a savings bank may not invest more than 10 per cent of its assets in electric or gas company bonds, or more than 10 per cent in telephone bonds.

### Definite Requirements Laid Down

While the new legislation does not make any blanket provision for investing in the securities of all power and light companies, it lays down definite stipulations with regard thereto. The corporation, for example, must have been in existence, as a rule, without default for eight years immediately preceding the investment; it must have outstanding stock equal to at least two-thirds of the bonded debt; it must have average yearly earnings for the preceding five years of at least twice average annual interest charges on its bonded debt during the period; it must have had net earnings of at least twice interest charges for one full year preceding the investment. The average gross operating revenue, moreover, must have been at least $1,000,000 a year for the five years preceding investment in the case of electric power and light companies. During each of these five years dividends of 4 per cent upon the minimum capital stock must have been earned or paid. With regard to the bonds themselves in the case of power and light companies, they must be part of an issue of at least $1,000,000 and the aggregate amount of bonds issued should not exceed 60 per cent of the physical value of the property.

New legislation relating to the investment of life insurance companies makes provision that domestic life companies may invest in the bonds, notes, debentures and preferred or guaranteed stock of any domestic corporation which has earned at least 4 per cent dividend on its capital stock during each of five years preceding. No insurance company, however, may invest more than 2 per cent of its assets in such securities or purchase more than 10 per cent of preferred stock of any one company.

The list of power and light company bonds coming under this new legislation relating to savings bank and trust investment has already been published in the ELECTRICAL WORLD, issue of April 21, page 838. While the new legislation deals with only one state, it involves a huge amount of investment funds, and it may be assumed that the step taken is just one step in the direction indicated.

## Selling Organization and Procedure at Topeka, Kan.

By W. A. Gregory

*Commercial Manager Kansas Power & Light Company, Topeka, Kan.*

TO INCREASE energy consumption by merchandising revenue-producing appliances in the most effective and economical manner the sales department of the Kansas Power & Light Company has divided the city of Topeka, with a population of about 56,000, into eight districts and assigned a salesman to each. Each salesman receives credit for all sales in his territory, whether they are made by himself or not. Compensation is at the rate of $75 per month plus 8 per cent on all regular sales. In "employee sales" campaigns the commission may be more or less than 8 per cent. Salesmen furnish and operate their own cars.

CREDIT POINTS DETERMINE MONTHLY AWARDS TO APPLIANCE SALESMEN

| **Sales** | Points |
|---|---|
| Credits—Cash sales (per $100) | 10 |
| Short-term contract (each month off maximum terms) | 1 |
| Down payment (each 50 per cent increase of minimum down payment) | 1 |
| Largest gross sales | 10 |
| Quota attained | 5 |
| Debits—Reverts (each $10) | 1 |
| **Conduct** | |
| Credits—Best general conduct for month (this to be judged by district manager and commercial manager and based on all activities of salesmen) | 6 |
| Debits—Absence from sales meetings (no excuses accepted) | 2 |
| Tardy to sales meetings (no excuses accepted) | 1 |
| Smoking in salesroom (during business hours) | 1 |
| Personal appearance (if it becomes necessary to mention same) | 1 |

Short meetings, which all salesmen, floor clerks and supervisors are required to attend, are held each morning at 8 o'clock for the purpose of imparting information, checking sales reports and giving special instructions. On Monday evening of each week there is a meeting attended by the utility service men and sales force to enable manufacturers' representatives to give them instructions and tips on their particular products. To every fourth one of these meetings the wives of the employees are invited and the affair becomes a sort of family party, with refreshments and some entertainment feature. Each month the commercial manager writes personal letters to the wives of the salesmen, telling them what appliances are being pushed, the records their husbands are making and explaining their work. These letters have been welcomed by the salesmen because they simplify the problem of fitting evening calls into their domestic relations. It has also been demonstrated that a wife's acquaintance with her husband's work is beneficial to all concerned.

Except for large appliances, salesmen make deliveries. Demonstrations of devices are made by the salesmen on their personal responsibility, the appliances being charged to them during the period of the demonstration. It is also the duty of the salesmen to see that devices returned from demonstration are put into clean and salable condition. List prices are maintained. Terms of payment vary with different types of merchandise, but the carrying charge is fixed at 6 per cent. All credit arrangements made by salesmen are subject to approval by the credit manager. Salesmen are empowered to make trade-in allowances on their own responsibility. Trade-ins are charged to a salesman's account at the price he allowed plus any service charges to put the merchandise in salable condition. Trade-ins are held in company stock and exposed for sale for 60 days. At the end of this period a trade-in is billed to the responsible salesman and he must remove it from stock within fifteen days. Commissions are not allowed on resale of trade-ins, but the difference between the resale price and the trade-in allowance, plus service charges, is paid.

To add incentive to the selling job a contest is conducted in which prizes of $25, $15 and $10 are awarded each month to the highest rating salesmen. Points are credited according to the accompanying schedule.

## Tungsten Lamps in Therapy

By M. Luckiesh
*Director Lighting Research Laboratory, National Lamp Works, Nela Park, Cleveland, Ohio*

Although radiant energy of various kinds is already serving well in the prevention and cure of diseases, many phases of radiation-therapy have not emerged from the twilight zone of knowledge.

We do know that much of the energy emitted by tungsten-filament lamps will penetrate to a considerable depth into the human body. On being absorbed most of this energy is converted into heat. This localized heating is achieved with less discomfort and often with greater safety and convenience with tungsten lamps than with hot towels or heating pads. Therefore, there are many legitimate uses for large tungsten lamps where such heating is desired. Perhaps medical research will establish many other uses of these lamps in the preservation of life and health.

PERCENTAGES OF TOTAL ENERGY EMITTED BY THE FILAMENT OF A 500-WATT MAZDA LAMP IN VARIOUS SPECTRAL REGIONS

| Special Region | Wave Lengths | Per Cent of Total Radiation |
|---|---|---|
| *Far and middle ultra-violet .. | (λ2,000 to λ 3,200) | 0.02 |
| Near ultra-violet ........... | (λ3,200 to λ 4,000) | 0.2 |
| Visible ..................... | (λ4,000 to λ 7,600) | 12.4 |
| †Near infra-red ............. | (λ7,600 to λ14,000) | 35.4 |
| Far infra-red ............... | (beyond λ14,000) | 52.0 |
| Total ....................... | (λ2,000 to limit) | 100.0 |

*Effective in rickets, etc.; not transmitted by ordinary glass.
†Transmitted by water (of which flesh is largely composed).

Progress in ultra-violet-therapy has been going on for years, but only recently has the public become interested. Much value of sunlight arises from the ultra-violet rays, particularly those which are not transmitted by ordinary glass (wave lengths shorter than λ3,200). Naturally this has led to a flood of inquiries regarding ultra-violet radiation emitted by tungsten filaments. Only 0.02 per cent of the total energy emitted by the filament of a 500-watt tungsten lamp is of wave lengths (shorter than λ3,200) which produce effects similar to those of one of the vitamines—preventing and curing rickets, for example.

The very small amount of this ultra-violet radiation that is emitted makes the tungsten lamps appear unpromising in this field of therapy at present. Obviously no special bulbs can increase the ultra-violet emissivity of the filament.

## Utah Sells 1,841 Washers in One Month

When the Utah Power & Light Company sold 1,841 washing machines during its eighth annual March washer campaign it broke not only all of its own previous records but established what is believed to be a record sale for the entire country. The slogan "A Copper Washer for a Silver Dollar," as in past years, played an important part in the campaign. Terms were $1 down and $5 per month. A quota of 1,000 machines was apportioned among the company's divisions, according to the number of customers in each. Employees other than the regular sales force were permitted to participate in the benefits of the campaign by the payment of $2 in cash for every prospect turned in which resulted in a sale.

*One of many store displays which aided in sale of 1,841 washers during month campaign*

Newspaper space was liberally used and special attention was given to store and window displays. The accompanying illustration shows rather an unusual store display which created interest. Sales during the March washer campaign of previous years were as follows: 1920, 1,711; 1921, 1,168; 1922, 1,191; 1923, 1,118; 1924, 1,148; 1925, 1,264; 1926, 1,012; 1927, 1,367. The total number of machines sold during these annual campaigns, including the 1,841 recently sold in March, 1928, now amounts to 11,820.

# High Voltage from Clouds

## Preliminary results from German endeavor to secure atomic breakdown from atmospheric electricity. Work to be continued

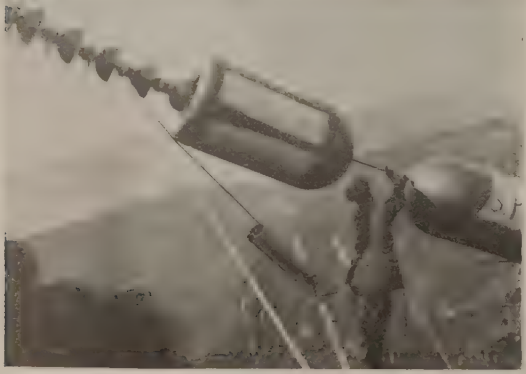
By Dr. Alfred Gradenwitz
*Berlin, Germany*

According to an account of preliminary tests given by Dr. Lange, assistant at the Physical Institute of the University of Berlin, at a recent meeting of the German Physical Society, he and his fellow workers A. Brasch and C. Urban expect by means of atmospheric electricity during thunderstorms to break up atoms during the coming summer.

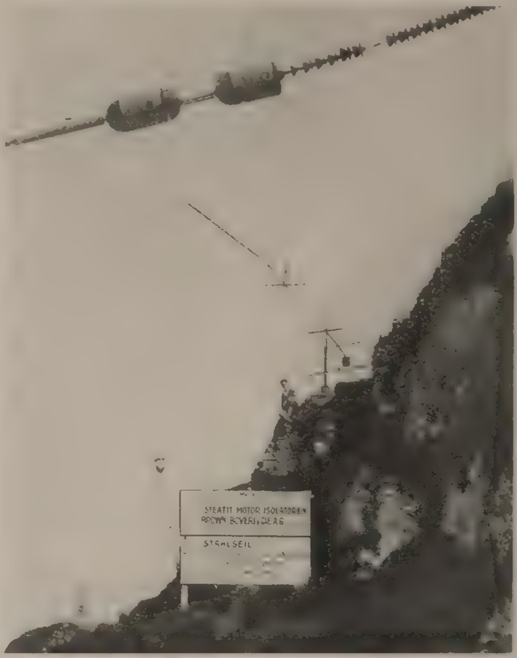
Accurate measurements of thunderstorm fields have shown the existence of field intensities up to a few hundred thousand volts per meter, so that a potential of, say, 5,000,000 to 30,000,000 volts is found to exist at a height of 100 m. If these potentials could be brought under control they would afford a means of producing extremely rapid corpuscular rays, of the same kind as those so far yielded by radium, though in much greater abundance.

The three experimenters found the most suitable place for installing their apparatus to be on the summit of Monte Generoso, a beautiful peak towering to a height of about 6,000 ft. near Lugano, which is noted for the frequency and violence of its thunderstorms. Also a mountain railway leading to the summit made this site an especially desirable location. The use of kites or balloons for collecting the electric charges was, of course, out of the question, such unstable systems constituting a serious danger to the experimenters. Only a stationary installation could be used and the three physicists chose a suspended network held by a messenger cable stretched out in a free span, antenna fashion, between two mountain tops.

Two experimental outfits were installed in succession, a smaller one for preparatory tests and a larger plant for what was intended for a definite test. The atmospheric electricity was collected by means of a network of wire comprising a multitude of small points, losses in leading in the collected charge being reduced to a minimum. Adequate insulation was provided at both ends of the messenger cable, which was given a radius of curvature as large as possible. The span adopted in connection with preparatory tests was 270 m. long, the network being situated at a height of 40 m. above the ground and insulated with 25 insulators. The lower part of the messenger cable, which served to lead the collected charges to the measuring instruments, was protected against corona losses by threading over it a series of hollow cylinders of very light material (thin galvanized-iron sheet) with a progressively growing diameter toward the ground. A potential of 3,000 to 5,000 volts was noted in normal cloudless weather, which, however, would grow to 70,000 volts (with several million amperes) whenever there was a thunderstorm passing over the plant. Two kinds of discharge were noted: First, those attending the passage of a lightning flash in the neighborhood; second, those characterized by a uniformly high potential and a uniform sequence of sparks not passing across the insulators.



*Corona cylinders on antenna at Mount Generoso*



*Antenna installation on Mount Generoso*

After conducting a set of preparatory tests with this small plant, a larger plant, with a span 760 m. long and a network stretched out at a height of about 80 m. above the ground, was installed. Voltage and other readings were taken from a small lightning-proof metal cabin, in which the spark gap installed below the corona guards could be controlled. The actual field intensity between the end of the antenna and the ground could not be ascertained, the clouds of ions produced by corona interfering with the normal distribution of field intensities at the very high potentials.

The installation of the larger plant was commenced in July, 1927, and, on account of local difficulties, could not be completed before the end of August. The main thunderstorm season was over, therefore, there being only one thunderstorm actually passing over the completed plant. This storm, however, unmistakably showed that very high potentials could be attained by the experimenter. The maximum sparking distance of the spark gap, which was 4.5 m., was readily bridged, the sequence of sparks during the period of maximum strength being about one per second. These discharges continued during 30 minutes and were remarkably constant. Actual experience with an auxiliary antenna and with remote thunderstorms showed that with such a dense sequence of sparks it was always possible to extend the spark gap to about twice its initial sparking distance before the limit of sparking was reached. Inasmuch, however, as such an increase in sparking distance was not feasible during thunderstorms a potential of only 2.3 million volts can be stated to have been measured, which corresponds to a sparking distance of 4.5 m.

The plant was left in position during the winter and is now to be extended so as to lend itself to measuring voltages several times as high. The potentials are so high, in fact, as to warrant the prediction that a definite success will be recorded in the endeavor to secure a breaking up of atoms.

## Letters from Our Readers

### *Suggests Salesman's Approach to Executives*

*To the Editor of the* ELECTRICAL WORLD:

I have read with a great deal of interest your editorial in the ELECTRICAL WORLD, issue of April 21, "The Salesman's Approach to the Executive." It occurs to me that the matter which you discuss has been improperly handled in the past due to the precise reasons as set forth. In my opinion more could be said as to the salesman's approach and I would suggest your consideration of the following facts for a further discussion of this subject through your columns.

In addition to submitting a business proposition, the salesman should bear in mind the fact that the executive does not think in terms of merchandising. He is interested only in technical matters pertaining to the operation of his property in order that his earnings may be adequate. When he is presented with a proposition which deals with earnings he at once becomes interested, and this interest can only be held through continuity of the same practice; that is, discussing earnings. Perhaps I can make myself better understood by assuming a salesman who is interested in selling 50,000 50-watt "Mazda" lamps to customers having an aggregate of 50,000 empty sockets. In order to secure the approval of this plan the salesman should point out to his executive that he is not particularly interested in the merchandising phase of the transaction, but is primarily interested in adding to the company's income, the potential income to be derived from this sale of 50,000 lamps. To set up his exhibit properly the salesman will point out to the executive that 50,000 50-watt lamps burning a lamp life average of 1,000 hours at 10 cents per kilowatt-hour will return $250,000, without adding one cent to capital investment account.

Likewise, a salesman contemplating a flatiron campaign should set up the same type of exhibit. He should, first of all, point out the potential revenue to be derived as a result of a certain number of irons sold. He probably is setting up a quota, in which case the quota figures should be used, the revenue to be derived based on the figures of the N.E.L.A., which would be considered authoritative. I am quite sure you see the point which I am making and which I should like to emphasize further with some personal experience.

A number of years ago, when I was connected with some of our operating companies, we were making figures on power requirements for certain coal mining operations which were at that time using their own power. We found it to be necessary in those pioneering days to present our proposition in a manner which would be understood by the coal operator. In other words, we had to reduce our sales to cost per ton of coal mined rather than cost per kilowatt-hour for electrical energy. This resulted in building up a very large volume of business. It was found at that time that other electric light and power companies were attempting to secure the same class of business on the basis of cost per kilowatt-hour. The result was that little headway was being made because the operator was not informed on such technical matters and, in fact, was not interested in the cost per kilowatt-hour. He only knew the cost per ton of coal mined.

We have the same picture in discussing a power proposition with a flour mill operator. It is absolutely impossible to make marked headway in this case if the cost per kilowatt-hour is discussed. The flour mill operator understands only the cost per barrel of output.

In conclusion, our executives, or our operators as you may choose to call them, are in about the same position so far as merchandising terms are concerned. It is difficult to secure their wholehearted and enthusiastic backing unless you can point out profits, and the profits which they are particularly interested in are those which reflect in the net earnings from operation. Merchandising profits are secondary.

C. J. EATON,
Vice-President in Charge of Merchandise Sales.
Middle West Utilities Company,
Chicago.

### *Conductor Movements Influence Line Design*

*To the Editor of the* ELECTRICAL WORLD:

We have noted with interest the editorial entitled "Conductor Movements Influence Line Design," which appeared on page 695 of the April 7 issue of the ELECTRICAL WORLD. Some of the values given seem to be in error, however, as we note there is a tension of 10,400 lb. on a No. 4/0 conductor. The minimum breaking strength of a No. 4/0 copper conductor, according to A.S.T.M. specifications, is in the neighborhood of 9,200 lb., while the minimum breaking strength of a No. 4/0 A.C.S.R. conductor is about 8,500 lb. We, therefore, question the tension of 10,400 lb. mentioned in the editorial.

Another point which occurred to us was the fact that there was a maximum throw of conductors of 4.07 ft. when used on a 150-ft. span. We are wondering whether this amount of throw was permitted by the sag in the conductor or whether an elongation in the conductor took place due to the high current suddenly thrown into the line which would be accompanied by a temperature rise.

DAVID T. WERNER.
New York, N. Y.

[The tension of 10,400 lb. mentioned in the editorial referred to represents the pounds per square inch allowed in the conductors and not to actual stringing tension of the conductor. However, there was one error in the figures given. It was stated that the conductor spacing was 4 ft. Although a number of tests were made at this spacing, the spacing was 18 in. in the particular case mentioned.

The sag of the conductor was approximately 1 ft. and the throw of 4.07 ft. was permitted partly by temperature rise due to the high current and partly by elongation of the conductor due to the very high stress set up by the violent repulsion of the conductors. Of these factors the latter was by far the most important.—EDITOR.]

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*Direct-Fired Powdered Fuel Boilers with Well-Type Furnaces.* — H. M. Cushing and R. P. Moore.—The 1926 extension to the Charles R. Huntley station of the Buffalo General Electric Company includes the addition of four 1,250-hp. boilers each with water-cooled furnace walls and 76 per cent economizer surface. The article describes the evolution of the furnace design, gives reasons for the selection of pulverized coal and the adoption of the direct-fired system and presents the operating results. Tests indicate unit efficiencies in excess of 85 per cent within the operating range of the equipment, which is from 125 per cent to 550 per cent of the rating of boiler and walls. The adoption of well-type furnaces for this station has enabled the utility to utilize coal with a low fusion temperature of the ash and no efforts are made to cool the ash which collects on the inner surfaces and gravitates in a liquid state to the well. The ash remains in a molten state until removed at desired intervals. This practice permits the use of the less expensive fuels and is said to represent an improvement in ash handling in pulverized fuel plants.—*Transactions of the American Society of Mechanical Engineers,* January-April, 1928.

*Some Economic Factors in Power Station Design.*—H. Boyd Bryden.—As a result of an analysis of design factors in connection with several generating stations, the author has concluded that the adoption of a 400-lb. operating pressure is desirable because of simplicity, ease of operation and cost of equipment. Conditions under which 1,200 or 1,500-lb. steam pressures may be attractive are anticipated and foreseen as desirably applicable to generating station work. On the contrary, 600-lb. pressures are discerned as offering few advantages. The author has reached this conclusion as the result of an examination of fixed charges, capacity and operated-hours factors. — *Mechanical Engineering,* May, 1928.

## *Transmission, Substations and Distribution*

*Some Experimental Results for Lightning Arresters.*—H. Rokkaku.—A comparative study of the various types of lightning arresters utilized in connection with high-voltage transmission circuits has been undertaken by the author. Observations secured through the use of the Braun tube are considered to offer the most informative data regarding the various styles. Arresters of the oxide film, air film, glass bead, carborundum and autovalve type were tested under similar conditions. It is concluded that the oxide film arrester has an ample discharge capacity, but there seems to be some uncertainty of action due to the change of material and displacement within the arrester cell. This type failed to indicate in these tests an operating reliability commensurate with that of the glass pellet and air film arresters. It is stated that any one of the arresters is subject to uncertainty of action due to the change of the materials with time, and that tests made with the Dufour oscillograph indicate behavior under single impulses which give satisfactory results.—*Journal of the Institute of Electrical Engineers of Japan,* March, 1928.

*Time-Limit Fuses.* — G. W. Stubbings. — It is the contention of the author that an exponential expression for the time-current characteristics of a fuse is based on an erroneous assumption and that it is hardly possible to secure more than an approximate value for the limiting current of a fuse by calculations based upon experimental values of the current for moderate time lags. A simple algebraic expression has been developed as a substitute for the more complicated exponential one and the curves have been derived to illustrate the simplified method used by the author for obtaining approximate time current accuracy. — *Electrical Review* (*England*), April 27, 1928.

## *Motors and Control*

*A New Starting Pulley.* — H. H. Schulmann.—A new starting pulley designed to permit the application of squirrel-cage motors where the use of such equipment has been restricted due to the heavy surges involved in starting, and more especially when starting against a full load torque, has been devised. It is stated that the use of this pulley makes the starting conditions of ordinary squirrel-cage motors and of double squirrel-cage motors quite as favorable as those of the slip-ring motor. It is also said that the simpler construction and the minimized attention requirements, better efficiency and power factor of the squirrel-cage motor may now be utilized without difficulty. The mechanism consists essentially of a centrifugal device, forming the necessary connections between the driver or driven parts. An important feature of this device is that the centrifugal weights which bring about the power transmission are not rigidly connected to the driving or driven parts. Cone-shaped disks move in an axial direction and are fitted on their outer surfaces with brake pieces of a material with a high coefficient of friction and good wearing properties. The inclosed form of this device permits its utilization under extreme dust conditions.—*A.E.G. Progress* (*Germany*), March, 1928.

## *Units, Measurements and Instruments*

*Design and Behavior of Magnetic Potentiometers.* — J. Ernest Shaw. — The possibilities in the use of the magnetic potentiometer for general electric measurements have led the author to discuss its application with particular reference to alternating current in networks that could not otherwise be easily measured, circulating current in various parts of machinery, reluctance of magnetic joints, ampere-turns on any assigned part of a magnetic circuit, exploration of leakage fields and similar applications. The theory and application have both been considered and direct-current and alternating-current measurements have been given special consideration. The design and the calibration of the potentiometer has also been considered and it is stated that it is always advisable to calibrate the potentiometer before making any measurements with the particular instrument with which it is to be used as considerable errors occur in calculating factors for a given circuit, the cross-sectional area and currents per centimeter are not uniform. The applicability of this device to the measurement of high-frequency current is pointed out. — *Electrical Review* (*England*), April 20, 1928.

*A Water-Level Gage of the Long-Distance Recording Type.* — E. B. Strowger.—The practical use of a water-level gage for hydraulic developments, utilizing the selsyn motor principle, is described by the author. The gage consists, essentially, of two selsyn motors. The position of the rotor of the transmitting device is controlled by a float or some similar means. The receiving motor operates a pen carriage which records, on a paper with suitable scaled divisions, the movements of the transmitting equipment. The motors are essentially induction motors with wound rotors excited from an alternating-current source. Conditions in the plant under discussion required close supervision of the headwater level because of the comparatively shallow intake existing at this development. — *Mechanical Engineering,* May, 1928.

## *Heat Applications and Material Handling*

*The Behavior of Metals and Alloys During Hot-Forging.*—W. L. Kent.—The research described in this article was initiated in order to investigate the forging properties of metals and alloys with a view to the application of a forging test as a measurement of their malleability at high temperatures. Many investigations have previously been made to determine this property by means of ordinary mechanical tests, but results given have not been entirely satisfactory. It is stated by the author that no mechanical test made may be considered satisfactory for this purpose, and that the only way in which malleability of a material may be determined is by actually rolling, drawing or otherwise working it under industrial conditions. It is, however, indicated in the present discussion that under certain circumstances useful information may be obtained regarding the variation in the working properties of a material with rise in temperature by combining the results of a special test herein described with that of a standard procedure. — *Engineering (England)*, March 16, 1928.

*The Autogenous Welding of Stainless Steels.*—The desirability, wherever possible, of subsequently heat-treating all stainless steel articles after the completion of the welding process is pointed out by the author. It is shown that all commercial welding involves heating the parts to be welded to a high temperature, usually approaching the melting point of the metal. This induces the formation of a coarse crystalline structure in the material in the region of the weld. In the case of the air-hardening stainless steel increased hardness is produced as a result of cooling in air from a high temperature. These two factors cause the resultant welded material to lack toughness. A comparison between various types of stainless steel and the difficulties encountered in the welding process have been covered in this discussion. Temperatures, electrodes material compositions, process requirements and general welding procedures, suggested in handling this material, have been covered by the author both for electric arc welding and for gas welding. —*Engineering (England)*, April 20, 1928.

### *Electrophysics, Electrochemistry and Batteries*

*Electrolytic Gas Generation Under Pressure.*—J. E. Noeggerath. — The electrochemical production of hydrogen and oxygen on a commercial basis furnishes gases of a remarkably high purity, but the installation of motor-driven compressors, by which the generated gases are forced into the customary steel cylinders, decreases the over-all efficiency of such a plant and makes close attendance a necessity. If the water dissociating cell is completely sealed the generated gas will, without additional effort, gradually reach any desired amount of pressure, and may thus be carried directly into its commercial containers. Certain difficulties have been experienced with the insulation between electrodes and ground to withstand such high pressure. Another problem was to find a safe and fully dependable means of keeping the oxygen and hydrogen separated. The paper describes construction of such equipment, generating gases at a pressure of 2,800 lb. per square inch, which gave excellent service. At this high pressure 3.25 kw.-hr. will produce 35 cu.ft. of gas of over 99 per cent purity. One of the greatest advantages is the exceedingly small floor space required, particularly when compared with gas generators operating at atmospheric pressure. — *Zeitschrift des Vereines Deutscher Ingenieure*, March 17, 1928.

*Some Comments on Dry Cell Service and Tests.*—C. A. Gillingham.—In a dry cell chemical depolarization takes place only while the cell is under load. Physical depolarization, such as the gradual rise of hydrogen bubbles, takes place both while the cell is under load and after load is discontinued. There are also shelf reactions, such as the slow dissolution of the zinc metal. The cell performs most efficiently, according to the author, when the severity of service is just light enough to allow perfect depolarization without passing beyond this point. The author recommends specific tests for each of the many types of dry cells, emphasizing the desirability of having the individual test conform as closely as possible to the actual service to which the respective type of cell is to be put.—*Report American Electrochemical Society*, April, 1928.

### *Telegraphy, Telephony, Radio and Signals*

*Quartz Radio Resonators.*—G. W. N. Cobbold and A. E. Underdown.—Practical applications of the piezoelectric behavior of crystals and their use for frequency stabilization are reported by the authors. Shapes and dimensions, modes of vibration, other frequency standards and a number of practical applications with particular reference to methods of frequency measurements are included. It is stated that in comparison with forks of special steel, quartz resonators possess the advantage that their natural frequencies are well within the limits of the frequencies used in wireless so that, in comparison with standard electrical circuits consisting of inductance associated with capacity, they are more compact and constant and of lower temperature coefficient. The method of mounting the crystals is indicated as being of considerable importance, as the dependence of the frequency upon the dimensions of the air gap and upon the presence of moisture has been clearly demonstrated. It seems probable according to this determination that the crystal should be mounted in a vacuum and that either blocks of fused quartz should be used as distance pieces between the electrodes, or else the air gap should be dispensed with altogether by pressing one of the electrodes on to the crystal by means of a light spring.—*Electrical Review (England)*, April 27, 1928.

*Tuned Radio-Frequency Amplifiers.*—R. S. Glasgow.—A simplified method of calculating the performance of a tuned amplifier circuit is given by the author and the effect of the various circuit constants on the characteristics is indicated. The predicted results are found to check quite closely with experimental observation. Curves showing the performance obtained with various types of tubes are also presented and the factors affecting the stability are pointed out and typical methods for suppressing undesired oscillations are given. The principles involved have been developed as a fundamental consideration applicable to such work.—*Journal of the American Institute of Electrical Engineers*, May, 1928.

### *Traction*

*Southern Railway Electrification.*—E. C. Cox.—The operating advantages and economies realized in the electrification of the Southern Railway (England) have been outlined by the author. Comparative cost data for railway operations are offered for several divisions of this road and for several other companies. — *Electrical Review (England)*, April 20, 1928.

### *Miscellaneous*

*The Strength of Flat Plates.*—Tandy A. Bryson, Thomas Cheeger and Harvard H. Gorrie.—The results of three investigations upon the strength and properties of square flat steel plates subjected to uniformly distributed pressure are offered by the authors. It is stated that the experimental conditions were such that the edges of the plates may be considered substantially as fixed edges. An equation to facilitate the design work in connection with flat plates was developed as a result of work by two investigators, working separately. Experiments to determine the strain actually produced in a flat plate under a uniformly distributed load, followed by an analysis of the stresses developed, is considered in the third paper. Among the conclusions derived are the following: The greatest stress does not occur in the center of the plate, as might ordinarily be expected, and ideal clamping conditions are necessary in order to check by practical investigation the theoretical conditions suggested by the equation.—*Rensselaer Polytechnic Institute*, April, 1928.

*A Thermodynamic Study of Fundamental Corrosion Reactions.* — W. J. Sweeney.—The fundamental corrosion reactions of iron in the absence of oxygen and the iron-ferrous ion-hydrogen equilibrium are discussed from an electromotive and free energy standpoint. From a critical survey of the literature on the solubility of iron and of ferrous hydroxide, a solubility product and a provisional value for the free energy of formation from the elements of ferrous hydroxide are obtained. With this value at hand the conclusion is drawn that there is a small free energy decrease for the attack of iron by water to form ferrous hydroxide and hydrogen even in the absence of oxygen. The interdependence of the iron, ferrous ion, hydrogen ion, hydrogen equilibrium and the ferrous hydroxide equilibrium is also pointed out.—*Report American Electrochemical Society*, April, 1928.

# Book Reviews

## *Transmission Line Engineering*

By W. W. Lewis. New York: McGraw-Hill Book Company. 360 pages, illustrated. Price, $4.

This is not a stereotyped book on electric power transmission. It is written by an experienced transmission engineer of a large manufacturing company and presents his solutions to the engineering problems most frequently encountered in practice.

The book will enable the student or engineer to calculate all the necessary constants of a line, to determine the performance of a line and to fix stability and power limits on a line. Other topics are the calculation of short-circuit currents, the control of triple harmonics, proper use of auto-transformers, control and calculation of line disturbances, calculation of line losses, telephone interference and line regulation.

College teachers will find this book splendid for use in their classes because of its thoroughness and scope. It is up to date and deals with problems of current importance. These problems should be presented to students, for they require fundamental electrical knowledge for their solution. Mr. Lewis restricts his treatment to electrical problems and rightly eliminates mechanical design features. His book is a welcome contribution to transmission literature.

## *Emile Berliner, Maker of the Microphone*

By F. W. Wile. Indianapolis: Bobbs-Merrill Company. 354 pages, illustrated. Price, $4.

A young man from Hanover started his American career as a clerk in a store and ended it as an outstanding contributor to the development of the telephone and talking machine. Inventive faculties of unusual order are found in Emile Berliner, and in the face of serious difficulties he brought his inventions to fruition and gained international recognition.

In this book the career of Mr. Berliner is outlined in a sympathetic and enthusiastic vein. In addition to an account of the personality and history of the inventor, it provides a résumé of the business and patent aspects of developments in the microphone, gramophone and radio. The early days of these arts called forth strenuous rivalries for success and an enormous amount of patent litigation. The original conception of Bell required a great amount of practical improvement to produce the telephone of later days, and Mr. Berliner did a great deal to develop the variable-contact transmitter, which forms an essential part of the modern telephone instrument. In those days technical knowledge was meager and yet practical, and empirical researches brought forth marvels in the electrical art. Bell, Edison, Berliner and Tesla are typical of noted inventors whose work became extremely valuable because they had the imagination to conceive inventions and in addition the untiring industry necessary to invention based on cut-and-try methods. Mr. Berliner has an enduring place as an inventor of the telephone transmitter, the lateral-disk gramophone record and the microphone. His life as outlined in this book should afford a stimulus to the youth of today.

## *Induction Motor Practice*

By A. M. Dudley. New York: McGraw-Hill Book Company. 236 pages, illustrated. Price, $2.50.

This book is a practical treatment of modern induction motors. It is well illustrated with halftones of machines and line drawings which show motor characteristics, winding schemes, control circuits and design details. Topics covered in chapters are: Fundamental considerations, rotating magnetic fields, mechanical parts and their assembly, windings, types of motors, electrical and operating characteristics, speed-torque curves, control, mechanical considerations and the circle diagram.

In the last part of the book a large number of practical questions about induction motors are asked and answered and a very good chapter is given on the circle diagram and its use.

The book does not develop a rigid mathematical and analytical treatment of the induction motor. It deals with results and applications, but should appeal to a large group of students, electricians and those using induction motors in industry.

## *American Universities and Colleges*

By David Allan Robertson. (The American Council on Education). New York and London: Charles Scribner's Sons. Cloth, 6 x 9 in., 884 pages. Price, $2.50.

The character, scope and organization of higher education in the United States is reviewed in Part I of this volume. Part II presents condensed information regarding each of the universities and colleges on the accredited list of the American Council of Education. Supplementary information regarding thirteen classes of professional and fifteen classes of graduate schools is given in Part I. For some unexplained reason, engineering schools have far less space in proportion to their number than the other schools. Thus 130 engineering schools are given less than three pages, while 25 schools of economics are given eleven pages.

It is a great pity that after bringing together so many figures on a variety of subjects as this volume contains, practically no summaries are included. Another sad lack of the volume is an introduction in the nature of a general summary. Valuable as the book is as a compilation, it is chiefly that and nothing more. Certainly a book sponsored by educators should supply digests of the data it contains instead of compelling thousands of users to make the digests separately or do without.

# Book Note

National Electrical Safety Code, fourth edition. By Department of Commerce. Washington, D. C.: U. S. Government Printing Office. 525 pages, illustrated. Price, $1.

The entire code, as revised, has been approved by the American Engineering Standards Committee as an American standard.

This edition represents only minor changes in the general substance of the rules. The regulations dealing with line construction probably incorporate more important changes than any of the other parts, since it is this field of construction regarding which the views of operating engineers represent the greatest diversity of opinion. The rules of this part and also of Part IV have been entirely rearranged, with the hope of facilitating reference and clarifying requirements. Part V, dealing with radio installations, is entirely new in substance and has been prepared to guide the installations of both antennas and interior equipment.

The code rules specifically provide for variation from requirements when circumstances warrant different practice. The rules have been made to recognize conditions as to climate and density of population where these involve a difference in the hazard or the number of persons exposed to the hazard.

The Blue Book (Electrical Trades Directory and Handbook), 1928. By Electrician. London: Ernest Benn, Ltd. 1,430 pages, illustrated. Price, 25 shillings net.

The book has been extensively revised. The greater part of the Legal Digest has been omitted and is replaced by a new and important feature, the Geographical Section, listing industry and allied trades in Great Britain, Scotland and Wales. Another feature is the more extensive use of celluloid thumb-index tabs. The various classifications of material and equipment listed are indicated by blue tabs. Red tabs are used to indicate Contents, Who's Who and Geographical Sections.

# Books Received

*Isolierte Leitungen und Kabel.* By Dr. Richard Apt. Berlin: Julius Springer. 235 pages, illustrated. Price, 13 marks.

*Hilfsbuch für die Elektrotechnik.* By Dr. Karl Strecker. Berlin: Julius Springer. 1,137 pages, illustrated. Price, 42 marks.

*Archiv für Elektrotechnik.* By Dr. Ing. W. Rogowski. Berlin: Julius Springer. 526 pages, illustrated.

*Vestiges of Pre-Metric Weights and Measures Persisting in Metric System in Europe,* 1926-1927. By Arthur E. Kennelly. New York: MacMillan Company. 189 pages. Price, $2.50.

*Berechnung von Drehstrom-Kraftubertragungen.* By O. Burger. Berlin: Julius Springer. 115 pages, illustrated. Price 7½ marks.

# News of the Industry

## Massachusetts for a Wide Rate Investigation

*Regulative Procedure Recently Discussed by Legislature Will Await Results of Sweeping Inquiry by Department of Public Utilities*

GOVERNOR FULLER of Massachusetts has signed a resolve providing for an investigation by the Department of Public Utilities of "ways and means for regulating in such manner as will be fair alike to the public and to gas and electric companies their rates, valuations and capital issues." In this connection the department will consider contractual relations between the companies and the state as recommended both by the commission and the Governor in their recent annual messages. The adoption of this resolve postpones action upon the regulative procedure lately under vigorous discussion in the Legislature of Massachusetts until next year.

## Special "Home Rule" Session of Illinois Legislature

On the advice of Mayor Thompson of Chicago, Governor Small of Illinois has called a special session of the Illinois Legislature, which convened at Springfield on Wednesday, May 15. Two bills in the interest of "home rule" for Chicago are the only business to be considered. While the traction situation in that city provides the reason for the special session, one of the bills is in the form of an amendment to the Illinois Commerce Commission act by which a local commission with all the powers now held by the state body might be set up and a clause which now permits appeals to be made from a local commission to the state commission would be eliminated. This bill, if passed, will obviously affect all Chicago utilities. The local commission would, by the terms of the bill, be elected, or jurisdiction over utilities might be vested in existing city officials.

## New Worcester Rate Survives Legal Technicalities

The 6-cent rate which the Worcester Electric Light Company had adopted, as reported in the ELECTRICAL WORLD for April 21, with the permission of the United States District Court, has been withdrawn from the tariffs on file at the State House, Boston, at the instance of the Massachusetts Department of Public Utilities, but is still in force in billing customers for service. The federal court had previously enjoined the commission from enforcing the maximum rate of 5 cents per kilowatt-hour ordered by the board last summer. The commission received a notification from the company some weeks ago that it proposed to establish a 6-cent rate in place of the former 7 cents beginning April 1. On that date bills began to be rendered on the 6-cent basis, and, according to a statement by President Robert W. Rollins to a representative of the ELECTRICAL WORLD, the company will continue to maintain the 6-cent rate unless it loses its fight in the courts against a lower tariff.

The Massachusetts commission, after deliberation, declined to sanction the compromise rate of 6 cents, evidently fearing that such action might from its point of view have an adverse effect upon the outcome of the case. Hearings are now progressing daily at Boston before Henry E. Warner, master, the company's side being first presented. The fundamental issue in the case is the method of ascertaining the rate base on which tariffs shall be made.

## Morin Muscle Shoals Bill Passes House

### Provision for Prepared-Fertilizer Manufacture Stricken Out—Boulder Dam Measure to Have Eight Hours' Time—Swing Assails Power Companies

BY A VOTE of 251 to 165, the House of Representatives on May 16 passed the Morin Muscle Shoals bill shorn of the clause providing for the government manufacture of fertilizer, in the place of which a provision for the manufacture of nitrogen alone was substituted. The Morin bill authorizes the government to operate its plants at Muscle Shoals and to sell both nitrogen and surplus power. The fertilizer clause succumbed to the avalanche of open attack upon it let loose by the National Fertilizer Association, which paid for full-page advertisements in Washington papers and brought scores of its members to the capital to work against the bill. The measure, which is similar to the Norris bill that passed the Senate, now goes to conference. Senator Norris indicated that no serious trouble is expected in reaching an agreement between the two houses.

The Snell substitute bill was defeated by a vote of 151 to 119. The Snell bill limited fertilizer manufacturing at Muscle Shoals to experimental work for a period of five years. An amendment offered by Representative Hoch of Kansas and aimed at the power section of the bill was passed by the House. It provides that the resale of power shall be regulated by the Federal Power Commission. Representative Quin of Mississippi, however, expressed the opinion that this amendment would be valueless because it constitutes a violation of state's rights. Other amendments adopted affecting this section include one introduced by Representative La Guardia of New York which grants preference to municipalities in the leasing of power and a committee amendment which insures that power shall not be leased in excess of the maximum amount needed for nitrogen fixation. Over the protest of Representative Byrne of Tennessee an appropriation of $2,000,000 was authorized to begin construction work on the Cove Creek dam during the next fiscal year. Provision for all dams below Cove Creek was stricken out of the bill.

For the Boulder Dam bill a rule has been granted allowing eight hours' time for its consideration on the floor of the House. The bill probably will come before the House next Tuesday. Representative Swing of California, coauthor of the bill, has issued a statement protesting against activities of senators from Arizona and Utah in seeking to postpone consideration of the bill. Mr. Swing also took occasion to censor the power companies for their opposition to his bill. He declares, however, that "their fight will be less effective since the Federal Trade Commission exposure of their disguised activities and insidious use of 'undercover' methods in newspapers, colleges and chambers of commerce."

The President has signed the flood-control bill and appointed Carleton W. Sturtevant of New York as civil engineer member of the commission created.

## Arkansas Utilities Association at Hot Springs

Members of the Arkansas Utilities Association, 250 strong, convened at Hot Springs, Ark., on May 14, 15 and 16 for the twenty-first annual convention of that body. The program dealt largely with the problems of light and power companies and with public relations. Among the prominent speakers were former Governor C. H. Brough, J. F. Owens of Oklahoma City, chairman of the Public Relations National Section of the N.E.L.A.; C. J. Griffith, vice-president Arkansas Power & Light

Company; Earl W. Hodges of Henry L. Doherty & Company; D. Dodson Lewis, secretary-manager Little Rock Chamber of Commerce, and F. Leslie Body, secretary-manager Hot Springs Chamber of Commerce. The retiring president, Robert M. Foster, Jr., vice-president Arkansas Utilities Company, Helena, made an official address. The election of new officers was to take place on Wednesday.

## Trade Commission to Send Another Questionnaire

*Information on Holding, Management and Service Companies Sought—More Information Bureau Men Heard—Municipal Propaganda Ignored*

AN ADDITIONAL questionnaire is to be sent out by the Federal Trade Commission in connection with its utilities investigation. The additional schedules have been prepared and are now being studied by the commission. They call for comprehensive information upon (1) the growth of capital assets and capital liabilities of holding-company and management groups, including their public utility and non-public utility subsidiaries, and of independent operating companies doing an interstate business; (2) the methods of issuing, the price realized and the commissions, bonuses and fees received or paid by such companies with respect to the various issues of securities made by them; (3) the intercompany relationships among holding companies, managing or service companies and financial, engineering, construction and electric and gas operating companies, and (4) the services furnished to electric and gas public utility companies by holding, management and service companies, the expenses and earnings of such companies, together with the fees, commissions or bonuses charged by them or their subsidiary or affiliated companies.

Provision is also made in these schedules to obtain information concerning political campaign contributions and the expenditure of funds to be used to influence or control public opinion with respect to municipal or public ownership of electrical power enterprises. Representatives of the commission are now visiting the offices of certain large holding and service companies in New York City, Philadelphia and Chicago, acquiring data on the various phases of the inquiry from the official records of the companies. As soon as available other examiners will be sent to other power-company groups.

Examination of R. J. Holly of Sanford, Fla., director of the Florida Public Utilities Information Bureau; H. E. Simpson of Miami, treasurer of that bureau and also of the Southeastern Division, N.E.L.A., and Willard Cope, executive secretary of the Utilities Information Committee of Georgia, took up the May 10 sessions of the investigation of utilities. Nothing of a nature to attract public attention or special political attack was developed by the testimony of the Florida men. Mr. Cope told of his committee's fight in 1921 against water-power legislation sponsored by the Municipal League of Georgia. The bureau had spent an average of $30,000 a year, he testified, but all vouchers and financial records were destroyed at the end of each year as a matter of office routine. The discontinuance of the legislative agitation over water power in Georgia Mr. Cope attributed to the death in 1924 of John J. Eagan of Atlanta, its chief advocate. He testified regarding the circulation of a weekly news bulletin, *The Week*, and discussed the distribution of various pamphlets relating to public utilities.

When the commission resumed its sittings on May 15, Joe Carmichael, director of the Iowa Committee on Public Utility Information, was questioned about the efforts of that committee to influence instruction in the public schools concerning public utilities. This is a line of inquiry that the commission has consistently followed. Mr. Carmichael said that schoolbooks were removed by local school authorities when protest was made that they contained matter favorable to government ownership of power units. The protests were voiced by local managers of utility companies.

On Wednesday Thorne Browne, managing director Middle West Division, N.E.L.A., was examined regarding the distribution of textbooks and pamphlets to the schools of Nebraska and Missouri. Mr. Browne said that the object was to provide supplemental information not covered by school textbooks and to achieve "better understanding on the part of the rising generation of the scope and field of public utilities." He said he could see no impropriety in the use of impartial material in such a way. The fact that the supplier of this material may have had an interest to serve would make no difference if the material itself were right.

Officials of telephone and telegraph companies were then called in an effort to obtain a check on messages to and from the Washington offices of the Joint Committee of National Utility Associations. S. E. Boney of the North and South Carolina Public Utilities Information Bureau was summoned to give testimony on Thursday morning.

In denying a request made by Representative Douglas of Phoenix, Ariz., that the investigation include the "lobby" working in behalf of the Swing-Johnson bill for the development of Boulder Dam, Judge McCulloch, the member of the Federal Trade Commission in charge of the investigation, stated that the full commission "adheres to its conclusion that the province of this investigation is directed entirely to privately owned utilities and not to those municipally owned." "We are not concerned here with the merits of Boulder Dam, nor with any city or public project, but we are only concerned with the activities of privately owned utilities," Judge McCulloch said.

There will be no hearings next week, as Judge McCulloch will be absent from Washington.

## Renewal of Demand for Curb on Federal Courts

*Samuel Untermyer Wants Limitation of Their Jurisdiction in Rate Cases, Basing His Argument on Traction Situation in New York*

PERMISSION granted by the United States District Court to the Interborough Rapid Transit Company of New York City to raise its fare from 5 cents to 7 cents has augmented the agitation for passage by Congress of a law limiting the jurisdiction of the federal courts in rate cases. Samuel Untermyer, special counsel for the city, last Saturday supplemented a memorial to Congress from the city's Board of Estimate by requesting Senators Copeland and Wagner, who represent New York State in the Upper House, to get behind legislation to this end.

Representative Loring M. Black of Brooklyn has a bill pending before the House judiciary committee which would amend the federal code by taking original jurisdiction in rate cases away from the federal courts. Under this bill, as under bills introduced by Representatives O'Connor and LaGuardia, the public utility companies would be required to bring their proceedings in the state courts. A bill including similar provisions has been fathered by Senator Norris in the other house. Utility companies would, of course, still have an appeal to the United States Supreme Court from the highest state courts.

## Ten-Thousand-Dollar Arc-Welding Prize Awarded

Award of $17,500 in prizes for the best contributions to the arc-welding art was the outstanding event at the opening session of the spring meeting of the American Society of Mechanical Engineers at Pittsburgh on Monday of this week. These prizes were offered by the Lincoln Electric Company of Cleveland through its vice-president, James F. Lincoln, with the desire to promote the whole art and to reduce the cost of construction.

The first prize, $10,000, was awarded to James W. Owens of Newport News, Va., for a paper entitled "Arc Welding. Its Fundamentals and Economics." Prof. Henri Dustin of the University of Brussels, Belgium, received the second prize of $5,000 for his paper on "Fundamental Principles of Arc Welding," while Commander H. E. Rossell of the United States Naval Academy took the third prize of $2,500 for his review of "Electric Welding of Ship's Bulkheads and Similar Structures."

Seventy-seven papers were entered in the contest from twenty-five states and five foreign countries. Honorable mention was given to Frank B. Walker of Winthrop, Mass., and B. K. Smith of Houston, Tex.

There was a central-station power session of the society on Thursday, with papers by H. B. Brydon and George A. Orrok.

# Ten Thousand Expected in Atlantic City

## Many Prominent Men and Women from Outside the Industry Will Unite with Its Own Leaders to Address Delegates on Vital Present-Day Topics

SAVE for the names of two speakers to be added to those addressing the general sessions and for the exact titles of several others of the addresses promised, the program of the fifty-first convention of the National Electric Light Association, to be held at Atlantic City on June 4 to June 8 inclusive, is ready. The functions of holding and investment companies, interconnection, railroad electrification, rural service, research, advertising, merchandising problems and the commercial outlook will be especially prominent in the addresses and discussions, as will the absorbing present-day topic of "government and business." An imposing array of speakers will address themselves to these subjects, and a thoroughly successful convention is foreseen. The estimated attendance of delegates and visitors is ten thousand, representing every part of North America.

Speakers from outside the light and power industry will include Melvin A. Traylor, president of the First National Bank of Chicago, who will make the chief address on "public policy night"; Dan Moody, Texas' famous young governor, who will be the main speaker from the sphere of politics; Samuel M. Vauclain, president of the Baldwin Locomotive Works; J. E. Edgerton, president of the National Association of Manufacturers; H. P. Davis, chairman of the National Broadcasting Company's board; Lawrence A. Downs, president of the Illinois Central Railroad; Hugh Frayne, representing the American Federation of Labor; H. G. Wells, president of the National Association of Railroad and Utilities Commissioners; Deane W. Malott, assistant dean of the Harvard Graduate School of Business Administration; P. W. Pinkerton, president of the American Society of Certified Public Accountants; Clifford V. Gregory, editor of the *Prairie Farmer;* Miss Belle Sherwin, president National League of Women Voters; C. O. Ruggles, dean of the College of Commerce and Administration, Ohio State University; William P. MacCracken, Assistant Secretary of Commerce; Merle Thorpe, editor *Nation's Business;* John T. Madden, dean School of Commerce, Accounts and Finance, New York University; Mrs. John D. Sherman, president General Federation of Women's Clubs; David Himmelblau, School of Commerce, Northwestern University; S. N. Halliday, General Outdoor Advertising Company; Mrs. Anna S. Richardson, *Woman's Home Companion,* and Clayton Rand, president Dixie Press, Gulfport, Miss.

From the industry itself, to speak at the general or the sectional sessions, are listed President H. T. Sands, Managing Director Paul S. Clapp and Director of Engineering H. S. Bennion of headquarters; Chairmen J. E. Davidson, E. A. Davis, E. C. Stone and J. F. Owens of the Commercial, Accounting, Engineering and Public Relations National Sections respectively; A. W. Thompson, president United Gas Improvement Company; Britton I. Budd, president Public Service Company of Northern Illinois; Franklin T. Griffith, president Portland Electric Power Company; Dr. W. R. Whitney, director of research, General Electric Company; W. W. Freeman, president Society for Electrical Development; John F. Gilchrist, vice-president Commonwealth Edison Company; James H. McGraw, president McGraw-Hill Publishing Company; George N. Tidd, president American Gas & Electric Company; Herbert A. Wagner, president Consolidated Gas, Electric Light & Power Company; W. E. Mitchell, vice-president Georgia Power Company; Charles B. Scott, Earle W. Hodges, E. W. Lloyd and A. D. Bailey.

The usual ample reports will be presented by the well-known men who head the general and sectional committees, and the Coffin, Forbes and other prize awards will be made.

The exhibition is expected to surpass all previous ones, every foot of space on the Million-Dollar Pier not occupied by assembly halls, offices and special booths (including one for good-will and institutional advertising material) having been assigned to the 206 manufacturers who will make displays. B. A. Rolfe's orchestra has been engaged to provide music in aid of the excellent entertainment program under preparation. It will also play at the public policy eve-

## N.E.L.A. Convention Program, Atlantic City, June 4-8

### General Sessions

TUESDAY, JUNE 5, 9:30 A.M.

Address of welcome, Mayor Ruffu.
Address by President H. T. Sands.
Reports of treasurer, membership committee, managing director and of Public Relations Section.
"Why the Investment Company," A. W. Thompson.
"Broadcasting," H. P. Davis.

WEDNESDAY, JUNE 6, 9:30 A.M.

Reports of exhibition, codes and standards, and rate research committees and of Commercial Section.
"The Electric Utility and the Public," Henry G. Wells.
"Government and Business," John E. Edgerton.
"Universities and Industry," Dean D. W. Malott.
"Speeding up for Prosperity," S. M. Vauclain.

WEDNESDAY, JUNE 6, 2:30 P.M.

*Forbes Magazine* awards.
Symposium, "Railroad Electrification," B. I. Budd and L. A. Downs.
"The Accountant as a Torch Bearer to Management," P. W. Pinkerton.
Report of rural service committee.
"Electricity and the Farmer," C. V. Gregory.
"Power in Political Education," Belle Sherwin.

THURSDAY, JUNE 7, 9:30 A.M.

Reports of prize awards and lamp committees and of Accounting Section.
"The Clearing House of the Industry," F. T. Griffith.
"Education of Men for the Public Utility Industry," Dean C. O. Ruggles.
Address by Governor Moody of Texas.
"Electrical Research and Progress," Dr. W. R. Whitney.

THURSDAY, JUNE 7, 2:30 P.M.

Reports of educational committee and of Engineering Section.
"Teamwork for Electrical Development," W. W. Freeman.
"Commercial Aviation," W. P. MacCracken.
Address by Hugh Frayne.
"From Bottom up or Top Down," Merle Thorpe.
"The Investment Company in Business Development," J. T. Madden.

FRIDAY, JUNE 8, 9:30 A.M.

Reports of memorials, insurance and other committees.
Address by Mrs. J. D. Sherman.
"Electrical Advertising," J. F. Gilchrist.
Address by James H. McGraw.
"Interconnection with Its Benefits," George N. Tidd.
Appreciation, H. A. Wagner.
Election of officers.

### Public Policy Committee

WEDNESDAY, JUNE 6, 8:30 P.M.

Presentation of Charles A. Coffin Award.
Report of public policy committee.
Address, Melvin A. Traylor.
Music and dancing

### Accounting Section

TUESDAY, JUNE 5, 2:30 P.M.

Address by Chairman E. A. Davis.
"Insurance Costs," Charles B. Scott.
"Common Sense and Dollars," E. W. Hodges.
"Accounting Treatment of Securities Discount and Expense," D. Himmelblau.
"Some Problems for the Accountant," E. W. Lloyd.
Reports of committees.

### Commercial Section

TUESDAY, JUNE 5, 2:15 P.M.

Address by Chairman J. E. Davidson.
Address by Samuel N. Halliday.
Reports of committees.

### Engineering Section

TUESDAY, JUNE 5, 2:30 P.M.

Address by Chairman E. C. Stone.
"Purposes and Accomplishments of Engineering Staff," H. S. Bennion.
"Organizing the Industry's Engineering Research," A. D. Bailey.
"Spending Our Company's Money," W. E. Mitchell.
"Engineering for the Future," E. C. Stone.

### Public Relations Section

TUESDAY, JUNE 5, 2:30 P.M.

Address by Chairman J. F. Owens.
"Woman's Place Is in the Home," Mrs. A. S. Richardson.
"Thunder and Lightning," Clayton Rand.
Reports of committees.

ning meeting, when there will be other music as well.

An open meeting for women delegates, with two sessions, will be held at the Dennis Hotel on Monday morning and afternoon, under the guidance of Miss Sophia Malicki. The session of the Commercial National Section will be held in the Haddon Hall Hotel and that of the Accounting National Section in the Hotel Traymore. All other sessions will be on the Million-Dollar Pier.

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# "Electrical World's" London Letter

## Central England Electricity Scheme Announced—British Industries Fair and Electrical Trade—"House of the Future"—Cable-Wireless Merger

By Bernard C. Holding

*Editor of The Electrician*

London, April 28, 1928.

Outstanding in importance among electrical items of early spring was the publishing of the proposed electricity scheme for operation under the Central Electricity Board for the central England area. This constitutes the third scheme so far published, the other two covering Scotland and southeast England. The proposed arrangements for central England embrace an area of approximately 7,000 square miles, including virtually the whole of the industrial zones of the Midlands, and they comprise the whole or the major portion of the areas of supply of 49 existing authorized electricity supply undertakers. The sale of electricity in the area in 1926-27 by all the undertakers concerned was 762,000,000 kw.-hr., equal to about 146 kw.-hr. per head of population according to the 1921 census. A rate of growth has been taken as the basis of estimates for the scheme, which would give a sale in 1934-5 of 1,890,000,000 kw.-hr., or 362 kw.-hr. per head. It is expected that by 1940 the output will have reached 2,820,000,000 kw.-hr., or 540 per head. Of the 46 generating stations at present operating in the area, it is proposed that 19 be taken as "selected" stations, while six others will be used as temporary stations. The remaining 21 stations will be gradually closed down as generating stations and made into transformer stations. The total expenditure in the Midlands scheme may be given as about £7,500,000 during the first six years, while the saving to the authorized undertakers is put down as about £1,500,000.

Another interesting feature of last month was the closing of the British Industries Fair, at Birmingham and London, for another twelve months. The electrical section of the fair was again very successful, no single instance having been heard in which the fair was thought to be not worth while; in fact, the immediate success of the exhibition as a promoter of trade has been greater than some exhibitors anticipated.

Still another successful exhibition during March, in which the electrical industry played a not inconsiderable part, was the "ideal home exhibition" held in London. Here was shown an example of the house of the future. Lighting, heating, cooking, cleaning and services of every description were all electrical, and from the time one entered the garden it was practically impossible to find anything which was not in some way associated with electricity.

With regard to the announcement during March of the fusion provisionally arranged between the Eastern & Associated Telegraph Companies and Marconi's Wireless Telegraph Company, this does not necessarily mean that the problems of either party are entirely solved. It is not in any way certain at present that a satisfactory agreement with the British government and the governments of the Dominions and Canada can be arrived at, although no suitable alternative seems possible. Government control of telegraphic communication has not, on the whole, proved profitable; the general feeling is therefore that the Post Office may not be anxious to hand over those enterprises, including the "beam" service, which are understood to be making a profit. Be this as it may, the final decision must rest with the Imperial Wireless and Cables Conference, which is thus confronted with as heavy a responsibility as any commission in recent years has had to bear. The world has eagerly paid tribute to the genius of Marconi and the wonders that have evolved through his organization. Justice, however, suggests recognition of the fact that the Marconi enterprise is scarcely 30 years old, while the cable has been facilitating and expediting the progress of the world for about 80 years. When, in 1851, Brett laid his Dover-Calais cable, after a fierce struggle to secure the £300 necessary for the experiment, it may be said, however, that he scarcely anticipated the amazing expansion of cabling, with its record of brilliant achievements.

On the personal side it is interesting to note that Sir Oliver Lodge, F.R.S., was admitted a freeman of the city of Stoke-on-Trent, his birthplace, while Sir Alexander Kennedy, F.R.S., celebrated his eighty-first birthday on March 17. George Offor, an electrical pioneer, celebrated his one hundred and first birthday on March 30, and on the same day a jubilee dinner was given to Col. R. E. Crompton to commemorate the founding of Cromptons, Ltd., 50 years ago. J. M. Gatti was elected chairman of the British Electrical Development Association, and it was announced that Dr. J. A. Fleming, F.R.S., is to be awarded the honorary degree of doctor of engineering by Liverpool University in May. Among those this month whose loss will be widely felt are Sir William B. Forwood, one of the founders of the Liverpool Overhead Railway Company, and John P. Hooper, who superintended the manufacture of cables which were laid between Para, Pernambuco, Bahia and Rio de Janeiro from 1872 to 1875.

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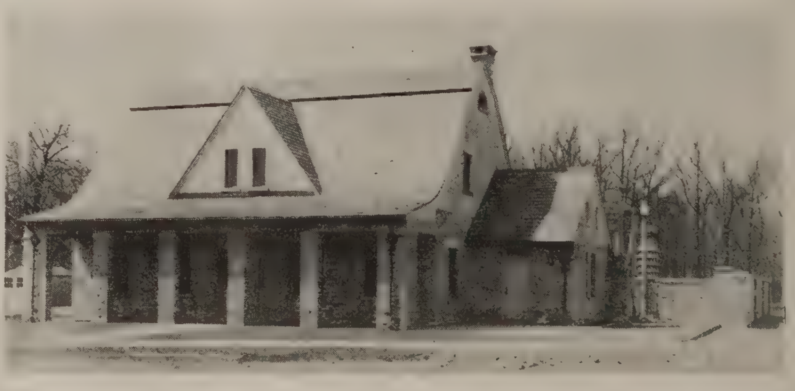
# Unique Substation in Residential Part of South Bend



The unusual type of substation building shown here was erected not long ago by the Indiana & Michigan Electric Company to serve South Bend from the company's 27,000-volt loop around the city. Building restrictions made it obligatory to design a building that would largely conceal the electrical apparatus and enhance rather than depreciate the value of the adjacent lots. The building is 30 ft. wide by 40 ft. long, built of brick with a slate roof of varied colors. The windows and doors are equipped with shades and curtains similar to those of any fine residence. From the street it has the appearance of a bungalow. There is 200 ft. of underground construction connecting it with the overhead loop. The station contains four 1,000-kva., 27,000/2,500-volt single-phase transformers, three for service and one as a spare. The 27,000-volt apparatus is out of doors back of the substation building and surrounded by a brick wall such as might surround a garden.

## Purchases and Mergers

*Plans Mature for the Acquisition of the Brooklyn Edison Company by Consolidated Gas—Merger of Penn-Ohio Edison and Northern Ohio Power Becomes Effective*

OUTSTANDING this week in news involving changes in the control of light and power companies is the approval by both the trustees of the Consolidated Gas Company of New York (which controls the New York Edison and its associated companies) and the directors of the Brooklyn Edison Company of the plan mooted for some time for the acquisition of the latter by the former, thus bringing all the Brady electrical interests in Greater New York under a common management. When this plan shall have been indorsed by the stockholders of the respective companies, the only electric light and power companies of size in the metropolitan area not included in the consolidated group, whose capitalization will exceed $1,343,000,000, will be the Long Island Lighting Company and the Staten Island Edison Corporation. Details of the proposed financial arrangement are printed under "Financial and Statistical" (page 1039).

The merger of the Penn-Ohio Edison Company and the Northern Ohio Power Company, noted in the Electrical World for April 21 (page 829) as under negotiation, was declared effective on May 15.

No opposition was made on May 9 before the New York Public Service Commission to the petition of the New York Power & Light Corporation to acquire the Ticonderoga Electric Light & Power Company or to the petition of the Mohawk-Hudson Power Corporation to acquire the Cortland County Traction Company, which does a light and power business. The decision of the commission was reserved.

Purchase of the Ardmore Light & Improvement Company by the Annapolis & Chesapeake Bay Power Company, a subsidiary of the Consolidated Gas, Electric Light & Power Company of Baltimore, has been approved by the Maryland Public Service Commission.

A petition asking authority to purchase electric transmission lines and property in seven Indiana counties, including Marion County, has been filed with the Indiana Public Service Commission by the Southeastern Indiana Power Company of Indianapolis. The lines in question belong to the Evans Electric Company, the Eastern Light & Power Company and the Suburban Power & Light Company. The petitioning company asks to be declared a public utility.

The Interstate Public Service Company of Indianapolis has been authorized by the Indiana Public Service Commission to pay $35,000 for the properties of Frank Crull, known as the Home Light & Power Company, at Mooreland, Millville, New Lisbon, Ashland and Messick.

The North Dakota Railroad Commission has authorized the Otter Tail Power Company to purchase the Clyde Electric Company and the Page Electric Company. A recently printed report that the Otter Tail company had bought the Eckelson (N. D.) plant was erroneous. A proposal to sell the electric distribution system at Williston, N. D., to the Montana-Dakota Power Company was defeated at a special election by a margin of 299 votes. Williston has 4,000 people.

To the Great Western Power Company of California permission has been granted by the Railroad Commission to purchase all of the outstanding stock of the Fair Oaks Electric Company and to consolidate the property with its own system. The company, which has been purchasing its energy from the Great Western, serves a district 12 miles northeast of Sacramento. The Great Western was directed to charge to capital account not more than $28,736 of the purchase price, excess indebtedness of the Fair Oaks company to be charged to profit and loss.

Several utilities at Ketchikan, Alaska, have been purchased by the W. B. Foshay Company of Minneapolis, including the Citizens' Light, Power & Water Company, and are to be merged as soon as possible with other public utility holdings of the Foshay company.

Consummation of the arrangement by which financial interests represented by Nesbitt, Thomson & Company, the Power Corporation of Canada, Sir Herbert Holt, Lord Rothermere, the Canadian & Foreign Power Corporation, J. H. Gundy and Andrew Holt & Company are to take ownership of the British Columbia Electric Railway Company is announced.

## Chamber of Commerce Adopts Resolutions

### Denounces Unethical Practices and Corruption of Public Servants—Declares Against Government in Business and Against Limiting Power of Federal Courts

A RECORD-BREAKING attendance, the presence of scores of industrial leaders of the first rank from all parts of the country, the high character of the addresses, the willingness shown to exercise guidance in the ethical, economic and legislative problems that confront business, and the determination evinced to make American industry worthy of the pre-eminence it has achieved among the factors that control the social life and progress of the nation, combined to make the sessions of the Chamber of Commerce of the United States that closed at Washington on May 11 the most memorable yet held by that body. Before adjourning, the chamber, some of whose proceedings with a special bearing on the electric light and power industry were reported at length in last week's Electrical World, adopted seventeen resolutions.

*William Butterworth*

In one of these resolutions, based on the keynote address of Judge Edwin B. Parker, unethical practices in business were condemned and stockholders were told that they "cannot accept the profits flowing from corruption and escape the moral stigma which inheres in such profits." This resolution declared further that American business "insists upon protecting its professional status by the maintenance of the highest standards and intends scrupulously to discharge its collective responsibilities." "The moral turpitude of corrupters of public servants is even greater than that of those whom they debauch," the resolution said:

Another resolution dealt with "government and business," specifying "transportation and communication" as fields the government should not enter. This resolution reads:

> The very essence of civilization is that there be placed upon the individual only that degree of restraint which shall prevent his encroachment upon the rights of others, thus releasing to the utmost individual initiative in every proper direction. Our form of government most effectively expresses and maintains this principle. Within our basic law exists ample provision for such changes as may from time to time be necessary to safeguard our people. It is, therefore, essential that our government should scrupulously refrain from entering any of the fields of transportation, communication, industry and commerce, or any phase of business when it can be successfully undertaken and conducted in the public interest by private enterprise. Any tendency of government to enter such fields should be carefully weighed in the light of its possible effect upon the very genius of our institutions.

Other resolutions passed opposed limitation of the power of the federal courts and advocated a reduction in the corporation tax to 10 per cent, improvement of federal tax laws and administrative regulations, the application of the budget system to state and local expenditures, legislation for the encouragement of shipbuilding by responsible private interests, extension of the Webb-Pomerene act to include import associations, compilation of more comprehensive industrial statistics, enactment of the Hague rules for ocean bills of lading in so far as applicable to America, and international commercial arbitration.

The board of directors elected the following officers for the ensuing year: Chairman of the board, Joseph H. Defrees of Chicago; president, William Butterworth, Moline, Ill.; vice-president Eastern Division, Alfred J. Brosseau, New York; vice-president South Central Division, Robert R. Ellis, Memphis; vice-president North Central Division, Robert P. Lamont, Chicago; vice-president Western Division, Paul Shoup, San Francisco.

# Merger Movement Fundamentally Sound

## President of Middle West Division, N.E.L.A., Points Out How Individual Operating Companies Benefit from It—Public Relations and Commercial Development

UNSWERVING determination on the part of electric utility executives, operators and employees to stand for and demand complete vindication of their industry overshadowed all else at the sixth annual convention of the Middle West Division, N.E.L.A., held in St. Louis on May 9-11.

Utility men must realize that they are living in a day when all businesses are in a melting pot of mergers and consolidations, said Don M. Sterns, president of the division, at the opening session. Fundamentally and economically this movement is sound, and in the central-station industry, through holding-company operation, individual companies have benefited directly by being able to do cheaper financing, install better and more efficient equipment and in turn reduce rates to the public. This has been possible in spite of the fact that costs of labor and materials for producing electricity have increased in line with other commodities.

The importance of the electrical industry and electrical service to a metropolitan city was emphasized in the address of welcome by Mayor Victor J. Miller, who pointed out that of $87,000,000 to be spent in St. Louis on civic improvements in the next five years between $8,000,000 and $9,000,000 will be for electrical improvements.

J. F. Owens, chairman Public Relations National Section, outlined the functions and purpose of his various subcommittees and made a plea that utility executives get a fuller appreciation of value of service on association committees.

The condition of farmers is of direct concern to utilities and the principal problem of the Middle West, declared F. J. Hanlon, Mason City, Iowa. He pointed out that there are many parallel conditions when utilities and farming are considered as businesses. Both have high investments, a low rate of capital turnover and high taxes, with problems of quantity production.

Speaking on "Some Fundamentals Under Government," Carl D. Jackson, chairman of the national committee on co-operation with educational institutions, declared that the utilities have a constitutional right to organize and engage in publicity for self-preservation.

H. T. Sands, president of the national body, in his address on "The Full Measure of Service," said that the greatest danger is from the public utility man who believes his public relations work is all done. He is due for a rude awakening.

Louis H. Egan, president Union Electric Light & Power Company, reviewed the developments in public utility financing in the Middle West, pointing to the changed conditions as compared with the early years of the industry, when utilities were financed partly by promoters and partly by electrical manufacturers.

That the sale of more electric service to existing customers is one of the best means of building better public relations was emphasized by J. E. Davidson, chairman Commercial National Section, N.E.L.A., who addressed the meeting on "Commercial Developments in the Electrical Industry." Commercial activities in the Middle West were traced by W. J. Krug, chairman of the division's Commercial Section, who pointed out to commercial men that their plea of lack of executive interest in commercial activities may be due largely to the commercial man's own failure to present his story in complete and tangible form to his executive.

Public utilities are taking more and more active interest in rural electrification, C. F. Stuart, Northern States Power Company and chairman national rural electric service committee, asserted. Soon to be published by Mr. Stuart's committee will be a report on "Four Years' Operation of the Red Wing Line," which it is expected will provide an affirmative answer to the question whether electricity pays its way or not on the farm.

Discussing some phases of "Government in Business," Judge C. W. Appleton, vice-president General Electric Company, declared that the present form of state regulation of utilities is in the best interest of the public and the companies themselves and pointed out difficulties that would be encountered if some method of federal regulation were undertaken instead.

Training of utility employees to engage in public speaking as part of the utilities' public relations program was considered vitally important by W. S. Vivian, chairman N.E.L.A. public speaking committee. J. B. Sheridan, director of Missouri Committee on Public Utility Information, in an address on "Telling the Public," outlined the work of his committee.

"The Banker's Point of View" was the subject of an address by A. C. Allyn, president A. C. Allyn & Company, on Friday morning. Relations between utility operators and the banker have changed greatly in the last eight years, he said. From a combative attitude which formerly existed both the banker and the operator have come to realize that the interests of the utility owner, the operator, the banker and the investing public are the same. Mr. Allyn traced the decreasing cost of investment money for utilities over the last few years and prophesied that interest rates would probably go lower than they are today and that many companies will be able to put out bonds bearing 3½ per cent coupons.

"Superpower—What Is It?" was the subject of an address by E. S. Hight, chief engineer North American Light & Power Company, who described in detail the development of electric service in the Middle Western States. Other addresses on Friday morning were on "Flood Control," by Major George R. Young, and "The Poetry of Power," by the Rev. W. C. Timmons, St. Louis.

The annual banquet and carnival held on Thursday evening was attended by about four hundred members and guests. At the close of the meeting the following officers were elected for the ensuing year: President, R. T. Smalley of the Kansas Electric Power Company; vice-presidents, A. E. Bettis of the Kansas City Power & Light Company, K. R. MacKinnon of the Nebraska Power Company and E. F. Buhlman, of the Iowa Southern Utilities Company; managing director, Thorne Browne.

# Briefer News

UNITED LIGHT & POWER MOVES FROM GRAND RAPIDS.—The home office of the United Light & Power Company was moved early this month from Grand Rapids, Mich., to Chicago, whence all of the administrative and executive functions of the company will be directed. The new address is 2200 Bankers' Building.

CENTRAL MAINE POWER REDUCES RATES.—The Central Maine Power Company is proceeding with a general revision and standardization of rates throughout its territory. The latest change is a reduction affecting the southern division beginning June 1 and averaging 10 per cent. It will include customers in Bath, Brunswick, Lisbon and ten or twelve smaller places.

NEW IRRIGATION AND POWER DAM IN MEXICO.—President Calles of Mexico last week laid the first stone of the Tepuxtepec Dam, to be constructed in the State of Michoacan jointly by the Mexican Light & Power Company and the Mexican government. It will cost $10,000,000 and permit the generation of 30,000 hp. in addition to the irrigation features of the project.

ELECTRICAL AND ENGINEERING BUILDING FOR TORONTO EXHIBITION.—The first sod on the site for a new electrical and engineering building at the Canadian National Exhibition, Toronto, was turned by Mayor McBride on May 4 in the presence of a large gathering. The structure will cost upward of $500,000. All space has been already leased for a term of years.

NEW GENERATING PLANT FOR EVANSVILLE, IND.—A two-million-dollar steam-electric power plant is to be built in Evansville, Ind., by the Southern Indiana Gas & Electric Company. Work on the plant will start at once, and it is expected to be ready for operation by the fall of 1929. The plant will be built on the Ohio River in the part of Evansville known as the West Side on a site of 20 acres just purchased by the company. The new plant will be linked with the Division Street plant, which will be kept in operation and used as the main distribution station. The first unit to be installed will have a rating of approximately 22,500 kw., and an ultimate station capacity of five times as much is provided for.

Progress on New Municipal Plant at Hamilton, Ohio.—Electricity will be generated at the new municipal electric light plant of Hamilton, Ohio, in September or October, according to a forecast just made by F. H. Froehlich, the engineer who drew plans for the plant. The plant, complete, will cost $750,000, according to Mr. Froehlich's estimate.

East River Plant of New York Edison Company Inspected by Electrical Society.—Seven hundred members of the New York Electrical Society visited the new East River generating station of the New York Edison Company last Saturday and were escorted through the plant, speeches being made by Dr. E. E. Free, president of the society, and Vice-Presidents Thomas E. Murray, John W. Lieb and Arthur Williams of the company.

Intensive Development Planned for Tidewater Virginia.—The development in tidewater Virginia of six electrical divisions, with centers respectively at Waverly, West Point, Urbanna, Chicoteague, Onley and Colonial Beach, is planned by the Virginia East Coast Utilities Company, according to President W. F. Stevens. Surrounding communities will be linked to these central points and considerable territory hitherto without service will be supplied.

Calgary Power Company Gets Bow River Site.—The Calgary Power Company of Calgary, Alberta, has obtained a lease of the water-power site on the Bow River at its junction with the Ghost River (Electrical World, May 5, page 934), an announcement from Ottawa says. Application for this site was in the nature of an alternative to the development of Spray Lakes power, which is left in abeyance. It is asserted that the additional power to be had from the Bow River will take care of the requirements of the Calgary Power Company during the next five years.

Commission Gives Public Service Company of Colorado a Month to File Royal Gorge Brief.—After hearing testimony from municipal officials of Cañon City, Colo., in favor of the application of the Public Service Company of Colorado for permission to erect a power plant in the Royal Gorge, the Public Service Commission of the state gave the company thirty days in which to file a brief. This time will expire two weeks hence, after which final argument will be heard and the decision rendered. Engineers, ranchmen, farmers and fruit growers, who fear interference with water supply, as well as those who fear injury to the scenic attractiveness of the gorge, have opposed the application.

Hydro Plant Contemplated in Kentucky to Serve Mines and Power Companies.—A permit for which L. E. Bryant of Roberta, Tenn., has applied to the Federal Power Commission would allow him to construct two power dams on the Rock Castle and Laurel Rivers in Kentucky. The power would be used in coal operations and the surplus sold to power companies in the vicinity. The estimated installed capacity contemplated is 39,300 hp. The two dams would store 20,000,000,000 cu.ft. of water.

Conditions Good in Southeast for Hydro Generation. — Water supply and stream conditions as they affect hydro-electric power in the Southeastern States are the best in years, according to reports made by representatives of the power concerns in the territory who met last week at Raleigh, N. C. The meeting was that of a committee on operations, composed of officials of the larger power companies in Virginia, West Virginia, North and South Carolina, Georgia, Alabama and Tennessee. It was brought out that reservoirs are in better shape and stream flow better than at any time in recent years at this season of the year. With normal rains throughout the summer no shortage of power is expected and it will probably not be necessary to plan extensive interchange of energy.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

Indiana Electric Light Association (jointly with Indiana Public Utilities Association) — Columbia Club, Indianapolis, May 22-24. William Stokes, 1548 Consolidated Bldg., Indianapolis.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

American Institute of Electrical Engineers—Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

New Hydro Development for Washington Coast. — Authority to proceed with the construction of a concrete dam across the North River near Brooklyn, Wash., just given by the Federal Power Commission, permits the Western Washington Electric Light & Power Company of Raymond to begin work on its hydro project, where it is said as much as 70,000 hp. may be generated. The federal permit was necessary owing to the fact that the North River, tributary to Willapa Harbor, is navigable in certain sections.

Floods Sweep a Small Quebec Plant and Three Dams Away.—The power plant of the Vanchesteing Electric Power & Light Company, at St. Jovite, Quebec, valued at $30,000, was washed away by floods which swept through the northern section of the Laurentian district recently. The floods resulted from the breaking of three power dams under the pressure of waters released by the melting of snow and ice. St. Jovite is about 75 miles north of Montreal.

To Harmonize Substation with Public Building Architecture.—The Union Electric Light & Power Company of St. Louis has awarded a contract for a substation to be erected on Clark Avenue, west of Fourteenth Street, at a cost of $200,000. The structure will be equivalent in height to an ordinary three-story building and has been designed to harmonize architecturally with the municipal and state building fronting on the St. Louis Memorial Plaza. The exterior walls will be of Bedford stone.

Tennessee Company Files Holston River Application. — The Tennessee Eastern Electric Company has filed application with the Tennessee Railroad and Public Utilities Commission to construct a dam and hydro-electric plant on the Holston River. The company agrees that the project shall be started within eighteen months after the issuance of the permit and shall be completed for operation within three years. It will cost $5,200,000. The dam, on the south fork of the Holston, would form a reservoir extending 8 miles up the Holston and 4 miles up the Wautauga River.

Court Denies Injunction to Halt Hydro Development on Kings and San Joaquin Rivers.—An injunction applied for by J. J. Stevenson, a corporation owning about fourteen thousand acres in Merced and Stanislaus Counties, Cal., and intended to restrain further development of power resources by the San Joaquin Light & Power Corporation on the Kings and San Joaquin Rivers, has been denied in the Superior Court at Merced. The plaintiff claimed that the power company's development was an infringement upon its rights to a continuous flow of these streams. If granted, the injunction would have affected the Crane Valley, Kerckhoff and Balch plants.

North Central Division Will Not Hold Convention This Year.—The North Central Electric Association, geographic division of the N.E.L.A., has decided to hold no convention this year. Instead it will hold conferences during the year in various parts of the district. The next of these—a managerial conference—will be held at Breezy Point Lodge, near Pequot, Minn., on June 15 and 16. Sixty reservations have already been made. Accounting, commercial and engineering conferences have already been held. The managerial conference will be the first of its kind to be held by this body.

More Interconnection in New Hampshire.—Preliminary surveys have been started by the Utilities Power Company for a 33,000-volt transmission line extending from Melvin Village to Center Ossipee, N. H. This 11-mile line will form on its completion a connecting link between the Laconia division of the Public Service Company of New Hampshire, the Utilities Power Company, the Franklin Light & Power Company and the Tilton Light & Power Company. The three latter companies are controlled by the New England Public Service Company and are operated by the Public Service Company of New Hampshire with headquarters in Manchester. Another survey will be started at once for an interconnection between the Garvins Falls plant on the Merrimac River, south of Concord, and the Bristol plant of the Utilities Power Company. The distance is 35 miles.

Indiana Men Meet Next Week.—The Indiana Electric Light Association will hold its annual convention at Indianapolis on May 22, the day before the Public Utilities Association of the state convenes. President Robert M. Feustel of Fort Wayne will preside, and Thomas F. English, South Bend, president of the Great Lakes Division of the N.E.L.A.; G. C. Neff, vice-president Wisconsin Power & Light Company, and C. V. Sorenson, vice-president Attica Electric Company and chairman of the Indiana rural electrification committee, will speak, the two latter on rural electrification. Truman E. Heinton will discuss the Purdue University short courses. Before the Public Utilities Association John B. Malling of Hammond, Ind., will speak on "The Government in Business" and Morse Dell Plain will read a paper on "The Training of Supervisory Forces." A member of the Indiana Public Service Commission will be invited to address the meeting and a round-table discussion on utility advertising will be held.

# Recent Court Decisions

Company Not Entitled to Damages When Compelled to Remove Wires from Vacated Alley.—In Northern Indiana Gas & Electric Company vs. Merchants' Improvement Association the electric company showed that it had occupied an alley in the city of Hammond with poles and electric light wires erected under a franchise grant from the city to supply its inhabitants with electricity. The alley was vacated by order of the board of public works, and the association, as the owner of abutting lots, brought action to enjoin the company from maintaining its poles and wires on the premises. The trial court found that the company should be enjoined from maintaining its poles and wires and that it was not entitled to damages because it was compelled to remove them from the vacated alley, and the Indiana Appellate Court has sustained this finding. (160 N.E. 50.)*

Evidence to Show Negligence on Two Counts, Notwithstanding Admission of One of Them by Defendant, Need Not Invalidate Trial.—Sustaining a judgment for injuries to a boy from a fallen wire (Martin vs. Pacific Gas & Electric Company), the Supreme Court of California found that a charge of negligence against the company based not only on its failure for several hours to remove the wire from the sidewalk where it fell but also on alleged failure to maintain it properly before it fell was not prejudicial or inflammatory. The defendant was willing to admit liability on the charge of not removing the fallen wire and contended that subsequent admission of testimony on this as well as on the unadmitted charge of faulty maintenance led to excessive damages being fixed by the jury. The Supreme Court held that the damages—$25,000—were not as a matter of law excessive, the boy having suffered what appeared to be great and permanent injury. (264 Pac. 246.)

Water-Power Rights Permit Increased Use in Public Interest.—When a hydro-electric utility finds it necessary to reconstruct its plant and appropriate additional water in order to maintain a service adequate to meet the demands of the public, such expansion does not interfere with the original water-power rights of the operator. This is a decision of the Hood River County (Ore.) Circuit Court involving water rights of the People's West Coast Hydro-Electric Corporation acquired from the West Coast Power Company. In 1919 the People's West Coast company reconstructed the plant and increased its power capacity. Before this was done the State Fish Commission issued an order closing Herman Creek to further appropriation except for the purpose of fish culture, and this suit was instituted by the commission in an effort to cancel the utility's water rights on the ground that the company violated the provisions of its original application by reconstructing and altering its plant and appropriating more water than the initial permit called for. The greater interests of the public must prevail in such instances, the court held.

Commission Rules Governing Transmission Lines Are Not Applicable to Private Roadway.—The Central Illinois Coal Mining Company brought action against the Illinois Power Company in the Illinois Appellate Court on the ground that an award of $14,100 under the workmen's compensation act was made against the plaintiff for the death of one of its employees who was killed when a 12-ft. pipe he was carrying came in contact with the power company's high-tension line at a height of 12 ft. over a roadway used by the victim. The coal company alleged that the employee's death was caused by the negligence of the power company in constructing and maintaining its line at an altitude lower than that required by the Illinois Commerce Commission. Sustaining the judgment of the trial court, the Appellate Court held that the rules and regulations of the commission prescribing the minimum height of wires did not apply to wires over private property and that the roadway in question, not being a highway, street, alley or right-of-way, came under that designation.

# Commission Rulings

High Bill Should Be Adjusted in Case Where Meter Was Read After Its Removal from Demolished Building.—The New Jersey Board of Public Utility Commissioners has decreed, in settling a complaint made against the Atlantic City Electric Company by the Dixie Candy Company, that an adjustment should be made of an unusually high bill covering a period when service was not received and based on the reading of a meter after its removal by house wreckers because of the failure of the utility company to read and remove it upon receiving notice that the building in which it was installed would be torn down. The board said it would not permit a discontinuance of service if, in payment of future bills, the consumer deducted an amount already paid under protest in excess of what the board had approved as a reasonable charge, the commission lacking authority to order a cash refund of the excess.

Application of Reproduction-Cost Theory to Land Values.—In authorizing an issue of bonds and capital stock under certain restrictions by the United Electric Power Company the Rhode Island Public Utilities Commission considered the cost of reproduction new less depreciation only for the purpose of determining whether the amount of capitalization for which authorization was sought bore a relation to or was in excess of its fair value. In the matter of land values the commission said: "We believe a proper application of the cost-of-reproduction theory is a determination by appraisal of the value of each parcel in accordance with the market value of other land similarly situated in the same locality and enjoying similar public improvements, but without regard to the purposes for which the property is used. To this should be added the broker's commission which usually obtains where such land is located and an item of 1 per cent for other transfer costs, which we believe to be amply adequate for such costs under the testimony in this and other similar cases."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *H. L. Doherty's Birthday Celebrated*

Henry L. Doherty's fifty-eighth birthday was celebrated by his employees with an elaborate carnival at the Hotel Astor, New York, Tuesday, May 15, at which more than 1,800 members of the organization and their guests were entertained with a program lasting from 4:30 p.m. to 1 a.m., utilizing the entire tenth floor of the hotel. A number of entertainers prominent in theatrical circles furnished the program of the evening. A telegram was received by Frank R. Coates from Henry L. Doherty expressing his pleasure at the celebration and his regret at not being able to be present.

*H. L. Doherty*

Mr. Doherty, who is at the Battle Creek Sanitarium, Battle Creek, Mich., convalescing from his recent illness, was the recipient of many messages of congratulation and felicitation. Mr. Doherty is head of the firm of Henry L. Doherty & Company and president of the Cities Service Company.

Henry Maulshagen, district manager of the Alabama Power Company at Gadsden, has been appointed manager of that company's western division with headquarters in Birmingham. Mr. Maulshagen served as superintendent of the company's steam plant at Gadsden prior to becoming district manager.

H. O. Clarke, Jr., assistant general manager of the Houston Lighting & Power Company, Houston, Tex., was elected second vice-president and chairman of the electric section of the Southwestern Public Service Association at the recent convention held in Dallas. Mr. Clarke has been associated with the Houston properties for a number of years.

Claude L. Matthews, vice-president and treasurer of the W. N. Matthews Corporation, St. Louis, Mo., arrived in Los Angeles May 15 to address a meeting of the electrical industry of southern California held at the Hotel Biltmore, having left Chicago the preceding day by airplane. Mr. Matthews carried with him messages of felicitation and greetings from power companies and electrical manufacturers of both Chicago and St. Louis to the electrical fraternity on the Pacific Coast.

James L. Tonge has been appointed distribution engineer of the Narragansett Electric Lighting Company, Providence, R. I.

William H. Lipscomb, formerly president of the Habirshaw Cable & Wire Corporation, New York, has been elected president of the Dubilier Condenser Corporation to succeed Fred D. Williams. Mr. Lipscomb, who also served on the directorate of the Habirshaw organization, was at one time identified with the United States Steel Corporation.

## *C. F. Brush Honored by Franklin Institute*

Charles F. Brush, engineer and inventor of Cleveland, was made the recipient on May 16 of the Franklin medal by the Franklin Institute of Philadelphia. This latest award is just another expression of esteem in a lengthy list of honors conferred upon Mr. Brush in the course of his scientific career. Among the outstanding examples of recognition are the decoration as Chevalier Legion d'Honneur (France) and the award of the Rumford medal by the American Academy of Arts and Sciences and the Edison medal by the American Institute of Electrical Engineers. Mr. Brush is especially noted for the Brush electric arc light, which he perfected and gave to the world in 1878, the system first having been adopted by the city of Cleveland and subsequently extending to all parts of the world. Later he contributed many other fundamental inventions in both arc and incandescent lighting, storage battery and other devices.

*C. F. Brush*

## *R. P. Stevens President of New Utility Company*

Ray P. Stevens, chairman of the board of Stevens & Wood, Inc., has been named president of the Allied Power & Light Company, the organization just formed from the consolidation of the interests of Hodenpyl, Hardy & Company, Inc., and Stevens & Wood, Inc. B. C. Cobb, vice-president of the Commonwealth Power Corporation and an operating official of other Hodenpyl and Hardy properties, will be chairman of the board of the new corporation.

*R. P. Stevens*

Mr. Stevens has long been an outstanding figure in the electrical industry. After he had built and operated a large number of electric light and power plants in the South he then, in the capacity of consulting engineer, designed and constructed at Everett, Wash., an entire new railway and a light and power system, of which he became manager. Transferring his interests to the East, he spent several years in central New York before removing to Allentown, Pa., where, during an administration that covered a period of six years, he effected a consolidation of eighteen light and power companies, which resulted in great benefits to the communities served. In 1913 he resigned as president of the Allentown companies to become president of the Mahoning & Shenango Railway & Light Company and its subsidiary companies with headquarters in Youngstown, Ohio, and at the present time is president of the Penn-Ohio Edison Company, which has just taken over the Northern Ohio Power Company. Mr. Stevens has been active in association work, being president of the A.E.R.A. and a member of the A.I.E.E., the A.S.M.E. and other technical organizations.

Ralph P. Ormsbee has been appointed assistant superintendent of distribution of the Narragansett Electric Lighting Company, Providence, R. I.

## *O. G. Thurlow Awarded Potts Medal*

Oscar G. Thurlow, vice-president and chief engineer of the Alabama Power Company, was made the recipient of the Howard N. Potts medal by the Franklin Institute in recognition of his work in inventing the Thurlow backwater suppressor. The medal is awarded by the Institute for distinguished work in science or the arts, important developments of previous basic discoveries, inventions of products of superior excellence or utilizing of important principles. This award is the second honor to be conferred upon Mr. Thurlow in recognition of his service to the study of science by the invention of the backwater suppressor and other engineering achievements. Last spring the University of Alabama conferred upon him the degree of doctor of science because of this accomplishment and because of his practical services in using it in the development of Alabama's resources.

*O. G. Thurlow*

Dr. Thurlow is a native of Massachusetts and a graduate of the Massachusetts Institute of Technology. He first came to Alabama in 1909 with the Tennessee Coal, Iron & Railroad Company and in 1912 he became associated with the Alabama Power Company. In addition to being vice-president in charge of engineering for this company he is also a member of the board of directors.

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David Sarnoff, vice-president of the Radio Corporation of America, sailed for Europe May 5 aboard the *Leviathan*.

George E. Learnard, president of the International Combustion Engineering Corporation, sailed for Europe aboard the Cunard liner *Aquitania* May 9.

E. L. Callahan has been appointed general commercial manager of the Central Public Service Corporation with headquarters in Chicago. Mr. Callahan has had a long and varied experience in the electrical industry, his activities having extended into every department of the commercial side of central-station practice. Early in his career he was connected with Westinghouse, Church, Kerr & Company, the Simplex Electric Heating Company, the Prometheus Electric Company and the General Electric Company. So successful had he been in handling pioneer sales problems for the central station companies that he was selected by H. M. Byllesby & Company in 1909 to organize and direct the new-business department. He resigned six years later to become district manager of the Westinghouse Lamp Company in Chicago, subsequently being promoted to the position of sales manager of the company. Mr. Callahan has been active in association work, having been one of the founders and chairman of the Commercial Section of the National Electric Light Association and a frequent contributor to convention programs and to the technical press.

## *H. C. Blackwell Heads New Company*

H. C. Blackwell, formerly president of the Union Gas & Electric Company, Cincinnati, has been named president of the new Cincinnati Gas & Electric Company, the organization resulting from the merger of the Columbia Power Company, the Cincinnati Gas & Electric Company and the Union Gas & Electric Company. Mr. Blackwell is well known in national engineering circles, both as an executive of long standing of electric light and power companies in the Middle West and as an officer in the representative engineering societies. His early connections included the Wabash Railroad Company, J. G. White & Company and the People's Light Company at Davenport, Iowa, advancing in the last-named company from engineer to the position of vice-president and general manager. As vice-president and general manager of the Kansas City Power & Light Company in charge of construction and operations, he was closely identified with the Kansas City development, one of the most successful of the larger electric enterprises in the country.

***H. C. Blackwell***

In 1924 Mr. Blackwell removed to Cincinnati to become vice-president in charge of operations of the Union Gas & Electric Company, succeeding W. W. Freeman as president two years later.

## Obituary

Charles E. Merritt, assistant treasurer of the Commercial Cable Company, New York, for the past 27 years, died, of pneumonia, at his home in that city April 17. Mr. Merritt had been associated with the submarine cable industry in various capacities for the past 60 years. He was 82 years of age.

Raymond B. Keating, vice-president of the West Penn Electric Company and its major subsidiaries, died May 12 after a brief illness. Mr. Keating was born in Pittsburgh in 1880 and spent the greater part of his business life in that city. Early in his career he was identified with the Philadelphia Company, the Electric Properties Company of New York, the Lackawanna & Wyoming Valley Railroad Company, the Electric Power Security of Niagara Falls, New York, owned and operated by the Westinghouse Electric & Manufacturing Company, and the Merchants & Manufacturers' Exchange of New York City. In 1914 Mr. Keating became vice-president of the West Penn System at its New York offices and in August, 1915, returned to Pittsburgh to continue his active duties with this company. At his death he was vice-president of the West Penn Electric Company, West Penn Railways Company, West Penn Power Company, as well as their subsidiaries. He was also a director and vice-president of the Monongahela West Penn Public Service Company of Fairmont, W. Va.

Robert Wales Emmons, 2d, treasurer of the Lawrence (Mass.) Gas & Electric Company from 1903 to 1926, inclusive, died recently at Buzzards Bay, Mass.

Alvah W. Sulloway, for many years president of the Franklin Light & Power Company, Franklin, N. H., died April 23 at his home in that city, in his 90th year. Mr. Sulloway was born in Framingham, Mass., and after schooling entered the hosiery manufacturing industry, with which he was connected a great part of his life. He organized and was president of the Franklin National Bank from 1879 until the time of his death. He was also president of the Franklin Savings Bank. For many years he was a director of the Boston & Maine and Maine Central Railroads, president of the Franklin Light & Power Company and the Acme Knitting Machine & Needle Company and a director and officer in other enterprises. Mr. Sulloway was also active in state politics.

# Financial and Statistical News

## Westinghouse Electric Sales Totaled $175,456,815

Sales of Westinghouse Electric Company for the year ended March 31 last were $175,456,815. Net manufacturing profit amounted to $14,000,000 and net income available for dividends $15,600,000. Earnings per share on the preferred and common stock amounted to $6.57, or 13.4 per cent. Dividends were paid during the year on both stocks at the rate of 8 per cent per annum, or $4 per share of $50 par value. This represents a slight decrease in business as compared with the previous year, when sales totaled $185,500,000 and earnings amounted to $6.80 a share.

As of March 31 the company's balance sheet shows current assets aggregating $122,000,000, which is more than eight times current liabilities. The sum of $3,000,000 representing a federal income tax reserve no longer required was restored to surplus.

Approximately $40,000,000 has been spent in the past six years for new plants and extensions. All plants have been provided with modern facilities, and the company is now in a position to take care of a business, at present prices, of more than 25 per cent in excess of this year's shipments. A statement of earnings, operating costs, interest charges, etc., in comparison with those of last year is shown in the accompanying table.

| | 1928 | 1927 |
|---|---|---|
| Gross earnings | $175,456,815 | $185,543,087 |
| Costs | 161,347,356 | 169,764,086 |
| Net manuf. profit | 14,109,459 | 15,779,001 |
| Other income | 3,031,704 | 2,585,614 |
| Gross income | 17,141,163 | 18,364,615 |
| Interest, etc. | 1,501,991 | 2,226,174 |
| Net for dividends, etc. | $15,639,172 | $16,138,441 |

## Hartford Residential Service Analysis

The Harvard Graduate School of Business Administration, through its department of public utility management, has made an analysis of the residential electric business of the Hartford (Conn.) Electric Light Company covering the years 1914 to 1926, inclusive. After presenting the usual growth figures, the study proceeds to analyze by rate classification and by types of residential areas, giving actual billing records of the various groups, and includes particularly a study of the effect of promotional type rates and of appliance merchandising. For example, it was found that even in the better class of apartment house districts the use per customer was remarkably low. A commentary by Prof. Philip Cabot, reprinted from the *Annalist*, is appended. The report was prepared by J. Gardner Coolidge of the department's research staff; it is published as a 41-page pamphlet, of which copies are obtainable at a small charge from the department, Soldiers Field Station, Boston, Mass.

## Penn-Ohio Edison Capital

On completion of the exchange of Northern Ohio Power common stock for Penn-Ohio Edison common under the merger plan capitalization of the latter will comprise: $5,999,000 6 per cent debentures, $8,151,800 7 per cent preferred stock, 49,229 shares 6 per cent preferred stock, 717,003 shares common, 119,270 option warrants for purchase of common at $25 a share and 166,650 option warrants for purchase of common at various prices up to $60.

## Wyman Heads Portland Company

The New England Public Service Company has acquired from the National Electric Power Company substantially all the common stock of the Cumberland County Power & Light Company, Portland, Me. Out of 41,000 shares, only 35 are held outside. At a recent meeting of stockholders in Portland the following officers were elected: H. M. Verrill, chairman of the board; Walter S. Wyman, president; Fred D. Gordon, vice-president in charge of operations; F. D. True and George Otis Smith, vice-presidents; C. F. Berry, treasurer and clerk. George E. Haggas continues as chief engineer and Frank R. Fowles manager of the power and light department.

## Billion Dollar New York Merger at Last Ratified

### Brooklyn Edison Company Will Be Acquired by Consolidated Gas on Exchange of Stock if Stockholders and Public Service Commission Approve

THE long-anticipated and much-rumored merger of the Consolidated Gas Company of New York and the Brooklyn Edison Company has at last been ratified by the trustees of the former company and the directors of the latter. Conditions remaining to be fulfilled are: Approval of the Public Service Commission of New York, receipt of assent to the plan on the part of at least 70 per cent of Brooklyn Edison stockholders before June 15 and, of course, formal ratification by Consolidated Gas shareholders of capital structure changes necessary to accomplish the absorption. The plan involves acquisition of Brooklyn Edison common stock by Consolidated Gas on the basis of an exchange of one share common and one share $5 preferred of the latter company for one common share of the former.

Completion of the present merger plans will give Consolidated Gas Company of New York control of virtually the entire electricity and gas business of New York City, Westchester County and Long Island. The Brooklyn Union Gas Company, Staten Island Edison Corporation and Long Island Lighting Company remain independent. Reported heavy holdings by the Mellon interests in Brooklyn Union Gas and Consolidated Gas, as well as in United Gas Improvement of Philadelphia, suggest the possibility of a larger merger in the future.

From a statistical standpoint the present merger is one of large proportions. Assets of the Consolidated Gas system at the end of 1927 exceeded $842,000,000 and those of the Brooklyn Edison $170,000,000, bringing the total to more than $1,012,000,000. Gross revenues of the two systems for 1927 were $200,481,641. At current prices capital stocks of the group exceed $1,000,000,000. Combined net profits for 1927, after interest and taxes, amounted to $52,310,157. Connected horsepower of the Consolidated Gas system totals 3,450,000. Consolidated Gas properties last year sold 2,320,531,525 kw.-hr. and Brooklyn Edison sales were 754,635,609 kw.-hr., bringing the total to 3,075,167,134 kw.-hr. for the two systems. Combined earnings of the two companies will be equal to $4.04 a share.

A development which will probably follow the merger is the segregation of the gas and electric properties of the combined system with the formation of separate operating companies and a controlling holding company.

It is intimated that the Consolidated Gas Company common stock will be split on a two for one basis. At current prices this would bring the new stock to around $82 a share. Brooklyn Edison common is currently quoted around $262. Completion of the exchange would call for the issue of about 6,120,000 shares of Consolidated Gas common.

While substantial economies in various directions are anticipated from the merger, an official of Consolidated Gas Company informed the ELECTRICAL

WORLD that no definite action had yet been taken with regard to any possible reduction in rates. Other important details of joint operation yet remain to be worked out, while the financial set-up is being revamped along necessary lines.

## A Quarter Billion Horse-Power Utilized

The total capacity of all the power-generating equipment installed in the various industries in the United States in 1923, from the highest type of steam turbine and internal-combustion engine down to the erratic windmill and the farm-work animal, was 230,514,000 hp., exclusive of the horsepower of pleasure automobiles. It is an astonishing fact, says the Department of the Interior, which agency compiled these figures, that the total horsepower capacity of the internal-combustion engines of pleasure automobiles is nearly twice as much as that used in all the industries, the total capacity for 1923 inclusive of pleasure automobiles being 684,044 hp. This tremendous capacity, if converted into man-power, would furnish about 60 able-bodied servants in constant attendance on every man, woman and child in the United States. The horsepower of industrial prime movers in 1923 was distributed as follows: Manufactures, 9 per cent; mines and quarries, 2 per cent; agriculture, 17 per cent; electric central stations and electric railroads, 11 per cent; steam railroads, 32 per cent; ships, 4 per cent; work animals not on farms, 1 per cent; automobiles not classed as pleasure cars, 23 per cent; miscellaneous, 1 per cent.

The population of the United States increased 45 per cent from 1899 to 1923, while the capacity of industrial-power equipment increased 260 per cent. In 1849, 66 per cent of the total industrial power equipment of the country was installed in farms; in 1923, only 17 per cent, the greater part being utilized by steam railroads, manufactures, central stations, electric railways and automobiles other than pleasure cars.

These figures are taken from a report entitled "Power Capacity and Production in the United States," just published by the Department of the Interior as Water-Supply Paper 579 of the Geological Survey. It contains information about the capacity of the different types of prime movers installed in the industries in the United States from 1849 to 1923 and shows their relative growth by index numbers and by diagrams. The report also contains the monthly figures of production of electricity and consumption of fuel by public-utility power plants from 1919 to 1926, estimates of the potential water-power resources of the United States, and reports of the developed water power for different years which have previously been published by the Geological Survey in mimeographed form.

The information contained in the report has been collected in part by the Geological Survey in connection with its activities in studying the water resources of the country and their best utilization, in part by the Bureau of the Census in its periodic statistical study of the country's activities, and in part by the Federal Power Commission in connection with the administration of the federal water-power act. Some of the data have therefore been previously published in scattered statistical form, and some have been made available in multigraphed or mimeographed

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday May 15 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new—no par | 83 | 72 | 85 |
| Ala. Pwr., $7 cum. pf.—no par | k115 | 114⅜ | 115½ |
| Allis Chalmers Mfg., 6% com., ex.div. | 126 | 115¼ | 129⅞ |
| Aluminum Co. of Amer., com. | 197¾ | 120 | 197¾ |
| Aluminum Co. of Amer., 6% pf. | k110 | 105½ | 110¼ |
| Amer. & Foreign Pwr., 7% pf. no par | 109¼ | 105¼ | 109⅜ |
| Amer. & Foreign Pwr., com.—no par | 37¾ | 22⅛ | 38⅞ |
| Amer. Bosch Magneto, com.—no par | 30¼ | 15⅝ | 34½ |
| Amer. Brown Boveri Elec.† | 20½ | 10⅝ | 20½ |
| Amer. Brown Boveri Elec., pf. $7 | 64 | 40½ | 65 |
| Amer. Gas & Elec., 6% pf.—no par | 109⅝ | 106¾ | 111 |
| Amer. Gas & Elec., com. †—no par | 177 | 117½ | 184 |
| Amer. Lt. & Trac., 6% pf. | 118 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 284½ | 170 | 248½ |
| Amer. Pwr. & Lt., 6% pf. | 107¾ | 104 | 109⅞ |
| Amer. Pwr. & Lt., com. †—no par ev.div. | 93¾ | 62½ | 95 |
| Amer. Pub. Serv., 7% pf. | a102 | 97⅛ | 102 |
| Amer. Pub. Serv., com. † | k 70 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | a 96½ | 87¼ | 97 |
| Amer. Pub. Utilities, 7% pr. pf. | a102½ | 95¾ | 102½ |
| Amer. Pub. Utilities, com. | k 55 | 60 | 65 |
| Amer. States Sec., A | a 13 | 4 | 13⅞ |
| Amer. States Sec., B | a 16½ | 4⅞ | 17⅛ |
| Amer. Superpwr., 6% 1st pf. | l 105 | .... | .... |
| Amer. Super pwr., Class A†—no par | 49⅝ | 36⅞ | 56 |
| Amer. Super pwr., Class B†—no par | 51⅞ | 37 | 56⅞ |
| Amer. Wtr. Wks. & Elec., 6% pf. | 105 | 101½ | 106 |
| Amer. W.W. & E., com. new—no par ex.div. | 66⅞ | 52½ | 70⅝ |
| Anaconda Copper cap. $3 | 74⅞ | 53¼ | 74⅞ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr. & Lt. 7% pf. | 107½ | 107½ | 111 |
| Assoc. Gas & Elec., $3.50—50 | 54½ | .... | .... |
| Assoc. Gas & Elec., pf.—$6 no par. | 95 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 52⅝ | 47 | 52⅞ |
| BABCOCK & WILCOX, 7% com. | 124½ | 117½ | 127 |
| Binghamton L., H. & P., $6 pf. | 107½ | 102 | 109¼ |
| Birmingham Elec., pf.—$6 no par. | 107 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf. | k108 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k163 | 135 | 170 |
| Blaw-Knox, com.† | i101 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., com., new | f 64⅜ | .... | .... |
| Broad River Pwr., 7% pf. | 105½ | 105 | 108½ |
| Brooklyn Edison, 8% com. | 264½ | 206⅞ | 268¼ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26½ | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 43 | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | 99 | 98 | 101 |
| California Ry. & Pwr., 7% pf. | m135 | ... | ... |
| Carolina Pwr. & Lt., pf.—$7—no par | l111⅞ | 109 | 111 |
| Central & S. W. Util., $7 pf.—no par | a104½ | 99⅛ | 105½ |
| Central & S. W. Util., pr. In. $7 pf.—no par | a112 | 103½ | 112 |
| Central Ark. Ry. & Lt., 7% pf. | 106½ | 105 | 107½ |
| Central Ill. Pub. Serv., $6 pf. | a 99⅜ | 97½ | 100⅜ |
| Central Ind. Pwr., 7% pf. | a101 | 95 | 101 |
| Central Maine Power, 6% pf. | 97 | 96 | 98½ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 110⅜ | 104¼ | 110 |
| Central States Elec., 7% pf. | 120⅝ | 104¾ | 121⅝ |
| Cincinnati Gas & Elec., 5% com. | g100½ | 97½ | 100¼ |
| Cities Service, $6 pf.—no par | l 103¼ | 94½ | 103¼ |
| Cities Service, pf. B—no par | l 9⅜ | 8⅞ | 9⅜ |
| Cities Service, pf. BB—no par | l 97 | 88½ | 97 |
| Cities Service, com.—20 | l 70½ | 54 | 70 |
| Cities Service, Bks. Shrs.—10 | l 34⅞ | 26⅞ | 34⅞ |
| Cities Service Pwr. & Lt., 7% pf. | k108 | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf. | k101 | 95 | 100½ |
| Cleveland Elec. Illg., 6% pf. | 114 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 420 | 350 | 425 |
| Columbia Gas & Elec., 6% pf. | 109½ | 107½ | 110½ |
| Columbia G. & E. com. $5—no par | 118 | 89½ | 118 |
| Columbus Elec. & Pwr., $2 com.—no par | k 79⅞ | 66 | 79⅞ |
| Columbus Elec. & Pwr., 7% | 113 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 109½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 109½ | .... | .... |
| Columbus Ry., P. & Lt. com. no par | 125 | 120 | 125 |
| Commonwealth Edison, 8% com. | a187 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 103¾ | 102⅞ | 104⅞ |
| Commonw'th Pwr., $2, com.—no par | 87¼ | 62¼ | 87½ |
| Conn. Lt. & Pwr., 8% pf. | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117½ | 118 | 121 |
| Cons. Gas of N. Y., pf. | 103⅜ | 101⅛ | 105 |
| Cons. Gas of N. Y., com. $5—no par, ex.div. | 166 | 119⅝ | 170½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111 | 110 | 113 |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e105½ | 100½ | 105¾ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 88 | 67½ | 93 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | ... | .... |
| Consumers Pwr., 6% pf. | 104⅞ | 106 | 107 |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108¼ | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par | k240 | 240 | 265 |
| Crocker Wheeler, com.† | 47 | ... | ... |
| Crocker Wheeler, 7% pf. | 95 | ... | ... |
| DALLAS PWR. & LT., 7% pf. | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 109⅞ | 108½ | 110½ |
| Derby Gas & Elec., 7% pf. | 102 | 96 | 100½ |
| Detroit Edison, 8% com. | k192 | 166½ | 194⅞ |
| Dubilier Condenser, com.—no par | 5½ | 2⅞ | 5⅜ |
| Duke Pwr., cap. | k138 | 130 | 145 |
| Duquesne Lt., 5% pf. | 105½ | 104⅞ | 105⅞ |
| EASTERN NEW YORK UTIL., $7 pf. | k110½ | 111 | 112½ |
| Eastern States Pwr. B | k 26½ | 11½ | 26½ |
| Eastern States Pwr., pf. | k100 | 98 | 100½ |
| East. Tex. Elec., 7% pf. | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d301 | 252 | 301 |
| El Paso Elec. 7% pf. | 113 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l109⅞ | 108⅞ | 111⅞ |
| Elec. Bd. & Sh. Sec., com. $1—no par ex. rights | l120 | 76 | 127½ |
| Electric Household Util.† | a 23⅞ | 13½ | 25 |
| Elec. Investors, 6% pf.—no par | 104 | 101 | 104½ |
| Elec. Investors, com.†—no par | 79⅞ | 40⅛ | 79¼ |
| Elec. Pwr. & Lt., ctfs. pf. | 109¾ | 106½ | 110½ |
| Elec. Pwr. & Lt., ctfs., 40% pd. | m127 | 120⅞ | 129⅞ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 45½ | 28⅞ | 45½ |
| Elec. Ry. Securities, com.—no par | 6⅞ | .. | .. |
| Elec. St. Battery com. $5.25—no par | 84¼ | 69 | 84¼ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 105 | 104 | 107 |
| Empire Pwr., ptc.† | 39 | 27½ | 39½ |
| Engr. Pub. Serv. $7, pf.—no par | 110⅞ | 107 | 110½ |
| Engr. Pub. Serv., com.—no par | 45 | 33 | 46⅞ |
| Eureka Vacuum Cleaner, com. $4—no par | 75½ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | 112 | 104 | 114⅞ |
| F.-M., com.—$3—no par | 44⅛ | 32½ | 54 |
| Federal Lt. & Trac., com $1.40 | 54¾ | 42 | 56⅞ |
| Federal Lt. & Trac., $6 pf.—no par ex.div. | 107¼ | 98 | 109 |
| Florida Pwr. & Lt., 7% pf. | k107½ | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf. | i114½ | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf. | 82 | 75 | 85 |
| Galveston-Houston Elec., com. | 42½ | 31⅞ | 42½ |
| General Cable, Cl.A | 78 | 56 | 84¼ |
| Gen. Elec. $3 com.—no par | 169 | 124 | 174½ |
| Gen. Elec., special—6% | 11½ | 11⅛ | 11¼ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par | 47 | 35½ | 48⅛ |
| Gen. G. & E. (Del.) pf. A $8—no par | 135 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par | 118 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 | 114½ | 105½ | 114⅞ |
| Gen. Pub. Serv., $7 pf. | 140 | 115 | 140 |
| Gen. Pub. Serv., com., no par | 28 | 16⅞ | 29 |
| General Public Utilities, $7 pf. | k102½ | 98 | 101 |
| Ga. Lt., Pwr. & Rys., com. | k 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | h105 | .... | .... |
| IDAHO PWR., 7% pf. | 110 | 109 | 111½ |
| Ill. No. Utilities, 6% pf. | k 99 | 96 | 100 |
| Ill. Pwr. & Lt., 7% pf. | k105½ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 105½ | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf. | 102 | 100 | 105 |
| Ingersoll Rand com. | 97 | 90 | 98 |
| Int. Combus. Engr., com. $2—no par ex.div. | 65⅝ | 45½ | 65⅞ |
| Int. Combustion Engr., 7% pf. | k104½ | 103 | 106 |
| Int. Util., Class A—$3.50—no par | 49⅞ | 44⅞ | 52 |
| Int. Utilities, Class B—no par | 13⅞ | 6⅞ | 16¼ |
| Interstate Pwr., pf.—$7—no par | 103½ | 99 | 103¼ |
| Interstate Pub. Serv., 7% pf. | 106 | 103 | 106½ |
| Iowa Ry. & Lt., 7% pf. | 101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 106½ | 105 | 107 |
| Johns-Manville com †—no par. | 130½ | 111½ | 134 |
| Johns-Manville, 7% pf. | m122½ | 119½ | 121½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, May 12. *l*Bid price Wednesday, May 16. *m*Latest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday May 15 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY POWER & LIGHT pf. $7 | k112½ | 111½ | 114 |
| Kansas Gas & Elec. 7% pf. | l110¼ | 107 | 110 |
| Kelvinator Corp. | 19⅝ | 11⅛ | 22⅜ |
| Kentucky Hydro-Elec., 7% pf. | h104 | 100 | 105 |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 105 | 100 | 105 |
| LACLEDE GAS LT., 10% com. | 232 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 37 | 19⅛ | 40 |
| Long Island Ltg., 7% pf. | k110½ | 110⅛ | 112½ |
| Long Island Ltg., 6% pf. | k109 | 107 | 109 |
| Long Island Ltg., com.†—no par | k210⅛ | 170 | 225 |
| Los Angeles Gas & Elec., 6% pf. | h112 | 105½ | 112½ |
| Louisville Gas & Elec., cl. A. $1.75 | 38⅝ | 28 | 38⅝ |
| MAN. ELEC. SUPPLY, cap. $5—no par | 55½ | 50 | 61 |
| Maytag Co., com. 50—no par | 38⅝ | 30 | 40½ |
| Memphis P. & L., pf.—$7—no par | 110 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 100 | 103 | 109⅛ |
| Metropolitan Ed., pf.—$7—no par | 109⅛ | 109 | 111 |
| Metropolitan Ed., com. $8—no par | k170 | 125 | 185 |
| Middle West Utilities, 6% pf. | a100½ | 93⅛ | 100½ |
| Middle West Util., 6% pr. lien | a107 | 99 | 108 |
| Middle West Util., com. $7—no par | a160 | 123½ | 169 |
| Midland Utilities, pr. ln. 6% pf. | a 95½ | 94⅛ | 97 |
| Midland Utilities, 6% pf. A | a 90⅜ | 89½ | 92½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 100 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | l108⅜ | 107 | 109 |
| Miss. River Pwr., 6% pf. | k112 | 94 | 112⅛ |
| Miss. River Pwr., 3% com. | 112 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | 109½ | 107½ | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | k105 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 50½ | 29½ | 53 |
| Montana Pwr., 5% com. | 171 | 102½ | 175 |
| Montreal Pwr., 7½% com. | f114⅛ | .... | .... |
| Mountain States Pwr., 7% pf. | k104 | 97 | 105 |
| Mountain States Pwr., com.† | 18 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110½ | 98 | 110½ |
| National Carbon, 8% pf. | m136⅛ | 136⅛ | 139⅞ |
| National Elec. Pwr., A† | a 40 | 27⅛ | 42 |
| National Lt., Ht. & Pwr., com. | m 24 | 20 | 30 |
| National, Light, Ht. & Pwr., 5% pf. | m 72 | 70 | 80 |
| National Pwr. & Lt., pf.—7% | 110 | 108½ | 111 |
| National Pwr. & Lt., com.†—no par. ex.div. | 36⅛ | 21⅞ | 36⅞ |
| National Pub. Serv., 7% pf. | 102⅛ | 99 | 103 |
| National Pub. Serv., 7% ptc., pf. | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 29½ | 22 | 29⅝ |
| National Pub. Serv., B com.—no par | 33⅞ | 24⅛ | 34⅛ |
| Nebraska Pwr., 7% pf. | l110⅛ | 110 | 111⅛ |
| Nevada-Calif. Elec., com. | m 33 | 22 | 37 |
| New Brunswick Pwr., 4% pf. | 64 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 110 | 98⅛ | 110⅛ |
| New Eng. Pub. Serv., pf. $7 | 98 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 102 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | 105 | 101 | 105½ |
| New York Power & Light 7% pf. | 114½ | .... | .... |
| NiagaraFalls Pwr., 7% pf.—25 | 28⅛ | 27⅛ | 28⅞ |
| No. Amer., 6% pf.—50 | 55 | 53½ | 55½ |
| No. Amer., com.—10 | 77⅛ | 58⅞ | 78⅞ |
| No. Amer. Edison, $6 pf.—no par... ex. div. | 103⅞ | 102⅛ | 105⅞ |
| Northeastern Pwr., com. | 30⅞ | 19⅞ | 31 |
| No. N. Y. Utilities, 7% pf. | 109 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 31⅛ | 18 | 32 |
| Northern Ohio Pwr. & Lt., 6% pf. | 100 | 90 | 99 |
| No. Ont. Lt. & Pr. 6% pf. | h 99⅛ | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | m 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 109 | 108⅞ | 110½ |
| No. States Pwr. (Del.), 8% com. | 148⅞ | 123 | 152 |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par. | 94⅛ | 89 | 100⅛ |
| Ohio Brass, 6% pf. | k105 | 106 | 111 |
| Ohio Pwr., 6% pf. | 108 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | 108 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 112⅛ | 107 | 112 |
| Ohio River Edison, 7% pf. | 109⅛ | 106 | 109⅞ |
| Oklahoma Gas & Elec., 7% pf. | 114⅜ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 29 | 26½ | 30 |
| Pacific Gas & Elec., 8% new com. | 53⅛ | 43½ | 53½ |
| Pacific Pwr. & Lt., 7% pf. | l110⅛ | 106 | 110 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 81 | 79⅞ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 99½ | 93½ | 100 |
| Penn-Ohio Edison, 7% pf. | 108 | 97½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 111 | ... | .... |
| Penn Pwr. & Lt.—$7—no par | l110¼ | 109⅛ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 89 | 68 | 90 |
| Phila. Co., 5% pf.–50 | k 48 | 45⅛ | 48⅛ |
| Phila. Co., 6% pf.—50 | 55 | 52 | 57 |
| Phila. Co., com.—50 | 174½ | 145 | 174½ |
| Phila. Elec., 8% com.—25 | c 74⅞ | 55½ | 74⅞ |
| Portland Elec. Pwr., 7% pf. | 104½ | 100 | 104½ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 46 | 42½ | 52 |
| Potomac Elec. Power, 6% pf. | j113½ | .... | .... |
| Pwr. Sec., pf.—no par | 60 | 50 | 68 |
| Pwr. Sec., com.—no par | 13½ | 11 | 14⅛ |
| Public Serv. of Colorado, 7% pf. | 105 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 114½ | 103⅞ | 115 |
| Pub. Serv. of N. J., 7% pf. | 128½ | 118 | 129⅞ |
| Pub. Serv. of N. J., $2 com.—no par | 63⅞ | 41½ | 66⅞ |
| Pub. Serv. of No. Ill., 6% pf. | a110 | 110 | 115 |
| P. S. of No. Ill., com. $8—no par | a185 | 159½ | 185 |
| Pub. Serv. of No. Ill., $8 com. | a185½ | 159⅞ | 185½ |
| Pub. Serv. of Okla., 7% pr. ln. | 109 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 110 | 108 | 110⅛ |
| Puget Sound Pwr. & Lt., 7% pf. | k110 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 102½ | 92 | 105⅞ |
| Puget Sound Pwr. & Lt., com. | 77⅞ | 34⅞ | 84⅞ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 58½ | 54⅛ | 58½ |
| Radio Corp. of Amer., com.—no par. | 206⅞ | 85½ | 211 |
| Rochester Gas & Elec. 6% pf. D | 105½ | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107⅛ | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 105½ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 117 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | 15⅛ | 4½ | 17½ |
| Sierra Pacific Elec., 2% com. | k 40½ | 29 | 40½ |
| Sioux City Gas & Elec., 7% pf. | 106½ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 109 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 89⅞ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 60 | 40⅞ | 61 |
| So. Calif. Edison, 8% pf. | 49 | 38½ | 41 |
| So. Calif. Edison, 7% pf. | 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 27⅛ | 25⅞ | 27⅞ |
| So. Calif. Edison, 8% com. | 53 | 43½ | 53½ |
| Southern Cities Utilities, 7% pf. | 92 | 75 | 92 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 65 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 95 | 88 | 96½ |
| Southwestern Pwr. & Lt., 7% pf. | k113½ | 103 | 115 |
| Standard Gas & Elec., 8% pf. | 70⅛ | 65 | 71 |
| Standard Gas & Elec., 7% pr. pf. | 114¼ | 110½ | 115 |
| Standard G. & E., com. $3.50 | 73⅛ | 57⅛ | 74½ |
| Standard Power & Light, com. | 51⅛ | 29⅞ | 51¼ |
| Standard Pwr. & Lt., 7% pf. | k106½ | 98 | 106 |
| Staten Island Edison, pf.—$6—no par | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | 155 | 155 | 178 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 112½ |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | k 70 | 62 | 71 |
| Tenn. Elec. Pwr., 6% pf. | 103 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109½ | 107 | 110 |
| Tex. Pwr. & Lt., 7% pf. | l114½ | 113½ | 115 |
| Tide Water Pwr., 8% pf. | 111 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 129½ | 112⅛ | 134 |
| Toledo Edison, 7% pf. | 109½ | 108 | 111 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | k145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 96½ | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c148½ | 114½ | 149½ |
| United Lt. & Pwr., pf.—$4—no par | a 57½ | 53 | 58 |
| United Lt. & Pwr., pf.—$6.50—no par | 102⅞ | 94½ | 103½ |
| United L. & P., com. A .48—no par | h 25⅞ | 13½ | 26⅝ |
| United L. & P., com. B .48—no par | k 30 | 20 | 30 |
| Utah Pwr. & Lt., 7% pf. | l112½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105½ | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 101½ | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 41⅞ | 28½ | 41½ |
| Utilities Pwr. & Lt., com. B $1—no par | 30⅞ | 18½ | 30⅞ |
| VERMONT HYDRO-ELEC., 7% pf. | 99 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | k110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102½ | 97 | 103½ |
| WAGNER ELEC., 7% pf. | b105 | 96½ | 105 |
| Wagner Elec., com.—no par | b110 | 37 | 110 |
| Washington Ry. & Elec., 7% com. | j450 | .... | .... |
| Washington Ry. & Elec., 5% pf. | j102½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | 225 | 175 | 235 |
| West Penn Elec., 7% pf. | 113⅞ | 109½ | 115 |
| West Penn Elec., Cl. A $7 | 109⅞ | 106½ | 112 |
| West Penn Pwr., 7% pf. | 115⅞ | 114⅞ | 117 |
| West Penn Pwr., 6% pf. | k110 | 108⅜ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf. | 104 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | k104 | 100 | 106 |
| Western States Gas & Elec., com. | m 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 107½ | 88½ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | 32⅝ | 30⅞ | 34 |
| Weston Elec. Instrument, com.—no par | 17⅜ | 12½ | 18⅝ |
| Wheeling Elec., 6% pf. | 106 | 95 | 109 |
| Worthington Pump, 7% pf. A | 57½ | 46½ | 58½ |
| Worthington Pump, 6% B | k 49 | 41 | 51 |
| Worthington Pump, com. | 36⅞ | 28 | 36⅞ |
| YALE & TOWNE com. $5—25 | 78 | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, May 12. *l*Bid price Wednesday, May 16. *m*Latest quotations available. †Dividend rate variable.

preliminary reports, but some have never before been published. All these statistics are now brought together in such a form as to be available for further study and any other use that may be found to be desirable. They will serve as base data on which must rest any future study in this country of the problems of power utilization in relation to economics and government.

OUTPUT IN CANADA SHOWS INCREASE OVER LAST YEAR.—Output of power from central electric stations in Canada during the month of February was 1,273,982,000 kw.-hr., as compared with 1,317,882,000 in January and with 1,065,850,000 in February, 1927. This total includes both water and fuel developed power, the amount attributed to the former in February being 1,256,242,000 and to the latter 17,650,000 kw.-hr. Quebec stations continue to account for the majority of output, being credited with 603,303,000 kw.-hr., an increase of roughly 25 per cent over February of last year. Ontario was second with 462,441,000, followed by the Prairie provinces with 105,972,000 British Columbia, 87,882,000 and the Maritime provinces, 10,317,000. British Columbia reported a daily average of 3,028,000 kw.-hr. for February, as compared with 3,011,000 in January last and 2,610,000 in the same month of 1927. The total in the Maritime provinces equals that of March, 1927, which hitherto was the highest point ever reached by the Maritime stations. Exports of energy from Canada averaged about 4,300,000 kw.-hr. daily and have fluctuated but slightly in the past year or two. The amount is about 9 per cent of the total generated.

## Buffalo, Niagara & Eastern Adds to Directorate

Three new directors were elected at the annual meeting of the Buffalo, Niagara & Eastern Power Corporation, held May 8 in Buffalo. Lewis G. Harriman, Walter W. Huntley, and Hans Schmidt were added to the directorate to fill vacancies. Lewis G. Harriman is president of the Manufacturers & Traders-Peoples Trust Company and president of the Buffalo Chamber of Commerce. He is also connected as a director and officer with a number of Niagara frontier business organizations. Walter W. Huntley is also a director of the Niagara

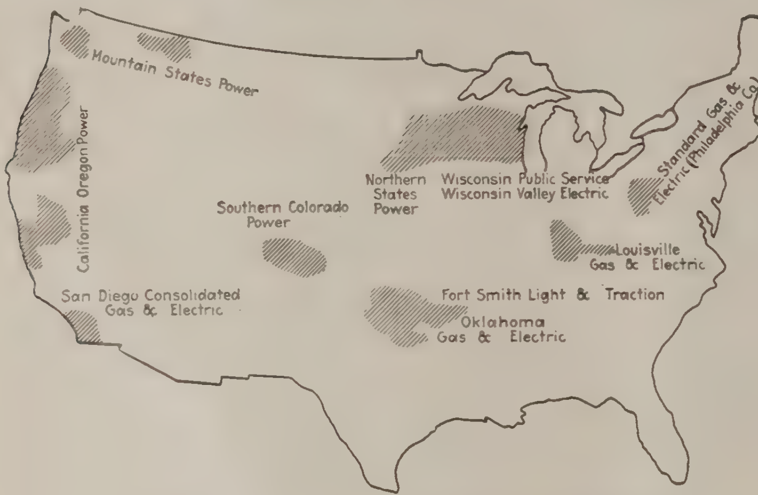
Electric Service Corporation. For a number of years he was connected with the Buffalo General Electric Company, but later entered the contracting field. Mr. Huntley is now president of the Elmwood Construction Company, Inc., of Buffalo. Hans Schmidt has long been prominent in business and financial circles on the Niagara frontier. Mr. Schmidt is a director of the Niagara Falls Power Company and president of Schoellkopf & Company.

## Standard Gas & Electric Has Built Exceedingly Sound Structure

GRADUALLY extending its operations across the map of the United States, the Standard Gas & Electric Company has placed its imprint thereon at ten major points. One of the most romantic features of America's industrial progress during the past generation is the development of the power and light industry, the Standard Gas & Electric Company, with gross earnings from its system of slightly under $150,000,000 annually, has been no mean contributor toward this development.

In disbursements to shareholders this company has not been so liberal as have many other similarly situated holding companies. The average price of the parent company common stock in 1923 was $25. At a current price of about $72 its appreciation during the period has been exceedingly modest in comparison with that of other systems, such as American Power & Light, American Gas & Electric, American Water Works & Electric Company and others that could be mentioned, where stock splits have induced material enhancement in value. Standard Gas & Electric Company is among those which have intrenched themselves by turning back a large share of earnings into the system. Such a policy has built this group into one of the soundest utility systems in the country. Earnings last year on common stock amounted to $5.30 a share, against $4.68 the year before. This means that at a price of $70 the stock is worth about thirteen times earnings, which is considerably under the average for power and light holding companies. The property investment of the system is approximately $5.75 per dollar of gross revenue.

The financial year 1927 was a very profitable one for the Standard Gas & Electric System. Taking the holding company alone, the gross revenue amounted to $13,124,130, and of this $12,881,008 was net revenue. This is an increase of approximately 20 per cent both in gross and in net. For the system as a whole the gross earnings from the company's public utility properties amounted to $145,953,139, and net earnings were $63,145,163, which indicates an operating ratio of 56 per cent, against almost 58 per cent in 1926. There is a balance available for common stock equivalent to $6.60 a share on the average amount of common stock outstanding. The parent company pays a dividend of $3.50 on common stock.


Mountain States Power
California Oregon Power
San Diego Consolidated Gas & Electric
Southern Colorado Power
Northern States Power
Wisconsin Public Service
Wisconsin Valley Electric
Standard Gas & Electric (Philadelphia Co.)
Louisville Gas & Electric
Fort Smith Light & Traction
Oklahoma Gas & Electric

*Standard Gas System widely diversified geographically*

The financial set-up of the Standard Gas & Electric Company is in an unusually strong position. Common stock totals 1,418,803 shares of no par value. The surplus shown in the most recent balance sheet is $12,166,135. There are three issues of preferred stock, one 6 per cent, one 7 per cent and one 8 per cent, aggregating $48,274,000 in book value. The funded debt also comprises three separate issues, all bearing 6 per cent and totaling $40,000,000 book value. The company again established a new record in 1927 in the sale of preferred stock to customers. The par value of sales totaled $31,975,600, which is 27 per cent higher than the 1926 total. Approximately 22,000 new shareholders were added during the year, a factor of importance in the company's public relations.

During the year many of the company's subsidiaries took advantage of the low money rate and a satisfactory market for power and light securities to accomplish refunding operations with resulting large savings in interest and dividend charges.

## New Public Utility Financing Active

Eight new offerings were made by electric light and power companies during the week ended May 17, two in the form of debentures, five in the form of gold bonds and one in the form of gold notes. The American Commonwealths Power Corporation issued 5½ per cent gold debentures to the amount of $4,500,000 at 96½ and interest to yield over 5.75 per cent. The American Gas & Power Company made an offering of secured gold debentures at 95½ and accrued interest, to yield over 5.30 per cent, a piece of financing involving a total of $6,500,000.

Two new offerings were made by the Public Utilities Consolidated Corporation, the two issues totaling $5,500,000. One issue was in the form of ten-year 6 per cent secured convertible gold bonds priced at 98 and accrued interest and the other in the form of first mortgage twenty-year 5½ per cent gold bonds priced at 97 and accrued interest.

Twenty-five year 5½ per cent sinking fund secured gold bonds, series A, of the Islands Edison Company were issued to the amount of $2,250,000 at 96 and accrued interest, to yield 5.80 per cent.

First mortgage and refunding 5 per cent gold bonds of the Indiana Electric Corporation were offered to the amount of $3,268,000, the price being 100 and interest. The Electric Public Utilities Company made an offering of three-year 5 per cent gold notes at 97¼ and interest, amounting to $3,000,000.

The unexchanged portion of a new issue of $35,000,000 Associated Gas & Electric Company debenture bonds, amounting to $8,750,000, were offered at par and interest to yield 5 per cent.

RECENT LISTINGS.—The Baltimore Stock Exchange has authorized the listing of 5 per cent cumulative preferred stock, series A, of the Consolidated Gas, Electric Light & Power Company of Baltimore (par $100) to the amount of $15,500,000 and of 4½ per cent, series B, first refunding mortgage gold bonds of the Pennsylvania Water & Power Company to the amount of $6,000,000. The Boston Stock Exchange has authorized the listing of first mortgage sinking fund gold bonds, 6½ per cent series, due 1953, of the Electric Power Corporation (Elektrowerke Aktiengesellschaft) to the amount of $5,000,000 and additional 6 per cent convertible gold debentures of the Peoples Light & Power Corporation totaling $750,000.

# Business News and Market Conditions

## N.F.P.A. Accepts 1928 Code

*Rules Virtually Same as Advance Publication Report of Electrical Committee—Recognition Given to Increased Use of Higher Voltages in Wiring Work*

AT SIX well-attended sessions of a special meeting of the electrical committee of the National Fire Protection Association at Atlantic City, N. J., this month the 1928 National Electrical Code was approved subject to a letter ballot of its members. The electrical committee meeting was preceded by a three-hour meeting of the correlating committee which was appointed at the February, 1928, meeting of the electrical committee, the agenda for that meeting being too extensive for its complete disposal during the time available.

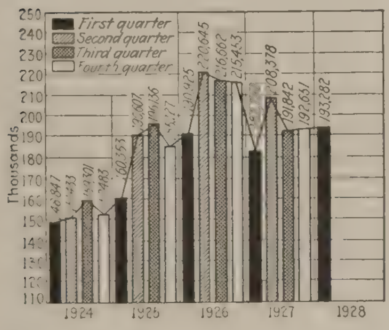
At the annual meeting of the N.F.P.A. held at Atlantic City on May 7, 8, 9 and 10 an enthusiastic reception was accorded the electrical committee's report. The report was approved by the N.F.P.A. subject to a letter ballot of the members of the electrical committee, after which it will be sent to the executive committee of the N.F.P.A. and later to the American Engineering Standards Committee. It is thus expected that the 1928 code will be available for distribution in the early fall.

Substantially all the rules as submitted by the correlating committee were adopted by the electrical committee and virtually all the articles were approved unanimously. Under the head of definitions the term "extra hazardous location" was omitted and the definition applying thereto was combined under the head "hazardous location." Article 5, wiring methods, as well as article 9, grounding, came in for a good deal of discussion. In article 6, conductors, a very helpful development has been added in the way of providing larger circuits in dwellings and encouraging more circuits to provide for the greater use of appliances. The rules for electrical metallic tubing, under article 5, remained virtually the same as published in the advance publication report of the electrical committee covering the proposed 1928 National Electrical Code.

In article 50, circuits and equipment operating at more than 600 volts between conductors, provision was made under rule 5009, service equipment, to permit the use of other than oil circuit breakers if such devices are developed and found suitable and will satisfy the interest of the code. The section devoted to automatic overload circuit breakers under this rule also was expanded. In general, article 50 was considerably expanded, both in number of items and treatment, to keep in step with the considerable increase of the use of higher voltages in wiring work.

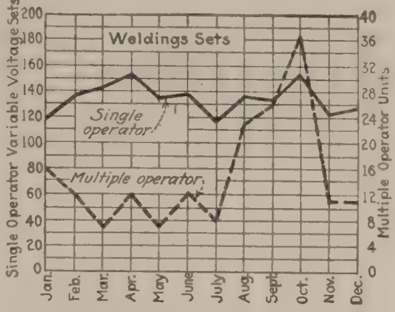
At the annual meeting of the N.F.P.A. A. M. Schoen, chief engineer of the Southeastern Underwriters' Association of Atlanta, Ga., was elected president.

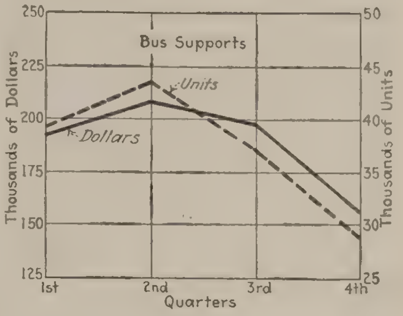
## Sales of Electric Washing Machines by Quarters

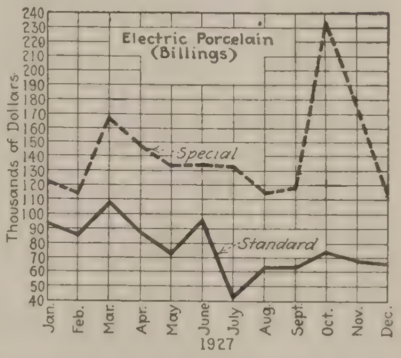


NOTE—March sales figures showed a substantial gain over those of February.

## N.E.M.A. Statistics







Other data covering 1927 appeared in preceding issues.

### *Production of Steel—All Kinds (Tons per Year U. S.)*

From American Iron & Steel Institute Statistical Department

| Year | Ingots and Castings—by Processes<br>Open Hearth | Bessemer | Crucible | Electric | Miscellaneous | Total Production | Per Cent Electric | Alloy Steel—Included in Total Production Table<br>Open Hearth Bessemer and Crucible | Electric | Total Alloy | Per Cent Alloy by Electric Furnace |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1909 | 14,493,936 | 9,330,783 | 107,355 | 13,762 | 9,185 | 23,955,021 | 0.0574 | ........ | ....... | ........ | ...... |
| 1910 | 16,504,509 | 9,412,772 | 122,303 | 52,141 | 3,194 | 26,094,919 | 0.2000 | ........ | ....... | ........ | ...... |
| 1911 | 15,598,650 | 7,947,854 | 97,653 | 29,105 | 2,844 | 23,676,106 | 0.0123 | ........ | ....... | ........ | ...... |
| 1912 | 20,780,723 | 10,327,901 | 121,517 | 18,309 | 2,853 | 31,251,303 | 0.0586 | ........ | ....... | ........ | ...... |
| 1913 | 21,599,931 | 9,545,706 | 121,226 | 30,180 | 3,831 | 31,300,874 | 0.0965 | ........ | ....... | 714,357 | ...... |
| 1914 | 17,174,684 | 6,220,846 | 89,869 | 24,009 | 3,622 | 23,513,030 | 0.1020 | 637,249 | 9,344 | 646,593 | 1.442 |
| 1915 | 23,679,102 | 8,287,213 | 113,782 | 69,412 | 1,527 | 32,151,036 | 0.2160 | 993,203 | 27,944 | 1,021,147 | 2.735 |
| 1916 | 31,415,427 | 11,059,039 | 129,692 | 168,918 | 604 | 42,773,680 | 0.3941 | 1,291,486 | 71,129 | 1,362,615 | 5.220 |
| 1917 | 34,148,893 | 10,479,960 | 126,716 | 304,543 | 495 | 45,060,607 | 0.6750 | 1,513,757 | 130,578 | 1,644,335 | 7.940 |
| 1818 | 34,459,391 | 9,376,236 | 115,112 | 511,364 | 329 | 44,462,432 | 1.1500 | 1,496,891 | 290,961 | 1,787,852 | 16.300 |
| 1919 | 26,948,694 | 7,271,562 | 63,572 | 384,452 | 2,952 | 34,671,232 | 1.1100 | 1,299,556 | 181,632 | 1,481,188 | 12.250 |
| 1920 | 32,671,895 | 8,883,087 | 72,265 | 502,152 | 3,535 | 42,132,934 | 1.1920 | 1,414,720 | 245,572 | 1,660,292 | 14.780 |
| 1921 | 15,589,802 | 4,015,938 | 7,613 | 169,499 | 945 | 19,783,797 | 0.8570 | 746,302 | 63,246 | 809,548 | 7.810 |
| 1922 | 29,308,983 | 5,919,298 | 28,606 | 346,039 | ..... | 35,602,926 | 0.9710 | 1,548,077 | 125,419 | 1,673,496 | 7.500 |
| 1923 | 35,899,657 | 8,484,088 | 44,079 | 515,872 | ..... | 44,943,696 | 1.1490 | 1,911,513 | 194,976 | 2,106,489 | 9.270 |
| 1924 | 31,577,350 | 5,899,590 | 22,473 | 432,526 | ..... | 37,931,939 | 1.1400 | 1,837,846 | 188,563 | 2,026,409 | 9.300 |
| 1925 | 38,034,488 | 6,723,962 | 19,562 | 615,512 | ..... | 45,393,524 | 1.3610 | 2,139,193 | 293,780 | 2,432,973 | 12.080 |
| 1926 | 40,691,979 | 6,934,568 | 15,493 | 651,723 | ..... | 48,293,763 | 1.3500 | 2,156,603 | 306,811 | 2,463,414 | 12.460 |
| 1927 | 38,068,335 | 6,191,727 | 9,036 | 666,087 | ..... | 44,935,185 | 1.4823 | 1,922,922 | 343,517 | 2,266,439 | 15.156 |

# Market Conditions

DISTINCT optimism as to the business outlook pervades the electrical field and current business is in good volume. In New England many small orders were placed. Motor sales amounted to about $50,000. Central-station companies are buying wiring material steadily in small lots. The demand for motors in the Eastern district is strong and some sizable bookings are expected to mature in the next 30 to 60 days. A manufacturer of gypsum products will soon make commitments for new plants to cost more than $1,000,000; a copper company will make purchases for a proposed refinery to cost $4,000,000, while another copper interest in Utah will electrify at a cost of over $1,000,000. A washing machine manufacturer placed an order for $20,000 worth of motors and a maker of talking machines ordered disk type motor units amounting to $30,000. Railroads have purchased over $300,000 worth of equipment.

An order for four 40,000-kw. vertical water wheel generators was placed in the Southeast for a development in North Carolina. An order for power transformers from the same state amounted to $50,000. Industrial plant business also is active. In St. Louis spotty business is reported. The volume of sales is good in the Middle West, and utility companies continue active with construction work. On the Pacific Coast power company business is good and industrial plant buying is active. New steel plants in Los Angeles and San Francisco, a lumber mill at Klamath Falls, an automobile body plant in Seattle, a seed plant and warehouse in San Bruno and a terminal for San Francisco produce and provision wholesalers are active projects involving more than $10,000,000.

## Metal Market Active—Prices Higher—Lead Steady

Exceptionally active sales of copper with an advance in price took place in the non-ferrous metal markets. With the exception of lead which is steady prices have shown an advance. Copper producers have advanced their price from 14¼ cents to 14⅜ cents per lb. delivered Connecticut Valley basis. Effective May 15, Copper Exporters, Inc. advanced their copper price from 14.50 cents to 14.625 cents per lb. c.i.f. usual European destinations. Lead has been quiet with a few sales at price concessions below the prevailing market levels. Tin is easy with a good demand for spot metal.

NEW YORK METAL MARKET PRICES

| | May 9, 1928 Cents per Pound | May. 16, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic..... | 14.025-14.05 | 14.15-14.175 |
| Lead, Am. S. & R. price | 6.10 | 6 10 |
| Antimony.............. | 11⅜ | 11⅜ |
| Nickel, ingot........... | 35 | 35 |
| Zinc spots............. | 6.325 | 6.40 |
| Tin, Straits............ | 51.875 | 52½ |
| Aluminum, 99 per cent... | 24.30 | 24.30 |

Base copper wire price May 16, 1928, 16⅛ cents.

## Motor Demand Strong in Eastern District

The call for motors for industrial service is active in the Eastern district and transactions are reaching a higher level than in several weeks. Sizable bookings are expected to mature during the next 30 to 60 days. Motor units of a wide range in horsepower rating are enjoying a good market. A manufacturer of gypsum products will soon make commitments for three new plants to cost more than $1,000,000; a copper company will make purchases for a proposed $4,000,000 refinery, while another copper interest will electrify its surface properties in Utah and is placing orders for equipment of various character, including electric mine locomotives, to cost upward of $1,000,000. A manufacturer of washing machines in Northern New York has contracted for a quantity of ⅛-hp. motors, with a leading producer, totaling about $20,000. A maker of talking machines in New Jersey has placed an order for disc type motor units with the same manufacturer, at $30,000.

An order for motor and control equipment for a New York subway extension has been placed at a price of $175,000. A steam railroad in the same city has contracted for similar apparatus, for its electric system, totaling about $80,000. A Middle West steam line has purchased electric drive equipment for gasoline car service to an amount of about $35,000. Central-station business is a little spotty, with the bulk of orders centered in substation and affiliated equipment. A New Jersey utility has contracted for a quantity of feeder regulators, totaling $45,000. Another Eastern utility has placed an order for a sizable quota of bus supports and units of indoor type. A number of good contracts for similar apparatus are now pending. Instrument business is improving and inquiries are increasing both in volume and individual account.

Sales of electric appliances are lagging. Jobbers both in the New York and Philadelphia districts report business as unsatisfactory. Low prices and the tendency to cut below normal margins, coupled with keen competition, are making for a spotty situation which does not show signs of immediate betterment. Construction operations in the Eastern district includes the following:

The United Electric Light & Power Company, New York, will build a storage and distributing plant to cost $50,000. The Harlem Valley Electric Corporation has taken over the Carmel (N. Y.) Light & Power Company. The Purty Boat Works, Port Washington, N. Y., will erect a boat-building and repair plant to cost $150,000. The Nichols Copper Company, Laurel Hill, L. I., is arranging financing in amount of more than $4,000,000, for a new refining plant. The Atlantic City Electric Company is negotiating for the purchase of the municipal power plant at Beach Haven, N. J.

The Pennsylvania Railroad Company, Philadelphia, plans a cold storage plant to cost $1,000,000. The United States Gypsum Company, Chicago, plans a plant at Philadelphia to cost in excess of $300,000. Walker Brothers, Philadelphia, will build an electric equipment manufacturing plant at Spring Mill, Pa. to cost $80,000. County Commissioners, Pittsburgh, Pa., will receive bids until May 23, for ornamental cast iron light brackets. The Pusey & Jones Corporation, Wilmington, Del., will make additions in paper-making machinery plant to cost $350,000. The Annapolis & Chesapeake Bay Power Company has acquired the Herald Harbor Power Company and the Severna Electric Company, Anne Arundel County, Md. The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until May 29, for insulated wire and cable for Eastern and Western yards (Schedule 9060).

## Large Generator Order Placed in Southeast

The largest power company order placed in the Southeast was for four 40,000-kw. vertical water-wheel generators for a hydro-electric development in North Carolina. Another order from the same state was for large power transformers amounting to $50,000. A Georgia company ordered copper wire amounting to $16,500 and distribution and small power transformers totaling $14,500. Some other central-station orders were for watthour meters amounting to $4,800 and creosoted pine poles costing in excess of $3,600. An order for large power transformers aggregating $200,000 is in immediate prospect and will undoubtedly be placed in a few days.

A Georgia municipality ordered a 5,000-kw. turbine and switchboard, and an oil company in Louisiana ordered a turbine of the same size. A cotton mill in Georgia ordered $3,000 worth of wiring materials and lighting fixtures for re-lighting its mill. Engineers are working on plans for a rayon plant in Virginia for which two 2,500-kw. turbo-generators and other equipment aggregating $100,000 will be required. Bids for the equipment in that plant will be asked in about three weeks. A 40,000-spindle cotton mill to be constructed in Alabama will require electrical materials amounting to $75,000. The building contract for that mill will be let within six weeks. Engineers also are working on plans for a tobacco by-product plant to be constructed in Kentucky. Construction projects are as follows:

The Alabama Mills Company, Birmingham, will build mills in different parts of the state to cost $3,000,000. The Gould Tire & Rubber Company, Tampa, Fla., plans a mill to cost $150,000. Greenville, Miss., plans a municipal power plant. The Hudson Silk Hosiery Company, Charlotte, N. C., plans a mill to cost $300,000. The Crisp County Power Commission, Cordele, Ga., will receive bids on July 10, for a hydro-electric power plant on the Flint River, to cost $1,000,000. The Tennessee

Eastern Electric Company, Johnson City, Tenn., has applied for permission to build a hydro-electric power plant on the Holston River, to cost $5,000,000. The Jarman Shoe Company, Nashville, Tenn., plans a plant to cost $150,000. The constructing Quartermaster, Fort Monroe, Va., will receive bids until May 28, for a lighting system at the Langley flying field, Va. The Bristol Gas & Electric Company, Bristol, Tenn., will make extensions in its transmission and distribution system to cost $500,000.

The Appalachian Electric Power Company, Charleston, W. Va., plans a substation near Williamson, W. Va., to cost $150,000. The Alabama Power Company, Birmingham, Ala., has acquired the power plant of Millport Gin, Ice & Power Company, Millport, Ala. The Southern Cities Power Company, Chattanooga, Tenn., plans a transmission line from Selma to Waynesboro, Tenn. The Virginia Electric & Power Company, will build a transmission line from Quantico to Occoquan, Va., to cost $150,000.

### *New England Places Small Orders in Good Volume*

Small motor orders in the New England district were encouraging and amounted to about $50,000. A number of these orders included general purpose motors for power in reorganized shoe and leather working plants, and textile mills also ordered a number of loom motors. Control equipment business was steady, with one consisting of switchboard apparatus amounting to $5,000 being reported. Several small orders for sub-station equipment amounting to $8,000 also were recorded.

Central stations are buying steadily in small lots, and wire, pole line material and insulators are in good demand due to numerous short extensions of service lines. A number of arc welders recently were placed in eastern Massachusetts, and sales of welders so far this year are above those of last year. Electric furnaces are in demand though negotiations are slackening. Contractors power tools are in strong demand and orders are being considered for extensive equipment for a large state water supply contract. Equipment for twelve large electric service elevators has been ordered at a cost of about $25,000. Construction projects are as follows:

A 33,000-volt line, 11 miles long, will be built by the Public Service Company, New Hampshire, connecting Melvin Village with Center Ossipee. A transmission line approximately 33 miles long is planned between the Bristol Falls plant and Bristol by the Utilities Power Company, New Hampshire. The Blackstone Valley Gas & Electric Company, Pawtucket, R. I., plans an addition to its power plant, to cost $120,000.

### *Spotty Business Reported in St. Louis District*

Business in the St. Louis district has been decidedly spotty. An order for wiring equipment in a federal building amounted to $6,000. Two fair-sized electric signs were sold at a cost of $2,000 each. Sales of stock apparatus has been below normal. Construction projects are as follows:

The Cowden Manufacturing Company, Kansas City, Mo., will build a garment factory to cost $130,000. The Chevrolet Motor Company, Detroit, plans an assembling plant near Leeds, Mo., to cost $1,000,000. The Union Electric Light & Power Company, St. Louis, plans a substation to cost $200,000. The Phillips Petroleum Company, Bartlesville, Okla., will make additions in its gasoline refining plants in Panhandle district of Texas, to cost $350,000. The American Potash Company, Dallas, Tex., plans a plant near Odessa, Tex., to cost $200,000. The Oklahoma Portland Cement Company, Oklahoma City, Okla., is planning a cement mill near Saratoga, Ark., to cost $500,000.

Olathe, Kan., is planning a municipal power plant. The Pumicite Company, St. Louis, plans plants at Stanley, Meade, Wilmore and Fowler, Kan., to cost $125,000. Boonville, Mo., will soon take bids for an addition to its municipal power plant. Campbell, Mo., will receive bids until June 5, for a municipal power plant to cost $40,000. The Arkansas Power & Light Company, Little Rock, Ark., has acquired the Southern Edison Company, Searcy, Ark. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans a transmission line to Elmore City, Okla. The Central Power & Light Company, San Antonio, Tex., has acquired the Nixon Electric Light & Power Company, Nixon, Tex. Baton Rouge, La., will receive bids on May 29, for an ornamental lighting system. Fort Worth, Tex., plans an ornamental lighting system.

### *Volume of Business Good in Middle West*

Industrial activity in the Middle West is somewhat sluggish although the volume of business transacted is quite substantial. General movement of commodities, as indicated by carloadings, is less, but lack of movement of coal largely accounted for this condition. The various utility companies are busy with a good deal of construction work. Among the interesting orders placed were included two live steam reheaters, one feed water heater, one low pressure and one intermediate pressure closed feed water heaters, one portable oil purifier, 7,000 5-amp. watthour meters, 275 direct current watthour meters, 5 to 600 amp. capacity, a quantity of current transformers and Mazda lamps valued at $250,000. Jobbers' sales are increasing slightly. Construction projects are as follows:

The General Tire & Rubber Company, Akron, Ohio, will build a factory and distributing plant at Chicago, to cost $250,000. Evanston, Ill., plans a municipal power plant, to cost $65,000. The Bliss & Laughlin Company, Harvey, Ill., plans an addition to its shafting factory to cost $100,000. The Morgan Dyeing & Bleaching Company, Rochelle, Ill., will build an addition to cost $75,000. The Thieme Brothers Company, Fort Wayne, Ind., plans an addition to its knitting mill, to cost $115,000. The Southeastern Indiana Power Company, Indianapolis, Ind., is arranging for the purchase of the Eastern Light & Power Company, the Suburban Light & Power Company and the Evans Electric Company in Marion, Johnson, Fayette and other counties. The Chrysler Corporation, Highland Park, Mich., will build additions to its automobile plant, to cost $300,000, including a power plant, to cost $80,000. E. I. du Pont de Nemours & Company, Wilmington, Del., plans an ammonia plant at Barksdale, Wis., to cost $400,000. Superior, Wis., plans an airport lighting system. The Wisconsin-Michigan Power Company, Appleton, Wis., will build a transmission line from Iron River to Phelps, Mich. The Interstate Power Company, Oelwein, Iowa, will make extensions in transmission lines at Westbrook, Minn. The Montana-Dakota Power Company, Minneapolis, Minn., plans extensions in transmission lines at Tappen, N. D. Cedar Rapids, Iowa, plans a call for new bids for an ornamental lighting system following the rejection of bids recently received. St. Paul, Minn., and Lincoln, Neb., plan an ornamental lighting system.

### *Industrial Business Active on Pacific Coast*

Power company business has included orders for two carloads of steel guy strand, four carloads of poles and $2,500 worth of special steel pins. The Pacific Gas & Electric Company intends to spend $12,000 for rebuilding portions of its San Rafael to Petaluma transmission line. The United States Reclamation Service is requesting bids for a 19-mile, 66,000-volt, single power line and a 13-mile telephone line in the Nyssa (Ore.) district. Industrial business both actual and projected is excellent.

New factories projected include steel plants in Los Angeles and San Francisco for the Bethlehem Steel Corporation, a lumber mill and plant for Klamath Falls, a $2,500,000 plant in Seattle for the Fisher Body Corporation, a complete seed plant and warehouse in San Bruno and a $3,000,000 Marina district terminal for San Francisco produce and provision wholesalers. Street lighting business is very good.

The Seattle City Council has passed ordinances covering about $500,000 worth of work on its distribution lines. Ellensburg, Wash., has authorized an expenditure of $35,000 for improvements to its municipal plant. The port of Seattle plans a grain elevator to cost $1,500,000. Sales reported by jobbers include about $5,000 worth of transformers to local central-station companies, approximately 100 motors from 60 hp. down to industrial plants and $3,000 worth of pulleys for lumber mill drive. Construction projects are as follows:

Yuma, Ariz., is arranging to acquire the electric, gas and water utilities for $300,000, and will make extensions to cost $250,000. The Pacific Gas & Electric Company, San Francisco, has applied for permission to construct a hydro-electric power plant on Mokelumne River, near Jackson. A. M. Castle & Company, 1132 Blackhawk Street, Chicago, will build an iron and steel works at Los Angeles, to cost $350,000. The Montana Gypsum Products Company, Lima, Mont., plans a mill to cost $100,000.

The Royal Crystal Salt Company, Salt Lake City, Utah, plans a plant to cost about $500,000. The Centralia Lumber & Manufacturing Company, Centralia, Wash., plans a mill to cost $100,000. The Richfield Oil Company, Seattle, Wash., plans a plant to cost $200,000. San Jose, Torrance, Salinas, Culver City, Modesto and Santa Paula, Calif., plan ornamental lighting systems.

# Activities of the Trade

## Westinghouse Gets Order for Large Heating Equipment

Orders recently have been received by the Mansfield works of the Westinghouse Electric & Manufacturing Company for what is believed will be the largest installation of core baking ovens. The equipment goes to the New Zealand Government Railways, having been placed through Turnbull & Jones, Ltd., of Wellington, New Zealand, and the Westinghouse International Company. The complete installation will consist of a solid bank of baking compartments, ten in all, varying in width from 7 to 16 ft. The total width is 115 ft. Each compartment is 19 ft. long by 7½ ft. high.

Electricity will be used for heating the ovens, the heaters having an installed capacity of 1,185 kw. distributed through 192 5-kw. and 90 2½-kw. units. The order includes ovens, heaters, indicating and recording control panels and instruments for automatically controlling the temperatures in the compartments, motor blowers, transformers, ammeters and watt-hour meters. Bristol controlling instruments and American Blower Company motor blowers will be used.

The A. J. Lindeman & Hoverson Company, Milwaukee, manufacturer of electric cooking and heating appliances, announces the new "L & H" electric storage type water heaters which are automatically controlled by a mercury switch contactor actuated by a helical thermostat.

The Celoron Company, division of the Diamond State Fibre Company, Bridgeport, Pa., in conjunction with the opening of its new laboratory, and the introduction to the electrical, radio and automotive fields of Celoron molding compounds, announces the appointment of R. W. Wales as factory representative on molding powders and resins.

The Union Metal Manufacturing Company, Canton, Ohio, has received a contract from Seattle, Wash., for 538 twin-light standards 23 ft. high. The standards are of special design and construction and will embody the new type of fluted steel pole which was recently announced by the company.

The Eureka Vacuum Cleaner Company, Inc., Cleveland, has issued a 36-page folder embodying a sales plan for the "Premier" dealer. The plan covers a complete description of the new line of advertising and dealer sales helps for 1928.

The Chisholm-Moore Manufacturing Company, Cleveland, manufacturer of chain hoists and trolleys, traveling cranes and electric hoists, announces that the Columbus McKinnon Chain Company, Tonawanda, N. Y., has acquired control of its hoist division. The general sales offices and factory will continue to operate at Cleveland, under the same name as in the past. S. H. Moore, who has been with the company for the past 30 years, will continue with the organization and the personnel as a whole will remain the same.

The Foxboro Company, Inc., Foxboro, Mass., manufacturer of indicating, recording and controlling instruments, has established a branch office at 2104 Magnolia Building, Dallas, Tex., with J. B. McMahon as district manager. He will have as his associates R. L. Mallory and C. L. Bryan. The Dallas territory includes the states of Texas and Louisiana and the southern sections of New Mexico and Arkansas.

The General Electric Company announces price reductions on its popular types of "Mazda" flashlight, radio panel, toy train, mine and hand lantern lamps. These reductions, the company states, have been made possible through improvements in manufacturing processes and will mean a saving to the consumer of about 20 per cent in his future purchases. Since 1924 prices on miniature "Mazda" lamps, including lamps for automobiles, have been reduced approximately 50 per cent. During the same period motor vehicles have been reduced in price about 12 per cent, while all commodities have increased 62 per cent in price.

The W. N. Matthews Corporation, St. Louis, manufacturer of electrical specialties and mechanical painting equipment, announces the removal of its Chicago office to 9 South Clinton Street, Madison Terminal Building, Room 720, on May 1. H. L. Brueck is district manager. The company also announces that E. B. Josler, formerly with the Central States General Electric Supply Company, has recently joined its Chicago organization.

The National Flue Cleaner Company, Groveville, N. J., manufacturer of soot blowers for fire tube boilers, announces the appointment of the following representatives: Walter G. Heacock Company, 30 Euclid Arcade, Cleveland, and 413 Penobscot Building, Detroit; the Jack Deerwester Company, 1621 University Avenue, St. Paul, Minn.; Charles Zinram, P. O. Box 487, Erie, Pa., and the Laib Company, Louisville, Ky.

The Truscon Steel Company, Youngstown, Ohio, announces that it has purchased the Hydraulic Pressed Steel Company, Cleveland, which will be operated as its pressed steel division. The company states that the entire plant is being completely modernized and with the increase in facilities it will have one of the largest capacities for furnishing pressed and deep drawn steel of every description.

## Williams Oil-O-Matic Adds Refrigerator to Line

An electric refrigerator known as the Williams "Ice-O-Matic" has been placed on the market by the Williams Oil-O-Matic Heating Corporation, Bloomington, Ill. The "Ice-O-Matic" is furnished in boxes of from 5 cu.ft. to 20 cu.ft. food storage capacity and retails at $200 to $260 for the machine and $310 to $515 for the box and unit. Five different cabinet models are available. The refrigerating unit uses methyl chloride.

The same two-cylinder heavy-duty compressor is used on all jobs, the cooling unit or evaporator varying with each size. The units will be sold under the same terms as "Oil-O-Matics" are sold to the dealers and the distribution will be offered first to regular "Oil-O-Matic" dealers. During April the company conducted a special sales drive to introduce the unit. On June 25 and 26 the company will hold its fourth international convention.

The Ideal Commutator Dresser Company, Sycamore, Ill., announces the appointment of the Superior Supply Company, Bluefield, W. Va., as its sales representative for the sale of Ideal commutator resurfacers and other maintenance equipment in the Bluefield territory.

Landers, Frary & Clark, New Britain, Conn., manufacturer of electrical appliances, announce that they have withdrawn from sale the electric heating devices branded "Thermax" and "Reliance." The company is now offering in their place the new "Universal" popular priced electric appliances and at the same time is retaining the higher priced "Universal" appliances.

The Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, has placed on the market a new dust-tight glass cover developed to meet the demand for a lightweight, economical device that will guarantee the original efficiency of lamps and reflecting surfaces, and a new hand portable inspection light designed especially for very close inspection work.

The Robbins & Myers Company, Springfield, Ohio (W. J. Myers, receiver), manufacturer of electric motors, generators and fans, announces that its New York office and warehouse are now combined and are located at 200 Varick Street.

Hatheway & Company, Inc., 16 Hudson Street, New York City, announces the removal to larger quarters at 225 Varick Street. The company is a national distributor for the Rattan Manufacturing Company, the Clifton Conduit Company, the A. E. Rittenhouse Company, the Clifduct Company, and the Superduct Company as well as local distributor for the Wirt Company, the Royal Electric Company and the Heinemann Electric Company. The Hatheway-Paterson Company, associated with Hatheway & Company, Inc., and representing the Gulf Cross Arms Company and the Bell Lumber Company, has also moved to 225 Varick Street, New York City.

The Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., manufacturer of "T V" safety switches, etc., announces that Ralph Mason has been elected vice-president in charge of sales. Mr. Mason has been identified with the company since 1913.

The Rollway Bearing Company, Inc., Syracuse, N. Y., announces the appointment of Alfred E. Munch, Jr., as its representative in the Chicago-Milwaukee district, with headquarters at 544 Railway Exchange Building, Chicago.

Copeland Products, Inc., Detroit, manufacturer of electric refrigerators, announces that April shipments showed an increase of 41 per cent over the best previous month in the company's history.

# New Equipment Available

## Transposition Conduit

The "Natco" transposition conduit, to assist in meeting certain underground construction problems, has been placed on the market by the National Fire Proofing Company, Pittsburgh, manufacturer of "Natco" underground clay conduit. This new shape of conduit provides a means of transposing the position of ducts and cables in six-way, three-way or two-way multiple duct lines a quarter turn or 90 deg., or from an edge to a flat position or vice versa, in a distance of only six lineal feet. It also provides a means of transposing such duct lines and cables a half turn or 180 deg., or from a top to a bottom position or vice versa, in a distance of only twelve lineal feet.

It is supplied in six-way, three-way and two-way multiples in 24-in. lengths and each piece has a 30-deg. twist. "Natco" transposition conduit is used in building approaches to manholes or to central offices, where it is desired to change the position of cables in already existing duct lines, before entering such structures, thus avoiding the bending and crossing of cables therein. It also provides a means of changing the over-all height of conduit lines to avoid underground street obstructions or for bridge crossings.

## Portable Oil-Testing Set

A portable set for testing the dielectric strength of transformer and circuit-breaker oil has been placed on the market by the Westinghouse Electric & Manufacturing Company. The set is light and compact and may be easily carried by one man. The case is of cast aluminum with a hinged cover so arranged that it may be removed entirely if desired. When the cover is thrown back the complete control equipment is easily accessible and the set is ready for service.

The set consists of a small testing transformer inclosed in a cast aluminum case and covered at the top by a "Micarta" panel which carries the voltmeter and the control equipment. Two high-voltage bushings are brought through the panel and form the support for the oil testing cup. The voltmeter, mounted flush with the panel and calibrated in kilovolts, indicates the breakdown value of the oil. The transformer used is designed so as to eliminate surges in the high-voltage winding and the method of control used for obtaining variable voltages does not cause any distortion in the wave form. As a special safety feature, a push button is furnished, mounted in a depression in the panel, with the control so arranged that this button must be held down during tests in order to obtain voltage at the terminals of the testing cup.

## Clutch-Type Split-Phase Refrigerator Motor

A clutch-type split-phase refrigerator motor in which the starting current has been reduced to from 12 to 15 amp. has been placed on the market by the Day-Fan Electric Company, Dayton, Ohio. The efficiency and power factor also have been increased over those of the present repulsion-induction motors. The company states that the clutch which has been added to the motor is very dependable and has fewer working parts than are found on some brush-lifting devices. This motor is said to be a development of several years experience and a great number are now in operation. The manufacturer claims for the motor quietness, extraordinary efficiency in operation, high power factor, does not use brushes and does not introduce radio interference.

## Disconnecting Switch

An improved form of single-pole disconnecting switch has been placed on the market by the General Electric Company for outdoor service in voltages from 7,500 to 154,000 with a minimum current rating of 600 amp. The new switch has extra large break distances. It is assembled on cemented cap-and-pin type insulators and is designed for horizontal or vertical mounting. It is known as the type FA-1.

The tongue-type contact is so designed that there is no soldering or brazing used in its construction. A positive blade latch, which makes it impossible for the switch to be opened until tripped by the movement of the operating eye, is also incorporated. Tripping and opening are accomplished by a single downward pull with the switch hook. The blade consists of two copper channel-sections mounted back to back to form a narrow truss. On switches of 37,000 volts rating and above, the channel sections are formed in a wide truss which provides increased stiffness and mechanical strength. The standard switches are equipped with multi-bolt punched-tube terminals, with or without extended guide clamps.

## Portable Test Set

A portable truck-type high-voltage set for testing insulation and also transformer and circuit-breaker oil has been placed on the market by the Westinghouse Electric & Manufacturing Company. This set has a maximum testing voltage of 50,000 volts. The complete equipment consists of a testing transformer, auto-transformer, induction regulator, oil-testing cup and control equipment. The transformer of this set is of the oil-insulated, self-cooled, shell-type construction. One end of the high voltage winding is solidly grounded to the tank and the other is brought through the cover by means of a bushing. The auto-transformer adapts the set for the different primary voltage ratings. The induction regulator gives a variable, test voltage from zero to 50,000 volts in a continuous smooth curve. Red and green indicating lamps are provided, the green indicating voltage on the supply circuit terminals and the red showing potential on the high-tension terminals.

The control circuit consists of an overload relay with an electrical reset, a double-pole contactor with blowout coils and a make-and-break interlock for the signal lamps, all controlled from a pushbutton. A voltmeter coil is provided on the testing transformer, so designed as to develop a voltage equal to ½ per cent of the developed voltage. The terminals of this coil are brought out to suitable binding posts for voltmeter connection. As a further means of indicating test voltage a dial calibrated to the approximate high-tension voltage is provided on the tank cover with a pointer geared to the regulator shaft.

Motors for Use in Explosive Atmospheres—A line of both alternating- and direct-current motors, built for application where explosive gases, fumes or dust are present, is announced by the General Electric Company. These motors have been approved by the Underwriters' Laboratories for operation under such conditions. The announcement of the complete line marks the culmination of several years of application in individual sizes and rating. The motors bear the designation "Class BU Form JA" and are of a totally inclosed design.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued April 24, 1928)

1,667,638. Adjustable Magnet Device; H. B. Rex, Lynn, Mass. App. filed July 29, 1927. For controlling the effective flux of permanent magnetic damping devices such as those employed in integrating meters.

1,667,647. Electric Motor; E. F. W. Alexanderson, Schenectady, N. Y. App. filed March 11, 1925. Reversible motor wherein the same coils are utilized to produce both the exciting and commutating motor field fluxes.

1,667,650. Theft Signal Switch; J. P. Bradley and O. A. Prough, Weed, Calif. App. filed April 29, 1925.

1,667,652. Contact Finger; F. E. Case, Schenectady, N. Y. App. filed April 22, 1925. For drum controllers.

1,667,655. Controlling or Tripping Apparatus for Alternating-Current Electric Circuits; H. W. Clothier, Wallsend-on-Tyne, and W. A. A. Burgess, Monkseaton, England. App. filed Sept. 17, 1925.

1,667,656. Antitheft Attachment for Meters; W. A. Dilzell, New Orleans, La. App. filed Aug. 16, 1926.

1,667,660. Liquid Contact Connecter; E. H. Gehm, Stockton, Calif. App. filed Jan. 27, 1927.

1,667,662. Protective Arrangement; H. S. Holbrook, Rugby, England. App. filed Feb. 11, 1926. For the circuits of electric traction systems.

1,667,664. Compensated Induction Motor for Single or Polyphase Alternating Current; F. Kade, Kiel, Germany. App. filed June 20, 1925.

1,667,672. Frequency Changer; S. P. Nixdorff, Schenectady, N. Y. App. filed Sept. 22, 1926.

1,667,674. System of Distribution; O. Pollok, Berlin-Halensee, Germany. App. filed May 9, 1925. In which a mercury arc rectifier is employed in connection with translation devices capable of developing a counter electromotive force.

1,667,688. Clamp for Connection Boxes; W. Goetzelman, Chicago, Ill. App. filed Aug. 30, 1926.

1,667,702. Connecter; R. E. Powell, Toledo, Ohio. App. filed April 23, 1926. For storage battery.

1,667,704. Terminal for Storage Batteries; R. A. Szeits, Hawthorne, Calif. App. filed Sept. 14, 1926.

1,667,705. Self-Induction Coil; K. von Wysiecki, Lausanne, Switzerland. App. filed Nov. 28, 1925.

(Issued May 1, 1928)

16,947 (reissue). Motor-Control System; H. W. Williams, East Pittsburgh, Pa. App. filed Sept. 8, 1923. Employed in connection with elevators, machine tools and similar machines.

1,667,716. Key-Controlled Lighting and Ignition Switch; S. F. Briggs, Milwaukee, Wis. App. filed March 15, 1915.

1,667,718. Machine for Driving Nuts, Screws, and the Like; E. L. Connell, East Cleveland, Ohio. App. filed Dec. 11, 1925.

1,667,726. Electrical Hair-Curling Apparatus; C. Fayer, Flushing, N. Y. App. filed June 18, 1925.

1,667,743. Voltage-Gradient Regulator for High-Tension Cable Ends; E. G. Sievert and H. Svensson, Sundbyberg, near Stockholm, Sweden. App. filed Nov. 9, 1925.

1,667,746. Magnetic Alloy; W. S. Smith, Newton Poppleford, H. J. Garnett, Sevenoaks, and J. A. Holden, Gidea Park, England. App. filed Jan. 21, 1927. Magnetic substantially carbon free material comprising iron 10 to 17 per cent, silicon 1.5 to 4 per cent, a fourth metal selected from the group comprising chromium, tungsten, vanadium, and molybdenum 1 to 4 per cent and the balance nickel.

1,667,747. Relay for Electrical Control Apparatus; H. E. Somes, Philipse Manor, N. Y. App. filed Oct. 19, 1923.

1,667,752. Regulating Means for Systems of Electrical Distribution; P. H. Thomas, Upper Montclair, N. J. App. filed Aug. 27, 1924. A plan and a suitable apparatus for supplying electric power to local consumers from a high tension electric source and at the same time to supply power to or receive power from general distribution circuits connected at the same load point and to so regulate the relations of these elements as to preserve a suitable range of voltage and of current on each.

1,667,757. Light Signal; W. B. Wells, Wilkinsburg, Pa. App. filed Jan. 23, 1925. As used in railroad work.

1,667,758. Electric Boiler Apparatus; G. Welter, New Haven, Conn. App. filed June 28, 1926.

1,667,766. Magnetic Chuck; J. Bing, Eisenach, Germany. App. filed March 26, 1925.

1,667,775. Surgical Baker; W. S. Edmands, Boston, Mass. App. filed March 8, 1926.

1,667,794. Device for the Synchronization of Alternating-Current Machines; R. Michl, Kosice, Czechoslovakia. App. filed Jan. 10, 1924.

1,667,813. Outlet-Box-Supporting Means; J. Morgenstern, Cleveland, Ohio. App. filed Oct. 24, 1924.

1,667,814. Cable Clamp; J. Morgenstern and C. Raus, Cleveland, Ohio. App. filed March 17, 1926. For securing cables or conduits of electric wiring systems to receptacles such as switch boxes, outlet boxes, etc.

1,667,815. Electric Hot-Water Faucet and Means for Operating Same; A. M. Nickerson, Winthrop, Mass. App. filed May 10, 1926.

1,667,816. Electric Radiator; A. M. Nickerson, Winthrop, Mass. App. filed April 13, 1927.

1,667,817. Electrode; Y. Noishiki, Tokyo, Japan. App. filed Jan. 26, 1927. For electrotherapeutic application.

1,667,824. Multiple-Unit Cable; A. L. Richey, Boonton, N. J. App. filed Dec. 5, 1925.

1,667,828. Lamp Post; J. W. Speer, Lansing, Mich. App. filed Feb. 23, 1926.

1,667,857. Heating Unit; C. C. Harpster and W. R. King, Mansfield, Ohio. App. filed April 2, 1927. Incased tubular heating units.

1,667,871. Troughing System for Electric-Appliance Receiving Cabinets; J. Sachs, Hartford, Conn. App. filed Sept. 7, 1926. For meter service layout.

1,667,873. Disk-Pile Lightning Arrester; J. Slepian, Swissvale, and S. M. Pineles, Pittsburgh, Pa. App. filed Nov. 23, 1922.

1,667,879. Tubular Heater and Method of Making the Same; J. C. Woodson, Mansfield, Ohio. App. filed Sept. 2, 1926.

1,667,905. Electrical Measuring Instrument; J. Slepian, Swissvale, Pa. App. filed Dec. 15, 1924. For measuring the maximum value of an alternating voltage regardless of the wave form or frequency.

1,667,910. Lamp Grip; J. R. Townsend, South Bend, Ind. App. filed March 24, 1924. Retainers for electric lamps, fuse plugs and the like.

1,667,914. Pressure-Governed Circuit Controller; R. E. White, Chicago, Ill. App. filed Jan. 29, 1923.

1,667,954. Fluid Purifier; F. J. Simington, Chicago, Ill. App. filed July 12, 1926.

1,667,988. Automatic Electric Toaster; G. P. Richardson, Los Angeles, Calif. App. filed March 5, 1927.

1,668,016. Crystal Wire Filament for Incandescent Electric Lamps and the Method of Winding It; M. Hauschild, Dresden, and W. Berger, Blasewitz-Dresden, Germany. App. filed Feb. 23, 1926.

1,668,043. Extension Grip for Electric-Lamp Connecters; E. H. Bixby, Astoria, Ore. App. filed May 1, 1926.

1,668,049. De-electrolizer; M. A. Clinton and M. W. Collet, Philadelphia, Pa. App. filed May 20, 1922. Used to remove charges of static electricity.

1,668,106. Hot-Wire Vacuum Meter; W. Dällenbach, Zurich, Switzerland. App. filed May 12, 1924.

1,668,110. Electrical Transformer Construction; J. Fischer, Baden, Switzerland. App. filed Feb. 27, 1926. Tapping arrangements.

1,668,111. Terminal for Electrical Accessories; J. E. Gaffney, Birmingham, England. App. filed Dec. 16, 1924.

1,668,115. Magnetizable Material; E. Gumlich, Berlin-Charlottenburg, Germany. App. filed Nov. 30, 1926.

1,668,138. Fuse Plug; L. Baenziger, Abington, Mass. App. filed Feb. 23, 1927.

1,668,142. Heated Roller; J. D. Conger, Clarkston, Wash. App. filed March 7, 1927. Electrical combined, smoothing, heating and securing device for floor coverings, designed primarily for use in connection with linoleum.

1,668,161. Portable Electric-Control Apparatus; J. E. Long, Multnomah, Ore. App. filed April 13, 1927. For electric signs.

1,668,177. Alternating-Current Motors; H. Weichsel, St. Louis, Mo. App. filed April 4, 1925. Across-the-line type synchronous motor.

# New Trade Literature

MOTORS.—The Century Electric Company, 1806 Pine Street, St. Louis, is distributing a folder, form 663, describing and illustrating its most recent addition, the type DM direct-current motors.

POLE MOUNTS.—The Malleable Iron Fittings Company, Branford, Conn., is distributing a bulletin describing the "Williams" pole mounts for wood and tubular iron poles. Illustrations showing typical pole mount installations are included.

VACUUM-TUBE SYNCHRONIZING EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-777A, covering its vacuum-tube synchronizing equipment, such as bushings equipped with capacitance transformers, outdoor amplifiers and indoor amplifier assembly, including motor-generator set and synchroscope. Illustrations and dimensions of the equipment are included.

SAFETY SWITCHES, POWER PANELS, ETC.—The Square D Company, Detroit, has issued catalog No. 33 covering its products, including safety switches, motor starters, power panels, porcelain insulators, "Square-Duct," test plugs and sockets, voltage testers, etc. Tables giving dimensions of switch boxes in inches and knockout sizes and locations and wiring data for motors are included.

INDUSTRIAL LIGHTING. — "Modern Retailing Success" is the title of booklet No. 444-A issued by the Holophane Company, 342 Madison Avenue, New York City. It contains an article entitled "Special Lighting," which features its control lenses for special lighting, and a number of illustrations showing various installations of Holophane reflector-refractors for show-window lighting, department stores, etc., are included. The company also is distributing booklet No. 600 covering lighting specifics for gasoline-filling stations which gives full information on Holophane units for the lighting of every part of the gasoline station and contains illustrations showing typical installations.

ELECTRICAL MEASURING INSTRUMENTS.—The Jewell Electrical Instrument Company, 1640 Walnut Street, Chicago, has issued catalog No. 16, covering the Jewell electrical measuring instruments. It describes and illustrates the various portable type instruments, switchboard and panel-mounting instruments and radio instruments. It also contains descriptions of its X-ray and electro-therapeutic and automotive testing instruments. The company also is distributing a circular which features its new line of "Master" portable instruments and its 7-in. line of switchboard instruments. The catalog is very complete and contains dimension diagrams and reproductions of the various scales employed.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Wellington, New Zealand (No. 31,168), of small electrical devices.

An agency is desired in Dublin, Ireland (No. 31,112), for household electrical appliances.

Purchase is desired in Iquique, Chile (No. 31,109), of electric portable paint-spraying equipment for automobile bodies and metal work.

Purchase is desired in San Luis, Cuba (No. 31,111), of electric household refrigerators.

An agency is desired in Carmaux, France (No. 31,170), for sewing-machine motors.

Purchase and agency are desired Genoa, Italy (No. 31,128), for electrical machinery for ships and motor ships.

Purchase and agency are desired in Cardiff, Wales (No. 31,110), for electrical vibrators.

An agency is desired in Bietigheim, Germany (No. 31,127), for electrical washing machines.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## Water Power Serves Nation's Homes and Industries

THE preponderating percentage of energy generated from fuel in the more densely populated northeastern quarter of the United States and the predominance of water power in the far West and in the Southeast are evident from every fresh survey of our national electrical output. In the summary of operations of public utility plants for 1927, published in the ELECTRICAL WORLD of April 28, 1928, that situation again appears.

The hydro output amounted to 37.2 per cent of the total. More than half of it was reported from the Pacific and Middle Atlantic States. Water furnished more than nine-tenths of the energy in the Pacific States, not quite seven-eighths of that in the mountain region and almost two-thirds of that in the East South Central States. Even in these regions, liberally as they are endowed with water, reliance must nevertheless to some extent be put on fuel.

During 1927 the installed generator capacity increased by 2,292,506 kw. to a final total of 27,690,891 kw. The greatest increase in any one region, in rate as well as in amount, occurred in the South Atlantic States; the change from 2,835,074 to 3,475,795 kw. between the beginning and the end of the year exceeded 600,000 kw., or 22 per cent. Next came the Middle Atlantic and East North Central States. The West South Central region had the second highest rate, 19 per cent.

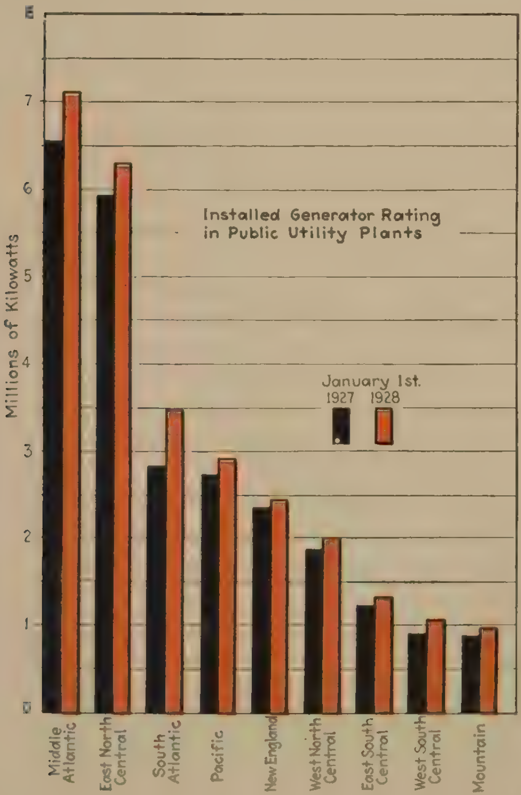
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.

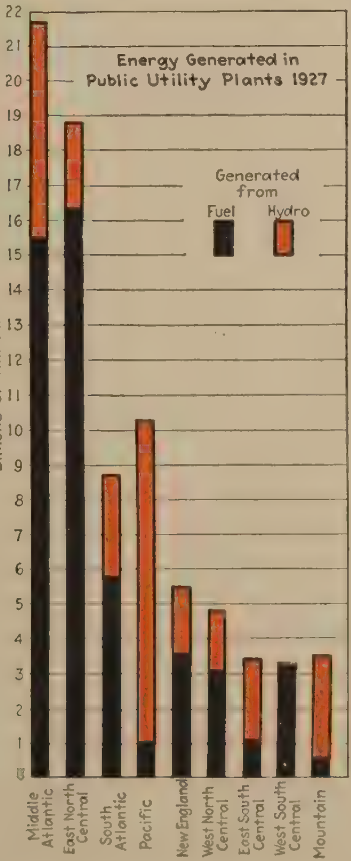
The Middle Atlantic, with 7,113,361 kw., and the East North Central, with 6,311,870 kw., continue to be the sections with the largest total rating, as might be expected in view of their rank in population and their industrial importance.

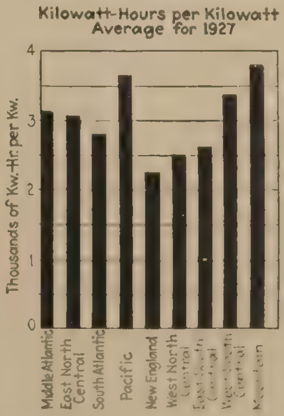
In kilowatt-hours per kilowatt, considering the latter as the mean of the installations at the beginning and end of the year, the two great water power regions stand out conspicuously. Both have large long-hour loads and the amount of steam reserve necessary is comparatively small. The Mountain States show the highest regional average, namely, 3,800 kw.-hr. per kilowatt. New England, where the lighting load is relatively large, fluctuates widely with the seasons, and therefore demands large peak-load capacity, and is at a definite disadvantage in this regard. No doubt the erection of new plants of high efficiency in the very recent past and the impossibility of at once eliminating the older plants have lowered the load factor in some regions, but this condition is probably to be regarded as temporary and unavoidable.

The national totals corresponding to these various regional figures are: 80,205,474,000 kw.-hr. generated in 1927; an installed rating of 25,398,385 kw. at the beginning of 1927 and 27,690,891 kw. at the beginning of 1928.

The data here quoted relate to all public utility plants in excess of 100 kw. and include not only those for light and power but also railway and other plants generating energy not exclusively for private use.







*Increase has occurred in every section. Output per kilowatt varies widely*

# Industrial Activity in the North Central States 5.7 per Cent Over 1927

MANUFACTURING plants in the North Central States have been reporting a rate of operations above that of the same month in the year previous ever since last October. The low point in activity reached during the winter of 1926 does not appear to have been duplicated during the past winter, due very largely to the fact that the production of equipment and replacement parts in the automobile industry was some 30 per cent above that of the winter of 1926, thereby raising the index of operations in that industry to a plane materially above that of the year previous. Since December the operations of industry in this section have followed very closely the trend established during 1927, but on a plane about 5 or 6 per cent above that of last year.

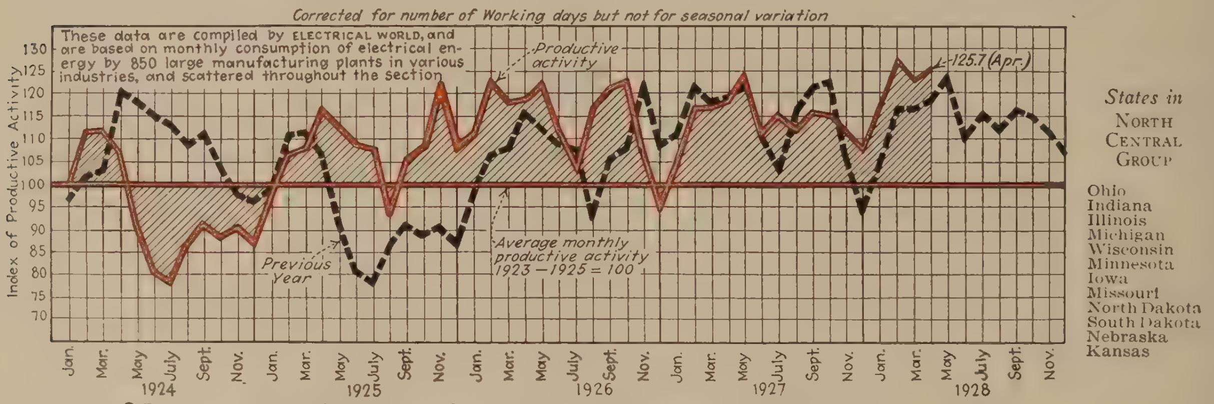
*Indexes of Productive Activity in the North Central States*

All Figures Adjusted for Number of Working Days

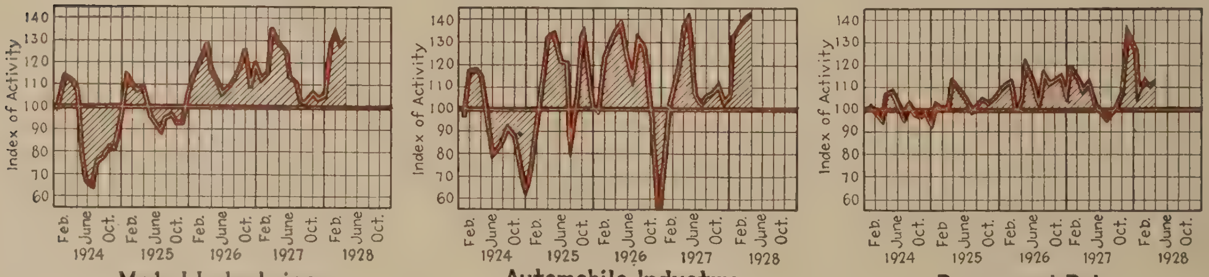
| | April, 1928 | March, 1928 | April, 1927 | Average for First Four Months, 1928 | Average for First Four Months, 1927 |
|---|---|---|---|---|---|
| All industries | 125.7 | 122.3 | 118.9 | 123.2 | 114.8 |
| Chemical and allied products | 146.2 | 129.7 | 97.4 | 113.5 | 94.2 |
| Textiles | 123.8 | 112.7 | 129.6 | 123.4 | 133.8 |
| Lumber and its products | 118.5 | 119.8 | 115.2 | 121.7 | 119.7 |
| Paper and pulp | 111.8 | 110.2 | 112.3 | 110.5 | 113.8 |
| Automobile, including the manufacture of parts | 148.7 | 136.0 | 138.3 | 142.3 | 109.5 |
| Rolling mills and steel plants | 129.9 | 127.5 | 129.5 | 131.2 | 125.6 |
| Metal-working plants | 133.3 | 130.0 | ..... | 131.1 | ..... |
| Food and kindred products | 108.7 | 115.2 | 108.2 | 111.5 | ..... |
| Leather and its products | 99.8 | 109.3 | 88.7 | 110.7 | ..... |
| Rubber and its products | 131.2 | 139.3 | 115.7 | 137.7 | ..... |
| Stone, clay and glass | 114.5 | 101.8 | 111.0 | 99.8 | ..... |

The rate of operations in April was about 2.8 per cent above March and 5.7 per cent above April last year. During the first four months of the current year the average rate of general productive operations in this section was about 7.4 per cent above that during the same period in 1927.

ELECTRICAL WORLD *Barometer of Industrial Activity in the North Central States*



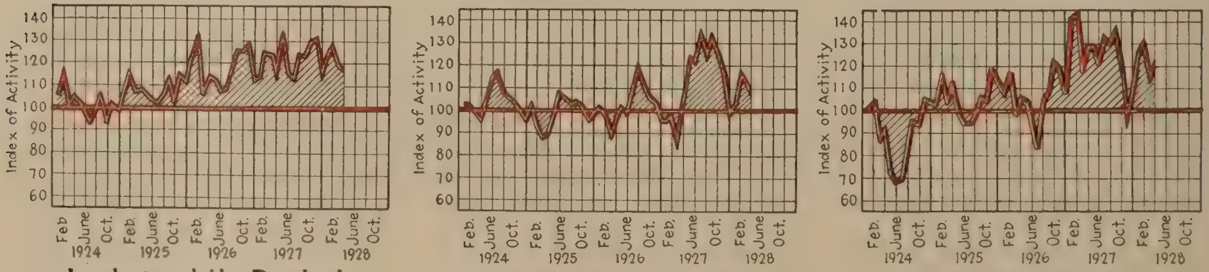
GENERAL INDUSTRIAL ACTIVITY IN THE NORTH CENTRAL STATES



**Metal Industries**

**Automobile Industry**
(Including Equipment and Parts)

**Paper and Pulp**



**Lumber and its Products**

**Food and Kindred Products**

**Textiles Industry**

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NORTH CENTRAL STATES

Electrical World

*McGraw-Hill Publishing Company, Inc.*
James H. McGraw, *President*
Edgar Kobak, Vice-President

W. H. Onken, Jr
*Editor*

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## *Stock Taking at Atlantic City Will Show No Cause for Alarm*

THE Atlantic City convention of the National Electric Light Association will be held under auspicious circumstances. Gratifying progress has been made by member companies of the organization, which means almost the entire electric light and power industry, and the only cloud discoverable in an otherwise clear sky is the investigation of the Federal Trade Commission. That, of course, involves only a small percentage of the membership of the N.E.L.A.; nevertheless, it will be difficult to get the public to believe that any policy of the few does not apply to all. The investigation is a challenge to the industry to enlarge and improve its public relations. What is being doled out by the sensational press makes its appeal to the heart, and if the heart governs the head, it is because not enough effort has been made to instruct the head.

Aside from the diversion which Congress and the Federal Trade Commission offer, the economic evolution of the business goes steadily on. Consolidations and mergers still occupy the attention of executives and bankers although playing havoc at times with operating organizations. It is inevitable that in the changes brought about in the interest of economy and better service some temporary maladjustments will occur; but so long as any human need or desire remains unsatisfied—and there is great demand for electricity—none in the industry need be without employment. Mergers are not to be feared. They are in keeping with the economic trend of the times. Properly conceived and executed, they make for stability, standardization of equipment and operating practices, simplicity of financial structure, greater opportunity for decentralized management with centralized credit and control, and cheaper and better service to the public.

Technically, the electric light and power companies, thanks to their array of outstanding engineers, have always made an excellent showing. If in anything they have not measured up to possibilities, it has been in commercial exploitation of their product. However, here, too, progress is beginning to be evident. Companies are adopting aggressive and balanced policies whereby new business is being sought and no longer waited for. Salesmen are out after new factories for their territory; surveys of resources are being made with a view of selling the region to national industrial groups; commercial and street lighting are being developed, and domestic load is taking on a new meaning. Only through the development of all classes of business is it possible to do pioneering in new business without jeopardy to the balance sheet, and it is gratifying to note that the electric light and power companies of the country, under the leadership of the national association, are beginning to visualize the opportunities of the business and to realize them commercially. Thus the industry bids fair to continue on its uninterrupted march of progress with satisfaction to itself and the public it serves.

* * * *

## *An Unfinished Industry*

DESPITE the epic proportions of the light and power industry it is unfinished. It has not yet attained the standards which all desire and which can be brought about. It will always be an unfinished industry, for the end of electrical developments is not even remotely visible and there is no boundary to the opportunities for service presented by the future. In this fact lies the inspiration for builders of the industry. The streams of electricity have entered into sixteen million American homes to afford light, to iron, to cook, to clean and to entertain. They have entered into cities and factories to give brain power unlimited possibilities to replace muscle power. They have flowed across natural resources and changed them into useful products for civilized man. It seems as if a modern Aladdin had indeed rubbed a lamp and sent warmth, light and energy into the world.

Our standards of living and comfort have risen through the progress of scientific research, discovery and invention and through our joyous application of every new development. New electrical devices fitted with the social instincts of our people and became the tools which helped to build national prosperity and comfort. In contrast as they are with past civilizations, our present standards are matters for country-wide gratitude to those who have guided electrical developments. They were men of large initiative and greater courage. But public gratitude must be earned through public understanding, and public understanding of the electrical industry does not exist in the degree necessary to enable it to do its best work.

The industry has grown too rapidly, it has expanded its services too greatly, it has invested money too heavily, and it has become too technical. In these respects it is far in advance of public understanding, and in this fact lies reason for serious thought. Those in the industry know that public good has been the inspiration for electrical developments. They know the joy which industry builders have experienced in developing every possibility for public service. They know that exploitation and enormous earnings have never characterized light and power enterprises. But people in general have not grasped utility values or utility ideals. They are apt to respond to demagogic appeals and to distrust corporations because of past experiences with large industries and because of innate prejudices against something big and not easily understandable.

These are matters which deserve the undivided attention of leaders of American thought. The initiative is with the electrical industry, but the responsibility is shared by all thoughtful leaders of industry in general. A growing and prosperous light and power industry is the greatest asset for maintaining and expanding nationwide standards of wellbeing. Whatever electricity has accomplished in the past is nothing when measured in terms of future possibilities. Builders of the industry have money, initiative and brains, but to use these tools to the best advantage they need public understanding as well. They and the public must belong to the same union and have, in addition, no jurisdictional fights. How to bring about this desired condition is the big problem confronting the light and power industry today.

* * * *

## *Tools for Doing the Job*

THE task of the electric light and power industry never changes and is never ended. Today as yesterday it is to provide good electric service at a fair price. It is to keep abreast of and apply technical progress in the art. It is to expand existing services and provide new services by acting upon all opportunities to bring savings and comforts into American homes and industries. It is to co-operate in all local, state and national activities which are worthy. It is to become a friend to its customers and remain one. It is to get public approval and understanding of its activities and policies. For the most part the light and power industry has succeeded in this work. Only in its attempts to get public understanding does there appear to be any degree of failure and a touch of the amateur. Human traits have not always been measured or appealed to intelligently.

A first reaction to the political hubbub at Washington is that the usual "public relations" practices should be discarded, forgotten and thrown away; that they have lost their vital significance and have become merely a departmentalized activity; that they strike false notes when they take the form of alleged propagandic pamphlets and books, of press releases which glorify and addresses which degenerate into self-eulogy, of professed altruism unsupported by acts, and even possibly now and then of political actions which call back to mind the railroad lobbyists of other days.

None the less, the tools used in the past to get public understanding are good tools if used properly. They should not be discarded. They should be sharpened and used more intelligently. The public utility information bureaus have done splendid work in making news available; books and pamphlets have been printed which are of great educational value; the light and power industry has leaders whose recorded addresses strike a very high note in announcements of policy and in contributions to American thought. The industry has a remarkably clean political record and has been noteworthy for its contributions to causes which sought to improve national welfare. Only in minor instances have the usual tools of the "public relations" department been used by clumsy hands. The point is, however, that these tools in themselves are unable to create public understanding and good will when wielded by a department only and when used in the customary manner. They must be supplemented by other tools.

Public relations must be part of the work of every utility man in all of his activities. An attractive-looking substation, a street without fairy draperies of poles and wires, a neatly uniformed employee, a truck driver who respects the rights of other motorists, a salesman who knows when to take "no" for an answer, a smiling employee at the complaint window, an executive group who are citizens, chamber of commerce men, clubmen and community builders because they like to be part of the community activities—these things gain and keep the confidence, sympathy and understanding of the community served. Utility advertising that supports community projects or that tells of actual contributions to community growth in a modest manner, utility show windows that tell the story of electric service in terms of tangible comforts made possible by appliances and set a pattern of style in display which other merchants desire to use, news releases which are free from bias and have human interest, addresses and talks to community groups about electricity and the local developments, commercial policies which bring co-operation instead of competition and, above all else, good service—all these tools are good and should be used intelligently by every utility.

Utility companies have no reason to be ashamed. There is no ignominy in fine service and no closet skeleton in their history. They are made up of people and are no more godlike than the people they serve, but there is an old proverb, "The servant of a king is a king."

* * * *

## *Engineers as Managers*

UTILITY engineers during the past year have been taking stock of their function in the light and power business. The result has been the development of some good plans and objectives. There is general agreement that engineers have a "dollar" responsibility in building systems and in addition that co-ordinated plans should replace current expedience in the development of a light and power property.

The assembly of an enormous amount of technical equipment is necessary in a modern plant. This equipment must operate to give service and, in this operation, must be controlled by engineers. In both assembly and operation the major function of the engineer, in the mind of the executive, is to get economic results. His technical competency is granted, but his business judgment has been challenged frequently. It is encouraging to note, therefore, that the engineer has come to realize his economic function, but he should go further and recognize his management function also, thereby introducing some human engineering into his technical plans and operations.

None is better equipped to manage utility properties than the engineer if he will add an understanding of men and an economic sense of values to his engineering qualifications. In a technical industry he has an asset which gives him the advantage over a lay competitor for executive position, but in the past the technical man has done very little to earn the executive standing for which he can qualify. He should plan economic systems and also manage them. The hired managers of the utility industry will be engineers, if the engineers will take the trouble to qualify for the posts.

## *Inducement Rates and Customer Revenue*

WHEREVER light and power companies have introduced inducement rates that enable domestic customers to use additional energy at low unit cost and have backed up these rates with vigorous sales effort they have raised considerably the average consumption per customer. Pittsburgh, without much electric range load, claims an average domestic consumption of 637 kilowatt-hours. Buffalo reports 743 kilowatt-hours. Out in the Northwest, with water heating added to range load, the average for most of the companies has gone away above these Eastern figures, and it reached 1,676 kilowatt-hours in the case of the Washington Water Power Company. Six Rocky Mountain and Pacific Coast companies averaged 502 kilowatt-hours.

Notwithstanding all these cases of high average consumption per domestic customer, however, the average annual domestic revenue ranges only from $25 to $33. As contributors to the general public in the form of more service for the same or little additional expenditure these companies have achieved results; but so far as regards making domestic customers more profitable not much progress has been made. Does this mean that the inducement rates are lower than necessary to attract business? Does it mean that the public sets a definite budget for electric service and will not spend any more? Or does it mean that enough additional household uses for electricity have not been found?

In any event the situation affords something to think about and act upon. Domestic customers individually and collectively have brought a notoriously low return for the investment to serve them, the cost of handling their accounts and the cost of maintaining service reliability. Certainly, the inducement-rate idea is not wrong—but added consumption should be profitable consumption.

* * * *

## *Mergers and Dividends Deserve Interpretation*

AN OPPORTUNITY exists for getting better public understanding of the larger business aspects of the public utility business. News of big mergers of operating and holding utilities or of stock dividend disbursements should include more than the bare financial details that are apt to suggest an atmosphere of "melon cutting" to the newspaper-reading public. There are tangible financial, operating and service reasons for mergers. All intelligent utility executives build their business on the basis of better public service as a fundamental, and they make business decisions as to mergers or dividends only after striking favorable balances in terms of benefits to the public as well as themselves.

The public has a right to know these reasons and needs them to understand the business moves. Private enterprise operates the majority of utilities in this country because it gives good service at a fair price. It acts as a hired executive, its books are open to public inspection, and there are many inducements that should lead utility executives to interpret their business transactions to the public they serve. Such a practice would prove good policy and good business, for it would gain the confidence of the public and thus help to police the industry. If the practice were universal, the exploiter and stock jobber would have no opportunity to exist because no legitimate reasons could be advanced for contemplated purchases or financing. The interpreted balance sheet so widely used by operating properties should be supplemented by a similar interpreted presentation of the tangible reasons for specific mergers and announcements of stock dividends or other operations of holding companies.

* * * *

## *Engineering Brains Needed for Building Business*

AN ANALYTICAL approach to the utility business calls for the type of training and approach typical of the engineer. The engineer has been very successful in the construction and operation of the physical facilities of the industry because he has planned his work in advance of installation and operation. Now the power industry is waiting with a new job for the engineer and it is of pressing importance. His orderly thinking is needed in the building of the market and in the commercial planning of utility expansion. For central-station selling has followed too long the easy policy of expediency and opportunism. The time has come when to the development of load should be given the same intelligent analysis and balanced effort that goes into the projecting and the designing and the progressive growth of a great transmission system. The same regard for the economics of the present and the future is called for both in the engineering and in the market-building enterprise.

All this would have been recognized long since had it not been for the fortunate popularity of electric service through the years. For a long time no selling was needed. Then it was but natural to seek the business easiest to secure. And the absence of commercial competition has ever been conducive to complacency. But now comes the commercial era. Systems will no longer grow by the simple accumulation of customers. New load must be developed in the years ahead by intensive selling—which raises two important questions: What kind of load and how?

The modern power company needs a fundamental development program if it is to answer these questions efficiently—a program that will govern the growth of the system in balance with the growth of the business. Based on the limits of the territory to be served, it should survey the prospective load and definitely plan the rate at which it shall be acquired. And this means a program for sales expense, a program for construction expenditure, a program for increase in operating costs—all advancing in step with a program for increased revenues expected and a clean-cut schedule of financial requirements.

In other words, a system plan for a modern utility is something more than a plan for the generation, transmission and distribution of energy, for the collection of bills and raising of money and for the maintenance of good public relations. The present-day power company is a great business. It needs commercial leadership and business judgment. It needs orderly market development, the kind that plans ahead what classes of load should be acquired for ten years and in what proportions. And this sort of selling can be as scientific a job as the building of a dam. It is high time, therefore, to apply more engineering brains to the building of the business of the power industry.

# *Atlantic City Beckons*

## *June 4-8*

Fairchild Aerial Surveys

*Once again the convention city calls the utility men to assemble for pleasure and profit. More than 40 addresses on timely subjects will be made by prominent men. Old friends and men with whom you can exchange experiences and discuss problems will be there*

# Leaders in Home Service

### Pacific Northwest outstanding in domestic load building. 70,000 range customers contribute to high residential consumption. Railway electrification, hydro development and interconnection hold bright future

By WALTER C. HESTON
*Pacific Coast Editor*

*Chelan plant, Washington Water Power Company*

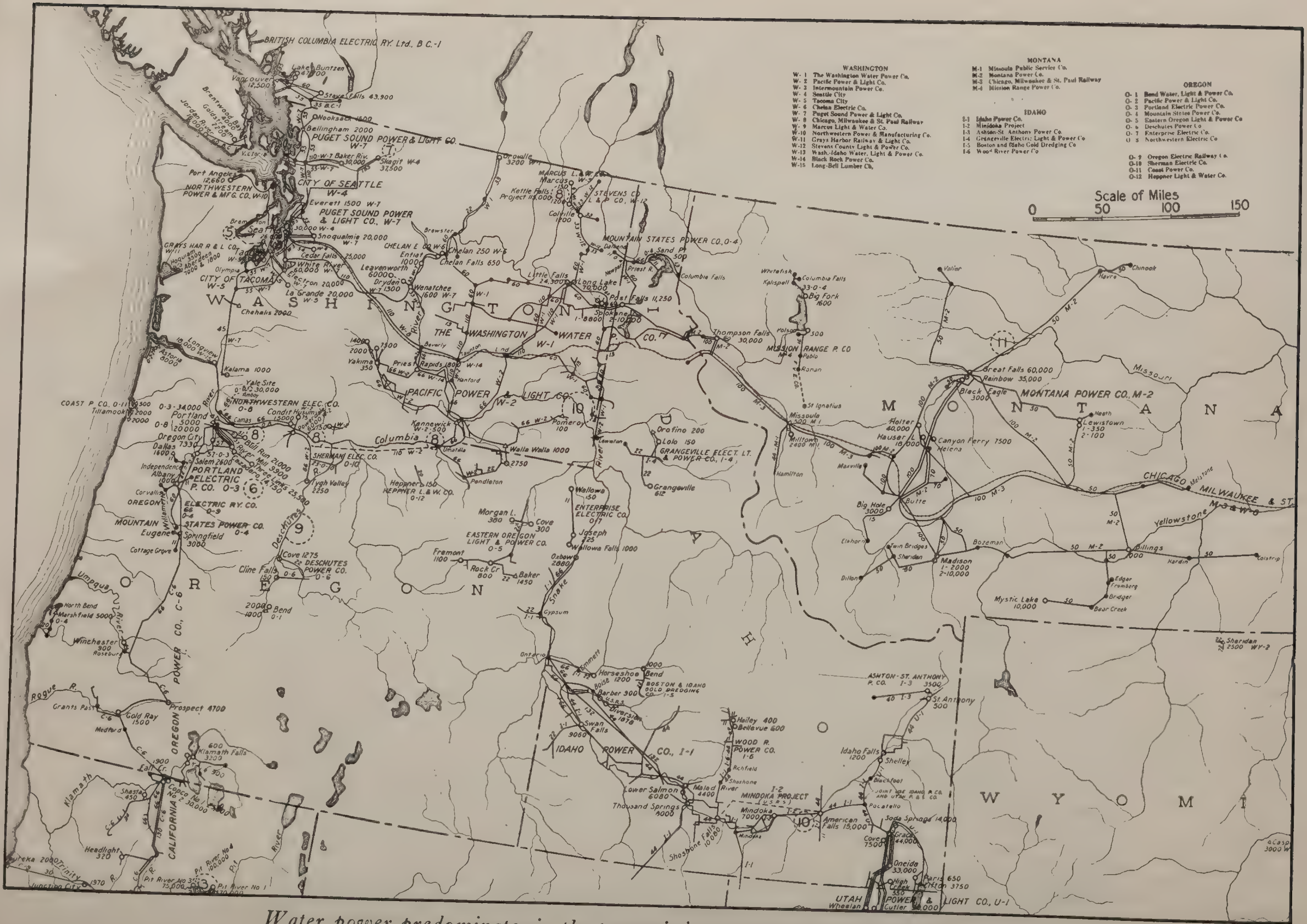
DEVELOPMENT of residential load is perhaps the outstanding accomplishment of the power companies of the Northwest, and having been leaders in this field they view with interest activities of utilities throughout the nation to get into tune with the commercial spirit of the day. Having an abundance of hydro-electric power, a limited industrial development and practically no unwired homes to which they might look for future growth, their efforts naturally have been directed to increasing consumption and revenue of existing domestic customers. Although the utilities of this section, which for the purpose of this article include the major utilities in the states of Oregon, Washington, Idaho, Montana and Wyoming, have been actively engaged in developing residential business for ten years or more, they are far from satisfied with results and are bending every effort further to increase residential consumption and revenue.

The electric range has been the chief contributing factor in this load-building program and the eight larger utilities of this section are now serving 70,226 range customers, bringing them an annual gross revenue of $2,809,000, or 26 per cent of the total revenue derived from domestic customers. Consumption of these ranges amounts to 34 per cent of the total energy sales to residential customers. New range users are being added at the rate of 17,500 a year, which means that 6 per cent of the available market is being sold each year, and there is every indication that this rate of sale will continue for several years. The largest number of range customers served by any one company is 22,369, on the system of the Puget Sound Power & Light Company. The Idaho Power Company has the greatest system saturation, with 31 per cent of its residential customers using electric ranges.

Taken in conjunction with water heating, the electric range has been responsible for very high average annual consumption per customer, reaching, in the case of the Washington Water Power Company, an average annual consumption for all domestic use in Spokane of 1,676 kw.-hr. The California-Oregon Power Company is a close second, with 1,423 kw.-hr. per year, and the Idaho Power Company is third, with 1,152 kw.-hr. per year. All companies show high averages, as will be seen from Table I. System data for eight major utilities are given in Table II.

Great possibilities lie in the development of the water-heating load also. The eight utilities referred to are serving 19,631 water heaters, which bring them a gross annual revenue estimated to be $900,000. These water heaters use annually 144,000,000 kw.-hr., which is 46 per cent of the total domestic energy sales of the companies concerned.

While intensive selling effort has been placed behind the electric range, and to some extent the electric water heater, increased use of lighting in the home and the


WASHINGTON
W-1 The Washington Water Power Co.
W-2 Pacific Power & Light Co.
W-3 Intermountain Power Co.
W-4 Seattle City
W-5 Tacoma City
W-6 Chelan Electric Co.
W-7 Puget Sound Power & Light Co.
W-8 Chicago, Milwaukee & St. Paul Railway
W-9 Marcus Light & Water Co.
W-10 Northwestern Power & Manufacturing Co.
W-11 Grays Harbor Railway & Light Co.
W-12 Stevens County Light & Power Co.
W-13 Wash.-Idaho Water, Light & Power Co.
W-14 Black Rock Power Co.
W-15 Long-Bell Lumber Co.
MONTANA
M-1 Missoula Public Service Co.
M-2 Montana Power Co.
M-3 Chicago, Milwaukee & St. Paul Railway
M-4 Mission Range Power Co.
IDAHO
I-1 Idaho Power Co.
I-2 Minidoka Project
I-3 Ashton-St. Anthony Power Co.
I-4 Grangeville Electric Light & Power Co
I-5 Boston and Idaho Gold Dredging Co
I-6 Wood River Power Co
OREGON
O-1 Bend Water, Light & Power Co.
O-2 Pacific Power & Light Co.
O-3 Portland Electric Power Co.
O-4 Mountain States Power Co.
O-5 Eastern Oregon Light & Power Co
O-6 Deschutes Power Co
O-7 Enterprise Electric Co.
O-8 Northwestern Electric Co
O-9 Oregon Electric Railway Co.
O-10 Sherman Electric Co.
O-11 Coast Power Co.
O-12 Heppner Light & Water Co.
Scale of Miles
0
50
100
150
BRITISH COLUMBIA ELECTRIC RY. Ltd. B.C.-1
PUGET SOUND POWER & LIGHT CO. W-7
CITY OF SEATTLE W-4
NORTHWESTERN POWER & MFG. CO. W-10
CITY OF TACOMA W-5
MOUNTAIN STATES POWER CO. O-4
THE WASHINGTON WATER P. CO.
PACIFIC POWER & LIGHT CO.
NORTHWESTERN ELEC. CO. O-8
PORTLAND ELECTRIC P. CO. O-3
OREGON ELECTRIC RY. CO. O-9
SHERMAN ELEC. CO. O-10
DESCHUTES POWER CO. O-6
EASTERN OREGON LIGHT & POWER CO. O-5
ENTERPRISE ELECTRIC CO. O-7
GRANGEVILLE ELECT. LT. & POWER CO. I-4
MISSION RANGE P. CO M-4
MONTANA POWER CO. M-2
CHICAGO MILWAUKEE & ST.
IDAHO POWER CO., I-1
BOSTON & IDAHO GOLD DREDGING CO. I-5
WOOD R. POWER CO. I-6
MINDOKA PROJECT I-2
ASHTON-ST. ANTHONY P. CO. I-3
UTAH POWER & LIGHT CO., U-1
CALIFORNIA OREGON POWER CO., C-6
COAST P. CO. O-11
HEPPNER L. & W. CO. O-12
WASHINGTON
OREGON
IDAHO
MONTANA
WYOMING

*Water power predominates in the transmission systems of the Pacific Northwest* sale of small appliances has not been overlooked. Some of the central stations in this group have done a particularly good selling job on small appliances, notably the Idaho Power Company, the Washington Water Power Company and the Pacific Power & Light Company.

What the future holds in the way of domestic use of electrical energy in this section is indicated in Figs. 1 and 2, which are curves projected to 1932 to show anticipated sales to residential customers in the city of Spokane. These may be considered typical for many of the other utilities. From this it will be seen that average use per domestic customer is expected to reach the figure of 2,560 kw.-hr. per year by 1932.

Attractive rates offered by power companies of the Northwest have enabled two transcontinental railroads to utilize central-station power delivered at high tension for electrification of their roads. The Chicago, Milwaukee & St. Paul has under electric operation its Cascade, Missoula and Rocky Mountain divisions, totaling 646 miles of main line and utilizing 40,000 kw. at an annual load factor of approximately 50 per cent. During 1926 the Great Northern placed 25 miles of its main line over the Cascade Mountains in western Washington under electric operation and before the end of the year expects to have 80 miles of its line between Skykomish and Wenatchee, Wash., electrified. This electrification will require approximately 15,000 kw. and is of special interest because of the fact that motor-generator type locomotives operating from an 11,000-volt, single-phase, 25-cycle contact line have been adopted.

With central station hydro-electric power available at reasonable rates throughout the Northwest and with increasing tonnage it seems reasonable to expect further electrification of these two roads and to look for the other two transcontinental lines serving this region to embark upon electrification programs.

Chief among the industries of the Northwest requiring large amounts of power are lumber, pulp and paper and mining. Of these the lumber industry utilizes the greatest amount of power, but is electrified to a lesser

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# *Bright Outlook for Northwest*

*By Guy W. Talbot*
*President Pacific Power & Light Company*

BECAUSE industrial growth has been slow, the commercial departments of electric power companies in the Pacific Northwest have given their attention particularly to domestic load building. Here the increase in the use of electricity during the past few years has been most gratifying, in some districts the average number of kilowatt-hours used per residential customer having increased as much as 50 per cent. In fact, the average residential use in the Pacific Northwest is the highest in the United States.

The Pacific Northwest is latent with possibilities of industrial growth because of its great supply of raw materials and the large potential markets of the Orient. Greater industrial development, combined with the present large use of electricity in the home, will show a constant increase because of new uses, and greater extension of present uses, particularly in rural communities, makes it certain that this territory is destined to witness a most important development electrically. There is ample undeveloped power for future needs and there is an adequate developed supply for present needs and for the immediate future. Increased use of electricity, together with physical interconnections which serve to hold down fixed charges, will make for lower rates and, consequently, more universal use of electricity both in the home and in industry. These factors will contribute very materially to industrial progress through the use of power-driven machinery.

One of the big problems for the electric power industry, and all industries in the Pacific Northwest, and the entire country, for that matter, is to bring about a more equitable distribution of the burden of taxation, so that our public utilities, productive industries and agriculture may operate with greater economy. Real property and productive enterprises are bearing an altogether disproportionate burden of taxation. A pronounced impetus to industrial development in the Pacific Northwest can be occasioned by holding down taxation on productive effort and keeping government interferences in business at a minimum consistent with the necessary protection of the public from unfair practices and unnatural competition.

*Guy W. Talbot*

Taxes are not a controllable item, nor can we thwart costly and burdensome restrictions of government interference. These repressive factors can be kept within reasonable bounds only by an informed and rational public opinion. They are not alone our problems but those of all industries. Industry today is interdependent and must ultimately feel the effects of all political action directed against public utilities. Our tax burdens cannot be made lighter nor held within present bounds except by lessened expenditures in government. Only by avoiding unnecessary governmental ventures in and too many restrictions to business enterprises and by preventing obvious inefficiency and waste will economy in government be achieved.

degree than either of the others. Sawmills of Oregon, Washington and Idaho cut about 15,000,000,000 b.-ft. of lumber a year, requiring approximately 1,000,000 hp. Although as nearly as can be estimated only 10 per cent of the mills are motorized, electrically operated mills have installed 500,000 hp. in motors and are responsible for 50 per cent of the total lumber production. For the most part mills produce their own electric power from steam plants burning mill refuse. Of the 375,000,000 kw.-hr. per year utilized in electrically operated mills not more than 5 per cent is supplied by central stations. The reason for this is quite apparent. The mills fall into three general classes, those that are so remote from power transmission systems as to make the cost of extending lines prohibitive, those that are within reach of central-station power but still feel that it is more economical to generate their own power and those that have found some means of disposing of their waste and purchase central-station power. Thus it is largely a case of the cost of extending transmission lines or disposing of waste at a price that makes it economical for the mill operator to purchase power. For the most part sale of mill refuse has been limited to power companies and small industrial concerns for use under boilers in steam plants. Success with stoker firing of mill refuse in household furnaces and the development of processes for utilizing sawdust and "hog" fuel in the manufacture of pulp and wall boards is offering the mills a further means of disposal and the central stations an ever-increasing market for power.

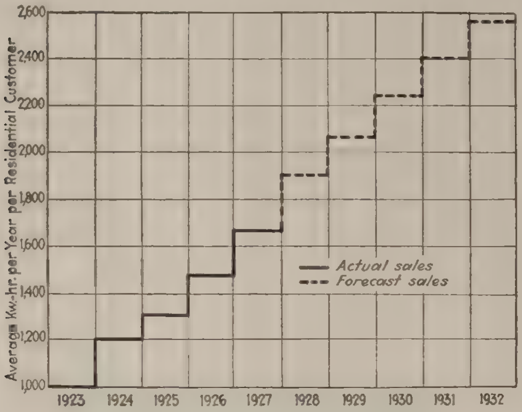

*Fig. 1—Average kilowatt-hours per year per residential customer for city of Spokane*

Actual increase from 1,000 kw.-hr. per customer in 1923 to anticipated use of 2,560 kw.-hr. in 1932

*Table I—Residential Consumption of Eight Northwest Power Companies for 1927*

| Company | Kilowatt-Hours per Domestic Customer: All Residential Consumption | Kilowatt-Hours per Domestic Customer: Without Water Heating† |
|---|---|---|
| Washington Water Power Co.* | 1,676 | 676 |
| California-Oregon Power Co. | 1,423 | 570 |
| Idaho Power Co | 1,152 | 486 |
| Northwestern Electric Co. | 938 | 680 |
| Portland Electric Power Co. | 840 | 486 |
| Puget Sound Power & Light Co. | 774 | 532 |
| Pacific Power & Light Co. | 763 | 522 |
| Montana Power Co | 504 | 483 |

*Spokane only.

†Derived by deducting 6,000 kw.-hr. per year from total residential sales for each water heater served and dividing by the number of residential customers.

The pulp and paper industry is rapidly coming to the front in the Pacific Northwest as Eastern sources of pulp wood are being depleted. At present there are 22 pulp and paper mills operating in Oregon and Washington, six of which are in Oregon and the balance in Washington. The daily output of these mills in paper products, such as newsprint, wrapping, writing, book, board and all other papers, is approximately 2,020 tons of finished product, for which the pulp requirements consist of sulphide, sulphate and soda pulp and total around 2,200 tons. In addition, two new mills are now building in Washington which will produce 270 tons of pulp daily and additions in an Oregon mill will add a production of 120 tons of newsprint daily. Newsprint production is the largest and as of the first of this year amounted to 1,077 tons per day for all mills. Other production was: Wrapping paper, 470 tons; writing and book paper, 125 tons; board, 220 tons, and tissues, fruit wraps and all others, 120 tons, daily.

From a power standpoint the 22 mills represent a total connected load of 136,827 hp., with an average power demand of 67,425 hp., a large percentage of which is central-station power. A few mills generate a small part of their power requirements either in hydro or steam stations, the steam being utilized in various processes after passing through the turbines.

*Table II—Gross Revenue, Customers and Range Data for 1927 and Growth During Past Five Years*

| | Electric Gross Revenue | Total Electric Customers | Total Domestic Customers | Av. Rev. per Domestic Customer | No. Electric Ranges Served | Per Cent Range Saturation |
|---|---|---|---|---|---|---|
| 1. Puget Sound Power & Light Co. | $10,251,720 | 131,192 | 100,380 | $31.39 | 22,369 | 22.3 |
| 2. Montana Power Co. | 8,796,526 | 48,844 | 35,900 | 27.62 | 6,436 | 17.9 |
| 3. Portland Electric Power Co. | 6,166,952 | 95,800 | 84,085 | 29.41 | 11,557 | 13.7 |
| 4. Washington Water Power Co. | 5,938,983 | 52,093 | 36,709 | 33.73* | 9,223 | 25.0 |
| 5. Pacific Power & Light Co | 3,776,205 | 59,588 | 40,628 | 32.89 | 4,956 | 12.5 |
| 6. Idaho Power Co. | 2,835,650 | 40,685 | 25,196 | 32.91 | 7,764 | 31.0 |
| 7. Northwestern Electric Co. | 2,737,301 | 26,226 | 20,423 | 30.62 | 6,100 | 29.9 |
| 8. California-Oregon Power Co. | 2,271,911 | 20,091 | 15,626 | 37.75 | 3,125 | 20.0 |
| Total for all companies | $42,775,248 | 474,519 | 357,947 | $32.04 | 71,530 | 21.5 |
| Percentage increase for five-year period, 1922–1927, based on companies 1, 2, 3, 5 and 8 | 60 | 53 | 68 | 17 | 469 | 147 |

*Spokane only.

The paper industry as it has developed in the Northwest exceeds by far the lumber industry with respect to the class of plants built, engineering involved, high-grade equipment used and the large amount of electrical engineering involved, particularly if the plant is for manufacturing newsprint.

Until quite recently paper produced by the mills on the Coast and British Columbia was used to supply the Coast trade. Recently, however, certain of the plants have been shipping bleached sulphide pulp to the East Coast, competing with similar pulp coming into the east from Canada and abroad. Due to the low freight rates applying on material of this kind from the Pacific Coast to the Atlantic seaboard, it is said that it is possible to deliver pulp to New York or other Eastern seaports as cheaply as from the mills in Michigan, Wisconsin and Canadian points as well as pulp imported from Norway, Sweden and other foreign countries. With the vast undeveloped timber and hydro-electric resources of the Northwest the outlook for the pulp and paper industry is promising indeed.

There are two important mining regions in the territory under discussion. In the Cœur d'Alene district in Idaho there are extensive mining operations producing chiefly lead, zinc and silver; at Butte, Mont., is one of the largest and richest copper deposits in America.

These mining operations are all extensively electrified and central-station energy is used in all cases. At the Butte mines of the Anaconda Copper Mining Company 27,000 kw. is utilized at an annual load factor of approximately 80 per cent. At the Great Falls reduction department of the same company the load is approximately 65,000 kw., of which 50,000 kw. is utilized at an annual load factor of 95 per cent in an electrolytic zinc plant. This plant requires 1.73 kw.-hr. per pound of zinc produced and has an output of 335 tons of pure zinc each 24 hours. A plant of similar capacity is now nearing completion at Anaconda which will be operated by the same company.

At Kellogg, Idaho, the Sullivan Mining Company will place in operation in June a 50-70-ton electrolytic zinc plant which will utilize 8,000 kw. of central station energy.

The importance of the mining load to the Montana Power Company and its effect upon system load factor may be judged from the fact that 83 per cent of the energy sales of this company are made to mining properties. The annual system load factor is 81.5 per cent.

Data on system growth for the eight large Northwest power systems used as an index to show major trends are given in Table III. It will be seen that for the systems of the California Oregon Power Company, Pacific Power & Light Company, Northwestern Electric Company, Portland Electric Power Company, Puget Sound Power & Light Company, Washington Water Power Company, Idaho Power Company and Montana Power Company, which produce 82 per cent of the energy sold in the Northwestern states, 68,000 kw. of additional generating capacity is required each year based on the growth during the past five years. These combined systems, which are showing an over-all annual increase of approximately 20 per cent in energy produced, require $16,000,000 of new capital each year.

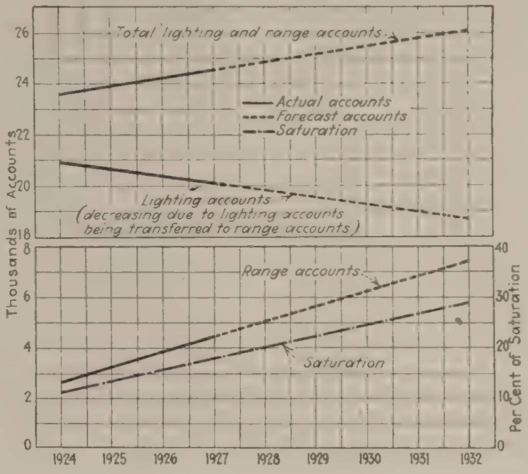

*Fig. 2—Forecast of electric range business in city of Spokane*

The greatest individual system growth has been that of the California Oregon Power Company. This company has more than trebled its installed plant capacity and has practically trebled its output in the past five

*Table III—Composite System Data for Eight* Major Northwest Power Systems*

| | 1917 | 1922 | 1927 | Per Cent Increase 1917–1927 | Per Cent Increase 1922–1927 |
|---|---|---|---|---|---|
| Total installed hydro capacity (kw.).......... | 423,155 | 564,605 | 865,182 | 105 | 53 |
| Total installed steam capacity (kw.).......... | 35,200 | 83,700 | 123,300 | 250 | 47 |
| Percentage steam of total capacity............. | 7.7 | 12.9 | 12.5 | ... | .. |
| Total yearly generation (million kw.-hr.)...... | 2,020 | 2,613 | 4,314 | 114 | 65 |
| Total yearly hydro generation (million kw.-hr.) | 1,977 | 2,482 | 4,088 | 107 | 65 |
| Total yearly steam generation, million kw.-hr. | 33 | 131 | 226 | 590 | 73 |
| Percentage steam to total generation........... | 1.6 | 5.0 | 5.2 | ... | .. |
| Total electric energy sales (million kw.-hr.)...... | 1,621 | 2,156 | 3,386 | 109 | 57 |
| Total system investment (million dollars)...... | ....... | $292 | $371 | ... | 27 |
| Approx. miles of high-tension transmission over 6.6 kv.......... | ....... | 6,899 | 10,621 | ... | 54 |
| Approx. miles of distribution lines under 6.6 kv. | ....... | 12,413 | 21,698 | ... | 75 |
| Population of territory served (thousands).... | ....... | 1,735 | 2,251 | ... | 30 |
| Total population of northwestern states, 1927 U. S. Census estimate (thousands).......... | ....... | ....... | 3,930 | ... | .. |

*Puget Sound Power & Light Company, Montana Power Company, Portland Electric Power Company, Washington Water Power Company, Pacific Power & Light Company, Idaho Power Company, Northwestern Electric Company and California Oregon Power Company.

years. This has been due largely to wholesaling large blocks of power to the Mountain States Power Company on the north and to the Pacific Gas & Electric Company on the south.

Four of the eight major utilities of the Pacific Northwest are strictly hydro-electric companies and of the remaining four only 29 per cent of their capacity and 14 per cent of their generation are from steam. Taking the eight properties as a whole, steam plants constitute only 12.5 per cent of the total plant capacity and produce only 5.2 per cent of the kilowatt-hours generated. This condition has been brought about by the utilization of numerous small hydro-electric sites within short transmission distance from load centers and capable of low cost development. The potential water power capacity of Oregon, Washington, Idaho, Montana and Wyoming is given by the U. S. Geological Survey as 13,531,000 hp., of which 1,898,705 hp. had been developed up to the close of 1927.

### Formerly Uneconomical Developments Becoming Economical

To one who views the situation from the outside it appears that power development in the Northwest is to undergo a radical change during the next five to ten years. Since a large part of the smaller economical sites have already been developed it will be necessary to look to the larger potential water powers, development of which has been uneconomical due to the fact that the rate of growth of any one or two systems has been insufficient to absorb a large block of power in a reasonable period of time. All of the eight systems mentioned, with the exception of the Idaho Power Company, are interconnected, but the ties are of relatively small capacity and not at all adequate to permit distribution of a large block of power which might be developed on the Deschutes or Columbia River to the important load centers.

With four of the eight utilities now under the same holding company management it would appear that development of the 260,000-hp. Kettle Falls site on the Columbia River or the 350,000-hp. Priest Rapids site on the same river and the transmission of this power over 220-kv. trunk transmission lines to the load centers of Puget Sound, Portland and Spokane is imminent. From Kettle Falls to Spokane is approximately 90 miles; to Seattle, 225 miles, and to Portland, 350 miles. Priest Rapids is almost equidistant from the three cities, the distances being approximately as follows: To Spokane, 150 miles; to Seattle, 150 miles, and to Portland, 175 miles. With the existing transmission network of the Northwest as indicated on the accompanying map and properly placed 220-kv. trunk lines it would be a simple matter to provide for a free flow of power from either of the above sites or any of several others to the power markets of the Northwest. Stream flow east of the Cascades is almost diametrically opposite to that west of the Cascades and the situation is ideal for development of one of the larger power sites in central Washington or Oregon as the next major step in expansion of Northwest power systems.

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# *More Service at Reduced Cost*

*By Franklin T. Griffith*
*President Portland Electric Power Company*

*Franklin T. Griffith*

IN practically every state in the Union the control of electric rates is vested in public service commissions. The fundamental principle of regulation is that the serving company is entitled to such rates as will permit it to earn the cost of operation, taxes and a reasonable return upon the value of the property devoted to public service. There is no guarantee that the utility shall earn such return, but there is, under regulation, ample protection against the establishment of extortionate rates that would produce more than a reasonable return on the investment.

The average cost to the consumer of electrical energy throughout the country, and particularly in the Northwest section, is lower now than at any time in history. This has been brought about by increasing the efficiency of operation and increasing the use of energy by consumers.

All rate schedules are designed to lower the average cost per kilowatt-hour as the consumption increases, so that today the average cost per kilowatt-hour served to the residences of Portland, for instance, is less than one-half of the average cost per kilowatt-hour ten years ago. There is every reason to believe that as use per customer increases, as it certainly will, the cost per kilowatt-hour of energy delivered will continue to decrease.

If the Federal Trade Commission, or any other fair-minded investigating body, investigates the rate structures of the utilities now serving electric needs in the Northwest, I am quite sure it will be found that the principle of regulation above referred to has been rigidly adhered to.

# Public Understanding

## Should Not Fall Behind Industry Growth

By H. T. Sands

*President National Electric Light Association*

NOT only are the electric light and power companies of the country constantly striving for higher standards of public service but they realize how essential it is that public understanding of these utilities should not fall too far behind the growth of the industry.

The twelve-month period being brought to a close with the fifty-first convention of the National Electric Light Association has shown the industry to be increasing its contributions to the social and economic life of the country.

The household consumption curve is steadily rising. It is estimated that the average home in the United States consumed 5 per cent more electricity in 1927 than in 1926, and for this same period the average household bill for electric light and power increased only about 2 per cent. During 1927 the average cost per kilowatt-hour for domestic consumers decreased from 7 cents to 6¾ cents. This is incontrovertible evidence of the caliber of the service that the electric companies are giving to the country. These trends toward improved service and lower rates are continuing and it is apparent that the domestic load will become heavier as widespread appreciation of home electrification is fostered by electric light and power companies, manufacturers, contractors, jobbers and dealers.

The amount of electricity employed in industry is dependent on industrial activity. This showed a diminution in some parts of the country for the first months of 1928, but manufacturing is now consuming more power in many sections. Not only is industry relying more each year on the power facilities of electric light and power companies but the rapid development of interconnection gives ample supplies of current. Not only are smaller cities attractive to industrial activities but other decided advantages of interconnection are reliability and economy. It was the interconnection of the private companies that saved the city of Los Angeles from being without light and power when the St. Francis dam collapsed.

The completion of the Great Northern project adds another unit to the electrified railroad lines, the huge sums of money involved in this work naturally retard rapid advancement, but the advantages of electric trains in some centers and along some lines are overweighing the difficulties involved. The electric light and power companies, also, are persistently pushing farm electrification and rendering to the rural sections the same advantages that are at the disposal of all city dwellers.

The industry has been busy and it sees, and all the members of this association see, that it will continue to be busy.

# *LEADERS of the N.E.L.A.*

2.

3

1. H. T. Sands,
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2. P. S. Arkwright,
   Vice-President
3. Paul S. Clapp,
   Managing Director
4. John B. Miller,
   Vice-President
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6. W. A. Jones,
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7. P. S. Young,
   Treasurer

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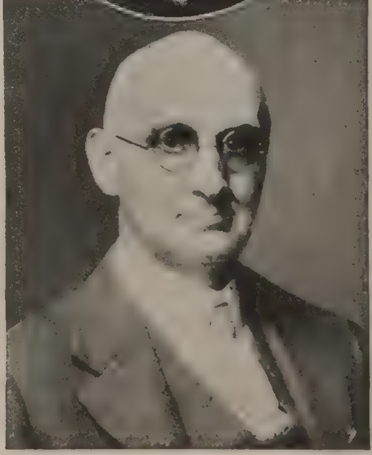
5

6



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# Serving Diversified Industry

### Ohio, Indiana, Illinois, Michigan and Kentucky record notable utility progress. Dense populations and diversified industries require high service standards

By T. P. KINDIG
*Western Editor*

ELECTRIC utilities located in the East Central States of Ohio, Indiana, Illinois, Michigan and Kentucky have been confronted by no mean array of problems in developing and building their systems to supply an electric service that must at once meet exacting requirements in dependability and adequacy and be economically profitable from an investment and operating standpoint. In these five states slightly more than 20 per cent of the entire population of the United States is concentrated. The territory itself presents a wide variety of characteristics in that it contains a number of cities of metropolitan proportions, it is highly industrialized, agriculture is carried on extensively, mining and the production of raw materials are of great importance. A glance at the industries and resources of each state will show considerable diversity of business but nevertheless reasons for mutuality of interest between states.

### CHARACTER OF TERRITORY

Ohio's leading industry, the manufacture of iron and steel, covers the entire northern and eastern part of the state along Lake Erie and down toward Pittsburgh. This state stands first in the output of pottery, machine tools and rubber goods and ranks second in automobiles and electrical machinery. Agriculturally it ranks fourth in the value of crops.

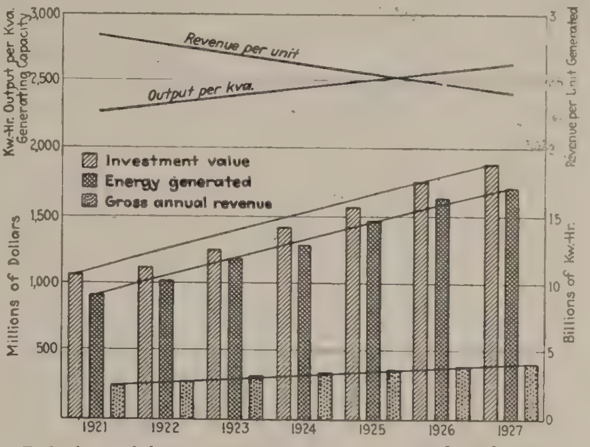
Indiana also has a large share in the production of iron and steel. It produces 70 per cent of the limestone used in the country for building and is a large producer of coal, petroleum, natural gas, pottery and cement. Almost the entire state is farmed intensively.

Illinois boasts of the second largest city in the United States. It stands first in the manufacture of meat products, agricultural implements and railroad cars. In value of farm products it ranks third and is one of the leading producers of coal and petroleum.

Michigan's production of automobiles is more than equal to the value of the automobiles produced in the rest of the country. It is the center of the country's furniture industry. Diversified farming gives the state a high rank in the total value of its crops and it is an important producer of iron ore, copper and coal.

Kentucky, long known as a great producer of tobacco, is rapidly taking on a distinctly industrial aspect. The state is a large producer of coal and its iron and steel industry is growing rapidly. It is an important railroad gateway for traffic from the South, West and North and a large amount of building material is produced in and shipped out of the state.

These five states have been the field of a vast commercial and industrial development during the past ten years. The central-station companies in this area have not only kept abreast of these developments but anticipated future requirements, fostered industrial and commercial development and extended their service as rapidly as practicable to the uttermost limits of the territory. How well they have done this and the consequent benefit to the public is told, in part at least, by the accompanying maps, graphs and tabulations.



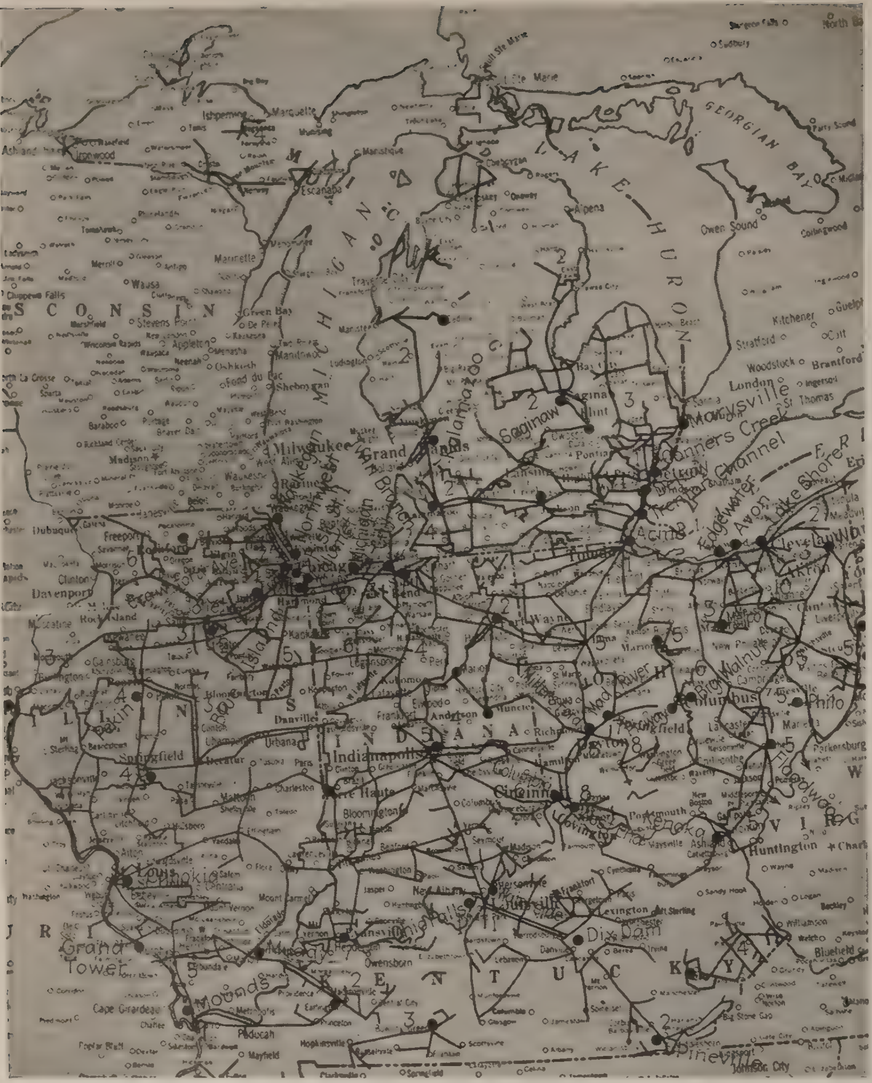
*Relation of investment, energy generated and gross annual revenue*

In the upper diagram it will be seen that the energy output per kilovolt-ampere of generating capacity has increased about 15.5 per cent in the past six years, indicating improved operating efficiency. At the same time the gross revenue received per unit generated has decreased 14.7 per cent, showing that the major portion of the economy has been passed on to the public.

### SIX YEARS' PROGRESS

From 1921 to the end of 1927 the central-station companies added $830,789,700 to the investment value of their properties, an increase of 68 per cent. Generating capacity increased 79 per cent, to 6,645,000 kva.; number of customers grew to 5,084,200, or 78 per cent; gross revenue was raised 71 per cent, to $416,968,500; miles of transmission lines rose to 27,900, or 53 per cent; energy generated increased 101 per cent, to 17,285,000,000 kw.-hr.; population grew only 12 per cent, to 24,184,000, and the per capita production of electric energy rose from 395 to 715 kw.-hr. per year, or 85 per cent.

While the output per unit of generating capacity has been increasing, denoting better efficiency and more economical operation of power plants, the gross revenue received by the utilities per unit of energy generated has decreased 14.7 per cent in six years. In other words,



**Illinois—2,342,000 kva.**

1. Commonwealth Edison Company.
2. Public Service Company of Northern Illinois.
3. Illinois Power & Light Company.
4. Illinois Electric Power Company.
5. Central Illinois Public Service Company.
6. Illinois Northern Utilities Company.

**Indiana—724,000 kva.**

1. Indiana & Michigan Electric Company.
2. Indiana Service Corporation.
3. Northern Indiana Public Service Company.
4. Central Indiana Power Company.
5. Indianapolis Light & Heat Company.
6. Interstate Public Service Company.
7. Southern Indiana Gas & Electric Company.

**Kentucky—259,000 kva.**

1. Louisville Gas & Electric Company.
2. Kentucky Utilities Company.
3. Associated Gas & Electric System.
4. Kentucky & West Virginia Power Company.

**Ohio—1,976,000 kva.**

1. Toledo Edison Company.
2. Cleveland Electric Illuminating Company.
3. Ohio Public Service Company.
4. Pennsylvania-Ohio Power & Light Company.
5. Ohio Power Company.
6. Columbus Railway, Power & Light Company.
7. Ohio Edison Company.
8. Columbia Gas & Electric Company.
9. United Utilities Company.
10. Northern Ohio Power & Light Company.

**Michigan—1,344,000 kva.**

1. Detroit Edison Company.
2. Consumers Power Company.
3. Michigan Electric Power Company.
4. Michigan Gas & Electric Company.
5. Michigan Northern Power Co.

**Total generating capacity in five states—6,645,000 kva.**

*Transmission system of the largest power pool in the Middle West, showing principal power companies' territories*

the results of more efficient utility operation and larger customer consumption have been passed on to the public in the form of lower rates.

The principal load centers are in the large cities, which have grown to their present size because of certain natural resources or their adaptability to commerce. They are situated chiefly on the Great Lakes and the Ohio and Mississippi Rivers. These waterways have also provided the essential sites for electric generating stations. Electric power at low cost has been a considerable factor in furthering the industrial growth of these cities.

In recent years there has been a marked tendency on the part of manufacturing industries to locate their plants away from the large centers of population. This trend toward decentralization would have been greatly retarded, if not made wholly impossible, were it not for the fact that large blocks of electric power could be obtained from high-tension transmission lines of the utilities at points considerably distant from the metropolitan areas. Still another factor influencing utility development in the East Central States is the large number of small cities and towns which have grown up as local commercial centers of agricultural activity with comparatively little manufacturing interest. Most of the cities and towns of this size had electric service of a sort, supplied from inefficient local plants, sometimes municipally and sometimes privately operated, with little hope of improved service because of lack of capital, incentive and vision of future possibilities.

With these elements the electric utilities have been and are confronted with the following conditions of service requirements: (1) Large metropolitan centers combined with intensive local industrial areas; (2) medium-sized cities with increasingly important but less intense industrial activity; (3) small non-industrial towns which merge into and carry with them the problems of rural service.

The accompanying map, which shows some of the most important power stations and the network of transmission lines, tells better than words how the utilities have gone about meeting power requirements.

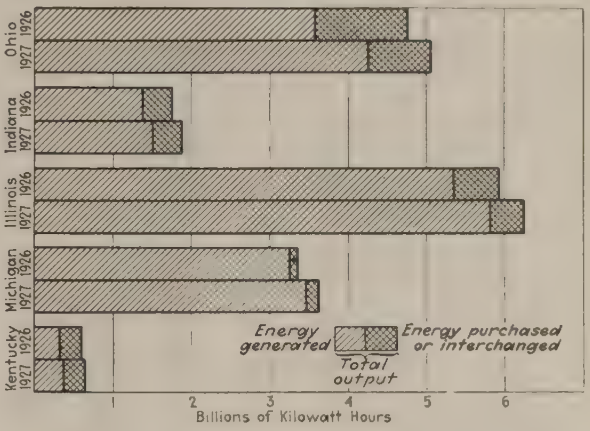
*Total Number of Customers by States—Dec. 31, 1921, to 1927*

| | 1921 | 1927 |
|---|---|---|
| **Ohio** (total) | 708,500 | 1,447,000 |
| Domestic | | 1,228,000 |
| Commercial | | 177,000 |
| Power | | 42,000 |
| **Indiana** (total) | 372,000 | 611,200 |
| Domestic | | 515,600 |
| Commercial | | 237,290 |
| Power | | 21,600 |
| **Illinois** (total) | 1,035,500 | 1,779,000 |
| Domestic | | 1,470,740 |
| Commercial | | 237,290 |
| Power | | 70,970 |
| **Michigan** (total) | 604,000 | 1,016,300 |
| Domestic | | 856,800 |
| Commercial | | 132,800 |
| Power | | 26,700 |
| **Kentucky** (total) | 137,000 | 230,700 |
| Domestic | | 181,300 |
| Commercial | | 39,200 |
| Power | | 10,200 |
| **Totals—all customers** | 2,857,000 | 5,084,200 |
| Domestic | | 4,252,440 |
| Commercial | | 660,290 |
| Power | | 171,470 |

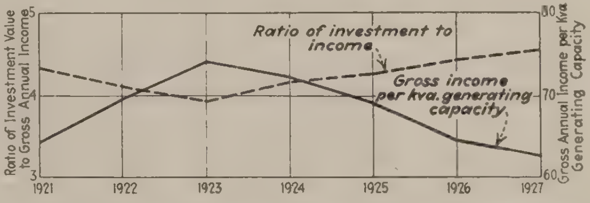
They have developed along several different lines: First, there is the power pool, where a number of large generating stations are located in and about the heaviest load centers. These stations are linked together with heavy tie lines and provision made for interconnection with other systems. Second, there is the territory where load concentration is not so heavy and generating stations are located advantageously for condensing water and coal supply, with radial or loop lines supplying the intervening territory and connecting with other systems. The third system plan also provides for advantageous location of generating plants, but because of the rather widely scattered nature of its territory considerable provision is made for interconnection and interchange of power with other utilities. A fourth general system is found in those territories which cover a wide area and whose power supply comes from hydro-electric plants and interconnection with other systems. Such systems employ longer transmission lines and as a general thing industrial loads are not as highly concentrated. There are, of course, many modifications of these classifications and some systems embody some of the elements of all.

### TYPICAL SYSTEMS

Typical of the first general plan are the Commonwealth Edison Company and the Public Service of Northern Illinois, which form the principal elements of the Chicago power pool. The Detroit Edison Company represents, in a single utility, the development of a power system to serve an intensely industrialized metropolitan district. The Cleveland Electric Illuminating Company, the Columbia Gas & Electric Company of Cincinnati and the Louisville Gas & Electric Company also represent this type of system in somewhat modified degrees. The second type of system is illustrated by the Penn-Ohio Power & Light Company at Youngstown, Ohio; the Illinois Power & Light Corporation and the Central Indiana Power Company. The Ohio Power Company, the Ohio Public Service Company, the Central Illinois Public Service Company and the Interstate Public Service Company in Indiana represent the third classification. Typical of the fourth general system plan are the Consumers Power Company in Michigan and the Kentucky Utilities Company.



*Total output and interchanged energy, 1926 and 1927*



*Ratio of invested dollars to gross annual income has increased, while gross income per kilovolt-ampere of generating capacity has decreased*

Central-station companies in the East Central States have been noted for pioneer engineering in adopting such things as pulverized fuel, high-pressure boilers and

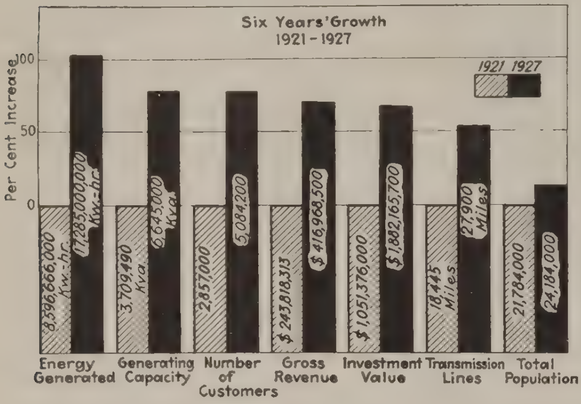
*Total Output, Energy Generated and Interchanged or Purchased Power—1926 and 1927*

| | 1926 | | | | 1927 | | | |
|---|---|---|---|---|---|---|---|---|
| States | Total Output, Kw.-Hr. | Generated, Kw.-Hr. | Purchased or Exchanged, Kw.-Hr. | Per Cent of Total | Total Output, Kw.-Hr. | Generated, Kw.-Hr. | Purchased or Exchanged, Kw.-Hr. | Per Cent of Total |
| Ohio | 4,761,028,000 | 3,551,726,888 | 1,209,301,112 | 25.45 | 5,018,000,000 | 4,289,000,000 | 729,000,000 | 14.4 |
| Indiana | 1,758,435,000 | 1,361,028,690 | 397,406,310 | 22.62 | 1,850,000,000 | 1,475,000,000 | 374,500,000 | 20.2 |
| Illinois | 5,930,399,000 | 5,364,045,900 | 566,353,100 | 9.55 | 6,247,000,000 | 5,832,000,000 | 415,000,000 | 6.8 |
| Michigan | 3,392,813,000 | 3,288,314,360 | 104,498,640 | 3.08 | 3,578,000,000 | 3,456,000,000 | 121,200,000 | 3.85 |
| Kentucky | 513,800,000 | 327,832,000 | 185,968,000 | 36.00 | 592,000,000 | 394,700,000 | 197,300,000 | 33.3 |
| Totals | 16,356,475,000 | 13,892,947,838 | 2,463,527,162 | 15.10 | 17,285,000,000 | 15,448,000,000 | 1,837,000,000 | 10.7 |

turbines, large single-shaft generating units and base-load plants. They have also been consistent in producing energy at maximum economy. The Columbia plant of the Columbia Gas & Electric Company holds the record for thermal economy in B.t.u. per kilowatt-hour.

### ADDED GENERATING CAPACITY

As a further example of this tendency to undertake large scale operations which reduce production costs and improve service to the public the project for the State Line Generating Company may be cited. The first unit of this plant is now under way on the shore of Lake Michigan on the Indiana side of the Illinois-Indiana state line. This project contemplates the generation and sale of power to several Illinois and Indiana companies whose transmission lines have been brought to a common focus at that point. The proposed ultimate capacity of this plant is 1,000,000 kw. and the first unit will produce more than 200,000 kw.



*Six years' growth of electric utilities in five states*

Many additions to generating plant capacity are under way through the territory. The Detroit Edison Company is going ahead with the construction of its Delray No. 3 plant, the first unit of which will be 100,000 kw., and is installing the sixth 50,000-kw. unit at Trenton Channel. The Cleveland Electric Illuminating Company is adding the third 35,000-kw. unit at Avon. At Philo station of the Ohio Power Company 165,000 kw. is going in, while the Ohio River Edison Company is installing 37,500 kw. at Toronto. The Columbia Gas & Electric Company is increasing the capacity of its system by some 100,000 kw. by additions to its Columbia, West End and Millers Ford stations. The Louisville Gas & Electric Company added 80,000 kw. of hydro-electric capacity this spring when the Ohio Falls plant went into operation. A 104,000-kw. unit is going into the Crawford Avenue station of the Commonwealth Edison Company. A new plant, the first unit of which is 50,000 kw., is being constructed at Pekin, Ill., to supply the increasing demand for power in central Illinois. These are only a few of the additions being made to generating capacity, but they serve to show how the electric utilities in the East Central States are preparing in advance to meet the increasing demand for electric energy.

### TRANSMISSION NETWORKS

The extent of transmission lines and interconnection is fairly well indicated by the map of the area. In general, the lines radiate from the heaviest load centers—Chicago, Cleveland, Detroit, Toledo, Cincinnati, Louisville and those plants on the Ohio River and in eastern Ohio. They extend from Chicago to the Mississippi River at Keokuk and to the southwest connecting with St. Louis and also cross the heart of the Illinois coal fields. To the south the lines reach the southern limits of the state and will shortly be connected with the systems across the Ohio River in Kentucky. Interconnected systems link Illinois with Indiana at several points, and extend across the Ohio River at Louisville, tapping the water powers in Kentucky. Within the state of Indiana is a series of interconnected systems, some of which form loops and others direct lines almost across the entire state. These lines, in turn, are interconnected with the systems in Ohio. Kentucky, as just noted, feeds power northward into Indiana and is rapidly completing a transmission system which will tie together the two great coal fields in the southeastern and southwestern parts of the state. From Louisville lines extend south, east and north.

In Ohio there is one unbroken line extending across the state from the southwest to the northwest and into Indiana. From Cincinnati lines extend in every direction and directly across the state. The northwestern section is covered by one of the most highly interconnected transmission networks in the country. It is now connected with Toledo, from where lines extend into southwestern Michigan and westward to Indiana.

In Michigan there is the Consumers Power Company system, which in itself represents a great interconnection of transmission lines, hydro and steam plants. This system is now tied in with Detroit, from where lines extend into the thumb of the lower peninsula of the state.

## *Investment Values, Generating Capacity, Output, Gross Revenue, Population and Customers per Thousand Population, and Length of Transmission Allocated Among Five States*

| | Investment Value of Utilities | | Generating Capacity, Kva. | | Energy Generated (Thousands of Kw.-Hr.) | | Gross Revenue | | Population | | Customers per Thousand Population | | | Transmission Lines (Circuit-Miles) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | Per Cent Increase | 1922 | 1927 |
| Ohio. | $260,728,000 | $538,284,000 | 1,318,370 | 1,976,000 | 2,520,000 | 5,018,000 | $68,544,000 | $120,933,800 | 5,909,000 | 6,710,000 | 132 | 216 | 62.5 | 4,560 | 6,815 |
| Ind.. | 136,896,000 | 227,366,400 | 447,736 | 724,000 | 905,617 | 1,850,000 | 24,622,782 | 44,585,000 | 2,964,000 | 3,150,000 | 125 | 194 | 55.1 | 4,035 | 5,990 |
| Ill.... | 381,064,000 | 661,778,000 | 1,154,180 | 2,342,000 | 2,984,134 | 6,247,000 | 81,167,444 | 150,552,700 | 6,627,000 | 7,296,000 | 156 | 244 | 56.2 | 5,120 | 7,620 |
| Mich. | 222,272,000 | 368,916,900 | 684,120 | 1,344,000 | 1,901,752 | 3,578,000 | 51,727,654 | 86,629,800 | 3,861,000 | 4,490,000 | 156 | 226 | 45.0 | 3,440 | 5,105 |
| Ky... | 50,416,000 | 85,820,400 | 105,084 | 259,000 | 285,163 | 592,000 | 7,756,433 | 14,267,200 | 2,423,000 | 2,538,000 | 57 | 91 | 62.8 | 1,310 | 2,370 |
| Total | $1,051,376,000 | $1,882,165,700 | 3,709,490 | 6,645,000 | 8,596,666 | 17,285,000 | $243,818,313 | $416,968,500 | 21,784,000 | 24,184,000 | 131 | 210 | 60 3 | 18,445 | 27,900 |

# Domestic Load Development

*By Alex Dow*
*President Detroit Edison Company*

*Alex Dow*

ON THE assumption that there will be an average annual use of not less than 1,300 kw.-hr. per domestic customer, the Detroit Edison Company now has in progress the rearrangement and reconstruction of its secondary circuits in the residential districts. This rearrangement is, of course, a slow job. It begins where it is likely to be most needed and it will be two or two and one-half years in extending to the lines where there is at the present time a comfortable excess capacity above the recent use of about 560 kw.-hr. per average customer.

To develop domestic load good service, particularly maintenance of voltage, is a *sine qua non*. A reasonable rate schedule is another. A schedule which, regardless of its make-up in the earlier billing blocks, will offer a sharp reduction in the rate for supply above the present average is desirable, and is successful in places where it is already adopted. A last condition, which is not so well understood as it ought to be, is provision for quick servicing and cheap replacements of domestic appliances. If the makers of range-heating elements, for instance, could get together and standardize on their sizes and connections it would be a big help to sales.

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Lines also extend into the southwestern part of the state from Indiana and other interconnections are under contemplation.

While some of these interconnections are suitable only for local interchange of power, there is a very definite tendency toward increasing the capacity of these tie-ins and the revamping of lines to transmit larger blocks of power.

While the work of tying separate systems together is going ahead, it is interesting and significant to note how much energy is exchanged between systems. A comparison has been made of the total amount of electric power interchanged by the utilities in the five states in the years 1926 and 1927. In 1926 2,463,527,162 kw.-hr., or 15.1 per cent of the total output, was either purchased from or exchanged with other utilities, but in 1927, while the total output increased, the interchanged energy amounted to only 1,847,000,000 kw.-hr., or 10.7 per cent. This does not mean that the interconnection of systems is any less important, but rather that systems formerly purchasing a considerable part of their power have found it economical to increase their own generating capacity. Also, some companies formerly operated separately and which purchased power have been consolidated or merged with the supplying company and the power transmitted is now reported as the total output of

*Four 66-kv. circuits from the Columbia terminal of the Columbia Gas & Electric System* one system. Interconnection has therefore been the means of pointing the way to the most economical method of serving a given territory from the system of a single well-organized and operated utility.

### COMMERCIAL DEVELOPMENT

Commercially, the central-station companies in the East Central States have expanded just as rapidly as they have physically. Few companies in 1921 had well-organized new-business departments. As a result of the war and post-war conditions the utilities' commercial departments were reduced in personnel and for the most part were working with skeleton organizations. It has been necessary, therefore, virtually to create entirely new sales staffs, map out and carry through sales programs and redevelop the central-station sales technique. That this has been done well and efficiently may be seen by comparison of a few significant figures for 1921 and 1927. The total number of customers has been increased by 2,227,200 from 2,857,000 in 1921. Total kilowatt-hour sales have more than doubled, and while the population of the area has increased by about 12 per cent the use of electric energy per inhabitant has grown from 395 kw.-hr. to 715 kw.-hr. per year.

From an industrial power standpoint utility commercial departments have worked closely with the manufacturers in their territories. Electrification of industry has gone ahead rapidly with the aid of the central-station power sales engineers and the trend toward decentralization of industry, previously mentioned, must be credited largely to the extension of reliable utility service into nearly all parts of the east central area. This trend has gone hand in hand with the commercial and physical development of the power companies.

### CUSTOMER OWNERSHIP AND PUBLIC RELATIONS

While the central-station industry has been expanding its systems and service, at the same time it has not over-

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# *The Backward Child*

*By T. O. Kennedy*
*Vice-President Ohio Public Service Company*

*T. O. Kennedy*

"DON'T give her a book for Christmas; she has a book." This is an old joke, but immortal because it has much wisdom in it. Apparently we electric utility executives, as a class, have never seen the point of that merry jape. If it were plain to us we would long ago have seen its obvious parallel in our industry.

"Why try to sell electric service to the people of the United States? They already have electric service."

There is hope that the point will finally become clear. It ought to because a lot of men are trying to explain it with charts, curves, diagrams and geysers of words, accompanied by much appropriate gesticulation. All are saying that just as the possession of one book does not prevent the enjoyment of many more books, so the fact that electric service is in the home does not prevent its extension to many more profitable uses.

Compared with other nations, our country is the leader in electrification progress, industrial, commercial and domestic. Our arms have developed swivel joints from patting ourselves on the back, but at the same time we calmly admit that one-third of our total business is unprofitable and we refuse to let it bother us, much less do we take effective action to correct the condition.

We are agreed that the residence business on our lines as a whole is hardly more than paying its way—if it is doing that. We are agreed that this business can be made to pay an adequate return, a return that will be open to no criticism because it will be accompanied by lower rates and greater service to the users of energy. We have the necessary equipment, devices and appliances already developed and of proved ability to build up the residential load. All we have to do is to get these energy-consuming devices on our lines by selling, either selling them ourselves or by encouraging others to sell.

The essential thing is not the manner in which appliances are put on the lines; it is to get them there. In the small progress already made by the commercial spirit in the electric utility industry the end has always been obscured by the means; among all the trees we have lost sight of the forest. In talking and worrying about how the job should be done we have forgotten the job itself.

The commercial development of our business in the widest field of electricity application, the home, has not got over the first hurdle in the race. That hurdle is executive interest. Not the interest that expresses itself in a mild, "Yes, yes, that's right. We ought to do something about that some time," but an active interest that manifests itself in enthusiasm, in an appreciation, not only of the size of the job but of the reward to follow its completion, and in participation in the work.

The electric utility industry is more than forty years old. It is commonly referred to as being still in its infancy, but with a brilliant future. This must be true because in one regard at least, domestic service, it is a terribly backward child.

It is time that the utility executive, the daddy of the electrical industry, took a more active interest in the rearing of his child.

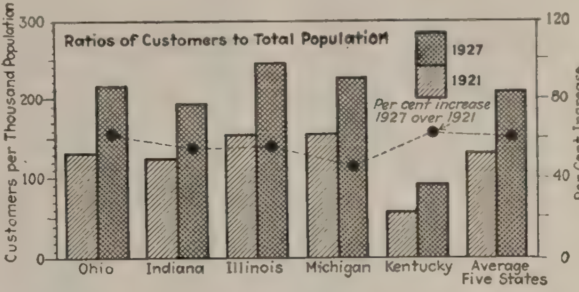
looked the value of taking its customers and employees into partnership through the sale of preferred stock, and there is scarcely a company which cannot boast of the fact that a large per cent of its customers are also stockholders. Many companies have established a fixed policy, when new capital is required, of obtaining part or all by the sale of its preferred stock direct to customers. So well has this practice been received by the public that frequently the stock issue is far oversubscribed within a few days after its first offering. Such an attitude on the part of the public speaks volumes for the cordial relations between the utilities and their customers and belies any alleged need for an investigation of the practices of these utilities.

In the construction of additional transmission systems and generating stations, work is going ahead in an orderly manner. There is still some work to be done in allocating certain territories and districts to those companies best situated to provide service. This will be carried out by carefully planned merging of systems and properties. The public ultimately will benefit from these operations, as it has in the past, by receiving better service at a lower cost as the consumption of energy increases.

### FUTURE GROWTH

That there is in prospect an enormous growth for the utilities serving the states of Ohio, Indiana, Illinois, Michigan and Kentucky is inevitable. Looking into the future, it would seem that they are but on the threshold of a vast expansion program.

Past experience shows a steady increase in population, which may be expected to continue and bring added service responsibility to the electric utilities. But volume of new customers as such will probably be the least source of additional load. The industry will have to concentrate its efforts on more intensive development of existing loads. In the last six years the per capita consumption of electric energy has almost doubled. Industrial applications and uses for power are increasing and many large industries are finding it most profitable to purchase their power requirements from the electric utilities. Further electrification of the railroads is imminent. Commercial, street and highway lighting intensities are mounting higher and using more energy. Domestic use of energy is still largely undeveloped.



*Increase in ratio of customers to total population, 1921 to 1927*

These general conditions and trends alone indicate the necessity for the electric utilities ever to be building in advance of these demands and to anticipate, in so far as possible, use potentialities.

It has been estimated that by 1950 the total consumption of energy in the territory would be 54,000,000,000 kw.-hr., with a coincident demand upon generating stations of 13,500,000 kw. This would require an installation of about 15,000,000 kw. total capacity to provide ample reserve. Based on these estimates of consumption and increased population the combined consumption for all uses would, in 1950, amount to 1,650 kw.-hr. per capita. Viewed in the light of the progress that has been made in the last six years it is hazardous to predict what may happen, but it seems safe to say that any available estimates of future growth that have been made thus far are ultra-conservative.

*Airplane view of the highly efficient Columbia station*

# Special National Committee Chairmen

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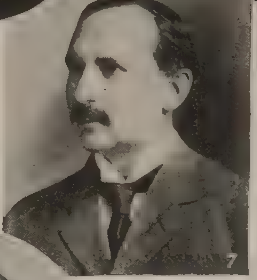

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1. Paul A. Schoellkopf
   Water Power Development
2. H. T. Sands
   Charles A. Coffin Prize
3. Irvin W. Day
   Codes and Standards
4. Robert F. Pack
   Constitution and By-Laws
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   Electrification of Steam Railroads
6. E. W. Goldschmidt
   Exhibition
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# New England Optimistic

### Progress in engineering, management methods and commercial activity points to greater triumphs in store with mutual benefits to companies and public

By Howard S. Knowlton

*New England Editor*

IN THE year 1919 the power companies of New England faced many problems. Prices of material and labor had risen to levels which strained the resources of the ablest management to overcome without burdensome increases in rates. Plants had expanded far beyond pre-war ratings and the trend of future loads was uncertain. Interconnection had made a good start in demonstrating its economic value as well as its military necessity, but comprehensive plans for further development were in an embryonic stage. Individual management prevailed in companies serving many important areas, and the holding company had not hit its stride in the advance of the regional industry toward widespread centralization. Personnel was more or less disrupted in organization and effectiveness by the demands of the war. Relations with the public were good but casual as compared with present conditions. Promotional rates were little known and commercial activity was extremely spotty in character and location. Executives were beset with difficult questions of policy, as to financing, engineering, load building and many other matters upon the wise handling of which depended the economic prosperity of the operating properties and to a large extent the success of the communities served by them in the readjustment period immediately following the conflict.

At the peak of the price curve in 1920 the transition of New England from a wartime basis of plant development and operation was well under way, and in this transition the utilities have played an outstanding part, carrying on through years of economic stress and contributing invaluable service to their territories. If electrical methods were absolutely necessary to war industries they have been scarcely less so to the manufacturing and business organizations of these states in the post-war era of readjustment. It is no mean achievement of private management to have met the demands of the public in such an unprecedented period so effectively that advocates of government ownership have been able to make little impression upon the popular mind in the northeast; that rates have been lowered all along the line, and the growth of the utilities economically guided to a status of financial stability and earning power surpassing all previous experience.

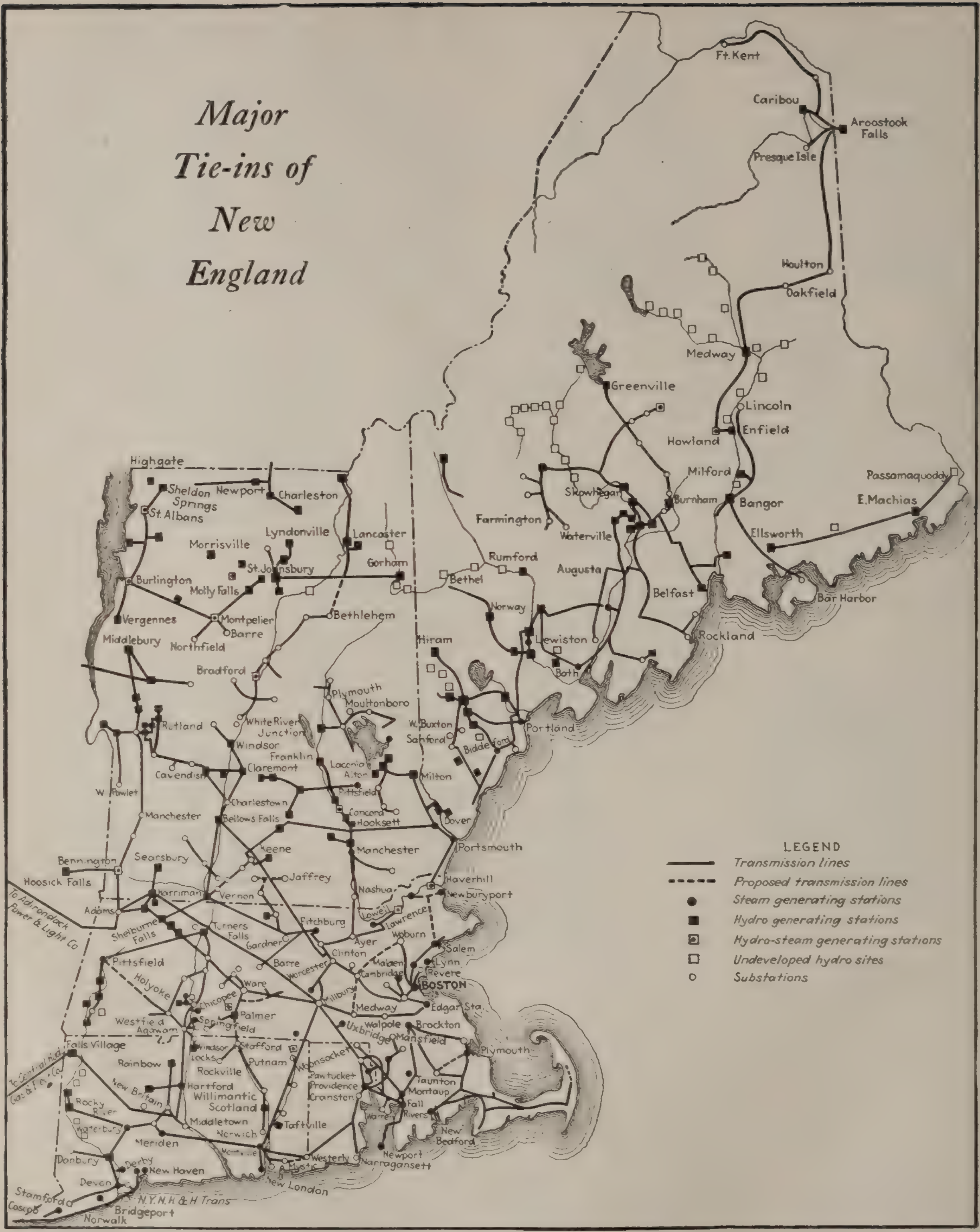
## Diversified Service Required

Maine, New Hampshire and Vermont, the three northern states of New England, embrace large agricultural areas, raw material districts, mountain, lake and river country of marked variety and appeal and many small cities blessed with diversified industries. The three southerly states of Massachusetts, Rhode Island and Connecticut include much attractive farming land and hill country, but in general constitute the major workshop of this region. The railroad trunk lines between Boston and New York are the equivalent of a set of industrial busbars to which are connected diversified factories producing an extraordinary range of commodities in whose creation and distribution electric service is a necessity of the first order. These last-named states contain many cities of rank in American industry and the density of population is such that their effective service by major steam plants on tidewater and by transmitted hydro-electric power from the interior western and northern areas of New England is desirable business.

## Interconnection Progresses

This interconnection of interior plants with tidewater stations by transmission systems has made remarkable strides since the war, and with the exception of Maine the New England States are interlinked with resulting advantages in the utilization of plant investment, transfer of energy to load centers, supply of power during emergencies, marketing of secondary hydro power, use of diverse river flows and decentralization of industry. Maine's law prohibiting hydro power export bids fair to be repealed or modified within a few years at the latest, and when this is done many millions of dollars will undoubtedly be invested in hydro-electric and transmission developments in the Pine Tree State to enable surplus power to be marketed outside and intrastate industries attracted, served and developed on a scale much beyond the present status. Comprehensive plans have been drawn for the development of water powers in the Penobscot and Kennebec Valleys and the construction of trunk transmission lines from central and southern Maine to connect with eastern Massachusetts systems and load centers. These plans include lines from the Passamaquoddy Bay tidal power development in case this works out satisfactorily. Still farther afield, the proposed hydro-electric developments in the St. Lawrence Valley and various projects in Quebec are being studied by New England utility engineers and executives in relation to possible future interconnection with the transmission networks planned and already existing on the American side of the frontier.

During the past seven years many important lines have been built in New England with the objective of interconnecting plants, systems and load centers. Among these are circuits tying the New England Power Company system to that of the Edison Electric Illuminating Company of Boston; a 110-kw. trunk line from the Harriman station of the former company to its load-dispatching center at Millbury, Mass.; a new line from



*WITH the exception of Maine, every New England state is now interconnected with its fellows by important transmission lines. Recently built 110-kv. trunk lines connect the Adirondack system on the west with the Edgar station near Boston, and the new Bellows Falls plant of the New England Power Company in Vermont with eastern Massachusetts load centers.*

Bellows Falls, Vt., to Pratt's Junction, Mass.; lines connecting the New England and Connecticut Company systems with those of the Adirondack and Central Hudson companies; a tie between the Turners Falls Power & Electric Company system and Hartford, forming the trunk connection of the Connecticut Valley Power Exchange; a line from Turners Falls to Pittsfield, Mass.; a line across southern New Hampshire from Keene to Dover, and a line across southern Connecticut from Meriden to Montville. Many shorter lines have also been built, so that today substantially all important properties in central and southern New England with the exception of the United Illuminating Company of New Haven are interconnected and in many cases are negotiating or planning for still further interchanges of energy. Many municipal plants purchase and distribute energy transmitted by this central network of 110 and 66-kv. lines. In Maine important line construction has taken place in connection with the expansion of the Bangor Hydro-Electric Company's system northeast of Ellsworth and in relation to the marketing of power from the Gulf Island development of the Central Maine Power Company. Interconnection of the Central Maine and Portland systems has also been effectively achieved.

### MERCURY VERSUS STEAM

Outstanding developments in generating station design in which pioneer work of the first order has been done may be credited to New England during the post-war period. The most conspicuous are, of course, the 1,200-lb. Edgar steam plant of the Boston Edison Company at Weymouth, Mass., and the mercury vapor installation of the Hartford Electric Light Company at Dutch Point, now being followed by a 10,000-kw. (plus 10,000 kw. in steam production from the mercury process) unit at the latter's South Meadow station. The Edgar station has produced energy upon a fuel consumption of 1 lb. or slightly less per kilowatt-hour, and the Hartford installation points the way toward still further fuel economies on a large-scale plant basis. The executives and engineers of each of these companies are backing their convictions as to the over-all merits of these two systems of power production by appropriating substantial funds for their further installation and expansion. Both processes have passed beyond the experimental stage and the race is settling down to a contest in which service results on a large scale and economic performance, including all costs and charges, will be most instructive to the producer of mass power from fuel. Other important steam plant construction, such as the Devon station of the Connecticut Light & Power Company, the Somerset station of the Montaup Electric Company near Fall River, Mass., and the rehabilitation of the South Street station of the Narragansett Electric Company in Providence can only be given passing mention at this time, to say nothing of betterment and new construction work at Portland, Lewiston, Lynn, Salem, Bridgeport, Stamford and other tidewater points. The trend of the times is away from interior fuel-burning plants in this territory, with few exceptions, the formula being "steam power production at tidewater plus hydro power in the hinterland.

Notable hydro-electric plant construction of the past seven years in New England includes stations at Gulf Island, Me.; Davis Bridge and Bellows Falls, Vt.; Searsburg, Vt.; Sherman, Vt.; Glen (near Rutland, Vt.); Holyoke, Mass. (Holyoke Water Power Company); Mollys Falls, Vt., and Rocky River, Conn. A force of engineers is at work on the tidewater project at Passamaquoddy Bay. Studies are being made of many undeveloped sites in northern New England and Maine. When co-ordinated with the fuel-burning plants on the seaboard these hydro developments usually prove advantageous from the operating standpoint and potent factors in fuel saving.

### LOAD BULDING PROBLEMS

From operating residential cellar stairway pilot lights and curling irons to driving locomotives in main line electrification and melting brass in the crowded industries of the Naugatuck Valley, central-station service in New England exhibits a range of great usefulness. During these past few years leading companies have increased their residential kilowatt-hour sales from, say, 250 per year to 400 and over per metered installation. Sales energy is now concentrated upon increasing domestic consumption through promotional rates and vigorous appliance merchandising. A few venerable utilities still remain unconvinced that appliance merchandising is a desirable central station function, but general industry opinion in Yankeeland is all the other way. Electric refrigeration is making rapid progress and electric cooking is winning headway, some very notable hotel installations having been made of late. Several utilities now are selling electric appliances at the rate of from $500,000 to $750,000 worth per year.

Many pages could be written about the progress of New England in industrial power and electric heating applications if space allowed. The sale of electric motors in New England from week to week often exceeds the $50,000 mark, and the shifting tides of fashion, changing demands of the market for commodities, rehabilitation of factories and attack on industrial and mercantile wastes create a constant market for modernized power units and improved control equipment. In the past six years a single industrial power sales department of a utility organization increased the connected power load 29 per cent, increased the power sales in kilowatt-hours 89.5 per cent and increased the power revenue 116 per cent. In the Naugatuck Valley of Connecticut as far back as 1924 about 90 per cent of the brass melting was done electrically and about 50,000,000 kw.-hr. per year was consumed in this work. The varied metal-working industries of lower New England are rapidly adopting industrial electric heating for approved processes, and in Boston, Worcester, Hartford, Rhode Island and many other places pioneer work has been done in this field with resultant large-scale commercial progress. The central stations have contributed largely to the betterment of working conditions and control of quality production in countless industrial plants by power, heating and up-to-date lighting installations.

Seven years ago commercial activities in New England utilities were less well organized, policies were almost as varied as the personalities of the executives in control, rates were going along without much regard to inducement features and the regional interchange of ideas among sales forces was not much in evidence except among the fortunate few whose expense accounts were allowed to reflect convention attendance. Conditions have now greatly improved. Staffs have been increased and leadership organized for more intensive coverage. Through N.E.L.A. activities and encouraged association of specialists from different parts of New England for the discussion of field methods load building has attained a new impetus. Commercial and industrial lighting has made great strides within the past few years as a result of the organization of divisions of sales departments to push this class of work. Prior to 1920 the value of systematic development of commercial lighting was far less generally appreciated. The prize-winning work of the Boston Edison Company in this field has received national recognition.

### HOLDING COMPANIES INCREASE

Within the past three years many "old-line" New England power companies have been acquired by holding company or management groups. The upheaval of this movement is still undulating and the industry is still in a transition stage from an era of individualized management to a period of centralized management. The so-called "independent" companies are gradually either being acquired by groups or are participating in the holding company movement. A goodly number of these properties remain intact at this writing, but scarcely a week passes without news of some advance toward group operation in this or that locality. The results of centralized management are attracting interest everywhere, and it is a fair statement that many areas in New England are now obtaining improved service at rates which would have been out of the question under the old régime

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# *Non-Exportation Law Results in Waste*

*An Interview with*

***Walter S. Wyman***
*President Central Maine Power Company*

*Walter S. Wyman*

"DURING the past winter the Central Maine Power Company has had a large amount of water power go to waste. At the beginning of 1927 we estimated that we should have a surplus of about 125,000,000 kw.-hr. during the year. As a matter of fact, the total amount going to waste last year was 131,000,000 kw.-hr. The same proportional waste has continued through the first quarter of 1928. This means that if we had business to use all the energy which our water-power plants could produce the present waterwheels and generators could have turned out 131,000,000 kw.-hr. more than they did.

"At the present time quite a few candidates for political office are saying a lot about Maine's water power and about the importance of 'keeping this priceless heritage for our children's children,' and so on. One of their favorite expressions is to question whether there is any surplus or not, and beginning with that question they conclude, presumably from sources of information which are available exclusively to them, that there is no surplus, so that there is no real need of exporting power. Regardless of this, however, it is a fact that there was a developed surplus on the Central Maine Power Company property in 1927 of 131,000,000 kw.-hr., and while I have no accurate information on the subject, I know enough about the situation to feel very confident that if the power wasted by the other companies in the state were added to this amount the total power going to waste at the plants of the Maine public utility companies in 1927 was more than 200,000,000 kw.-hr. Had the companies been able to sell this waste power their expenses at the power stations would have been no more than they were. Whatever revenue could have been obtained from this sale would have gone to cut down the expenses of the power companies and make more rapid rate reductions possible.

"It is true that not all of this power is available every day in the year, but this does not detract from the business importance of selling it. Since the 1927 Legislature adjourned more than 4,000,000,000 kw.-hr. has gone to waste on the undeveloped portions of Maine rivers. It will be many years before this very large amount of power could be used in Maine. Much of it might be developed and used during the next few years if it were possible to export the surplus. To say that this power, once exported, will never afterward be available for use in Maine seems the rankest kind of nonsense. All the other states in this country are allowing free passage of electricity across their borders. Many of them are prospering to a far greater degree than Maine. In no case has export deprived the local market of electricity. If export were permitted, the state of Maine might realize in taxation alone from $500,000 to $1,000,000 a year. We would have available and ready for use sufficient cheap power to attract large power-using industries, and Maine might begin to produce the raw materials used in many kinds of industry. Business in the state would go forward with no uncertain step; labor would find employment in large amount. All these things could happen without changing in any way the 'heritage of our children's children.'

"This matter of changing the state's policy in regard to exportation of power is extremely important. The law as it now stands seriously hinders our industrial progress. I have expressed the hope to our stockholders in very much the above language that they will make their influence felt to have this law changed, and the widest possible publicity of the facts in regard to this situation is desirable in order that a way may be found to remedy this great economic loss."

of local control. New generating plants and lines have been financed by more and more holding companies with great benefit to the regions served, and a vigorous effort to reach the rural customer is apparent in many localities formerly debarred from adequate line extensions. The remaining large independently operated companies, however, include some of the strongest, finest equipped and best managed utilities in the industry, and it would be farcical at this time to blow "taps" over the camp of isolated management. Thus far New England's experience with the holding company, whether "home ruled" or "foreign," has generally been encouraging and promising. In most cases the new interests have had the wisdom to capitalize the experience and local standing of competent managers and staffs already on the properties. The combination of technical, financial and managerial resources resulting from the correct application of the holding company principle has opened the pathway toward development often beyond the capacity of the isolated property to attain. Many problems, however, remain to be solved by each type of management, and the next few years will probably witness striking progress toward the common objective of each—maximum service at fair rates under the best modern methods.

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# *Utilities Advancing in New England*

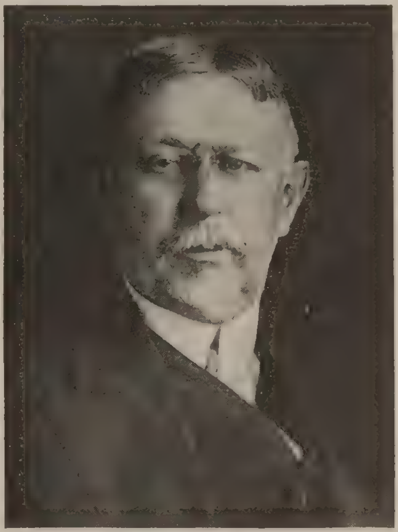
*An Interview with*

*Charles L. Edgar*

*President Edison Electric Illuminating Company of Boston*

"NEW ENGLAND utilities have progressed in so many ways since the close of the war that it is not easy to pick out their foremost achievement," said Mr. Edgar in response to a request by an ELECTRICAL WORLD representative that the dean of the industry in the Northeast give his impressions of regional electrical development since 1920 to the readers of this publication. "Growth along nearly all major lines of usefulness is perhaps the outstanding point which we may stress. New England is an old section of the country, undergoing many changes, but nowhere has the electrical industry been of more assistance in facilitating the development of new methods in manufacturing, in improving ways of doing business and in enriching living standards. The industry has prospered in this expansion, and it is today serving the public, broadly speaking, at prices not only far below the line of cost increases forced in other industries by the World War but generally under pre-war levels. There is reason to believe that the public at large is becoming 'price-conscious' in this sense."

"To what do you attribute this popular recognition, Mr. Edgar?" asked the ELECTRICAL WORLD editor. "It would be a mistake to overemphasize this change of feeling or, rather, growth of understanding by the public," replied the head of the Boston company. "The public relations work of the industry has been far-reaching, and the reiteration of the significance of the price trend in light and power circles is bearing fruit. Within the industry it is well known that we are continually striving to produce, transmit and distribute energy at lower over-all costs. Success here enables operating companies to institute rates which encourage greater use of service. Slowly but certainly the public is coming to appreciate that while the light and power stockholder's investment is entitled to a return which will attract new money for the upbuilding of the business, after all proper costs and charges are met and a surplus provided against future needs, wise management is striving to achieve rate levels that will develop volume business, whether in the home or in the factory. Of course this cannot be accomplished in a day, but the trend is toward a time when unfair attacks upon rates will be less frequent."


*Charles L. Edgar*

Mr. Edgar's attention was then called to the many problems of post-war readjustment which all industries have had to grapple with, and he was asked how the light and power companies of New England have been able to meet these conditions. Turning to his questioner, he said: "By taking advantage of improvements in equipment, by interconnection on a widening scale, by economies in operation, load building, prudent financing, and through the more skillful and analytical planning of system development savings have been made and business increased very substantially on leading New England properties. The policy of centralized operation has gained further headway, both in singly managed and grouped systems. The volume of service to the public represented in present energy sales and the increased amount of wholesale power blocks marketed regionally over intercompany tie lines indicate that comparatively speaking we are in an era of electrical mass production and distribution. This means that we can well afford to utilize the most advanced engineering ideas, support vigorous commercial policies, co-operate with other branches of the electrical industry to stabilize and safeguard profits, back up sound educational programs for employees, maintain more valuable contacts with other industries and in many cases play a valuable part in what might be called corporate community citizenship. New England utilities have been on the alert, for the most part, in making use of progressive ideas. Some companies have pioneered developments which are already making history, and interest is widespread in the results of such advanced installations as the high-pressure steam units at our own latest station and the mercury boiler and turbine application at Hartford."

"Mr. Edgar," said the representative of the ELECTRICAL WORLD, "has hydro-electric development in New England in any way threatened the basic value of steam plants of large capacity in this territory? Is there any reason to expect that steam plant development will cease to maintain its key position here as interconnections with distant waterpowers grow in number and transmitting capacity?" "We have in New England," was the answer, "an unusually good instance of the advantageous working together of both steam and hydro plants. For many years the public overestimated the value of water powers, but intelligent popular opinion today grasps the fact that many of these represent larger outlays per kilowatt of rating than do the later steam stations.

### STEAM AND HYDRO CO-ORDINATED

"The readers of the ELECTRICAL WORLD appreciate the economic benefits of interconnections between steam and hydro plants, and these need not be repeated. General statements of the value of water and steam plants carry little weight, but the system interconnections which have grown up in the past decade or so have added to the economic position of the tidewater steam stations of New England. Secondary hydro power has found a wide market when brought into the urban system load centers. Problems of interoperation have been many, but these are being attacked by engineers with good results. Taking the two kinds of plants together, it is a fair statement that thus far many economies have been reaped in this region from their association, and we may expect more to follow. Unquestionably some steam plant expansion has been postponed on account of hydro interconnections, but I am sure that we shall continue to purchase fuel-burning apparatus for large-scale electric generation.

"Present-day improvements in equipment and in methods," said Mr. Edgar, "proceed with a clear vision of our over-all cost responsibilities. In New England, as elsewhere in the United States, we are confronted with the necessity of working the invested dollar harder. Progress is apparent in many fields of load building from the home to the industrial plant. It is safe to say that through electric refrigeration, cooking, better lighting and in many other ways the average annual energy consumption of the home in New England will make great gains over present figures within the next few years, even as the present consumption much exceeds that of pre-war days. I doubt if many New England companies sold over 250 to 300 kw.-hr. per home per year before 1920, whereas today quite a number have reached 400 or over and 500 does not appear far off as a base, and in fact will become common as the full drawing power of promotional type rates becomes felt. This whole question of utilizing our capital investment more effectively is a very large subject. It receives constant study, and every diversified application of electricity that is established promotes it. It is intimately related to commercial activity, and New England's progress in industrial lighting, industrial electric heating, more efficient applications of electric power in old and new installations during the past seven years has been made in full recognition of the industry's investment responsibility."

"In connection with these improved methods," asked the ELECTRICAL WORLD man, "the question has arisen as to whether the property under holding company operation has an advantage over the singly managed company. I do not suppose the question can be answered categorically, but I think it would be helpful if you would say a word on this." "It is a question of methods rather than who applies them," said Mr. Edgar. "It is apparent that small, independent properties run under a considerable handicap, although public relations are good in many of these and some are doing an excellent job in the distribution field. The trend is toward centralization in management, but we obtain this on some of our larger singly run properties scarcely less than in holding company groups. The Edison company of Boston developed its present system by acquiring a large number of small suburban properties, shutting down wasteful generating stations and co-ordinating them with the metropolitan organization. Both types of property are illustrated in successful management. It is sometimes overlooked that there is an interchange of ideas and experiences throughout the electrical industry that is not confined to holding companies or to so-called independent properties, and it might be correct to say that the future depends more upon the quality of management rendered than upon ownership. So far as the public is concerned, a certain decentralization of company administrative functions will be necessary regardless of developments in ownership, in order to maintain understanding and friendly relations with localities and their individual interests. It is obvious that where securities can be bought and sold in the open market, properties may change owners. Many such changes have featured electrical development in New England since the war, and no one but a prophet can foretell how far this movement will go. In New England you can point to excellent relations between properties of each type."

### AN OPEN BOOK POLICY

"Could you not fairly say, Mr. Edgar," was the final question, "that the open book, as it were, of the light and power companies' policies and the desire of company managements to help build up prosperity in New England through every reasonable form of co-operation have powerfully influenced the successful development of the industry in these past few years? In other words, is not the effort to render public service in the best sense of the word fundamental? "It should not be necessary," said Mr. Edgar, "to elaborate this. It is simply fundamental to modern ideals of public service to build up friendship between ourselves and our customers by rendering the best service we can at reasonable rates. If the industry as a whole in New England had not done this in the past few years, it would have lost a large proportion of its business. A major reason for establishing the Boston Edison radio station, WEEI, was to build popular friendship. In all our activities, from serving the rural customer at the end of a costly line extension to co-operation with the New England Council in its constructive work for the development of these six states, from serving metropolitan industries to supporting worthy industry organizations, the utilities of this section are working in the open, and have long done so. The past seven years have been marked by many technical advances, but none has been of greater import than the quickening sense of responsibility among ourselves, our customers and the public in general which has yielded so much good."

*Birmingham is typical of a rapidly growing industrial city of the South*

# The Interconnected South

Industrial renascence of the South makes for wealth and social progress. The big five program gets results. Electric power the keynote of success

By L. W. W. Morrow
*Managing Editor*

THE renascence of the South is the most eventful happening of current American progress. This region lay prostrate for 40 years following the Civil War and upward of 8,000,000 discouraged young men left the South to seek their fortunes in a more favorable environment. What has happened to awaken the South and to make it the land of promise for American business executives? Why has the value of manufactured products increased in the South from $1,394,316,000 in 1910 to $4,754,824,000 in 1926? Why is the rate of industrial and commercial growth in the South greater than in any other region in America and why has the social progress of this region kept pace with its industrial achievements?

The traditional South is advancing one and one-half times faster than the country as a whole, according to a recent survey of the Department of Commerce. It has led the nation in industrial and commercial growth during the last twelve years and the basic factors for this growth are given as electric power, agriculture, mining, forestry and manufacturing, together with the fact that it is a region favored with splendid topography, a good climate, many natural resources, an abundance of raw materials, an ample labor supply and is near enormous domestic and export markets. Very largely it is a case of capital and industry going to power and labor under favorable taxation conditions.

About 1910 the South found the big five program which it follows today and the practical application of this program has brought about the astonishing progress of recent years. The big five program is the co-ordinated and active development of

1. Electric power.
2. Educational facilities.
3. Good roads.
4. Manufacturing industries
5. Diversified agriculture.

It is not exaggeration to say that the renascence of the South is largely a byproduct of technical electrical progress. Through the pioneering efforts of the utilities electric power was made available in all sections of the region and this power has brought industry to the workers and has made possible social progress.

Electricity completely reverses the older process of taking the worker to the power. Few students of industrial civilization realize that the steam engine age of power has gone and that no longer is it necessary to have congested cities, enormous factories and concentrations of mechanical power in one locality in order to obtain economic industrial development. Electricity can rush with the speed of light to the place it is needed, and through the most extensive and complete interconnected transmission system in the world the old South has coordinated its fuel and hydro power resources and sent them forth to diversify industry, to attract new industries and to raise the standards of comfort on the farm and in the home.

Electric power has been made ready for the industrial South. In case of need electricity can be relayed from Tennessee and Alabama to eastern North Carolina or Virginia, 600 miles distant, or power can be relayed from West Virginia to Alabama and Mississippi. Complete flexibility in transmission has been developed and the co-ordinated resources of the utilities are placed in service in any locality as needed to meet economic conditions. The waterpower installations aggregate more than 4,000,000 hp., and it is estimated that more than 3,000,000 hp. in new water-power installations will be added to meet the power demands of 1933. Added to this is an equal amount of fuel-burning station capacity so that the combined fuel and hydro power installations are expected to aggregate more than 12,000,000 hp. by 1933. In 1928 the nine Southern states listed in accompanying tables had 1,291 operating light and power companies with an aggregate generating capacity of 4,241,000 kva.

The waters on the eastern slope of the Appalachians and those of the western slope have been harnessed to the fuels of West Virginia, Kentucky and northern Alabama to afford an economical and flexible power supply to a region which has just awakened to its future despite the rapid growth of the past few years.

Utility executives in the South had the vision and courage to build this interconnected system to bring to the South new industries to use the power available. They went to industrial centers to sell the South, they worked with Southern town officials to show them how to build up their communities by co-operating in an industrial program and in many instances they went so far as to invest their money in new business enterprises. A romance in utility pioneering could be written of the South, and when recent history is recorded it will be found that the cornerstone of the new South was the initiative, faith and ability of these utility executives.

*Energy Generated Increased 50 per Cent in Four Years Thousands of Kw.-Hr.*

| | 1924 | 1925 | 1926 | 1927 |
|---|---|---|---|---|
| Virginia.......... | 743,668 | 801,568 | 925,882 | 1,099,000 |
| West Virginia...... | 1,762,737 | 1,642,894 | 1,807,360 | 2,143,000 |
| North Carolina..... | 647,330 | 942,294 | 1,117,378 | 1,324,000 |
| South Carolina..... | 943,577 | 881,536 | 1,038,198 | 1,232,000 |
| Georgia........... | 748,756 | 660,790 | 710,578 | 845,000 |
| Florida............ | 218,288 | 318,134 | 509,670 | 605,000 |
| Tennessee.......... | 694,073 | 874,973 | 894,015 | 1,030,000 |
| Alabama........... | 890,087 | 1,169,101 | 1,582,717 | 1,822,000 |
| Mississippi......... | 74,216 | 90,927 | 58,667 | 67,000 |
| | 6,722,732 | 7,382,217 | 8,644,465 | 10,167,000 |

*Number of Customers in South Increased 30 per Cent in Four Years*

| | 1924 | 1925 | 1926 | 1927 |
|---|---|---|---|---|
| Virginia........... | 134,965 | 153,455 | 182,450 | 199,900 |
| West Virginia...... | 118,553 | 131,088 | 141,528 | 152,500 |
| North Carolina..... | 164,439 | 180,059 | 195,600 | 209,500 |
| South Carolina..... | 94,291 | 98,641 | 106,000 | 114,200 |
| Georgia............ | 127,193 | 138,135 | 154,200 | 168,700 |
| Florida............ | 143,676 | 156,800 | 180,000 | 181,800 |
| Tennessee.......... | 167,050 | 180,704 | 192,000 | 206,900 |
| Alabama........... | 103,149 | 131,450 | 150,900 | 168,400 |
| Mississippi......... | 55,158 | 56,830 | 60,300 | 65,300 |
| | 1,108,474 | 1,227,162 | 1,362,978 | 1,467,200 |

Good roads in the South have called for about $400,000,000 a year for several years and these roads have helped to change the entire agricultural and industrial situation. Farmers can market their crops and can get ready money by helping to build the roads; each town and city is accessible to workers who dwell in the rural areas and tourists now drive South in winter to add new money and to bring new business. Good roads have brought about accessibility and have developed a community of interest in co-operative projects for the benefit of the states.

Education has had a revival in the South in marked degree. Leaders of the South based their program for progress on the development of a sound educational system, and in most of the states today public schools and colleges are found that are well conducted and supported. Education has become a paying commercial project as well as a desirable cultural development.

### BASIC RESOURCES OF SOUTH

Down through the Appalachian mountains and their foothills, extending from Pennsylvania to Alabama, lies the manufacturing region of the South. The mineral deposits, the raw materials, the best labor supply and the most favorable geological and geographical conditions are found in this area.

The leading manufacturing industries in the South are lumber, textile, furniture, iron and steel, quarries, tobacco and cement. A wave of popularity for textile manufacturing has resulted in the location of 18,399,832 cotton spindles in the South, compared to a U. S. total of 36,494,496 in 1928. In 1927 the South had a net increase of 502,210 spindles and the other states had a net decrease of 1,372,444 spindles. These spindles in the South work more spindle hours per year than those in other areas because statistics show that Southern mills, with 50.42 per cent of the spindles, worked 65 per cent of the total spindle-hours recorded in 1927. These textile mills are scattered over the Piedmont region of the South, where good labor is available and where climatic conditions are splendid. Many rayon mills are being built in this region to take advantage of these conditions.

In the Birmingham district the South has developed large metal, electrochemical and coal mining industries. The Tennessee Coal & Iron Company has very large metal-producing and coke-producing works near Birmingham and many allied types of industries have been constructed in this region because iron ore deposits, coal beds, shale deposits and limestone deposits are found. Cement mills and fertilizer plants occur in numbers and diversified manufacturing is very evident in central Alabama.

In western North Carolina near High Point one of the largest furniture manufacturing areas is now found. Southwest Virginia, southern West Virginia and western Tennessee are witnessing a very rapid growth of manufacturing, textile, electrometallurgical and electrochemical plants predominating. The Aluminum Company of America has large plants at Badin, N. C., and Alcoa, Tenn., and is enlarging its production facilities in the South. Many Southern manufacturing plants have been the result of local enterprise, but in a number of instances industries have been brought to the region solely because the industrial departments of the electric utilities have gone to manufacturing centers and brought new industries to the South. The genius of James B. Duke started the early development of textile and tobacco manufacturing in the Carolinas and many other utility executives likewise adopted a very aggressive industrial policy.

In the Kanawha Valley of West Virginia a large electrochemical and electrometallurgical industry has sprung into being and in eastern Tennessee rayon and textile manufacturing is growing fast. The ample power resources and the stable and competent native white labor combine with climate, natural resources and transportation facilities to make this region the center of this type of manufacturing.

### *Economic Progress of the South**

| | 1910 | 1926 |
|---|---|---|
| Population | 16,483,725 | 20,306,000 |
| Property value, dollars | 16,004,001,000 | 32,458,643,000 |
| Manufacturers: | | |
| Capital, dollars | 1,438,858,000 | 4,225,000,000 |
| Value of products, dollars | 1,394,316,000 | 4,754,824,000 |
| Mines, Quarries, Wells: | | |
| Capital, dollars | 434,241,000 | 795,368,016 |
| Value of products, dollars | 136,328,000 | 425,160,000 |
| Cotton Manufacturing: | | |
| Capital, dollars | 344,754,000 | 797,950,000 |
| Value of products, dollars | 229,529,000 | 886,573,000 |
| Furniture products, value | 10,160,000 | 93,650,000 |
| Value of farm land | 2,519,782,000 | 3,958,586,000 |
| Bank deposits | 650,282,000 | 3,017,737,000 |
| Motor vehicles, number | 66,765 | 2,506,198 |

*States of Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia. Based on *Census and Manufacturers' Record* data.

Between the foothills and the coastal plain lies a very fertile agricultural area where diversified agriculture, dairying, fruit growing and other industries are very promising under the new conditions, and down in the coastal plain lies a fertile belt for forest products, agriculture and manufacturing which can use negro labor to advantage. Almost any climate and any environment can be selected in the South to suit the business of any prospect and it is astonishing to find that these possibilities were unrecognized a dozen years ago.

Cotton is still king in the South, but the center of cotton growing is shifting to Texas and Oklahoma and more diversified agriculture is taking place in the old South. In south Georgia peaches and pecans predominate, in north Georgia apples are grown in large quantities. In Florida the citrus fruits of the lake regions will soon be challenged by the vegetable products of the truck gardens in the reclaimed Everglades. In the black hills of Alabama and Georgia the dairy industry is developing and in northern Florida, the Carolinas and other states general agriculture is being developed with crop diversification as the keynote to progress. The farm crops of the South in 1926 were worth $1,522,000,000.

In agriculture, as in manufacturing, the influence of electric power is felt decisively. Rural lines are built in all sections and a reliable source of electricity is available in nearly every village and cross-roads community. The farmhouse will soon be made comfortable with light, telephone and electric appliances and many electric ranges and water heaters are used. Co-operative work is going on in all states to bring the electric motor to do the work of the farm. Electric power, good roads and good rural schools keep competent farmers on their farms.

The South of today is capitalizing on the errors made in earlier industrial developments. It is rapidly proving that decentralized industries lend themselves more effectively to the economies of mass production than congested areas with enormous factories. Electric power, raw materials, a small plant and a small town with surrounding farms to feed the workers are proving to be a better industrial and social arrangement than any heretofore established. The South is finding the answer to the mechanization of civilization.

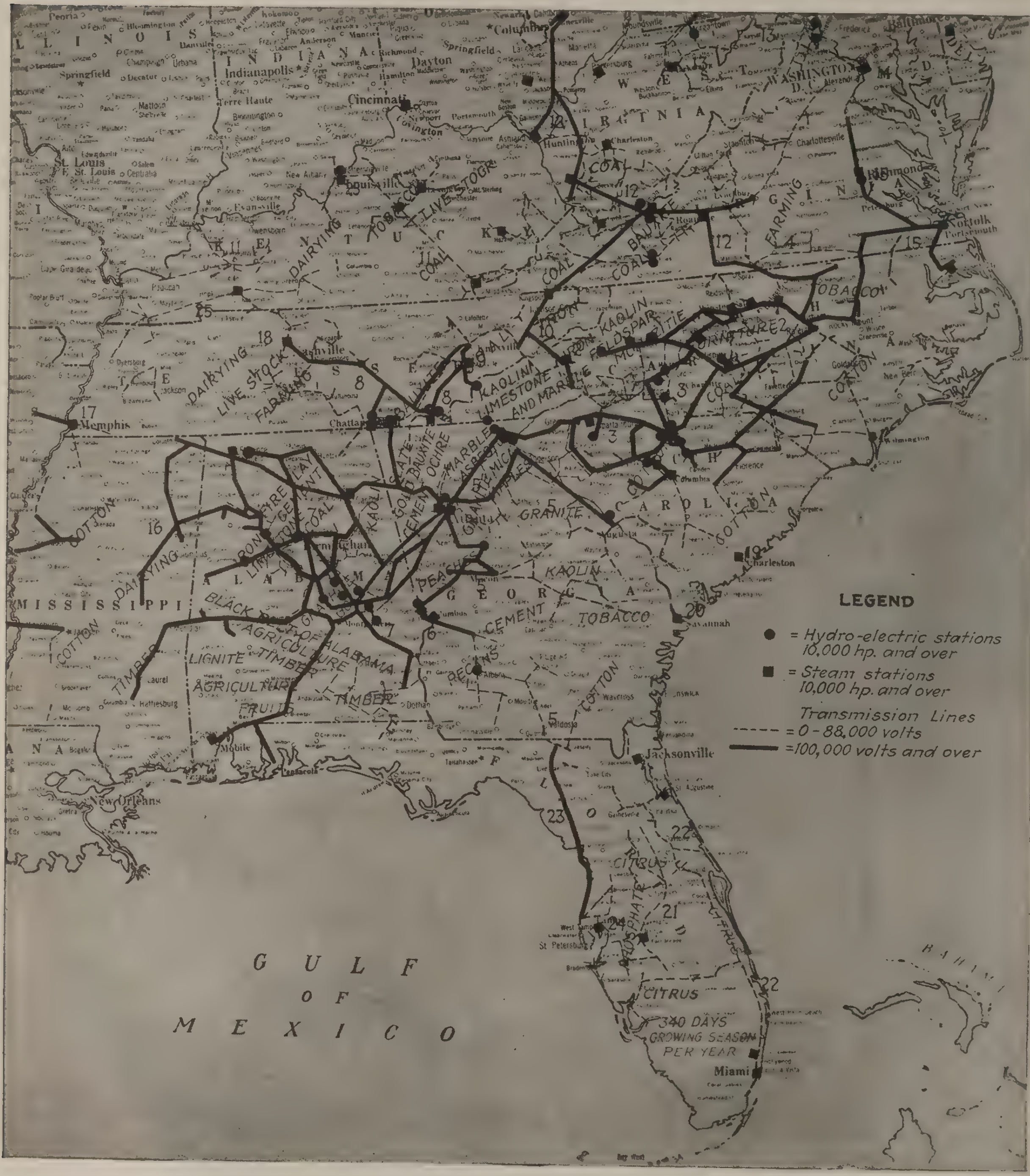
The light and power industry in the South has entered upon a new period of development. The rather small scale operations of local utilities are replaced by very large scale operations wherein multiple hydro and steam stations are tied to widely extended transmission systems. Along with this physical property development is the growth of a load-building and industrial policy whereby the utilities use every effort to bring new industries into the territory and to develop existing industries.

Fortunately these transitions were easy and logical, for they followed hard on the growth of local hydro-electric properties which were interconnected with adjacent utilities. The utilities of the South started largely as hydro properties serving distant cities over transmission lines. Because of the variable water flow in most Southern rivers the interconnection of utilities was a self-evident service insurance and was used as normal practice. The grouping together of utilities under one management and the co-ordinated use of steam and hydro stations was a logical step to take in the further electrical development of the territory. Today finds the South largely served by the following utilities:

Southeastern Power & Light Company.
Carolina Power & Light Company.
Duke Power Company.
Florida Power & Light Company.
Tennessee Electric Power Company.
Appalachian Power Company.
Virginia Public Service Company.

There is a very interesting interconnection between utilities in the Carolina region. The Duke Power Company has hydro plants along the Catawba River and several steam stations. The Carolina Power & Light Company has hydro stations on the Yadkin, a large steam

# *Electric Power Is Available to Develop All the Resources of the South*



## PRINCIPAL OPERATING UTILITIES IN THE SOUTHEAST

1. Tidewater Power Company.
2. Carolina Power & Light Company.
3. Duke Power Company.
4. Virginia Public Service Company.
5. Georgia Power Company.
6. Columbus Electric & Power Company.
7. Alabama Power Company.
8. Tennessee Electric Power Company.
9. Knoxville Power Company.
10. Tennessee Public Service Company.
11. Kentucky Utilities Company.
12. Appalachian Electric Power Company.
13. Monongahela West Penn Public Service Company.
14. Potomac Edison Company.
15. Virginia Electric & Power Company.
16. Mississippi Power Company.
17. Memphis Power & Light Company.
18. Nashville Power & Light Company.
19. South Carolina Power Company.
20. Savannah Electric Company.
21. Florida Public Service Company.
22. Florida Power Company.
23. West Florida Power Company.
24. Tampa Electric Company.
25. Louisville Gas & Electric Company.

plant at Cape Fear and small hydro steam plants near Asheville. The Tallahassee Power Company has hydro plants on the upper Yadkin which largely supply energy to the Aluminum Company at Badin. On the north the Carolina Power & Light Company has an interconnection with the Appalachian Power Company, which in turn has a connection with the Tennessee Public Service Company, which in turn interconnects with the Asheville-Carolina system.

By means of these interconnections many emergency and normal energy interchanges occur. This winter, when extremely cold weather limited the capacity of hydro plants at Asheville, energy was relayed from the Raleigh property via the Appalachian Power Company and the Tennessee Public Service Company. This enabled Asheville to carry its load without curtailment.

### *Growth of Typical Carolina Utilities*

| | 1921 | 1927 |
|---|---|---|
| Duke Power Company: | | |
| Total generating capacity, kva....... | 280,900 | 902,395 |
| Circuit-miles of high-tension line...... | 2,143 | 3,803 |
| Kilowatt-hours generated............ | 834,300,000 | 1,750,000,000 |
| Population of territory served........ | 1,650,000 | 2,000,000 |
| Carolina Power & Light Company: | | |
| Total generating capacity, kw......... | 34,525 | 84,710 |
| Kilowatt-hours generated............ | 150,854,366 | 426,425,000 |
| Miles of high-tension line............ | 606 | 1,820 |
| Number of electric customers......... | 25,347 | 63,102 |
| Miles of distribution line............ | 470 | 1,565 |

Again, the Pigeon River hydro project under way near Asheville will deliver a large block of energy to the northern part of the Duke Power system. This system will deliver an equal amount to the Carolina Power & Light system at Wateree, in the southeastern part of the state. Both systems will get needed energy from nearest generating sources to load areas which require the energy. Again, the Carolina Power & Light and Duke Power systems deliver energy to the Tallahassee Power Company to operate the Aluminum Company plants at certain periods and the Tallahassee Power Company returns energy from its hydro plants at other periods, depending upon load and water conditions. Again, it is possible to interchange energy with the Tennessee Public Service Company, the Georgia Power Company and the Appalachian Power Company at intervals, depending upon load and water conditions.

The Southeastern Power & Light Company is the most widely extended transmission system in the South. It operates in Mississippi, Georgia, Alabama, Florida and South Carolina. The larger operating subsidiaries are the Alabama Power Company, the Georgia Power Company and the Mississippi Power Company. The grouping of these properties under one management has been followed by an extension of lines to small towns and rural areas and by aggressive load-building efforts. The co-ordinated operation of many lines and plants has brought about many operating economies and improved service conditions.

For many years the major utilities in Georgia remained in the larger cities and used transmission lines to interconnect with utilities in neighboring states. But at present a rapid integration is occurring whereby the large systems are extending into adjacent territories. The Georgia Power Company has expanded very rapidly since it became part of the Southeastern Power & Light Company and has extended south and east.

Georgia in the north has coal and mineral deposits, including the famous marble quarries. In the central part of the state peaches, pecans and general farming predominate and the coastal plain is suited for timber and general farming. The peach and pecan business has grown by leaps and bounds and apples are being grown in large quantities in the north. The mineral deposits of Georgia are being investigated and a brick and clay industry is also growing rapidly in the central part of the state.

### *Typical Towns on Carolina Power & Light Company System*

1. **Oxford, N. C.**—A town served for many years which has a competing gas company. It has 724 residential customers and 70 ranges are served.

| | 1921 | 1927 | Per Cent Increase |
|---|---|---|---|
| Kilowatt-hours sold to lighting customers................ | 254,414 | 447,525 | 76 |
| Kilwatt-hours sold to power customers................ | 809,740 | 1,863,343 | 130 |
| Kilowatt-hours sold for heating and cooking........... | 66,116 | 100,279 | 51 |
| Number of street lights....... | 55 | 61 | 10 |
| Gross merchandise sales, dollars | 8,655 | 10,447 | 21 |
| Total number of customers.... | 957 | 1,131 | 18.2 |
| Estimated population........ | 4,100 | 6,000 | 47 |
| Miles of distribution line...... | 17.6 | 22.2 | 21 |

2. **Hamlet, N. C.**—A town served for many years. Railroad junction with railroad shops. It has 897 residential customers and 176 ranges are served.

| | 1921 | 1927 | Per Cent Increase |
|---|---|---|---|
| Kilowatt-hours sold to lighting customers............ | 353,874 | 563,669 | 60 |
| Kilowatt-hours sold to power customers................ | 2,360,991 | 3,650,784 | 57 |
| Kilowatt-hours sold for heating and cooking........... | 222,692 | 323,394 | 45 |
| Number of street lights...... | 131 | 187 | 42 |
| Gross merchandise sales, dollars..................... | 9,714 | 10,994 | 13 |
| Total number of customers... | 1,059 | 1,391 | 31 |
| Estimated population....... | 6,100 | 6,800 | 11.5 |
| Miles of distribution line..... | 19.5 | 27.7 | 42 |

3. **Hartsville, S. C.**—Industrial and residential town purchased in 1921. Notable increase in business followed as a result of the service and merchandising efforts of the Carolina Light & Power Company organization.

| | 1921 | 1927 | Per Cent Increase |
|---|---|---|---|
| Kilowatt-hours sold to lighting customers............ | 218,487 | 454,582 | 108 |
| Kilowatt-hours sold to power customers................ | 6,163,554 | 12,149,852 | 97 |
| Kilowatt-hours sold for heating and cooking........... | 61,038 | 222,788 | 264 |
| Number of street lights...... | 104 | 177 | 70 |
| Gross merchandise sales, dollars..................... | 7,211 | 17,166 | 138 |
| Total number of customers... | 659 | 1,231 | 87 |
| Estimated population....... | 4,100 | 4,700 | 14.6 |
| Miles of distribution line..... | 12.7 | 49.1 | 286 |

Georgia utilities in the past have relied very largely on water power and still do because of major interconnections. The Georgia Power Company is linked with the Alabama Power Company at several points, making it convenient to use fuel energy from Alabama and even Tennessee when economical. Atlanta is the chief city on this system and a center of utility activity. This city is a manufacturing and wholesale outlet of the South and is growing rapidly.

### *Growth of Georgia Utilities*

| Georgia Power Company: | 1921 | 1927 |
|---|---|---|
| Generating capacity, kw. | 106,200 | 219,098 |
| Energy generated, kw.-hr. | 246,440,991 | 329,829,017 |
| Energy purchased, kw.-hr. | 35,643,976 | 367,477,871 |
| Total system energy, kw.-hr. | 282,084,977 | 697,306,888 |
| Miles of transmission line | 354.75 | 916.48 |
| Miles of high-tension distribution | 330.01 | 1,341.14 |
| Number of electric customers | 33,222 | 83,637 |
| Population served | 730,000 | 1,550,000 |
| Columbus Electric & Power Company: | | |
| Generating capacity, kw. | 32,200 | 62,255 |
| Energy generated, kw.-hr. | 92,763,490 | 223,597,126 |
| Miles of transmission line | 60.0 | 176.2 |
| Number of customers | 6,267 | 9,900 |
| Population served | 134,350 | 84,467 |

### *Merchandise Sales per Customer on Georgia Power Company System*

| | Electric | Gas |
|---|---|---|
| 1925 | $4.76 | $5.31 |
| 1926 | 10.73 | 5.92 |
| 1927 | 15.27 | 6.09 |

At Columbus the Columbus Electric Company has hydro stations and interconnections with adjacent utilities. It has an extensive transmission system to serve agricultural towns in the southern part of the state. Several textile plants have been located in this region and this industry is growing.

Fourteen years ago the Alabama Power Company had five power customers who had a connected load of 6,000 hp. During 1927 this company operated generating stations with an aggregate capacity of 490,000 kw. and sold more than 1,400,000,000 kw.-hr. to customers.

This growth is typical of Alabama in late years. Coal in the north, iron and limestone in the central portion, fine agricultural lands, low taxes and good labor combined with electric power to build the state very rapidly. More than 2,000,000 tons of iron ore and 6,000,000 tons of coke produced in 1927 attest the size of this industry. Add the cement, coal mining, lumber, electrochemical and textile industries to the pool and it is seen that Alabama rightly can be proud of its accomplishments.

Birmingham is called the Pittsburgh of the South and the records of the Birmingham Electric Company prove that it has had an astonishing growth in the few years of its existence. Montgomery, Anniston and other interior cities have likewise grown rapidly and the development of the port facilities in Mobile bid fair to bring an export outlet of manufactured products which will make Mobile an outstanding city.

Raw materials and natural resources in themselves did not make Alabama growth. The electric utilities developed water and steam power, sent their lines out across the state and then went into the industrial centers of the country and sold their territory and facilities to industrial executives. For 1927 alone the Alabama Power Company secured new industries for the state which will add 30,000 people and $15,000,000 new capital spent for construction to the assets of the state.

There were 1,587,842 cotton spindles in Alabama on Jan. 31, 1928, and many new textile plants are contemplated in the near future because of the efforts of the Alabama Power Company in co-operation with Alabama towns.

Florida has not been injured by the collapse of the boom. This state still has its timber, phosphate, agriculture, fruits and warm sunshine. The tourist crop of 1927-28 was splendid and Florida is equipped to entertain winter tourists properly, thanks to the boom. Hotels are splendid and people with means flocked to the resorts to enjoy the sunshine and recreation facilities.

Central Florida is developing a splendid citrus fruit industry. In the Everglades five truck crops a year are luring gardeners to the region. Near Tampa the phosphate deposits afford a stable industry and in northern Florida general farming, lumber and fishing are splendid assets. The basic soundness of Florida is unaffected by the rise and fall of real estate speculators.

The Florida Power & Light system extends along the east coast and across the country to the west coast to Fort Myers and other towns. It serves 112 communities and 115,000 customers. It was put together in 1925 by closing down many small plants and connecting together these towns by transmission lines, so that today three efficient power stations do the work of nearly a hundred inefficient stations. This company is building its territory even to the extent of establishing an experimental farm in the Everglades. Properly developed, the Everglades will use about 1 kw. per acre for trucking and the utility is doing more than its share in bringing this garden spot into cultivation.

At Tampa the Tampa Electric Company has a very stable load because of the industries in and near that city, especially the phosphate industry and the tobacco industry. This utility reports very good conditions. In the citrus regions near Orlando the Florida Public Service Company has built a splendid system which supplies light and power to a large area from a modern system.

### *Alabama Power Company Grows Rapidly*

| | 1921 | 1927 |
|---|---|---|
| Installed capacity, kw. | 191,675 | 490,051 |
| Circuit-miles of transmission lines | 563 | 1,255 |
| Miles of distribution lines | 989 | 2,763 |
| Number of customers | 17,967 | 67,084 |
| Energy generated, kw.-hr. | 429,110,700 | 864,958,000 |
| Energy purchased, kw.-hr. | 3,878,600 | 445,083,150 |

### *Energy Sales Data of Alabama Power Company*

| Year | Number of Wholesale Customers | Number of Retail Customers | Total Energy Sales, Kw.-Hr. |
|---|---|---|---|
| 1921 | 159 | 18,000 | 370,470,000 |
| 1922 | ... | 20,000 | 511,914,000 |
| 1923 | ... | 35,000 | 627,584,000 |
| 1924 | ... | 40,000 | 680,718,000 |
| 1925 | ... | 51,000 | 918,535,000 |
| 1926 | ... | 63,000 | 1,173,013,000 |
| 1927 | 478 | 88,270 | 1,470,836,000 |

Note—Montgomery was acquired in 1923 and Mobile in 1927. The system was extended into outlying territory during the period covered in the data.

### *Classified Energy Sales of Alabama Power Company*

| Year | Wholesale, Kw.-Hr. | Retail, Kw.-Hr. |
|---|---|---|
| 1921 | 356,901,000 | 13,568,000 |
| 1922 | 496,877,000 | 15,036,000 |
| 1923 | 601,524,000 | 26,060,000 |
| 1924 | 645,679,000 | 35,038,000 |
| 1925 | 875,671,000 | 42,861,000 |
| 1926 | 1,121,943,000 | 51,070,000 |
| 1927 | 1,373,430,000 | 97,406,000 |

### *Data on Florida Utilities*

| Florida Public Service Company: | 1924 | 1927 |
|---|---|---|
| Generating capacity, kw | 3,935 | 31,350 |
| Energy generated, kw.-hr | 6,930,000 | 19,685,239 |
| Miles of transmission | . . . . . . | 374 1 |
| Number of customers, electric | 3,098 | 14,388 |
| Population served | 40,000 | 89,000 |
| **Florida Power & Light Company:** | **1925** | **1927** |
| Number of customers | 68,817 | 99,776 |
| Generating capacity, kw | 69,513 | 138,031 |
| Miles of transmission | 232 | 1,158 |

In northern Florida two municipal plants serve Tallahassee and Jacksonville and the Florida Power Company has built an extensive system from near St. Petersburg north to Jasper, where it interconnects with Georgia-Alabama Power Company systems. The Gulf Power Company serves 9,000 customers in Pensacola and thirteen towns in the surrounding territory and is interconnected with the utilities of the Southwestern Power & Light group.

### CONDITIONS IN TENNESSEE

On the western side of the mountains the Tennessee Electric Power Company operates a large system which has been influential in developing the industrial assets of middle and eastern Tennessee.. In Memphis, Knoxville, Nashville, Bristol and other towns local utilities are alert to every opportunity to get industries to locate on their lines and the executives devote major attention to local building.

Practically all of the industrial development of Tennessee during recent years has been in the territory served by power lines. During the last five years Tennessee, in keeping with the rest of the South, has secured a share of the textile mill business that has been moving away from New England and has developed local plants. These textile mills have all located in the

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# *Need More Publicity —Not Less*

*By P. S. Arkwright*
*President Georgia Power Company*

IF THERE is one outstanding lesson to be learned from the present investigation of the electric light and power industry by the Federal Trade Commission it is this—not that we should curtail or cease our public relations and educational work, but that we should increase it, expand it, and carry it forward with greater vigor.

It is upon this phase of our work that the attention of the commission has so far been centered, and we have been charged in the sensational press with "polluting the stream of education," with wholesale "corruption of editors and legislators" and with other grand and petty crimes too numerous to mention.

The very fact of these extravagant charges, the unrestraint with which the propagandists for government ownership have sought to give the color of corruption to entirely innocent acts, the complete and utter baselessness of many of the charges are all the proof we need that greater educational work must be done.

We have always been the target of the demagogue. Perhaps we always will be, no matter how we conduct ourselves. Perhaps we should take comfort in the fact that we are better off than we used to be, that our opponents now are forced to base their charges upon actions which further, cooler consideration will show to be blameless.

But events of the recent past have shown how much we have yet to do before the public at large learns to know and really to understand our business, our aims, our purposes, how vital it is to the public itself that private initiative in this industry be preserved, how harmful it is to the public itself when we are saddled with unjust tax burdens and subjected unjustly to political attack.

*P. S. Arkwright*

Our public relations work is a young activity, scarcely ten years old in the majority of our companies and still lacking entirely in some of them. If it has overstepped the bounds of right or decency in any case, we want to know about it more than any one else, so that we can correct the defects and raise the work to a still higher plane, but I do not believe this will prove to be true except perhaps in minor instances. I am confident that the commission will find what we already know to be true, that our public relations work is not only a legitimate activity but that it has benefited the public as much as if not more than it has benefited the industry.

Our public relations work has accomplished much in a short period of time in bringing about a sounder understanding and a pleasanter relationship between the public utilities and the public, and I believe that the public is better pleased and better served because of it. But there is still a great and an important work to be done, and I am confident that we, as an association and as individual companies, will go forward with it, undaunted.

territory that is served by adequate power systems.

In the wake of industrial progress has come increased commercial activity in the large and small communities of the state alike. New hotels, stores and other commercial establishments have been opened or are under construction in many small towns, showing that the decentralization of industry, effected by the widespread transmission of power, is affecting other social and commercial elements in the economic life of these communities.

In the territory of the Memphis Power & Light Company there has been a steady growth. In 1921 there were 426 industrial plants in Memphis, but in 1927 the number had increased to 606. Nashville, Knoxville, Bristol and other Tennessee cities record similar or greater industrial developments and have a notable reputation as progressive and rapidly growing cities with alert utilities serving them and helping them grow.

### Virginia Utilities Expanding

Virginia has been the scene of large utility consolidations in recent years. About Newport News developments have occurred whereby transmission interconnections are had with the Carolinas. Norfolk and Richmond have had a splendid growth and in the Shenandoah Valley and in the southwest small cities have been tied together to give extensive transmission systems, which in turn have brought about rapid industrial developments. While largely an agricultural state, Virginia has splendid assets for industrial developments on the coast and in the foothills of the Appalachian Mountains. A good roads program is under way and co-operative efforts are being made to develop the state in every possible manner.

Data on some typical Virginia utilities give a picture of the conditions which give promise of a prosperous future for the "Mother of Presidents." One of the new consolidations has been brought about by the Virginia Public Service Company.

*Growth of Tennessee Electric Power Company*

| | 1921 | 1927 |
|---|---|---|
| Kilowatt-hours generated | 342,948,926 | 651,397,468 |
| Installed generating capacity, kva | 137,490 | 265,050 |
| Miles of steel tower line, single circuit | 353.54 | 489.83 |
| Miles of wood-pole line, single circuit | 179.15 | 313.24 |
| Number of customers served | 45,464 | 91,259 |
| Population served | 440,000 | 500,000 |

In the year 1921, for the territory exclusive of Newport News, the generation was approximately 35,000,000 kw.-hr. In 1927 it exceeded 80,000,000 kw.-hr. The length of transmission lines in service at the close of 1927 was approximately 700 miles. In 1927 the number of customers was approximately 48,000 and the population of the towns served approximately 200,000.

The American Gas & Electric Company purchased some time ago the properties of the American Electric Power Company of Philadelphia, including the Roanoke Railway & Electric Company, the Lynchburg Traction & Light Company and the Consolidated Light & Power Company of Huntington, W. Va. About the same time it also acquired the old Appalachian Power Company of Bluefield, W. Va., and the Virginian Power Company of Charleston, W. Va. All of the electric lighting and power properties in these groups were merged into a new company, the Appalachian Electric Power Company, a Virginia corporation.

The following data cover operations in Virginia only:

| | 1921 | 1927 |
|---|---|---|
| Kilowatt-hours generated | 50,643,000 | 73,536,000 |
| Generating capacity, kilowatts | 14,000 | 20,500 |
| Miles single circuit transmission lines | 26 | 304 |
| Number customers | 17,000 | 26,500 |
| Estimated population served | 85,000 | 122,500 |

The small and overloaded local stations in this territory have been supplanted by an unlimited and dependable source of power supply received over 132-kv. transmission lines supplied by large modern and efficient generating plants, thereby affording an unlimited and dependable supply of electric power to the communities in this territory.

In southern West Virginia and eastern Kentucky rapid growth has been made since 1921. All the American Gas & Electric properties are connected together with high-voltage lines and interconnections of the American Gas & Electric system are had with the Carolina Power & Light Company at Danville, Va., with the Tennessee Public Service Company at Kingsport, Tenn., and through an interconnection with the Consolidation Coal Company the two Kentucky properties are tied together.

### Mine Load Predominates in Coal Regions

In the coal field areas electric power has been applied successfully to mining and some of the fields are completely electrified. Because of ample and low cost electric power mining companies can operate at any desirable location and many have increased production and lowered costs by using electrical mining equipments and methods.

In the Kanawha Valley near Charleston several large electrochemical and chemical plants have been built in recent years and afford the utility a splendid load. In some of these plants where process steam is used the industrial plants are interconnected to the utility system. Near Huntington the International Nickel Company has a very large plant and the future for these regions looks very bright to utility executives.

In the northern part of West Virginia the West Penn system gives an interconnection from the Pittsburgh area to eastern Pennsylvania. Water-power plants and fuel-burning stations are combined with transmission lines to give power in this large area, where coal and other resources are found in abundance. Diversified manufacturing is coming into being very rapidly in the West Penn territory.

### Still a Virgin Industrial Region

The South fairly hums with activity. Every utility is alert to build load and sends men to all parts of the country to sell industry the advantages of locating in its territory. Every barometer shows that the South is still a virgin region for commercial, agricultural and industrial growth. Yet it has gained national recognition for its possibilities at last and expects to capitalize on this recognition as soon as possible. In the front ranks of the aggressive leadership of the new South are found the group of energetic utility executives who are ready to reap the rewards deserved by those who have labored under the heart-breaking handicaps of past years. If Horace Greeley were alive today he would say, "Go South, young man." An electric spark has fired the South to build a new civilization.

*Latest addition to the chain of Bear River hydro-electric plants*

# Pioneering with Electricity

### Colorado, Utah and California characterized by hydro-electric development and high-voltage transmission. Customer ownership, irrigation pumping, oil field and mine electrification also are important

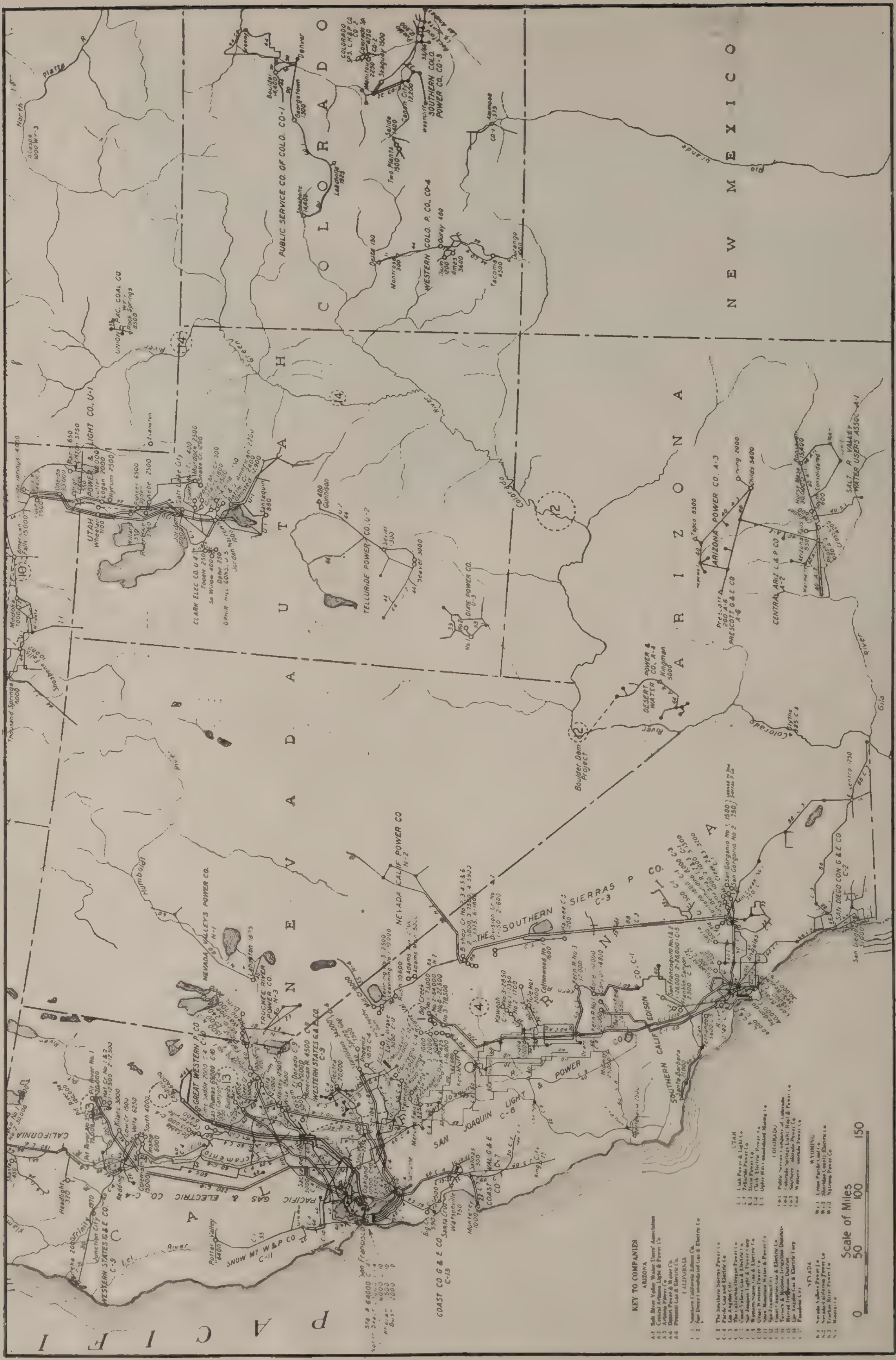
By Walter C. Heston
*Pacific Coast Editor*

DEVELOPMENT of large blocks of hydro-electric power in the high mountain regions of Colorado, Utah and California and transmission of this power over long distances at voltages ranging from 110,000 to 220,000 has meant conservation of water power and has brought about a degree of electrification exceeded by few sections of the country.

Remoteness of water powers from load centers early led to a solution of the engineering and operating problems incident to high-voltage transmission and a constant increase in transmission voltages has resulted. Today there is in operation in California more than a thousand miles of 220,000-volt lines. Five years of operation at 220 kv. by the Southern California Edison Company and the Pacific Gas & Electric Company has demonstrated the thorough practicability and dependability of high transmission voltage. Power from the Big Creek plants of the Edison company amounting to 258,000 kw. is transmitted to Los Angeles, a distance of 240 miles, over two 220-kv. lines and by the middle of the year 90,000 kw. from Big Creek No. 2-A plant will be added, at which time a third 220-kv. line will be placed in operation. Pit River power totaling 176,000 kw. is transmitted to the San Francisco Bay region by the Pacific Gas & Electric Company at similar voltage. The Great Western Power Company has 100 miles of 220-kv. line, at present operating at 165 kv., which interconnects its system with that of the San Joaquin Light & Power Corporation and will add an additional 80 miles of line to operate at 220 kv. to its system by the middle of the year.

In Utah the Utah Power & Light Company transmits 135,000 kw. from its hydro plants in northern Utah and southern Idaho to Salt Lake City at 130 kv., a distance of approximately 130 miles. The Public Service Company of Colorado has a 90-kv., 150-mile transmission line crossing the Continental Divide several times which delivers the output of the 15,000-kw. Shoshone plant to Denver. The 349-mile, 88-kv. line of the Southern Sierras Power Company between its Owens River plants and San Bernardino, Calif., is notable for its length, but cannot be considered as transmitting power from one extremity to the other.

With this brief mention of some of the most important transmission lines of the West and a study of the accompanying transmission map it will be evident that


PACIFIC
CALIFORNIA
NEVADA
UTAH
COLORADO
ARIZONA
NEW MEXICO
PACIFIC GAS & ELECTRIC CO.
SAN JOAQUIN LIGHT & POWER C-8
SOUTHERN CALIFORNIA EDISON CO. C-1
THE SOUTHERN SIERRAS P. CO. C-3
SAN DIEGO CON. G & E CO. C-2
GREAT WESTERN P. CO.
WESTERN STATES G & E CO. C-9
SNOW MT. W. & P. CO. C-11
COAST CO. G & E CO. C-13
COAST VAL. G & E CO. C-7
TRUCKEE RIVER POWER CO. N-3
NEVADA VALLEYS POWER CO. N-1
NEVADA CALIF. POWER CO. N-2
UTAH POWER & LIGHT CO. U-1
TELLURIDE POWER CO. U-2
DIXIE POWER CO. U-3
CLARK ELEC. CO. U-4
UNION PAC. COAL CO.
PUBLIC SERVICE CO. OF COLO. CO-1
SOUTHERN COLO. POWER CO. CO-3
WESTERN COLO. P. CO. CO-4
ARIZONA POWER CO. A-3
CENTRAL ARIZ. L & P CO. A-2
PRESCOTT G & E CO. A-6
DESERT WATER POWER & CO. A-4
SALT R. VALLEY WATER USERS ASSOC. A-1
Boulder Dam Project
San Francisco
Oakland
Los Angeles
San Diego
Denver
KEY TO COMPANIES
ARIZONA
CALIFORNIA
UTAH
COLORADO
WYOMING
NEVADA
Scale of Miles
0
50
100
150

Pacific Coast noted for high-voltage transmission and hydro development the populous sections of Colorado, Utah, Arizona and California are interlaced with a maze of transmission lines.

The policy of hydro-electric development and long-distance transmission followed by the utilities of this section over a long period of years has had a far-reaching effect upon development of the territory. It has enabled rural communities and practically every small city and town to enjoy full benefits of electric service and has been responsible for development of the "back country" upon which the larger cities must depend largely for their prosperity. With trunk transmission lines passing through the valleys it has been possible for the power companies to tap the lines at large load centers, from

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# *California Enters Commercial Era*

*By A. F. Hockenbeamer*
*President Pacific Gas & Electric Company*

*A. F. Hockenbeamer*

ELECTRIC utilities of California entered the year 1928 with an ample supply of power for all needs; in fact, more kilowatt-hours are available today to serve the rapidly growing needs of the state than ever before in the history of the industry. On their financial side credit was never better. Their stocks were never in greater demand nor more widely owned. Their bonds never commanded a higher price in the financial markets. Money on good terms is available for whatever expansion may be ahead and for refinancing old obligations where they can be retired with advantage.

It is not expected, however, that on the whole building programs of utilities will equal those of the period of 1920 to 1925. This was a period of unusual construction activity to catch up with work necessarily postponed during the war, or stimulated by the unusual business expansion which followed the war. Utilities of California were back to normal by 1926 and the year just closed was likewise one of normal activity, of consolidation and co-ordination and of welding together existing properties. Several important mergers were effected in the interest of economy and efficiency. Within a comparatively few years the Pacific Gas & Electric Company has through absorption of fourteen smaller companies abolished the management staffs and management fees of these companies and saved a total sum for the benefit of its consumers approximating the total of the salaries at present paid to its own executive staff.

Economy and efficiency in operation was the goal of utilities in 1927 and the year closed with excellent records of operating economies by the larger utilities. There were many rate reductions during the year as a result of these economies, some of them amounting to 10 per cent or more. It is confidently anticipated that the recovery of the revenue lost by reason of these reductions will be greatly accelerated by the inducements for greater usage offered under the lower rates.

The light and power industry of California enters the year 1928 with the greatest commercial development program before it in its history. New business activities will be confined largely to increasing consumption of existing customers rather than extension into new territory. This follows from the fact that 92 per cent of all potential residential customers in the state are now served and that 62,000 California farms, or 45 per cent of the total, now enjoy the benefits of light and power service. My own company will spend at the annual rate of $1,000,000 for development of new business during 1928 and expects to add a load of 115,000 kw. That this program is proving highly successful is shown by the fact that during March 7,791 hp. of new business in household appliances alone was added to our lines. This represents the greatest increase in this class of business in any one month in the history of the company. Reports coming from other power companies of the state indicate similar success in their load-building efforts, and 1928 without doubt will be one of noteworthy commercial achievement.

The customer-ownership plan which originated in California still goes ahead apace. Today there are approximately 175,000 customer owners in the state, or an increase of 133 per cent over the number five years ago. This movement, originally intended to raise money for new construction, has also demonstrated its value in creating more friendly relations between the utility and its customers through making them partners in the business. The widespread ownership of stock under this plan is shown by the fact that there are only two stockholders of Pacific Gas & Electric stock that hold more than 1 per cent of the outstanding stock, and the aggregate holding of these two is only 6 per cent.

Presidential years have come to be looked upon as unsettled, but in so far as the utilities of California are concerned they apparently have no reason to fear such years. In fact, the last two Presidential years witnessed as large a growth as in other years and the Pacific Gas & Electric Company actually had a larger annual growth in these years than in any that preceded them.

The utilities of California face 1928 with conservative optimism; they enjoy good public relations, and confidently expect sound growth and development in the industry.

### *Table I—Central-Station Customers in Six Western States, Showing Increase During Five- and Ten-Year Period*

| | Total Central-Station Customers | | | Domestic Lighting Customers | | | Commercial Lighting Customers | | | Power and Other Customers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1917 | 1922 | 1927 | 1922 | 1927 | Increase | 1922 | 1927 | Increase | 1922 | 1927 | Increase |
| California | 619,803 | 1,018,222 | 1,672,100 | 745,980 | 1,335,900 | 589,920 | 172,750 | 181,850 | 9,100 | 66,610 | 154,350 | 87,740 |
| Arizona | 24,370 | 38,552 | 43,480 | 21,580 | 35,700 | 14,120 | 2,750 | 5,660 | 2,910 | 750 | 2,120 | 1,370 |
| Nevada | 11,495 | 11,008 | 17,600 | 11,490 | 13,730 | 2,240 | 1,900 | 3,400 | 1,500 | 350 | 470 | 120 |
| Utah | ....... | 81,940 | 119,300 | 70,130 | 104,600 | 34,470 | 9,860 | 11,450 | 1,590 | 1,950 | 3,250 | 1,300 |
| Colorado | 92,242 | 132,708 | 204,500 | 125,210 | 169,000 | 43,790 | 17,240 | 26,250 | 9,010 | 6,400 | 9,250 | 2,850 |
| New Mexico | 13,988 | 18,834 | 27,050 | 17,490 | 22,540 | 5,050 | 2,960 | 3,410 | 450 | 610 | 1,100 | 490 |
| Total for six states | ....... | 1,301,264 | 2,084,030 | 991,880 | 1,681,470 | 689,590 | 207,460 | 232,020 | 24,560 | 76,670 | 170,540 | 93,870 |

which distribution lines are extended, in turn, to industries and farms that otherwise could never have been reached.

### INTERCONNECTION

Had the situation which exists today with reference to the relative economy of steam versus hydro-electric generation existed ten to fifteen years ago much of this hydro-electric development and most of this transmission network might have come more slowly. However, under the program pursued not only have the benefits mentioned accrued but extensive interconnection of systems has resulted, until today all of the major utilities of California are interconnected. Several of the Arizona properties are linked and the system of the Utah Power & Light is tied in with that of the Idaho Power Company.

These interconnections fall into three general classes: Those for standby or emergency service only, those for straight wholesaling of power from one utility to another in one direction only and those for interchange of power between systems to enable the most economical over-all operation of the two. In the latter class the most notable interconnection anywhere in the West is that between the Great Western Power Company and the San Joaquin Light & Power Corporation. These two systems were connected by a 100-mile, 220-kv. line between Sacramento and Merced, Calif., two years ago, and since that time there has been a free interchange of power which has not only enabled utilization of available water supply to the best possible advantage but has added to reliability of service as well. During the spring of 1927, when there was an over-supply of power available from stream flow plants on the San Joaquin system, a 66,000-kw. plant of the Great Western Power Company on the Feather River was completely shut down for a period of more than a month and the water that would have been required for the plant was stored in Lake Almanor, a 1,300,000-acre-ft. storage reservoir, for use later in the season when power would be needed on the San Joaquin system. During this period the interconnecting line, which for the present is operating at 165 kv., carried as high as 75,000 kw.

As time goes on more interconnections of this type will be made as economies of a given situation dictate. Although, as previously stated, the power systems of California are practically all interconnected, these interconnections are largely for wholesaling of power in one direction only or for emergency purposes. In the latter category they have been invaluable on more than one occasion, notably that of the power shortage in 1924 due to an abnormally dry year. During the period of this shortage 12,000 kw. of steam power in the San Francisco Bay region was transferred through three systems a distance of approximately 500 miles and made available in the vicinity of Los Angeles to help relieve the situation where the shortage was most acute. Steam power from San Diego also was transmitted over interconnecting lines to the Los Angeles region.

With higher steam plant efficiencies, low price of fuels and lowering steam plant construction costs, steam electric generation is rapidly increasing, particularly in southern California and Colorado. The ratio of steam to total generating capacity (Table II) of the Southern California Edison Company has increased from 49.5 in 1922 to 75 in 1927. This company has embarked upon a steam plant construction program which will further increase this ratio as units are added in a third plant at Long Beach which ultimately will have a capacity of

### *Table II—System Data for Six California Power Companies Showing Growt*

| | Pacific Gas & Electric Company | | Southern California Edison Company | | San Joaquin Light Power Corporation | |
|---|---|---|---|---|---|---|
| | 1922 | 1927 | 1922 | 1927 | 1922 | 1927 |
| Installed hydro capacity (kw.) | 417,828* | 621,213* | 194,300 | 347,600 | 78,210 | 112,90 |
| Installed steam capacity (kw.) | 173,592* | 206,266* | 96,220 | 261,600 | 52,000 | 52,00 |
| Per cent steam of total capacity | 29 | 25 | 49.5 | 75 | 40 | 3 |
| Total yearly generation | 1,608,941,000† | 2,094,880,000† | 1,131,518,000 | 2,419,530,000 | 451,173,000 | 504,431,0 |
| Total yearly hydro-generation | 1,120,762,000 | 1,484,414,000 | 1,058,700,000 | 2,168,000,000 | 379,800,000 | 499,132,0 |
| Total yearly steam generation | 251,724,000 | 15,567,000 | 72,818,000 | 241,530,000 | 71,373,000 | 5,299,0 |
| Per cent steam to total generation | 18.3 | 1.03 | 6.88 | 11.15 | 15.8 | 1. |
| System peak (kw.) | 393,710 | 423,403 | 239,160 | 448,900 | 67,885 | 128,8 |
| Electric energy sales (kw.-hr.) | 1,098,000,000 | 1,657,965,000 | 901,784,091 | 1,877,000,000 | 370,384,000 | 576,142,0 |
| Total system investment | $118,500,000 | $200,000,000 | $136,000,000 | $276,000,000 | $51,887,000 | $70,665,0 |
| Miles high-tension transmission | 2,954 | 3,240 | 1,550 | 2,242 | 1,086 | 1,3 |
| Miles distribution | 7,356 | 10,426 | 7,093 | 9,258 | 3,266 | 6,1 |
| Population of territory served | 1,500,000 | 1,860,000 | 1,700,000 | 2,600,000 | 302,000 | 312,0 |

*Horsepower. †Includes purchased power. Note—Any apparent discrepancies between kilowatt-hour sold and total generation are due

*Table III—Gross Revenue, Customers and Range Data for 1927, Showing Growth During Past Five Years*

| | Electric Gross Revenue | Total Electric Customers | Total Residential Customers | Per Domestic Customer Average Revenue | Per Domestic Customer Average Kw.-Hr. per Year | No. Electric Ranges Served | Per Cent Range Saturation |
|---|---|---|---|---|---|---|---|
| Pacific Gas & Electric Co. | $33,880,000 | 506,987 | 342,332† | $28.49† | 502† | 14,943 | 4.4 |
| Southern California Edison Co. | 30,297,697 | 376,312 | 312,267 | 24.22 | 456 | 12,241 | 3.9 |
| Los Angeles Gas & Electric Corp. | 6,991,927 | 142,843 | 115,518 | 22.97 | 453 | ...... | .... |
| Utah Power & Light Co. | 9,710,601 | 98,746 | 83,167 | 25.35 | 358 | 11,223 | 13.5 |
| San Joaquin Light & Power Corp. | 8,539,215 | 74,665 | 49,904 | 33.42 | 625 | 3,406 | 6.8 |
| San Diego Cons. Gas & Electric Co. | 3,971,736 | 64,165 | ....... | ...... | ... | 1,556 | .... |
| Great Western Power Co. | 8,699,709 | 56,580 | 44,095† | 29.80† | 682† | 4,802 | 10.9 |
| Central Arizona Light & Power Co. | 1,347,093 | 15,076 | 12,532 | 30.84 | 440 | 469 | 3.7 |
| Totals | $103,437,978 | 1,335,374 | 959,815 | $27.87 | 502 | 48,640 | 7.2 |
| Percentage increase for five-year period, 1922–1927 | 59 | 71 | 73* | 17.5* | 6.4* | 290 | |

*Based on all companies excepting San Diego Consolidated Gas & Electric and Great Western Power Company. †Approximate

720,000 kw. The first unit in this plant, which will have a capacity of 90,000 kw. and an economy of approximately 14,000 B.t.u. per kilowatt-hour, will be placed in operation in June of this year. Seven other units of similar capacity will be added as demands on the plant require.

The Great Western Power Company has under construction a steam plant in San Francisco which will have an initial capacity of 35,000 kw., the Pacific Gas & Electric Company is building a new steam plant in Oakland which will add 37,500 kva. of steam capacity to its system, the Los Angeles Gas & Electric Company is adding a second 43,750-kva. unit to its Seal Beach steam plant and the San Diego Consolidated Gas & Electric Company is adding a 25,000-kva. unit to its San Diego plant. Thus it will be seen that steam is destined to play a more and more important part in future power development in California.

### SYSTEM GROWTH

Several of the California utilities have shown phenomenal growth during the past five years, as will be seen from Table II. Of the six companies for which data are given the Los Angeles Gas & Electric Corporation has shown the greatest growth with an increase in generating capacity of 158 per cent and in output of 166 per cent, and this is in spite of competition with the Los Angeles municipal system. The Southern California Edison Company has shown the remarkable increase in generating capacity of 110 per cent and in generation of 114 per cent, or an increase of more than 20 per cent a year over the post five-year period. In the intermountain region—a section growing less rapidly than California in population and industrial development—the Utah Power & Light Company has shown an increase in generating capacity of 56 per cent and in output of 44 per cent, or approximately 10 per cent per year.

*During the Past Five Years*

| Great Western Power Company | | Los Angeles Gas & Electric Corporation | | San Diego Consolidated Gas & Electric Company | |
|---|---|---|---|---|---|
| 1922 | 1927 | 1922 | 1927 | 1922 | 1927 |
| 114,400 | 133,000 | None | None | None | None |
| 31,400 | 31,400 | 42,000 | 108,700 | 31,200 | 46,000 |
| 22 | 19 | 100 | 100 | 100 | 100 |
| 555,143,000 | 673,336,000 | 92,940,000 | 247,142,000 | 47,390,000 | 109,945,000 |
| 540,374,000 | 666,598,000 | ... | ... | ... | ... |
| 14,769,000 | 6,738,000 | 92,940,000 | 247,142,000 | 47,390,000 | 109,945,000 |
| 2.7 | 1.0 | 100 | 100 | 100 | 100 |
| .......... | 136,300 | 32,100 | 74,000 | 17,900 | 34,300 |
| 409,800,000 | 543,669,000 | 80,168,000 | 203,340,000 | 52,854,000 | 106,490,000 |
| $83,345,000 | $107,194,000 | $10,854,000 | $34,677,000 | $8,900,000 | $17,200,000 |
| 531 | 717 | None | 24 | 90 | 119 |
| | 2,532 | 870 | 1,407 | 780 | 1,221 |
| | 1,100,000 | 840,000 | 1,300,000 | 143,000 | 224,000 |

purchase of power.

To provide for rapidly increasing demands for electric service the six California utility systems given in Table II required an increase in generating capacity of 58 per cent, or 630,000 kw., during the past five years, or an average of 116,000 kw. per year. At an average of $150 per kilowatt for both steam and hydro this means that $17,400,000 of new capital is required each year for plant investment alone, and assuming that $400 per kilowatt is required for transmission and distribution, an additional capital outlay of $46,400,000 is needed. Allowing for several smaller companies not included, approximately $75,000,000 of new money all told is required each year.

### CUSTOMER OWNERSHIP

Approximately $15,000,000 of this new money is raised each year through the sale of securities to customers in the territories served. The origination of the customer-ownership idea is credited to A. F. Hockenbeamer, now president of the Pacific Gas & Electric Company, who in 1914 conceived the idea of junior financing through direct sale of stock to the company's patrons. The movement spread rapidly after 1917, when it was taken up by the Southern California Edison Company, and today there are approximately 175,000 individual stockholders among the customers served by California utilities, holding a quarter of a billion dollars of utility securities.

The number of customer owners of utilities in the Southwest has grown rapidly. During the past five-year period there was an increase of 132 per cent in the number of stockholders. The Southern California Edison Company has by far the greatest number of customer owners of any Western utility, having at the close of the year 1927 102,000 customer owners. By May 1, 1928, this number had been increased to 117,000.

At its inception the customer-ownership idea had as its primary object the raising of money for capital expenditures at a time when money was difficult to obtain.

That the plan did serve this purpose is evident from the widespread sale of stock. However, during the post-war period, when the money market had eased up and public confidence in the light and power industry had made it possible to secure capital in large amounts and at reasonable rates, the customer-ownership movement began to take on a different aspect, that of improving public relations in individual communities served. Today this is the primary object of nearly all customer-ownership activities. Without doubt the widespread and diversified holdings of utility securities has been responsible for a degree of public confidence in the utilities that serve them that could not have been brought about in any other way. Without doubt, too, it has been instrumental in the defeat of many pernicious public-ownership schemes proposed, particularly the thrice defeated water and power act of California.

### Agricultural Development

Irrigation pumping as a basic agricultural load has brought about widespread use of electricity on the farm in the great valleys of California, the region around Phœnix, Ariz., and in the great Salt Lake basin of Utah. Probably the first electric motor installation for irrigation pumping was made near Visalia, Calif., in 1899 by A. G. Wishon, now president of the San Joaquin Light & Power Corporation. Mr. Wishon had the vision to see the possibilities of developing a profitable pumping load and building a central-station load in a territory where there was little central station business in sight by fostering agricultural development, which would in turn bring more people and industries for his company to serve. The original rate made for pumping in the San Joaquin Valley was $50 a horsepower year and through a liberal extension policy the load has grown until today 31 per cent of the company's gross revenue and 31.4 per cent of its energy sales come from agricultural business. More than 12,000 pumping plants having a connected load of 136,178 hp., or 35 per cent of the motor load of the system, are now served. Important agricultural and pumping loads also are served by the Pacific Gas & Electric Company, Great Western Power Company and Southern California Edison Company.

The extent to which California farms are electrified is shown by a recent survey made by the California Committee on the Relation of Electricity to Agriculture. This survey shows that on the basis of 128,000 farms in California, as indicated by the 1920 census, 51,000 farms, or 40 per cent, were receiving electric service in 1925, the latest year for which figures are available. These farms had a connected power load of 635,913 hp. and consumed for power only 712,947,487 kw.-hr., which produced a gross revenue of $11,010,694. The average connected power load per customer was 15.77 hp., the average annual consumption 17,652 kw.-hr., average annual revenue $273.08 and the average rate paid per kilowatt-hour 1.54 cents. The large pumping load served by California power companies has been responsible for high system load factors and in most cases summer instead of winter peaks.

### Mine and Oil Field Electrification

Extensive coal and mineral mining operations in Colorado, Utah, New Mexico, Arizona and Nevada are practically all carried on with electric power. Probably not more than half of the power utilized is supplied by central stations due to the remoteness of the mines from transmission lines. The most notable case of utilization of central station power in mining operations in this region is that of the Utah Copper Company, near Salt Lake City, where the Utah Power & Light Company supplies all of the electrical energy used on the property. This and other mining loads served by the Utah Power & Light Company used 429,000,000 kw.-hr. in 1927, which was 65 per cent of the company's total electric energy sales. The high load factor of the mining load was largely responsible for a system load factor of 75.5 per cent for the year 1927.

In the large copper mines of Arizona, at Jerome, Globe, Miami, Bisbee, Ajo and the smelting center at Douglas, practically no central-station power is utilized, although mining, hoisting and refining are largely done electrically. As the territory develops and transmission lines are extended central-station power will be utilized to a greater extent to supply requirements over and above the capacity of the present isolated plants. Already the lines of the Salt River Valley Water Users' Association are connected to the system of the Inspiration Copper Mining Company at Inspiration and a line is now under construction which will tie in the Arizona Power Company with the plant of the United Verde Copper Company at Clarkdale.

One of the pioneer pumping installations in the oil fields of California was that made at Coalinga in 1909 on the system of the San Joaquin Light & Power Corporation. In 1913 the first electric drilling operation took place in the same territory. A great deal of effort has been devoted by the San Joaquin Light & Power Corporation to developing the oil field load and the success of this effort is evident from the fact that the company now serves an oil field load of 25,000 kw. and during 1927 its energy sales to this class of business amounted to 73,706,532 kw.-hr., or 13 per cent of its total energy sales. Oil fields of southern California also are extensively electrified, some of them completely and some only partially. Much of the pumping is still done with natural gas engines, but with the increasing market and rising price of natural gas, oil-producing companies are finding it more economical to sell their gas and utilize electric power for pumping. The economies of electric drilling as compared with steam or gas are so great as practically to preclude the latter forms of power in future drilling operations.

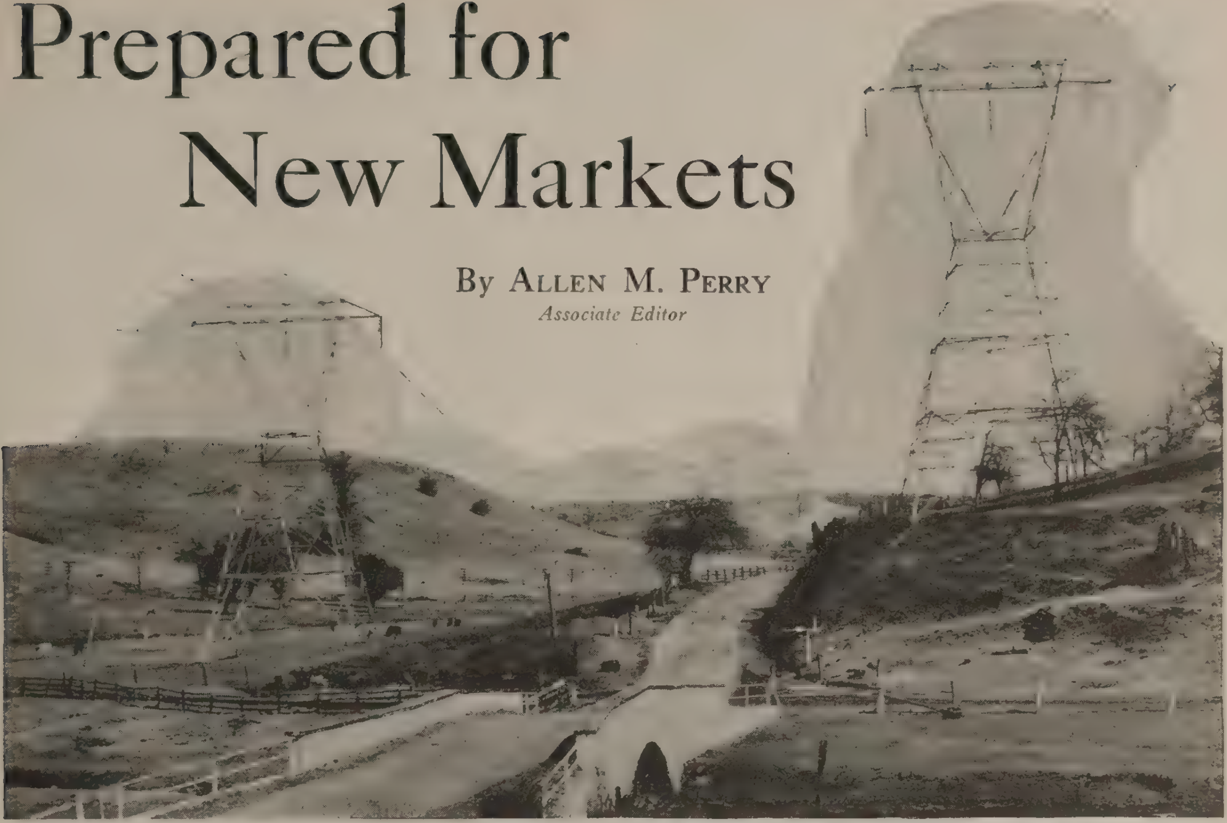
### Domestic Load Building

In their efforts to secure business the power companies of the Southwest have not concentrated on domestic load building to the same extent as their neighbors in the Northwest. As far as coverage of their territory is concerned the Utah Power & Light Company and the utilities of California have done a particularly good job. The Utah company serves 98 per cent of the available domestic customers in its territory, while 92 per cent of all potential residential customers in the state of California are served by the electric light and power companies.

Until recently few companies had intensively cultivated the domestic field. Within the past two years, however, there has been a general commercial awakening, and with only two or three exceptions every power company in Colorado, Utah, New Mexico, Arizona, Nevada and California is now engaged in an intensive commercial development program, with particular emphasis on the domestic customer. Already these effects are showing promising results and the next five-year period will see an increase of at least 50 per cent in domestic consumption.

# Prepared for New Markets

### By ALLEN M. PERRY
*Associate Editor*



Dense population and proximity of good-sized cities and towns to one another in the Middle Atlantic States, together with their highly industrialized territory, have brought interconnection and development on a large scale, chief interest now centering in maintenance of service and development of future markets

WITHIN the three Middle Atlantic States of New York, New Jersey and Pennsylvania there are more than 400 cities having a population of 5,000 or more, 233 with 10,000 or more and 44 with 50,000 inhabitants or more. With such nuclei for load centers and state populations averaging no lower than 207 persons per square mile in Pennsylvania and as high as 426 per square mile in New Jersey, there has not been the economic difficulty, which some sections have experienced, in spreading out systems, interconnecting and consolidating.

Such populous centers as New York, Philadelphia, Pittsburgh, Buffalo and Newark, with their concentrated domestic populations and commercial and industrial loads, have exacted very reliable service and called for the building of large, efficient generating stations, large load-center substations and high-density distribution systems.

Superposed over and interposed between these aggregations of human beings who make up the domestic load and justify commercial loads is a tremendous industrial market composed in 1925 of approximately 60,000 establishments using 10,000,000 hp. to turn out yearly products valued at close to $20,000,000,000. There are more than 33,000 of these establishments in New York State and more than 17,000 in Pennsylvania.

Delaware and Maryland are not so populated or industrialized, having jointly only ten cities with populations of 5,000 or more and 3,603 industrial establishments. Nevertheless, these states generated 583 and 437 kw.-hr. per capita respectively in 1927, compared with 1,025 kw.-hr. and 795 kw.-hr. for New York and Pennsylvania.

Faced with these opportunities for business and the economic possibilities of extending their systems, electric utilities in this territory early stimulated extensive utilization of purchased energy. When the World War broke out and this territory became the scene of unprecedented industrial and commercial activity many industries changed to purchased power. Demands were made on utilities that severely taxed their capacity for service and probably urged interconnections forward as much as anything.

Relief came during the adjustment period after the armistice and for several years utilities rehabilitated plants which had operated with virtually no maintenance for several years and installed much needed new generating capacity. The high unit costs at which these additional generating facilities had to be installed urged commercial departments to greater efforts. The extended taste of purchased power, the vigorous efforts to acquire new business and returning prosperity of a different order eventually called for more generating equipment and interconnections. Consolidations of the smaller properties into the larger ones became more numerous, and holding companies sought to increase their financial credit and hence their capacity for carrying on developments by extending and diversifying their holdings. Finally, the

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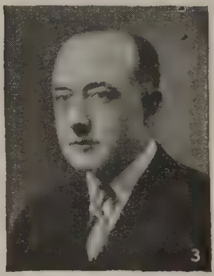
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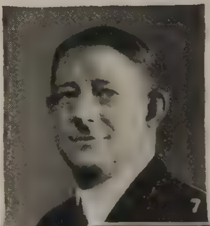
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plentiful money market of the last few years arrived that has permitted refinancing as well as raising of new capital at lower rates.

Despite the existence of Niagara Falls power in this territory and the recent completion of the Conowingo and Wallenpaupack hydro developments, steam power still predominates in the proportion of 68 to 32. Among the important steam stations built in the last six years were East River, Kearny, Hudson Avenue, Charles R. Huntley, Gould Street, Binghamton, Richmond, Delaware, Deepwater, Whippany, Pine Grove, Shippingport and Saxton.

Interconnection of adjacent systems and plants has grown apace, as the accompanying transmission maps and table of inter-system ties indicate. Networks have been developed that tie together practically every system within the states considered and even connect the group with outside territories that are just as extensively interconnected. For example, there is a tie with the New England Power system on the northeast through the Mohawk-Hudson Power system. On the northwest the Buffalo, Niagara & Eastern Corporation is tied in with the Hydro-Electric Power Commission of Ontario. On the west the West Penn Power Company is interconnected with the Ohio Power Company.

The inter-system interconnections within this territory, while requiring that the systems operate in parallel, do not permit bulk transmission of energy from one end of the interconnected network to the other. However, nonadjacent systems have been able to exchange energy by load displacement in the intervening systems.

A few examples of heavy ties between adjacent systems do exist like those between the Hydro-Electric Power Commission of Ontario and the Buffalo, Niagara & Eastern Corporation, or the more recent 220-kv. tie connecting the Pennsylvania Power & Light Company, the Philadelphia Electric Company and the Public Service Electric & Gas Company. But even these ties exist chiefly for adjacent system interchange.

Interconnection between stations of the same system or affiliated companies range from loose ties (having capacity sufficient to offset loss of local reserve) to trunkline ties the equivalent of a station bus. Probably the outstanding example of the latter type is the 132-kv. trunk between the Public Service Electric & Gas Company's Marion, Kearny and Essex stations, all within a stretch of about 3 miles. While ranking large in capacity, the ties between Canada, Niagara Falls and Buffalo and between the New York stations could hardly be considered as solid ties as the one in New Jersey. Brooklyn affords an example of large generating units paralleled only through substations, while Baltimore does likewise with its two generating stations.

Backbone transmission lines of the order of 110 kv. are evident in most of the Eastern systems that serve long narrow strips of territory like the Niagara, Lockport & Ontario Company and the Mohawk-Hudson Power Corporation. But they serve chiefly as transfer buses between separated generating stations and make power available where there may be inadequacies or loss of reserve. For such service multiple circuits are employed, in some cases over separate right-of-way.

Loop transmission lines of a similar order of voltage are used or are being favored by companies wherever their territory is adaptable to this method. They are also used around the outskirts of cities to provide reliable service to industries, raise the limits to loads which can be taken on and avoid radial feeds from generating stations to these industries as well as outlying residential sections.

Loops exist around the Buffalo-Niagara district and Pittsburgh. They have been started around the north of

## *Some Major Interconnections in Middle Atlantic States*

This shows that directly or indirectly all of the companies listed (with exceptions of Nos. 8 and 10), are connected with each other and with New England, Canada and Ohio, and therefore operate in parallel, although interconnections are used only to exchange power with adjacent systems.

| Co. No. | Name | Buffalo, Niagara Eastern | Philadelphia Electric | West Penn | Public Service | Duquesne | Mohawk-Hudson | Pa. Pwr. & Lt. | Con., Gas (Baltimore) | Pa.-N. J. | Pa. Water & Power | Penn-Ohio | Penn Public Service | Northern N. Y. | Rochester Gas & Electric | Central Hudson | Penn Central Light & Power | N. J. Central | N. Y. State Gas & Electric | Co. No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |
| 1 | Buffalo, Niagara & Eastern* | | | | | | ● | | | | | | ● | ● | ● | | | | | 1 |
| 2 | Philadelphia Electric | | | | ● | | | ● | | | | | | | | | | | | 2 |
| 3 | West Penn Power† | | | | | ● | | | | | | | ● | | | | ● | | | 3 |
| 4 | Public Service Electric & Gas | | ● | | | | | ● | | ● | | | | | | | | ● | | 4 |
| 5 | Duquesne Light | | | ● | | | | | | | | ● | | | | | | | | 5 |
| 6 | Mohawk-Hudson Power‡ | ● | | | | | | | | | | | | ● | | ● | | | ● | 6 |
| 7 | Pa. Power & Light | | ● | | ● | | | | | ● | | | | | | | | | | 7 |
| 8 | Consol. Gas, Elec. Lt. & Pwr. | | | | | | | | | | ● | | | | | | | | | 8 |
| 9 | Pa.-N. J. Power | | | | ● | | | ● | | | | | | | | ● | | | | 9 |
| 10 | Pa. Water & Power | | | | | | | | ● | | | | | | | | | | | 10 |
| 11 | Pa.-Ohio Power | | | | | ● | | | | | | | | | | | | | | 11 |
| 12 | Penn Public Service | ● | | ● | | | | | | | | | | | | | ● | | | 12 |
| 13 | Northern N. Y. Utilities | ● | | | | | ● | | | | | | | | | | | | | 13 |
| 14 | Rochester Gas & Electric | ● | | | | | | | | | | | | | | | | | | 14 |
| 15 | Central Hudson Gas & Electric | | | | | | ● | | | ● | | | | | | | | | | 15 |
| 16 | Penn Central Light & Power¶ | | | ● | | | | | | | | | ● | | | | | | | 16 |
| 17 | N. J. Central | | | | ● | | | | | | | | | | | | | | | 17 |
| 18 | N. Y. State Gas & Electric | | | | | | ● | | | | | | | | | | | | | 18 |

*Tied with Hydro Electric Power Commission of Ontario.
†Tied with Ohio Power Company.
‡Tied with New England Power.
¶Tied with Potomac Public Service & Keystone Power Corp.

Baltimore, the congested industrial district of New Jersey and are being considered on the eastern end of the Mohawk-Hudson system. The Penn Central Light & Power Company is an example of a company serving separated industrials through looped circuits. At points around the Duquesne loop as well as the New Jersey loop are tap substations from which lines run to load-center substations within the loop.

Interconnection arose as an opportunity for making the best use of investment in generating plants in adjacent districts. But it was soon observed that the most flexible utilization of interconnections could not be obtained under separate ownerships, as complicated contractual agreements and differing engineering practices often hampered operations and parties to the interconnections were chiefly interested in how they could benefit individually rather than in how the best use could be made of the entire interconnected capacity. As a consequence, consolidations of adjacent properties under the same financial ownership sprang up, giving a community of interest and purpose.

In such consolidations were also seen the opportunity to enhance financial credit standing, make purchases in bulk, avoid widely differing engineering and commercial practices, provide engineering and commercial staffs which smaller components could not support alone, simplify accounting and reports to government and commissions, reduce total overhead administration expense, smooth out demands on construction forces, etc.

In New York State the Mohawk-Hudson Power Corporation is well on the road to co-ordinating diverse interests and practices from Albany north and west through Utica and Syracuse. The Buffalo, Niagara & Eastern Corporation has well in hand the unification of service in the northwest part of the state from Buffalo and Niagara Falls east along the southern shore of Lake Ontario. A billion dollar merger involving the Brooklyn Edison Company and Consolidated Gas group of properties in New York City has at last been ratified.

The major changes in Pennsylvania have included bringing the Philadelphia Electric into one United Gas Improvement family, the Duquesne Light Company into the Byllesby group and the Penn Central Light & Power Company under Insull interests. The West Penn Power Company is developing and expanding service to the multiplicity of towns surrounding the Duquesne Light territory, which runs northwest and southeast through Pittsburgh.

The Consolidated Gas, Electric Light & Power Company, serving Baltimore and surrounding territory, still remains independent, although it has been rumored that a large holding company is seeking control.

As a recent example of what consolidation can do, the Mohawk-Hudson Power Corporation is typical. Only a few years ago the 27 or 28 plants that now constitute this system were divided among five major companies and a number of smaller properties. Water-power rights and different frequencies and voltages hindered the best use of these properties even after attempts at interconnection. Now the parent company, through providing a mutual financial interest, is fast removing barriers to unified operation, co-ordinating operation for best system results, eliminating diverse engineering practices where feasible, harmonizing water-power utilization with outside interests and avoiding sharp differences in handling customers of the component companies. This company is still in the transitory stage.

Because of the previous affiliations of the Niagara Falls Power Company, Buffalo General Electric Company, Niagara, Lockport & Ontario Company and other subsidiaries, the Buffalo, Niagara & Eastern Company, which was formed as a holding company just a few years ago, has been able to make very rapid strides toward simplification of its corporate and financial structures. Already it has exchanged holding company common stock for practically all of the outstanding common stock of its

*Some Significant Measures of Development and Increased Value te*

(Based on Repo

| | Duquesne Light Co. | | Public Serv. El. & Gas | | Penn Cent. Lt. & Pwr. | | Brooklyn Edisor | |
|---|---|---|---|---|---|---|---|---|
| | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 |
| Operating ratio | 46.8 | 58.1 | 63.7 | 69.3 | 42.4 | 59.5 | 66.5 | 71 |
| Taxes: government, state, municipal (000 omitted) | $1,814 | $745 | [7]$5,636 | [7]$2,610 | $251 | $94 | $4,700 | $1,3 |
| Number of employees | 2,660 | 1,690 | 5,700 | 3,900 | 813 | 398 | 9,400 | 3,5 |
| Salaries and wages (000 omitted) | $5,100 | $2,800 | $12,000 | $6,700 | $1,484 | $619 | $14,686 | $5,4 |
| Total gen., kva | 451,800 | 285,850 | 624,432 | 293,755 | 96,875 | 34,375 | 476,500 | 189,7 |
| Largest single gen., kva | 47,100 | 47,100 | 44,444 | 35,300 | 37,500 | 10,000 | 88,900 | 30,0 |
| Largest single station, kva | 308,800 | 140,600 | 215,588 | 90,500 | 62,500 | 21,250 | 276,400 | 108,5 |
| Maximum transmission voltage | 66,000 | 66,000 | 132,000 | 26,400 | 45,000 | 45,000 | 27,000 | 13,6 |
| Transmission miles | [1]932 | [1]530 | 1,287 | 947 | 492 | 260 | 485 | 4 |
| Construction budgets (000 omitted) | $13,940 | $9,655 | [8]$18,151 | [8]$4,758 | $1,398 | ....... | ....... | .... |
| Pounds of coal per kw.-hr | ....... | ....... | 1.514 | 2.235 | 1.418 | 2.204 | 1.46 | 2. |
| System losses | 8.6 | 25 | 15.8 | 15.5 | 15.2 | 17.8 | 15.4 | |
| Domestic customers | [2]135,868 | ....... | 657,232 | 179,010 | [2]19,471 | ....... | [2]471,000 | .... |
| Kilowatt-hours per domestic customer | 637 | 453 | [9]628 | [9]506 | [11]511 | [11]374 | 320 | |
| Merchandise sales per domestic customer | $4.26 | $3.53 | $4.09 | $5.32 | $4.46 | $4.91 | $1.06 | $1. |
| Per cent of industrial plants on purchased power | 88.9 | 73.8 | 98 | 94 | 92 | 66 | 96 | |
| Per cent of industrial horsepower on purchased power | [3]42.5 | [6]26.7 | 64 | 43 | ....... | ....... | ....... | .... |
| Kilowatt-hours sold (000 omitted): | | | | | | | | |
| Domestic | 144,617 | 41,546 | 413,246 | [10]147,821 | 18,186 | 6,324 | 202,439 | 52. |
| Commercial | [4]135,677 | [4]70,026 | | | 12,521 | 5,002 | 276,816 | 128, |
| Industrial | [5]865,113 | [5]513,367 | 770,756 | [10]257,874 | 148,787 | 56,769 | 275,380 | 144, |
| Number of isolated plants displaced since 1921 | 157 | ....... | 200 | ....... | ....... | ....... | ....... | .... |

[1] Circuit-miles.
[2] Added since 1921.
[3] 65 per cent exclusive of waste heat users.
[4] Retail.
[5] Wholesale and other utilities.
[6] 45 per cent exclusive of waste heat users.
[7] Electrical department only.
[8] Fixed capital increase.
[9] Ten typical houses.
[10] Exclusive of railways.
[11] Blair County only.
[12] All departments.
[13] Dec. average consumption.
[14] Purchases majority of power; genera capacity only for reserve.

## Middle Atlantic Utility Groups Rank High in Output

| Rank Compared with Other Utilities in Country, 1927 | Name of Utility or Group | State | Output, Million Kw.-Hr., 1927 | Output, Million Kw.-Hr., 1921 |
|---|---|---|---|---|
| 1 | Buffalo, Niagara & Eastern... | N. Y. | 4,634 | [1]4,464 |
| 3 | New York Edison, United & Allied.................... | N. Y. | 2,877 | 1,475 |
| 8 | Philadelphia Electric......... | Pa. | 1,861 | 877 |
| 10 | West Penn Power............ | Pa. | 1,728 | [4]1,141 |
| 11 | Public Service Elec. & Gas.... | N. J. | 1,702 | 821 |
| 15 | Duquesne Light............. | Pa. | 1,329 | 703 |
| 16 | Mohawk-Hudson........... | N. Y. | 1,250 | [2]810 |
| 22 | Brooklyn Edison............ | N. Y. | 958 | 439 |
| 25 | Pennsylvania Power & Light. | Pa. | 909 | 443 |
| 29 | Consol. Gas, Elec. Lt. & Pwr.. | Md. | 787 | 415 |
| 31 | Pennsylvania-N. J. System... | N. J. & Pa. | 782 | [1]938 |
| 34 | Pa. Water & Power.......... | Pa. & Md. | 634 | 420 |
| 37 | Penn.-Ohio................. | Pa. & Ohio | 574 | 203 |
| 43 | Assoc. Gas & Elec. (Pa. group) | Pa. | 413 | [4]182 |
| 44 | Northern N. Y. Utilities...... | N. Y. | 411 | [1]398 |
| 49 | Potomac Electric........... | Md. | 383 | 238 |
| 57 | Rochester Gas & Electric.... | N. Y. | 353 | 185 |
| 78 | Scranton Electric........... | Pa. | 238 | [3]164 |
| 81 | Penn Central Light & Pwr.... | Pa. | 227 | [4]147 |
| 88 | Central Hudson Gas & Elec.. | N. Y. | 212 | ..... |
| 92 | East Penn Electric.......... | Pa. | 195 | [1]176 |
| 102 | Atlantic City Electric....... | N. J. | 158 | [1]106 |
| 107 | Edison Electric (Lancaster)... | Pa. | 135 | [4]100 |
| 119 | Delaware Electric........... | Del. | 110 | [4]111 |
| 121 | Staten Island Edison........ | N. Y. | 108 | [1]101 |

[1]In 1926. [2]In 1925. [3]In 1924.-[4]In 1923.

subsidiaries, and before the year closes it is expected that all the subsidiaries' outstanding preferred stock will be replaced by holding company preferred stock and the bonded indebtedness of the subsidiaries assumed by the holding company. Thus the financial structure will be greatly simplified and the Buffalo, Niagara & Eastern Corporation can be made a true operating company and not merely a holding company.

### Looking for New Markets

At no time in the past has there been available so much money at such low rates as now to develop business facilities. Pushed by this incentive and the need of putting excess generating capacity to work earning money, the utilities' major thoughts now are on where to seek and how to develop additional business. All companies are interested in maintaining domestic customers' revenue at such a proportion of the total that it will continue to stabilize gross revenue during industrial depressions. Since municipal services and commercial and office building lighting do not vary appreciably with business conditions, these too are considered attractive stabilizers. Some companies have very diversified load, but wherever any one or a few industries dominate the industrial load attempts are being made to offset these loads by distinctly different loads, either through attraction of new industries or concentration of sales effort on diversified industries. A few utilities are looking to existing and additional interconnections as the chief means of disposing of their product.

One field for development which is beckoning is electric heat. Every place that coal, oil or gas is now used for some process affords a potential market. How extensive each local market is, what classes of applications are most attractive and where specifically to concentrate attention are questions that will have to be answered by each utility surveying its customers' uses of heat as a few companies are doing and others will eventually find it profitable to do. Baltimore and Pittsburgh have just completed detailed surveys.

Applications of electricity to chemical processes have hardly been touched, said one utility man, because neither power salesmen nor works managers of chemical industries have given sufficient study to the existing practical applications of electrochemistry.

Users of process steam and industries utilizing byproducts to produce their own power constitute the major remaining potential market for purchased power outside of that which comes from population growth. This market has been difficult to enter chiefly because industrialists or their consultants do not account for all items charge-

## Public of Seven Large Systems

from Companies)

| Rochester Gas & Elect. 1927 | Rochester Gas & Elect. 1921 | N. Y. & Queens 1927 | N. Y. & Queens 1921 | Consol. Gas (Balto.) 1927 | Consol. Gas (Balto.) 1921 | Consol. Gas (New York)[19] 1927 | Consol. Gas (New York)[19] 1921 |
|---|---|---|---|---|---|---|---|
| 49.28 | 49.14 | 67.9 | 72.9 | 51.6 | 46.9 | 66.5 | 71 |
| [7]$905 | [7]$387 | $1,120 | $239 | [7]$2,461 | $1,549 | $10,264 | $4,577 |
| [12]2,390 | [12]1,384 | 2,745 | 992 | 4,629 | 2,944 | [20]21,904 | [20]11,653 |
| [12]$4,219 | [12]$2,184 | $4,415 | $1,489 | $7,447 | $4,194 | ....... | ....... |
| 143,313 | 95,548 | [14]5,000 | [14]7,250 | [16]221,600 | [16]159,100 | [16]988,150 | [16]642,220 |
| 22,500 | 12,500 | [14]3,000 | [14]3,000 | [16]36,000 | [16]20,000 | [16] [21]60,000 | [16]35,000 |
| 82,525 | 54,746 | ....... | ....... | [16]165,000 | [16]138,500 | [16]285,000 | [16]166,000 |
| 110,000 | 60,000 | 26,400 | 13,200 | 66,000 | 26,000 | 132,000 | 23,000 |
| 119 | 60 | [15]453 | [15]142 | 980 | 521 | [1]1,693 | [1]1,176 |
| $4.063 | $955 | [14]$5,312 | [14]$1,209 | $4,428 | [17]$6,243 | [22]$50,754 | [22]$31,843 |
| 2.51 | 4.57 | — Footnote [14]. — | | 1.48 | 2.02 | 1.52 | 2.16 |
| 5.98 | 7.91 | 15.4 | 19.2 | 9.78 | 12.9 | ....... | ....... |
| [2]53,921 | ....... | 252,384 | 53,214 | 164,397 | 73,480 | ....... | ....... |
| [13]54 | [13]41 | 365 | 276 | 506 | 420 | ....... | ....... |
| $8.44 | $7.29 | $3.51 | $1.85 | [7]$9.64 | [7]$8.01 | ....... | ....... |
| 96 | ....... | ....... | ....... | 93 | 84 | ....... | ....... |
| 70 | ....... | ....... | ....... | 87 | 72 | ....... | ....... |
| 276,679 | 149.816 | 249.580 | 78,141 | 703,379 | 359,071 | 50,754 | 31,843 |
| 38,628 | 9,896 | 74,754 | 24,113 | 79,934 | 28,392 | ....... | ....... |
| 238,051 | 139,920 | 84,311 | 54,028 | 161,529 | 100.725 | ....... | ....... |
| | | 90,515 | | [18]461.916 | [18]229.955 | ....... | ....... |
| 6 | ....... | 29 | ....... | 198 | ....... | ....... | ....... |

[15]Underground. [16]Kilowatt.

[17]Includes purchase of street railway.

[18]Includes street railway.

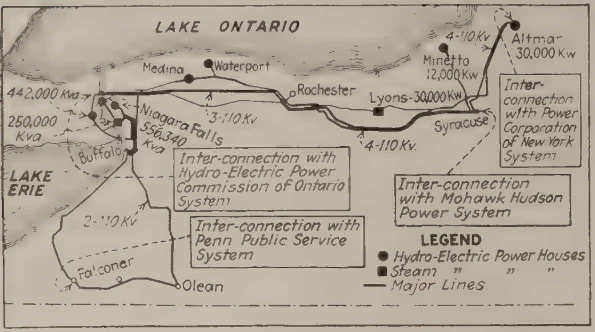
[19]Including electric companies, all or a majority of whose stock is owned directly or indirectly.

[20]Employees of combination companies arbitrarily apportioned.

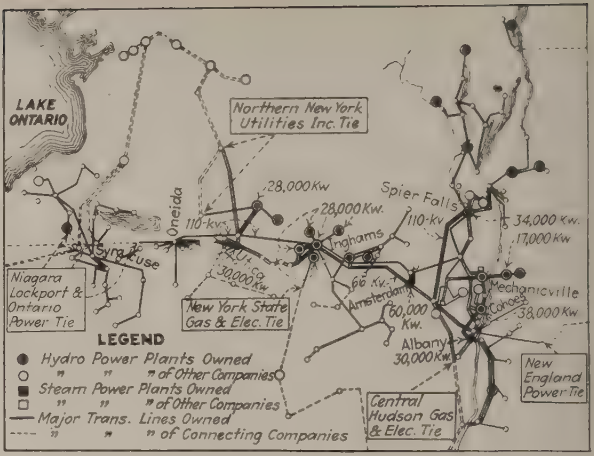
[21]160,000 kw. unit on order.

[22]Gross.

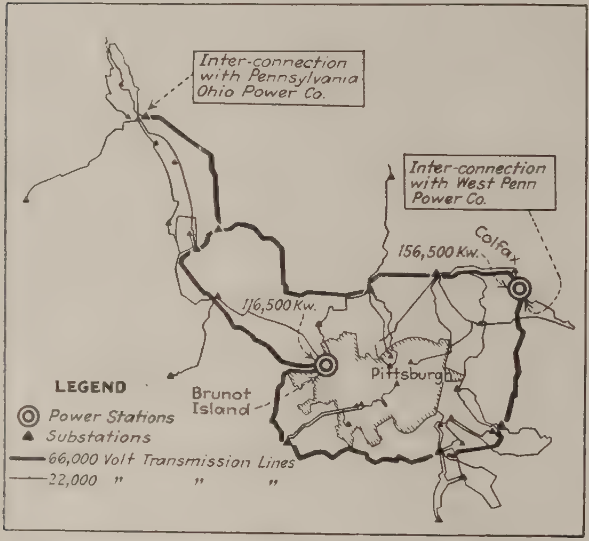
# *Typical Systems and Interconnections in the Middle Atlantic States*


LAKE ONTARIO
Medina
Waterport
Rochester
Lyons-30,000 Kw
Syracuse
4-110 Kv
Altmar-30,000 Kw
Minetto 12,000 Kw
442,000 Kva
250,000 Kva
Niagara Falls 556,340 Kva
Buffalo
3-110 Kv
4-110 Kv.
LAKE ERIE
Inter-connection with Power Corporation of New York System
Inter-connection with Hydro-Electric Power Commission of Ontario System
Inter-connection with Mohawk Hudson Power System
2-110 Kv
Inter-connection with Penn Public Service System
Falconer
Olean
LEGEND
● Hydro-Electric Power Houses
■ Steam " " "
— Major Lines

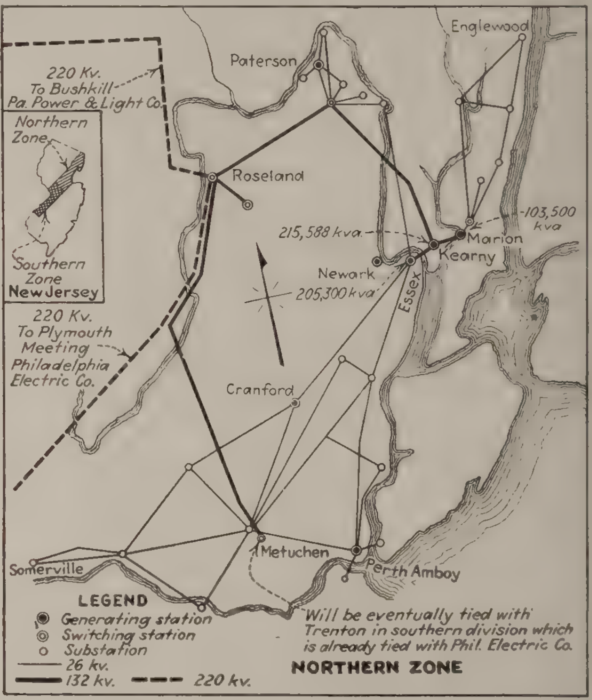
*Buffalo, Niagara & Eastern serves Niagara District and eastward*


LAKE ONTARIO
Northern New York Utilities Inc. Tie
Oneida
28,000 Kw
28,000 Kw.
Spier Falls
110-kv
110-kv
34,000 Kw.
17,000 Kw
Syracuse
Inghams
Amsterdam
66 Kv.
30,000 Kw
Mechanicville
Cohoes
38,000 Kw
60,000 Kw.
Albany 30,000 Kw.
Niagara Lockport & Ontario Power Tie
New York State Gas & Elec. Tie
New England Power Tie
Central Hudson Gas & Elec. Tie
LEGEND
● Hydro Power Plants Owned
○ " " " of Other Companies
■ Steam Power Plants Owned
□ " " " of Other Companies
— Major Trans. Lines Owned
- - - " " " of Connecting Companies

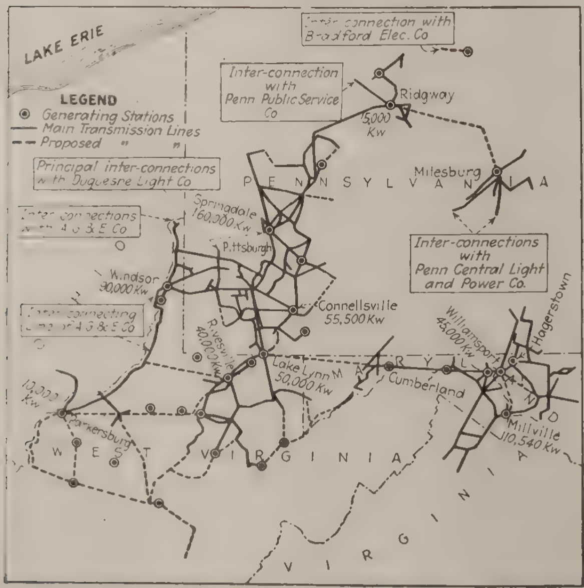
*Mohawk-Hudson Power Corporation is unifying service from Syracuse to Albany*


Inter-connection with Pennsylvania Ohio Power Co.
Inter-connection with West Penn Power Co.
Colfax
156,500 Kw.
116,500 Kw.
Pittsburgh
Brunot Island
LEGEND
◎ Power Stations
▲ Substations
—66,000 Volt Transmission Lines
—22,000 " " "

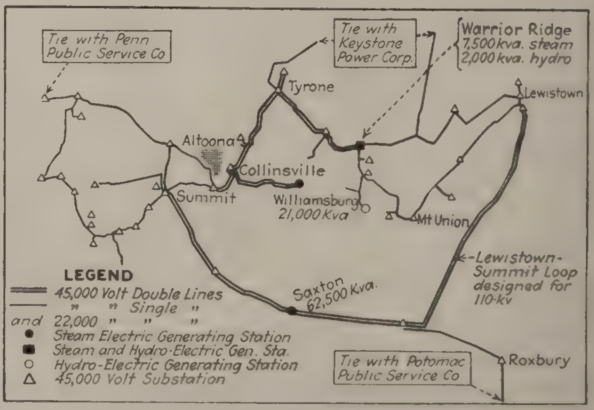
*Loop system characterizes Duquesne Light Company*



*Public Service Electric & Gas Company building 132-kv. loop*



*West Penn Power Company tying together scattered plants*


Tie with Penn Public Service Co
Tie with Keystone Power Corp.
Warrior Ridge 7,500 kva. steam 2,000 kva. hydro
Tyrone
Lewistown
Altoona
Collinsville
Summit
Williamsburg 21,000 Kva
Mt Union
-Lewistown-Summit Loop designed for 110-kv
Saxton 62,500 Kva.
LEGEND
═ 45,000 Volt Double Lines
— " " Single "
and 22,000 " " "
● Steam Electric Generating Station
■ Steam and Hydro-Electric Gen. Sta.
○ Hydro-Electric Generating Station
△ 45,000 Volt Substation
Tie with Potomac Public Service Co
Roxbury

*Penn Central Light & Power loop serves scattered industries* able to power production as rigorously as utilities do. If industrialists can be induced in some way to give more attention to proper accounting for production costs one of the greatest obstacles to proving the economics of purchased power to industrial executives will be broken down.

Meanwhile there are two approaches to this market that are being tried with varying degrees of success. To win process-steam users over to purchased power, the Rochester utility just recently built a steam-heating plant in the load center of about twelve large isolated-plant-operated industries and is already serving one of them with steam and electricity. In reducing the steam pressure for steam supply it passes the steam through turbogenerators floated on the utility system. As time passes it hopes to convince the other surrounding process-steam users that they can afford to do likewise. In eastern Pennsylvania it has been found feasible for one industry to locate near the utility's generating station from which it secures both steam for process operations and electric power for other operations, but many utilities point out that such a location is seldom convenient for industrial plants.

Interchanging power with large industrial private plants on the same basis as with another utility is being tried with varying degrees of success with the understanding that the industrials will purchase all increases in power demand and the hope that a taste of purchased power will induce them eventually to replace obsolete isolated plant equipment by purchased power. Industrial interchange of power, where it has been practical, has not brought the benefits of interconnection with other utilities because the surplus power from industrials is usually available to utilities when it is not needed, but

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# *Do We Want Applause Cards?*

*By Frank L. Dame*
*President the North American Company*

FOR a time applause cards were in vogue in the radio field. Tons of mail came in response to the familiar request: "If you have enjoyed this program write to So-and-so Company direct, or to the station to which you are listening." Today these cards have largely disappeared from radio. The movies, in a limited way, are carrying the idea a step further by asking for opinions of some films.

In most lines of business the applause card, in one form or another, has been sought. Is this really what is wanted? Is not constructive criticism a better guide for future plans for improvement?

My conclusion several years ago was that our company did not want applause cards, but on the contrary wanted criticism that was constructive. As a result we inaugurated a policy of sending letters to every person whose name disappeared from our stockholders' list asking frank expressions as to the reason for the disposal of the shares. The replies average more than 55 per cent of our inquiries, and all of them are tabulated and studied. I am glad to say that with few exceptions we have found no serious complaints regarding our policies and that cases of complaint have been generally removed by explanations of stockholders' previous misunderstandings.

This is a fair illustration of the value of constructive criticism as against mere applause. Criticism makes more noise than applause; it has greater news value because it is not so commonplace. This is quite apparent, and is very well illustrated, in the proceedings of the Federal Trade Commission in its examination of the public utility industry.

A year ago I publicly expressed my views on some of the conditions in the industry that merited criticism, and later events showed that these conditions were its disturbing elements. It was inevitable that such conditions should lead to criticism, which, unfortunately, has been more destructive than constructive. Consequently the emphasis has been heavy upon the mistakes, minor and major, which have been revealed. And the noise of this criticism—that which is justified and that which is not—renders quite inaudible the public approval of the policies and practices of the larger part of the industry.

*Frank L. Dame*

Criticism, to be valuable, must be constructive. I welcome that kind, and would rather have it than tons of applause cards. I join in the criticism of improper conditions and practices in the industry on the ground that their correction will benefit the public, the industry and its millions of investors.

A case in point has been brought forward by the secretary of the National Educational Association. He indorsed the industry's action in preparing information of value for the schools as a work of education, but he condemned the improper inclusion of propaganda against public ownership. And he asked the association to consider at its Minneapolis meeting, June 30, a report on the extent to which agencies other than public utilities "have imposed on teachers in the schools." To me this is constructive criticism, and it embraces all efforts toward propaganda, against the public utility industry and in favor of it.

We do not want applause cards, but constructive criticism.

the arrangement has proved advantageous in several places as a means of opening new markets.

What is known as a "business incubator" has been started in Rochester for the purpose of stimulating new industries or new processes. Electricity in all forms, steam at various pressures and superheats, gas and a variety of chemicals are made available in a loft building where a large number of industries can experiment with new processes at less expense than if they provided all their own facilities. In Baltimore industries which are too small to build their own quarters and equip for electric, steam and gas services have had the opportunity for twelve years of renting industrial quarters provided with these services. Where found worthy they have been able to secure financial aid until they are able to proceed on their own resources.

Quite a tendency is now prevalent for utilities to co-operate with their local chambers of commerce in attracting new industries into their territories. On the other hand, one state chamber of commerce is discouraging such activity, as it declares that national records prove that there are seldom economic justifications for such changes. Commenting on this subject, one utility says it never seeks outside industries unless they show a determined intention to move or decentralize their plants and then active efforts are made to interest them in local conditions. Decentralization of industries to reduce distribution costs is accounting for many of the changes in industrial plant locations, although cost of power has influenced congregation of electrochemical and metallurgical industries at Niagara Falls.

In western Pennsylvania it is declared that the most favorable conditions for progress cannot exist until the bituminous and anthracite mine operators adjust their difficulties. Subnormal production in some steel mills, copper rolling and drawing plants and metal-working factories is affecting some utilities which depend to a large extent on these industries for their power load.

For increased commercial load as distinguished from industrial, utilities are looking to selling purchased power to new buildings before they sink their money into private plants, to co-operating with architects and building owners in laying out the most effective lighting and to improving store and show-window lighting. Some utilities feel that through installation of the best street lighting, inadequate show window and store lighting can be most effectively demonstrated. Commercial refrigeration has been found a very attractive load builder in some communities. The potential market for this air conditioning has developed wherever department stores, theaters and other public gathering places have been shown the beneficial effect of artificially cooling interiors.

### INDUCEMENT RATES AND MERCHANDISING

Because domestic customers utilize such a notoriously low percentage of the investment required to serve them and require such high unit operating expenses for testing and reading of meters, accounting, billing, etc., and also because their aggregate revenue fluctuates so little with economic conditions, utilities as a whole are showing unusual interest in developing their usage of energy. Not many years ago few companies had inducement rates to stimulate more extensive usage, but a large number of utilities in the Middle Atlantic States now have them or are introducing them. With such rates customers can be impressed with the fact that any additional usage they make of electricity can be had at very small expense. Where the companies have backed up these rates with sales effort and do not require their domestic customers to take too many kilowatt-hours at the top step before they can take advantage of the low step, some really remarkable increases in customer consumption have been made. But the surprising situation in some local-

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# *Customer Ownership on Increase*

*By* ***P. G. Gossler***
*Chairman of the Board*
*Columbia Gas & Electric Company*

*P. G. Gossler*

IT IS gratifying to note that the sale of stocks and other securities by electric light and power companies to their customers during the past year have exceeded the record of any previous year. This is particularly gratifying because of the fact that market conditions during the past year have been unusually favorable, through low interest rates, for selling of long-term bonds for raising new capital, and also for the refunding of outstanding issues of bonds or stocks to meet maturities, or where outstanding securities may be called. As the sale of securities to customers is, for the greater part, in preferred stocks representing junior securities, it would be expected that the proportion of such junior financing would not be as large in years where a very strong bond market prevails. It is most significant, therefore, that customer-ownership shares sold during 1927, as reported, aggregated 3,484,000 shares, which is an increase of almost 30 per cent over the record in 1926. Also, the number of electric companies that have issued such stocks has increased during the year to 242, compared with 228 so reporting last year. The number of new stockholders added last year was 235,674, which brings the total to date to 1,668,000 stockholders having purchased an aggregate of 16,622,000 shares.

ities is that the increased consumption has not increased the average revenue per customer. On one system where the average domestic consumption is over 700 kw.-hr. a year the revenue is only $25. Furthermore, when inducement rates are first introduced it has taken as much as one and one-half years to bring the domestic revenue up to what it was on the old flat rate. . So utilities, while recognizing the wholesome effect of such rates on public relations, are chiefly concerned with finding applications which will be attractive to customers and at the same time build up the revenue per customer.

Some difficulty has been experienced in introducing inducement rates without taking too big a loss in revenues or raising the small customers' bills. If the inducement rate is formed to keep the small customers' bills the same the revenue loss from the domestic customers as a whole is considerable. And if the rate structures are made so that this loss is minimized, the antagonism of small consumers whose bills are raised is aroused. As a result some utilities have expressed the opinion that the time to institute an inducement rate is when surplus earnings are expected.

Along with this tendency to give domestic customers inducement rates has therefore come an increased incentive to concentrate on merchandising. There are still many schools of thought, ranging from merchandising purely for merchandise profit without regard to load building to merchandising chiefly for load building.

There has been a widespread improvement of electric shop layouts for the convenience of customers even in small towns. Greater attention is being given to simplifying applications for service, securing duplicate bills, adjusting complaints and paying bills.

More companies are adopting practices that improve public relations and not merely talking about them. Among some practices which have been adopted are: Removing sharp differences in practices brought about by mergers of adjacent companies; discontinuance of signed applications and deposits except where credit is questionable; leaving service connected in empty homes; following up service connection orders; minimizing public inconvenience from construction work; simplifying payment of bills; expediting correct connection of incoming telephone calls; remedying causes of radio interference; training of employees in courtesy by the legal-case method; committees formed of department heads to adjust practices that cause public irritation, and supervision of telephone complaint adjustments.

## *Some Actual Budgets for 1928*

The total of the expenditures here listed, excluding duplications and Ontario Hydro, is $301,555,770. Of that amount $295,655,000 can be associated with installations having a combined rating on Jan. 1, 1928, of 8,516,115 kw., according to the best available records. The total for the United States at that time may be taken at 25,760,000 kw., again using the most recent figures available.

| Company | Total, 1928 | Steam | Hydro | Transmission | Distribution | Substation | Miscellaneous |
|---|---|---|---|---|---|---|---|
| 1. Alabama Power | H $15,000,000 | | | | | | |
| 2. Beverly Gas & Electric (Mass.) | F 81,000 | | | | $78,000 | $2,000 | $1,000 |
| 3. Carolina Power & Light (Asheville Division) | 400,000 | | | $200,000 | | | |
| 4. Central Illinois Light (Peoria) | A | | | | | | |
| 5. Cleveland Electric Illuminating (Ohio) | 9,800,000 | | | | | | |
| 6. Columbus, Ohio Municipal | 515,000 | | | | | | |
| 7. Commonwealth Edison (Illinois) | 27,346,000 | | | | | | |
| 8. Commonwealth Power Corp | 17,500,000 | | | | | | |
| 9. Consumers Power (Jackson, Mich.) | A | | | | | | |
| 10. Dayton Power & Light (Ohio) | 600,000 | | | 200,000 | | | |
| 11. Detroit Edison (Mich.) | 30,164,000 | 8,862,700 | | 5,042,000 | B | 5,283,100 | 10,976,200 |
| 12. Eastern Massachusetts Electric | F 257,500 | | | 250,000 | | 5,000 | 2,500 |
| 13. Empire District Electric (Mo.) | 1,100,000 | | | | | | |
| 14. Georgia Power | H 12,755,000 | | | | | | |
| 15. Gulf States Utilities (Texas) | I 200,000 | | | | | | |
| 16. Houston Lighting & Power (Texas) | 6,242,804 | 3,254,845 | | 450,089 | 907,779 | 891,841 | 738,250 |
| 17. Illinois Electric Power (East Peoria) | A | | | | | | |
| 18. Illinois Power (Springfield) | A | | | | | | |
| 19. Kansas Gas & Electric | 3,000,000 | | | | | | |
| 20. Malden Electric (Mass.) | F 1,000,000 | | | 135,000 | 475,000 | 350,000 | 30,000 |
| 21. Malden & Melrose Gas Light (Mass.) | F 500,000 | | | | | | |
| 22. Michigan Electric Power (Thumb District) | 500,000 | | | | | | |
| 23. Michigan Electric Utilities (entire State of Michigan) | 39,000,000 | | | | | | |
| 24. Nebraska Power (Omaha) | 1,000,000 | | | | | | |
| 25 New England Power | 2,202,466 | | | 1,107,910 | | 1,094,556 | |
| 26. North Boston Lighting Properties | 1,935,500 | C193,000 | | 406,000 | 855,000 | 358,000 | 123,500 |
| 27. Northern States Power | 8,000,000 | | 1,500,000 | | | | |
| 28. Ohio Edison (Springfield) | A | | | | | | |
| 29. Otter Tail Power | 350,000 | 232,000 | D | | 118,000 | | |
| 30. Pacific Gas & Electric (San Francisco) | 22,500,000 | | | | | | |
| 31. Philadelphia Electric (Penna.) | G 12,000,000 | | | | | | |
| 32. Philadelphia Suburban-Counties Gas & Electric (Penna.) | G 6,000,000 | | | | | | |
| 33. Public Service Electric & Gas (N. J.) | 22,000,000 | | | 7,000,000 | 700,000 | 5,000,000 to 6,000,000 | |
| 34. Puget Sound Power & Light (Wash.) | 5,000,000 | 1,267,000 | | 787,000 | 1,652,000 | 618,400 | |
| 35. Salem Electric Lighting (Mass.) | F 443,000 | 180,000 | | 21,000 | 167,000 | | 75,000 |
| 36. Salem Gas Light (Mass.) (gas only) | F 82,000 | | | | | | |
| 37. San Antonio Public Service (Texas) | 750,000 | | | 750,000 | | E | |
| 38. San Diego Consolidated Gas & Electric (Calif.) | 4,000,000 | | | | | | |
| 39. Sand Springs Power & Light (Okla.), now part of Oklahoma Wt. & Pw. Co. | 2,500,000 | | | | | | |
| 40. South Texas Public Service | 150,000 | | | 150,000 | | | |
| 41. Southeastern Power & Light | 40,000,000 | | | | | | |
| 42. Southern California Edison | 32,000,000 | 5,987,000 | 5,982,000 | 3,100,000 | 2,565,000 | J | |
| 43. Southern Indiana Gas & Electric | A | | | | | | |
| 44. Stone & Webster, Inc. (Southern Texas properties) | 3,000,000 | | | | | | |
| 45. Suburban Gas & Electric (Mass.) | F 154,000 | 3,000 | | | 135,000 | 1,000 | 15,000 |
| 46 Tennessee Electric Power | A 5,000,000 | | | | | | |
| 47. United Gas Improvement and Allied Companies | 20,000,000 | | | | | | |
| 48. Hydro Electric Power Commission of Ontario | K 2,470,000 | | | | | | |

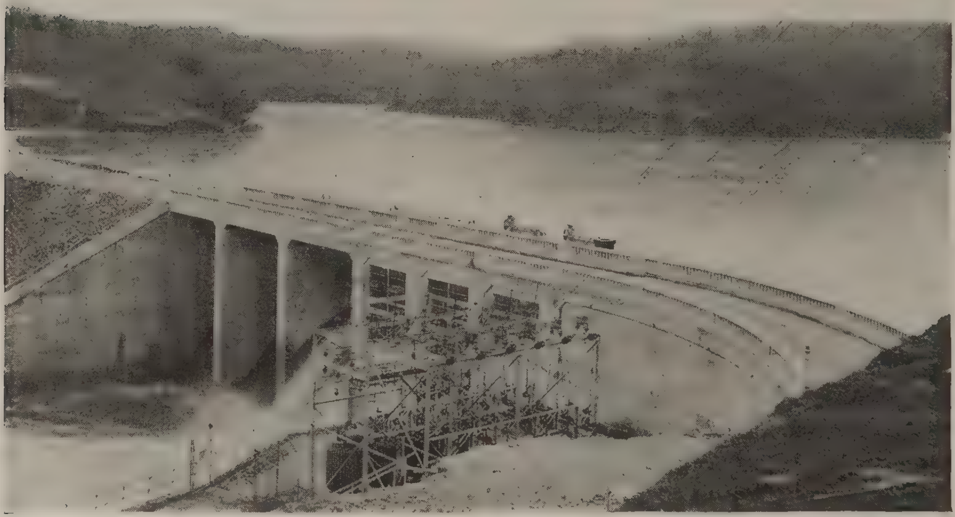
A—Included in Commonwealth Power Corporation.
B—Included in miscellaneous.
C—Includes $10,000 for general structures.
D—Included in steam.
E—Included in transmission.
F—Included in North Boston Lighting Properties.
G—Included in United Gas Improvement.
H—Included in Southwestern Power & Light.
I—Included in Stone & Webster, Inc.
J—Included in distribution.
K—Not included in U. S. total.

# Service in Rural Areas

Prairie states are interconnecting many independent properties and gradually consolidating. Load concentrations are chiefly around cities. Hydro powers have been developed to a high degree. Rural service active

### By Frank R. Innes

*Western Editor*



*Delhi station Interstate Power Company*

THE West North Central region, comprising Wisconsin, Minnesota, the Dakotas, Nebraska and Iowa, is predominant agricultural, including, as it does, the states which lead in the production of wheat, corn, barley and oats. Mineral resources exist in three of the states, but principally in Minnesota. A large share of the country's iron-ore production comes from the Mesaba Range in northern Minnesota. South Dakota contributes about 10 per cent of the national production of gold and, with its sister state to the north, has unexploited mineral resources, including petroleum.

Except in the southeastern part of Wisconsin, where a great and diversified manufacturing activity exists, the principal industries of the group are grain milling and meat packing. Milling centers largely in and around Minneapolis, while packing is chiefly concentrated at Omaha. However, these two industries are widely scattered over these states. In Wisconsin, and to a lesser degree in Minnesota, lumbering is an important activity, there being in these two states one of the few remaining stands of Northern pine. On account of the introduction of modern methods of timber production, these timber stands will remain in the productive state for many years to come.

Dairying and the manufacture of dairy products are important in the eastern part of this area, but particularly so in Wisconsin, which is rapidly earning a wide reputation for cheese production.

Population in this territory has increased nearly 6 per cent since 1920, the greatest increase having occurred in Minnesota and Wisconsin, the former adding nearly one-third and the other more than a quarter of a million.

Therefore there is not much to indicate any slacking up of electrical development in this region. And this evidence is not controverted by the facts concerning that development.

Some of the major electric utility interests concerned in these states are: The Electric Bond & Share Company, Standard Gas & Electric Company, Middle West Utilities Company, Utilities Power & Light Corporation, United Light & Power Company, American Gas & Electric Company, North American Light & Power Company, North American Company, American Light & Traction Company, United Gas Improvement Company and Engineers Public Service Company.

The Lakeside station of the Milwaukee Electric Railway & Light Company was the first large generating station to burn pulverized fuel. It was a pioneer in the use of high-pressure steam and the first large-scale studies of coal distillation in America were carried on there.

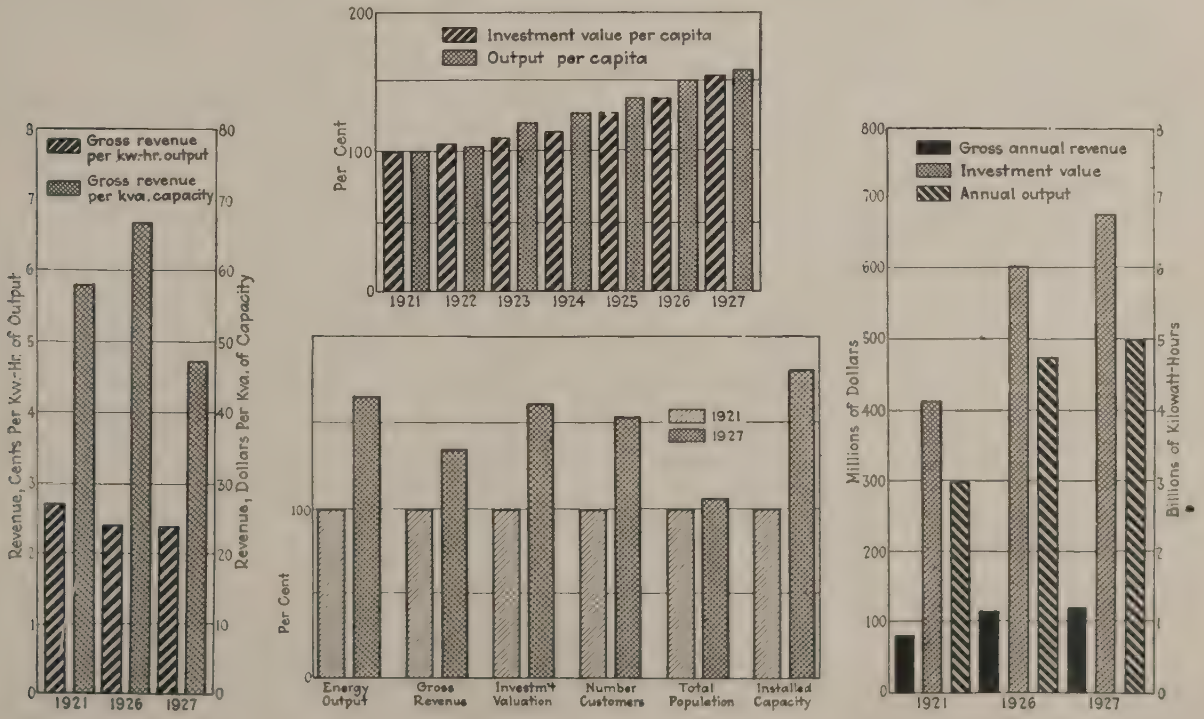
Privately operated utilities have made great progress

*Gross Revenues, Population, Generator Rating, Output and Plant Values for Six States*

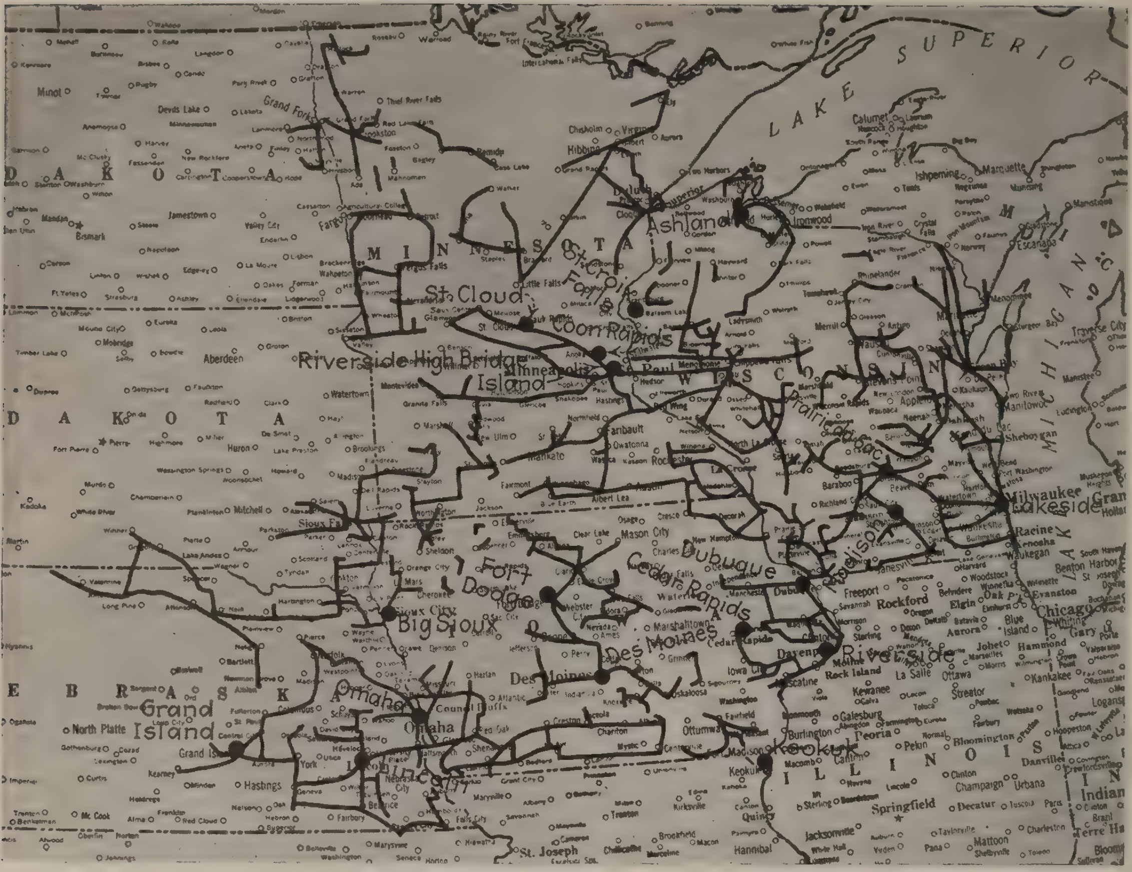
| | Gross Revenues | | Population | | Generator Ratings, Kva. | | Generated Kilowatt-Hours in Thousands | | Values of Plant and Equipment | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 |
| N. Dakota.. | $857,000 | $1,205,000 | 646,000 | 640,000 | 30,172 | 21,200 | 31,484 | 50,000 | $16,192,000 | $22,117,000 |
| S. Dakota.. | 1,394,000 | 2,023,000 | 649,000 | 696,000 | 36,912 | 35,800 | 51,264 | 84,000 | 20,608,000 | 25,724,000 |
| Nebraska | 7,210,000 | 9,980,000 | 1,315,000 | 1,396,000 | 134,527 | 176,000 | 264,729 | 414,000 | 56,120,000 | 76,855,000 |
| Iowa....... | 26,900,000 | 34,000,000 | 2,409,000 | 2,425,000 | 357,893 | 602,000 | 989,209 | 1,411,000 | 90,648,000 | 151,404,000 |
| Minnesota.. | 19,940,000 | 26,030,000 | 2,443,000 | 2,686,000 | 358,957 | 466,000 | 733,124 | 1,090,000 | 115,368,000 | 177,184,000 |
| Wisconsin.. | 24,930,000 | 46,200,000 | 2,688,000 | 2,918,000 | 483,335 | 724,000 | 916,819 | 1,919,000 | 116,288,000 | 220,143,000 |
| Totals .. | $81,231,000 | $119,488,000 | 10,150,000 | 10,761,000 | 1,401,796 | 2,538,000 | 2,986,629 | 4,968,000 | $415,224,000 | $673,427,000 |

against the local independent plant idea, whether it is expressed in municipal or private ownership. To the evidence presented by the published analysis of electricity rates before and after absorption of 62 Iowa municipal undertakings by Arthur H. Ford of Iowa City there may be added the following information furnished by F. R. Moulton of the Utilities Power & Light Corporation: "An examination of costs to the consumers served by local utilities in towns of the same population classes and in the same territory as those on the system of the Interstate Power Company shows that the privately owned central station saved $1,443,351.70 for its customers in 1927, this sum being the difference between what they actually paid and what they would have paid if they had been served from an independent plant and not from an interconnected system. In the last seven municipal plants taken over by the company the saving in electricity costs to consumers was 15.6 per cent for lighting service and 16.1 per cent for power. These figures take no account of the payment of taxes by the privately owned utility, whereas the municipal plants paid no taxes. Correcting them for this factor makes the actual savings 18.6 per cent for light and 19.4 per cent for power. That these savings will increase as time goes on is indicated by the fact that in 1927 voluntary rate reductions by the Interstate Power Company made a total reduction in customers' bills of $119,691.54."

In spite of the numerous municipal utilities in these states, or perhaps because of them, consolidation of electric properties into connected operating groups has made much progress. This progress would probably have been more rapid at first had it not been for the resistance interposed by independent utilities having a long history of prosperity and public regard, which made them reluctant to relinquish independence for the unproved advantages of consolidation. But this phase is now in the past. However, on account of the militant independence of the average municipal undertaking and the let-well-enough-alone attitude of some of the privately owned properties, base-load plants and unit planned systems are not so characteristic of these states as they are of the West and South. Instead, the systems are built up around the already established generating stations of the cities. In many cases these stations have taken on more than the local responsibility with which they started and assumed the character of base-load stations.



*North Central energy output has grown much faster than population in six years*



*Interconnections, hydro and steam plants have thrived in North Central States*

Concentration of power around important cities is not so conspicuous in Minnesota and Wisconsin, where the development of water powers has spread the systems out more. The plants of the Middle West Utilities subsidiaries on the Wisconsin River, of the Northern States Power Company on the Mississippi and St. Croix Rivers and other developments in northern Wisconsin and northeastern Minnesota have either been recently built or expanded from earlier installations at the same sites. In these two states a great many water powers were wholly or partially applied to milling long before the present era of electric power. As electric power came into use numbers of these were adapted to generation for local supply. In not a few cases it has been found advisable, from considerations of economy or policy, or both, to retain these water powers for continuous use or for stand-by when interconnected systems grew up. As a result the hydro powers of these states have been developed to a higher degree than elsewhere.

*Number of Customers in Six North Central States*

| | 1921 | 1927 |
|---|---|---|
| **North Dakota** (total) | 44,000 | 59,400 |
| Domestic | | 46,400 |
| Commercial and power | | 13,000 |
| **South Dakota** (total) | 56,000 | 69,150 |
| Domestic | | 53,900 |
| Commercial and power | | 15,250 |
| **Nebraska** (total) | 152,500 | 206,600 |
| Domestic | | 169,000 |
| Commercial and power | | 37,600 |
| **Iowa** (total) | 273,500 | 407,000 |
| Domestic | | 328,200 |
| Commercial and power | | 78,800 |
| **Minnesota** (total) | 313,500 | 476,300 |
| Domestic | | 384,750 |
| Commercial and power | | 91,550 |
| **Wisconsin** (total) | 316,000 | 564,900 |
| Domestic | | 443,900 |
| Commercial and power | | 121,000 |
| **Totals** | 1,155,500 | 1,783,350 |
| Domestic | | 1,426,150 |
| Commercial and power | | 357,200 |

Practically the only fuel used for steam generation of electricity in this region is coal, the greater part of which is brought in from Illinois and Kentucky fields. However, in Iowa and the Dakotas, also in Minnesota in lesser quantity, there are large deposits of low-grade bituminous coals and lignite. Iowa is much interested in the utilization of its local coals and a number of generating stations in the state are experimenting with burning these fuels. Not much has been done in exploiting lignite because the deposits are far from centers of power use and the national coal resources will have to be considerably more depleted than now to justify adding a freight charge to the cost of lignite.

Long-distance, high-voltage transmission of large blocks of power is not common in the north central region. However, it is used by a few utilities that operate major hydro-electric stations. The greater part of the systems in these states might be referred to as high-voltage distribution. The reason for this is that most of the systems have spread out from established nuclei by progressive extension of lines. Load concentrations at the end of long lines are infrequent; the more common condition is that of load distribution throughout the whole length of lines.

Interconnection, as a means for staggering investments in generating capacity between contiguous systems, is quite a common practice. The interconnections serve chiefly as means of exchanging reserve capacity rather than for the continuous transmission of large quantities of energy. A typical example of this class of interconnection is the 132-kv. tie between the Milwaukee Electric Railway & Light Company and the Public Service Company of Northern Illinois. This tie makes available to the systems of southeastern Wisconsin a certain part of the reserve capacity of the Chicago power pool and vice versa, both areas profiting in terms of system reserve investment even if no power were ever transmitted either way on the line.

In the western and more thinly populated part of this region the building of transmission lines is almost a direct measure of the taking over of municipal utilities and of

# *Consolidations Increase in Prairie States*

### *By Don M. Sterns*

*Vice-President Iowa Public Service Company*

ELECTRIC companies in the Middle West Division of the National Electric Light Association, comprising the states of Iowa, Nebraska, Kansas and Missouri, serve 1,617,200 customers in a population of 9,055,065. Figuring four and a half people to a family, more than seven out of nine people have electric service.

A steady and gratifying increase in production and consumption of electric energy, more and better construction of transmission lines and continuing consolidation of systems are the outstanding features of the development of the electrical industry during the past year in the Middle West Division.

The erection of new big and economical steam-generating stations and the development of new water-power projects where they are practical have added to the power available. The building of new transmission lines into hitherto undeveloped territory has carried this power to nearly every quarter of this division, and the aggressive salesmanship of member organizations has opened up new fields for consumption.

Production has increased by 622,945,000 kw.-hr. during five years, being 3,019,752,000 in 1923 and 3,642,697,000 in 1927.

During the four years ended Jan. 1, 1928, nearly a quarter of a million new customers were added to the central stations. In 1924 there were 1,386,627 and in 1927 there were 1,617,200 customers. During the year 1927 there were added 77,500 new customers. The number of customers by classes and the increase were as follows:

| | 1926 | 1927 | Increase |
|---|---|---|---|
| Domestic lighting ......... | 1,249,800 | 1,313,300 | 63,500 |
| Commercial lighting ....... | 215,000 | 224,500 | 9,500 |
| Power and miscellaneous.... | 74,900 | 79,400 | 4,500 |
| Total .................... | 1,539,700 | 1,617,200 | 77,500 |

Thousands of miles of new transmission lines have been built and the voltages of many more raised. In Iowa alone 1,000 miles of new lines were constructed in each of the past two years. It is gratifying to have the electrical engineer of one of our commissions make the public statement that the character of the construction of the transmission lines in his state far exceeds the requirements of the commission. As a result of the extension of these lines service has been extended to all of the cities and most of the towns. In my state, Iowa, 99.7 per cent of the urban population is located in cities and towns that have electric service.

Don M. Sterns

The problem of the electrification of the farms of this great agricultural district is receiving the most assiduous attention of the engineers and operators. Many thousands of dollars have been spent in research work during this time to determine how energy can be used on the farm to the profit of the farmer and the industry.

Consolidations continue, giving the small communities the benefit of vast power pools, better service and lower rates. Speaking of Iowa particularly, and the same trend is equally noticeable elsewhere in the division, the number of separate and independent operating companies in 1922 was 149. On January 1, this year, the number was 27. During the same period 79 municipally owned establishments have been absorbed by the larger Iowa operating companies. Each of these towns is enjoying a lower rate, has better and more dependable service and all the reserve power necessary for the development of new industries.

Prospects for development during the present year are gratifying and there is every reason to believe that the increase in the use of energy will continue even more rapidly than during the past.

## Economic and Social Aspects of Rural Service

"I HAVE already said elsewhere to the power companies that having, in their own interest, extended their great power transmission lines through rural communities in order to connect one city with another, they have taken on an obligation to serve the rural population of the area in which they operate. This does not mean that they can run service to the last farm or perhaps even to the last village in that district, but it does mean that the power companies must view their obligation as having both an economic and social aspect.

"The power company cannot refuse country lines because they are unprofitable. They cannot ride the economic hobby to the point where electrical service is not generally available in the community. Nor, on the other hand, can they ride the social hobby, as some visionary persons urge, to the point of financial bankruptcy. Wise human judgment must be exercised in the service of the constituency of the power company.

"Rates, so far as possible, should be simplified. The slide rule is not as unerring as the engineer sometimes thinks. The power company cannot use it as the sole guide to the social needs of a community in which human understanding and human sympathies must be mingled with economics in order to get a practical result. The power companies should recognize this kind of obligation to the farmer, should study his needs, and within every reasonable economic limitation supply his service.

"The only economic limitation is that the power companies should be permitted to secure earnings from the community as a whole which will yield a fair return on the investment of the power company as a whole. Therefore, rates should, in my judgment, be made practical for the farmer, and the Public Service Commission should co-operate and even insist upon their establishment. Some part of the savings resulting from these great transmission systems should be applied to the extension of farmers' service rather than be granted wholly to the cities in the diminution of their rate. This is advantageous to the farmer and is sound for the city."

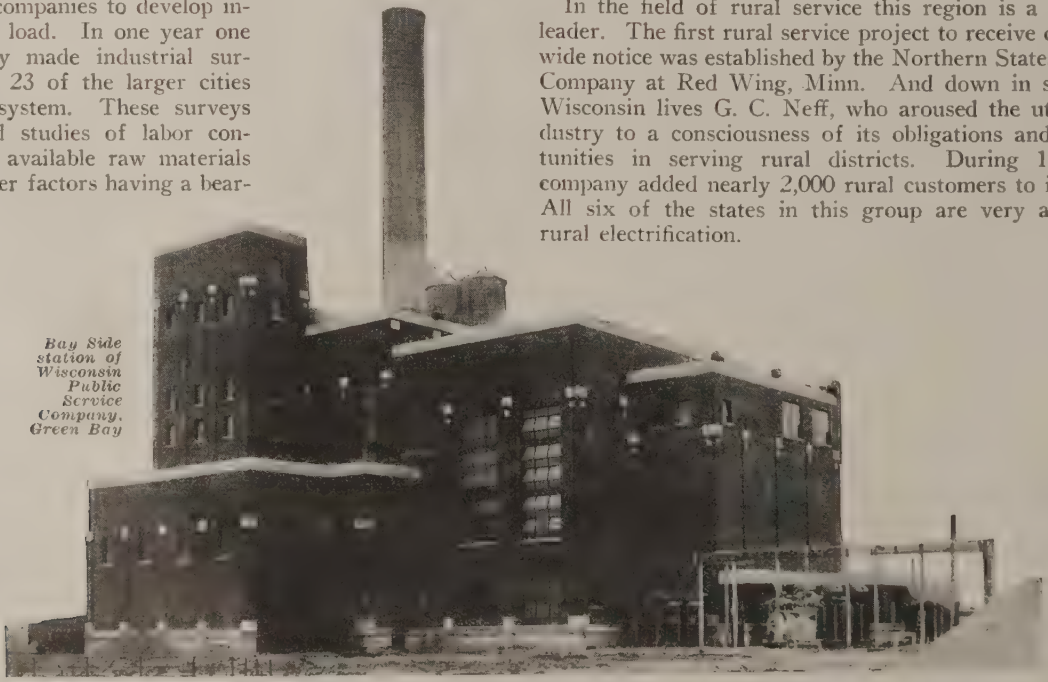
—OWEN D. YOUNG,
*Chairman of Board General Electric Company.*

the absorption of independent properties into the larger systems. The total length of transmission lines of 13,200 volts and over in these six states must approach close to 20,000 miles, of which probably not more than 15 per cent was in existence ten years ago.

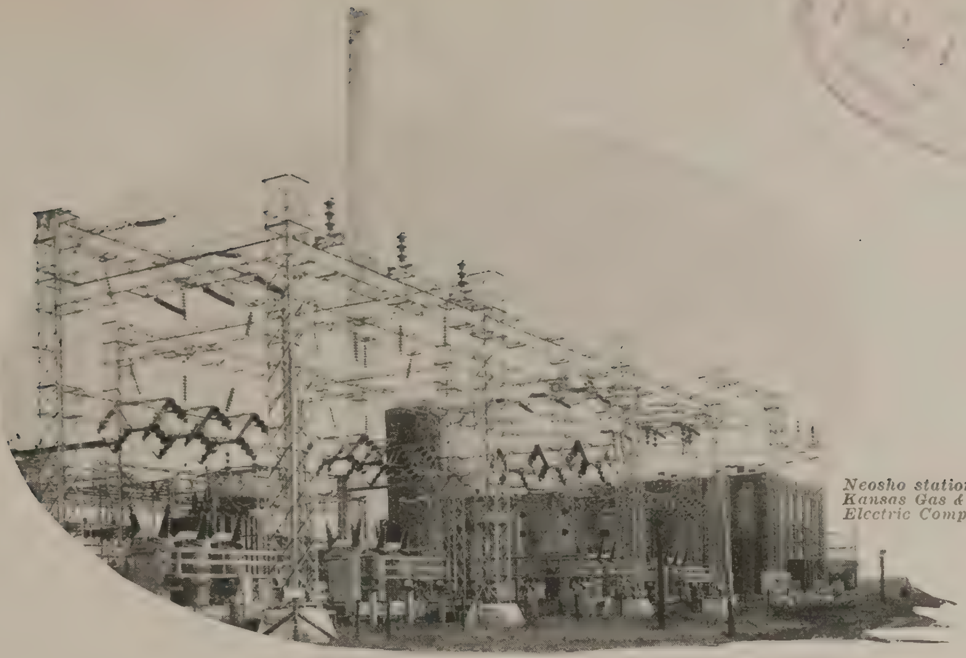
Since Nebraska includes one of the leading utility exponents of vigorous sales activity, it is almost inevitable that the utilities of this region should be thoroughly imbued with the commercial spirit. That this spirit is at work in more than the merchandising of appliances is evident from the efforts of some of the companies to develop industrial load. In one year one company made industrial surveys in 23 of the larger cities on its system. These surveys included studies of labor conditions, available raw materials and other factors having a bearing on the locations of definite types of industries. This activity is not confined to the one company.

Virtually every utility in the north central area is merchandising electric appliances as a part of its normal function. In spite of the availability of gas service in all of the cities and many of the larger towns, electric ranges are being sold in increasing numbers. Refrigerators are selling in large volume against the competition of natural and artificial ice. Water heaters apparently are coming into appreciation from both utilities and customers.

In the field of rural service this region is a national leader. The first rural service project to receive country-wide notice was established by the Northern States Power Company at Red Wing, Minn. And down in southern Wisconsin lives G. C. Neff, who aroused the utility industry to a consciousness of its obligations and opportunities in serving rural districts. During 1927 his company added nearly 2,000 rural customers to its lines. All six of the states in this group are very active in rural electrification.



*Bay Side station of Wisconsin Public Service Company, Green Bay*



*Neosho station, Kansas Gas & Electric Company*

# *Southwest*
# Accumulates Momentum

Base-load stations are large factors in power supply. Transmission networks already widely established and are still growing rapidly. Commercial activity yields tangible results

By FRANK R. INNES
*Western Editor*

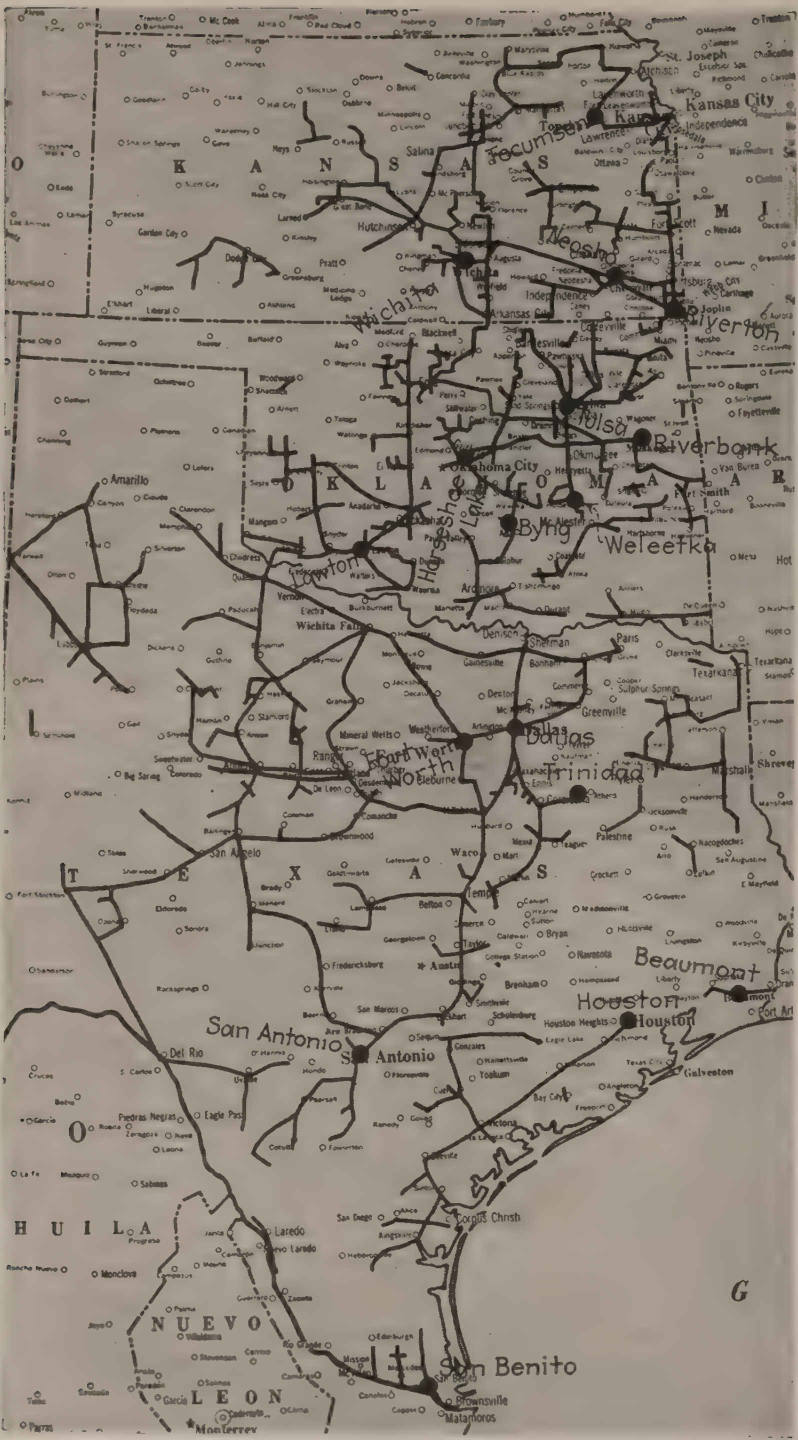
COMPARED with its status ten years ago, electric development in the Southwest has made more rapid progress than probably anywhere else in the United States. This development has been evident chiefly in extension of transmission lines, building of new generating stations or extension of old ones, spreading of service to new communities and consolidation of the smaller properties into larger ones for more economical unified service. The greatest improvements in economic and social conditions have apparently occurred chiefly in the sections where electrical development has been greatest. Regardless of whether general or electric development has forerun the other, either will stimulate the progress of the other.

Great as has been the progress of the last decade, the future is most enticing because this section has only started in its development. Many undeveloped mineral resources are waiting to be worked. The rapidity with which general development will occur will depend on the extent to which these territorial resources are made known to industrial capital, on attraction of industries to serve this great expanse which is now dependent on distant sources, continued extension of electric service and on co-ordinated participation of all business interests in making living conditions superior to adjacent sections.

The Southwestern states of Missouri, Kansas, Oklahoma, Texas, Louisiana, Mississippi and Arkansas are predominantly agricultural. The climatic range is great and the products of the soil include practically every fruit and vegetable known to the temperate zone. Cotton is common to most of these states and is easily the most important product of this territory. Industrial activity is more closely associated with the extraction of raw materials from the earth and with their preliminary processing than with the manufacture of finished commodities. Industry is growing more and more rapidly as new people come in. The population has increased 7½ per cent in six years—a gain of more than one and one-third millions.

As in other regions, electrical development here is not largely and directly affected by agriculture. However, the basic economic conditions determined by agriculture must be taken into account.

The production of wheat and corn in Missouri, Kansas, Oklahoma and in parts of the other states in this region amounts to about one-fourth of the total for the country. Cotton, rice, sugar cane, sorghum and a host of other



*Trinidad station burns lignite, Wichita and Dallas natural gas, Neosho uses stokers, and many plants are oil fired*

products make this territory of prime importance in the agricultural picture of the United States. Arkansas and Louisiana are leaders in pine lumber production, and the timber resources of the other states, such as Texas and Oklahoma, are considerable.

The mineral and allied resources of the region are tremendous. Oklahoma, Texas, Kansas and Arkansas are richly dowered with petroleum. Remarkably diversified mineral deposits also exist. Some are being worked, but most are not being developed at all. In the worked class are the zinc and lead deposits of Missouri and coal in some parts of Kansas and Oklahoma. Among the latent mineral riches of this country are the marble strata of Arkansas and the sulphur, graphite, quicksilver, diatomaceous earths, asphalt, lignite and the rare metals in Texas, Louisiana, Arkansas and Oklahoma.

During the past ten years the Southwest has been the scene of a widespread demonstration of the virtues and advantages of that politically criticised practice electric utility consolidation. Little evidence can be found that consolidated control and operation has been other than distinctly beneficial to the component utilities and the economic progress of the region in general. The great distances, the comparative smallness of communities, the frequent difficulties of obtaining adequate fuel and water for electric generation—all these and many other considerations make the Southwest an ideal territory for concentration of power generation at a few strategic points and for transmission to markets unfavorably situated for local or nearby generation.

One organization covers a major part of the states of Arkansas, Mississippi and Louisiana. Another spreads over as much of Texas as would comfortably contain four or five New England states.

The electric utility interests most largely represented in this region are the Electric Bond & Share Company, the Middle West Utilities Company, the Standard Gas & Electric Company, the Community Power & Light Company, the Cities Service Company, the North American Company and North American Light & Power Company.

State summations of generating capacities do not give a true conception of development in the Southwest, because scores of small plants are included, the total capacities of which amount to respectable figures. Many changes have involved the replacement of small plants by a few large generating stations, resulting in much higher system efficiencies. Some of these newer stations are: Tecumseh, Neosho and Wichita, in Kansas; Horseshoe Lake, Weleetka, Byng and Tulsa, in Oklahoma; Trinidad, San Angelo and San Benito, in Texas; Sterlington and Arsenal Hill, in Louisiana, and Remmel, in Arkansas.

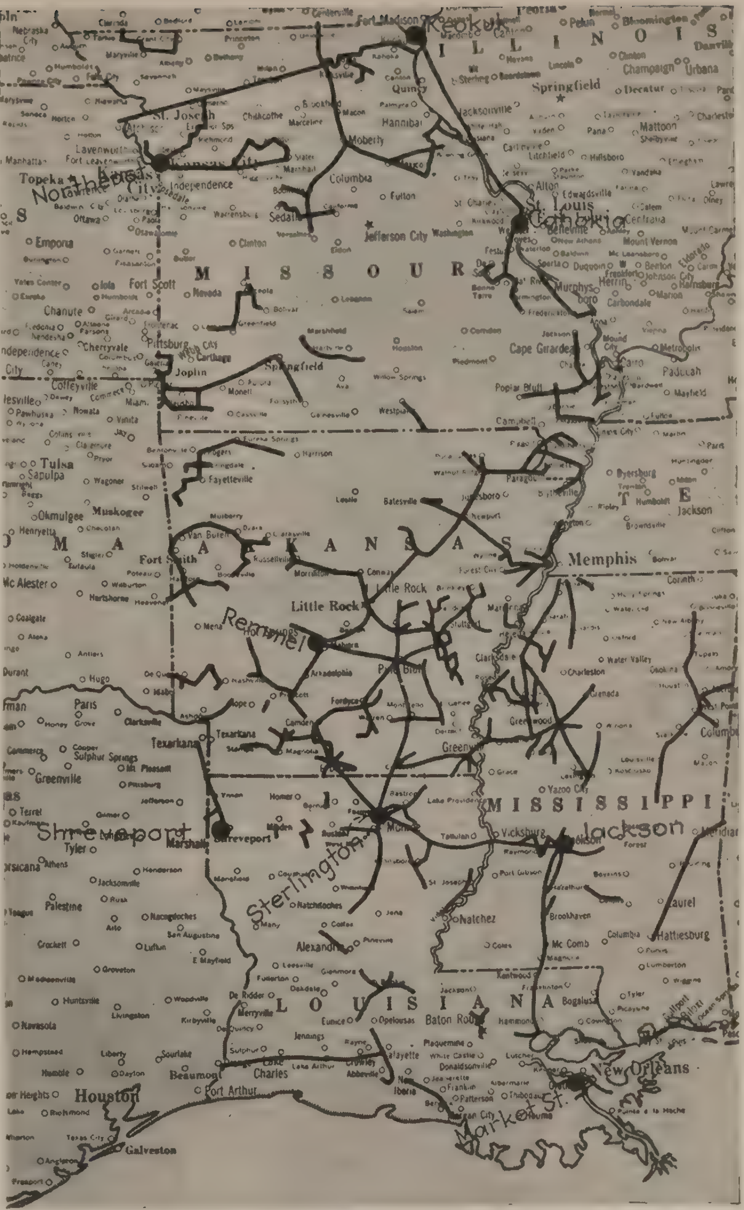
Considering new developments in steam plant design, the 10,000-kw., 1,500-lb. turbine at the Northeast station of the Kansas City Power & Light Company should not be overlooked. This machine will exhaust to the 350-lb. steam header. A project now under discussion by this company contemplates the installation of additional capacity in the recently absorbed 180-lb. street railway generating station, to operate at 700 lb. and exhaust into the 180-lb. header.

Among the stations in the Southwest, as elsewhere, there is wide divergence in fuels used and methods of firing. Pulverized coal systems, both unit and storage type, are to be found, as well as stoker installations. Neosho uses stokers on the new boilers; natural gas is burned at Wichita, Dallas, Sterlington; Trinidad uses powdered lignite, and a number of stations are oil fired. The performances of these stations over long periods average in the neighborhood of 18,000 B.t.u. per kilowatt-hour.

Most of the new stations are operated wholly on base load, the fluctuations being taken by the older and smaller plants remaining in the systems. Owing to the capacity effect of long transmission lines, power factor is easily maintained at close to unity. On one property the base-load station operates on Sundays and holidays at full kilovolt-ampere load and a leading power factor of 25 or below.

The amount of hydro power is not great in this region in comparison with the rest of the country. However, in the Ozark area in Missouri and Arkansas there are a number of promising hydro possibilities. Only one major project, at Remmel, Ark., has so far been developed. Above Remmel, on the Ouachita River, another project is under construction, and in the past few months the Insull interests have become associated with a projected development in Missouri. Texas also has a number of hydro power sites, some already developed and one on Devil River now under construction.

Of the present transmission network in this territory, probably not more than 10 or 15 per cent was in existence ten years ago. The increase of transmission mileage is due largely to the consolidation of independent properties, interconnection of contiguous systems, and development of natural resources, such as oil fields, mines, and quarries.



*Northeast station uses 1,000-lb. steam; Remmel is a hydro plant; Sterlington burns natural gas*

Although the systems in Missouri and Kansas are extensively tied together they are not so far flung as those in the five other states. Texas, for all its immensity, is practically covered by a continuous system of transmission lines. Oklahoma is crossed and recrossed with what amounts to a single transmission system, although quite a number of different companies are represented in ownership and operation. Extending north and south through Louisiana and Mississippi are the legs of a system that centers in Arkansas and nothern Louisiana.

A striking example of the value of interconnections between systems is furnished by the development of oil field load in Oklahoma. It also indicates a tangible value of holding company operation. At the beginning of the spectacular oil field rush of 1926-27 in Oklahoma it was not expected that the load would assume extraordinary proportions and no unusual provisions were made for it. But the success of the first few installations inspired more intensive and extensive selling effort and also caused a large number of oil operators to decide for themselves that they were going to have electric service if they could possibly get it. The result was that the peak demand on the utility system almost doubled inside of one year. Before the utility could increase its generating capacity it was imperative to supply energy from interconnected systems to the north, east and south. Meanwhile, the engineering and financial facilities of its parent company enabled the Oklahoma Gas & Electric Company to erect a new power plant and put it on the line in 85 days.

*Population, Gross Revenues, Plant Values, Generating Capacity and Output for Seven States*

| | Population | | Gross Revenues | | Values of Plant and Equipment | | Generated Kilowatt-Hours in Thousands | | Generator Ratings, Kva. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 | 1921 | 1927 |
| Missouri. | 3,421,000 | 3,510,000 | $22,650,000 | $26,230,000 | $138,368,000 | $251,658,000 | 722,320 | 957,000 | 477,493 | 407,000 |
| Kansas | 1,782,000 | 1,828,000 | 13,050,000 | 20,980,000 | 83,536,000 | .121,681,000 | 415,230 | 806,000 | 179,288 | 342,000 |
| Oklahoma ..... | 2,062,000 | 2,384,000 | 6,740,000 | 15,240,000 | 52,513,000 | 86,552,000 | 214,618 | 586,000 | 125,194 | 202,100 |
| Texas.......... | 4,770,000 | 5,397,000 | 23,700,000 | 49,200,000 | 113,160,000 | 248,412,000 | 755,160 | 1,892,000 | 280,541 | 650,200 |
| Louisiana. | 1,824,000 | 1,934,000 | 7,380,000 | 17,100,000 | 32,417,000* | 55,629,000 | 235,091 | 657,000 | 105,205 | 226,200 |
| Mississippi..... | 1,790,000 | 1,790,000 | 1,939,000 | 1,743,000 | 15,235,000 | 24,292,000 | 61,806 | 67,000 | 51,466 | 27,000 |
| Arkansas. ..... | 1,783,000 | 1,923,000 | 3,905,000 | 5,380,000 | 34,788,000* | 43,806,000 | 124,452 | 207,000 | 71,132 | 71,500 |
| Totals | 17,432,000 | 18,766,000 | $79,364,000 | $135,873,000 | $545,709,000* | $832,030,000 | 2,528,677 | 5,262,000 | 1,290,319 | 1,926,000 |

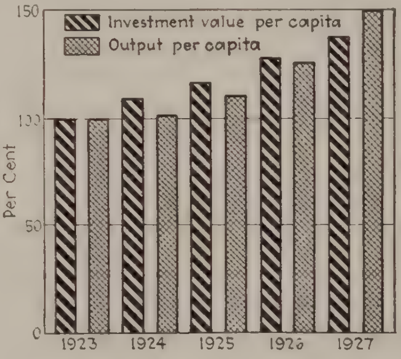
*No figures for 1921—these refer to 1923.

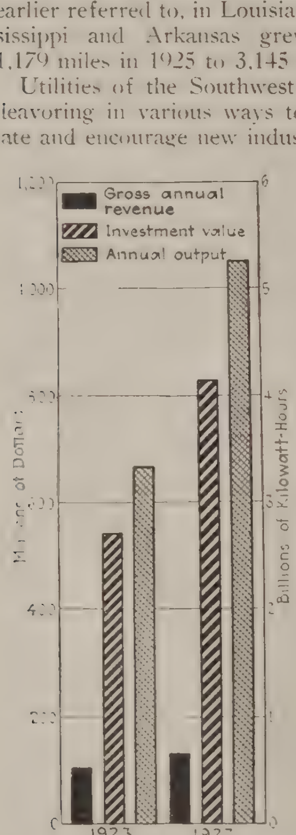
Between 1923 and 1927 the number of electric customers increased 14 per cent, to 97,168, but the connected load rose 100 per cent, to 254,476 kw., and the kilowatt-hour output skyrocketed 250 per cent, to 399,543,412, virtually 50 per cent more than the year before. The last two figures indicated the high load factor of the oil field load. To serve this load transmission lines had to be extended very rapidly. In 1923 there were 585 miles of line, whereas in 1927 there were 1,951 miles, 542 miles more than the year before.

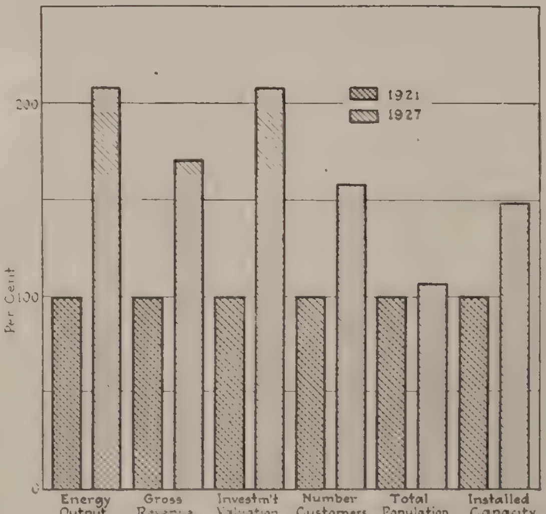
Other large systems of Oklahoma, Texas, Louisiana, Arkansas and Kansas can show similar records of growth. For example, one group of connected properties in Texas shows an increase of transmission mileage from 2,068 in 1925 to 5,296 in 1927. The system, earlier referred to, in Louisiana, Mississippi and Arkansas grew from 1,179 miles in 1925 to 3,145 in 1927.

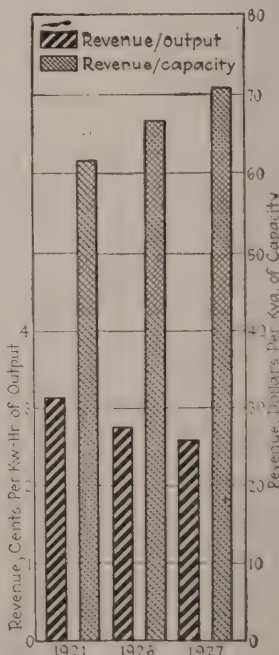
Utilities of the Southwest are endeavoring in various ways to stimulate and encourage new industries, to persuade new people to come into the region and to further their economic progress in every way. This work is done by all forms of publicity and sometimes by monetary help.

Practically all of the central stations in this territory have committed themselves to aggressive merchandising. Campaigns, house-to-house solicitation, special opportunities and other methods of getting the load on the lines flourish. Some companies have had rather disagreeable experiences with high-pressure selling, but the general opinion is that the fault was in the lack of control rather than in the method. In one Texas city domestic merchandise sales were pushed up to more than $40 per customer in 1927; a Kansas town reached $27. Sales of electric ranges are hampered in some localities by the cheapness of natural gas, which costs as low as 10 or 15 cents per thousand cubic feet of 1,100 B.t.u. gas. Refrigerators have had a wide sale on account of the long summer period and the difficulty, particularly in the small towns, of securing ice.









*Increased investment per capita and reduced revenue per unit of output show Southwestern contribution to public*

# *A Decade of Utility Progress*

*By Joseph F. Porter*
*President Kansas City Power & Light Company, Kansas City, Mo.*

*Joseph H. Porter*

ELECTRICITY has played a wonderful part in the development of our country in the past ten years. There has hardly been in that period an industrial achievement of any kind to which electricity has not contributed in an important degree. It is one of the very few commodities, to my knowledge it is the only one, that has steadily decreased in price to the user, while other costs for material and labor have as steadily increased. With the exception of the farming population, and the job of bringing electric service to this group is going along with rapidly growing momentum, there is hardly an individual in the United States who has not, or cannot have if he wants them, all the benefits, comforts and conveniences that electricity brings to its users. The use of electricity in homes has been extended far beyond the expectations of former years, although as yet that use has nowhere approached its limit. The average residence consumption not so long ago was about 180 kw.-hr. per year; today it is 425—an increase of 136 per cent. This indicates the great possibility latent in the residential load, and a signal accomplishment of the last ten years has been the comparatively recent appreciation of the tremendous potentialities of that load. It has been no small achievement of the industry to convince its members of the potential importance of the residential load and that electricity could be used in the home, profitably to both customer and utility, for more than a few lights. The greater achievement of complete development of domestic electric service still lies ahead of us—ten, twenty years, who can say?

I have spoken first of electricity in the home because that affects more people than any other application and because it is relatively a new thing with us and because while the sum of our efforts in this direction to date has seemed large to us, it is small in comparison with what there remains for us to do. In the applications of electricity to commercial uses there has been much progress, progress not only in the greatly increased consumption of energy for common and familiar uses, but also a remarkable widening of the field of application. While mechanical power remains the most important outlet for electric service in industry, there have been many new applications that were unknown or little considered ten years ago. Chief among these newer uses is industrial heating, a field of service that according to some men who speak with real authority will eventually make the power load seem small in comparison.

In support of the foregoing general remarks there can be instanced the progress of the city and company with which I am naturally most familiar. In 1918 the peak load of the Kansas City Power & Light Company was 26,400 kw.; in 1928 it is, so far in the year, 120,806 kw., an increase of 458 per cent. In 1918 the energy generated amounted to 118,192,608 kw.-hr.; in 1928 it will be nearly 500,000,000, an increase of more than 400 per cent. In 1918 unaccounted for losses were 18.52 per cent; in 1928 they are 11.26. Taking into consideration this 39 per cent reduction in losses, the amount of energy sold in 1928 will be about six times the amount sold in 1918.

The past ten years in Kansas City has seen many changes in the generation and distribution of electricity. These changes have been the milestones of definite economic progress in the community. Among them are listed the replacement by many incandescent lamps of the few sputtering arcs that were only a short time ago the best that could be used for street illumination; the installation of transformer substations in residence districts in place of noisy converting machinery; the changing of the power system from 25 to 60 cycles; the building of a large new generating station; automatically operated substations installed throughout on both alternating- and direct-current distribution systems, and a host of minor improvements. All of these changes have been made with the single view of producing a more reliable service at a lower cost to the consumer because it is good business to do so.

These figures and this information on the Kansas City utility are not given because this company has performed exceptionally well in the past ten years. Some companies have done better and, by the same token, some have done worse. But there is no intent at comparison here; it is only desired to show the general progress by a specific instance. Looking back over ten years, the record of the power and light industry has been one of constant progress, efficient operation and fair treatment of customers and stockholders. Any company or industry that lives by these policies has built on a secure foundation. Adherence to these policies assures our continued success in the future. The increasing use of electricity in the home, on the farm, in industry and by the railroads is evidence of the development yet to come. Electricity is the most efficient, economical and convenient source of power. So long as it holds this position and so long as the business of its supply is managed according to the policies here recited the future holds for us continued development and continued success.

# Letters from Our Readers

## *Matter and the Senses*

*To the Editor of the* Electrical World:

In regard to the interesting editorial entitled "What Is the Atom" in the April 28 issue of the Electrical World I should like to submit the following comment, in the hope that you may find it worthy to publish. Perhaps confusion exists in regard to the terms matter and energy, and in order to clarify these concepts it is necessary to consider human sense perception. Is it not well agreed that there are planets of varying size, then bodies, substances, molecules, atoms and electrons? Are there not electrons in atoms, atoms in molecules, molecules in substances, substances in bodies?

Why not go on and reasonably argue that the electron is probably divided into smaller units, magnetrons, for instance. Just as electricity is the expression of moving electrons, then magnetism is the expression of moving magnetrons! Light is then moving electricity (electrons) in matter. Daylight is moving electricity in the earth's atmosphere. Heat is then moving magnetism in matter, especially in solid matter!

What is matter on the above basis? Matter is locked-in energy perceived through the human senses directly or aided with instruments! The electron is matter since it was identified through the oil drop experiment of Dr. R. A. Millikan. Matter is real because it is perceived through the senses unaided, as in the case of bodies and substances. Matter is real because it can be perceived by the human senses through the use of instruments, as in the case of planets, molecules, atoms and electrons!

What is energy on the above basis? The higher manifestations of energy are unlocked matter not humanly perceived, yet to be controlled, relocked into matter and put to work for mankind. Lower manifestations of energy are partially unlocked known matter.

For instance, solar energy is unlocked, unknown sun matter. Heat energy from a wood fire is unlocked known matter—wood. In the first case, the control that unlocks the energy is unknown to us. In the second case, the control is in the hands of mankind and involves fire and the process of combustion (oxidation). No one knows when fire was first started, but some one obtained the idea, from some source, of rubbing two sticks together. In other words, Prometheus stole fire from the Gods!

Ordinary matter is locked-in energy whose rate of radiation is so slow, from the standpoint of human sense perception, that the radiation is unperceived. For instance, a sheet of glass is matter which is locked-in energy. The radiation rate of this locked-in energy is too slow to be humanly perceived.

Higher orders of matter, for instance radium, are locked-in energy whose radiation rate is perceived by the human senses. All matter radiates energy; in other words, it is slowly or rapidly unlocking! The unlocking of energy from matter—energy radiation—and relocking of energy into matter again are all relative actions involving time and human sense perception. The higher orders of energy unlock and relock the lower orders, thus deforming and reforming matter. The control of this action is slowly vouchsafed to mankind in measure as such control is merited! C. L. Kasson.

1165 Massachusetts Avenue,
Boston, Mass.

## *Dividends Paid on Profits, Not Volume*

*To the Editor of the* Electrical World:

The article "Profit vs. Volume in Pricing," by W. L. Churchill, that appeared in the March 24 issue of the Electrical World has proved of interest to us as it must to every company engaged in present-day competitive selling. Many of us have fallen into the habit of thinking that business is good or bad depending on whether it is ahead or behind last year's volume. Let two business men meet and the first question is, "How's business?" and the next is, "How does it compare to last year?" How many times have you heard one business man ask another, "How're profits?"

Trying to beat last year is the great American business game, and it's quite worth while if the players will only remember to keep their eye on the ball of "Profits." When business becomes a mad scramble, as I am afraid it has, after volume, let profits fall where they may, we are headed for trouble.

Purchasers wise in the lore of tendencies, sensing the fight for volume, dangle large orders before salesmen and the lure is a "better price." The better price is always a lower price and a lower price is very often a profitless one, but, rather than a lost order, a lost profit is accepted. And so business finds itself in what may prove to be a vicious circle. Very often the purchaser is blamed because he takes advantage of a buyer's market and drives a neat bargain, profitless though it may be. And yet the purchaser is out to buy at the lowest figure and can never be sure the figure he has before him is the lowest until he tries the salesmen to find out. And the salesman, driven for volume and his company striving for the same thing, cuts and cuts, until there's no profitable margin left.

The purchaser must realize that after all is said and done business to be mutually profitable must be done on a live and let live basis. He must have confidence in the companies he wants to do business with and, having that confidence, concede to those companies a fair profit on the merchandise he buys, just as he expects to make a fair profit on the merchandise he sells. This thought is admirably summed up in a recent advertisement of the Western Electric Company. Speaking of itself as a buyer of the Bell System, it says: "It (the Western Electric Company) must buy at prices which are fair to the Bell System. It must buy at prices which are fair to the seller, because he must be able to continue in business and prosper, to remain a reliable source of supply."

If every purchaser of electrical equipment in this country had a platform of that character, most of the ills spoken of by Mr. Churchill would disappear.

The seller, too, should have a platform. He should throw away his target of volume and drop his sights to profit. He should, as he does, charge a fair price for his goods and his service and take no business that returns no profit. That may be Utopia, or may be achieved in the millennium. I think it will be achieved when shrinking yearly profit balances will drive business to the realization that following blindly after volume is following the will-o'-the wisp that can lead only to disaster.

We in our company are trying to build a business on payment received for service rendered and merchandise delivered. We know that dividends are and can be paid only on profits, not volume. Albert L. Salt,

Graybar Electric Company, President.
New York City.

# Digest of Electrical Literature

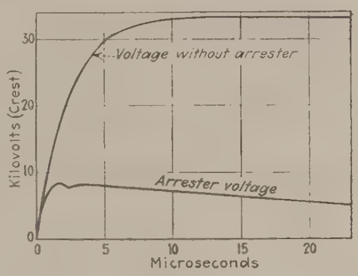
## *Generation, Control, Switching and Protection*

*Heat Losses in Direct-Current Armature Conductors.*—W. V. Lyon, E. Wayne and M. L. Henderson.—The authors have endeavored to indicate that it is incorrect to assume, while there are extra losses in the armature coil of a direct-current machine when it is undergoing commutation, that during the major portion of the time, since the current is steady, the loss in the coil is correctly computed by squaring the value of the current and multiplying by the true or ohmic resistance of the coil. The disturbance in the coil current produced by the process of commutation persists throughout the cycle, so that at no time is the current uniformly distributed over the cross-section of the conductor. Although the disturbance and resulting extra loss factors are greatest during commutation, the extra losses are present at all times, even while the current in the coil is steady. The procedure for determining extra losses is given and the case involving several coils side by side is likewise considered. It is also suggested that it is more important to laminate and properly arrange the armature conductors of a large direct-current generator than it is to do so in the case of an alternating-current machine.—*Serial No. 552 Publications from the Massachusetts Institute of Technology,* March, 1928.

*Protection of Supervisory Control Lines.*—Edward F. W. Beck.—Supervisory control lines used in the remote or automatic control of electric plants are subject to overvoltages dangerous to insulation and to operators. These overvoltages may be caused by lightning, crosses with the power lines or induction from them. Open wire control lines are influenced by all of these, cables with grounded sheaths are immune to disturbances caused by lightning or other electrostatic induction and are more or less safe from crosses. The ordinary cable is still subject to high voltages by electromagnetic induction when a fault occurs on the power line. These voltages may be dangerous not only to apparatus but also to the cable insulation. Protection by means of lightning arresters is therefore necessary. Calculations show that even if the apparatus locations are protected, high voltages may occur along the lines if the transmission line fault is between stations. This may cause a cable failure, so that it is advisable to protect the cable at certain intervals. Supervisory control protectors may be called upon to discharge heavy currents of appreciable duration. This requires extremely sturdy arresters and the conditions are met by a spark gap of a special design operating in argon at a reduced pressure. The author suggests that specially made cables will shield the line from extraneous disturbances and that in large installations such precautions may prove desirable.—*Journal of the American Institute of Electrical Engineers,* May, 1928.

## *Transmission, Substations and Distribution*

*Protection of Station Equipment on High-Voltage Transmission Lines.*—K. B. McEachron.—An interpretation of the effect of transient voltages on transmission lines and transformers has been undertaken by the author. Extensive consideration has been given to: Impulses due to overvoltages induced by lightning; insulator flashover characteristics and phenomena; the insulation of lines and transformers, and to lightning arresters both as regards the line and location for best results. The author concludes that in designing a high-tension system careful consideration must be given to all of the factors affecting the protection of the system against lightning. The effect of high towers, long spans, high line insulation, transformer and bushing strength and a proper relation and balance of the values involved must be considered so that no part of the system will be unduly stressed.—*General Electric Review,* May, 1928.



*Effect of lightning arresters on voltage-time characteristics*

## *Hydro-Electric Development and Steam Equipment*

*Characteristics of Modern Stokers.*—F. H. Daniels.—The characteristics demanded of modern stokers and the manner in which these requirements are met by the travelling grate and multiple-retort underfeed types has been outlined in a discussion of the several methods of securing the desired results. A consideration is offered of the plans for securing air control along the length of the retort and of duplex firing of multiple-retort underfeed stokers. The advantages of utilizing water tube furnace walls has been considered and the economic considerations involved in their application to generating station use have been reviewed. In connection with the duplex firing scheme involving the use of pulverized fuel and stoker feed in the same combustion chamber it is stated that the only increase in cost would be the price of the unit pulverizer and burner and that this would easily justify itself by reason of the increased capacity obtained from the boiler during peak hours. The tendency of the stoker to show a large drop in efficiency at high capacity would be largely offset and it would not be necessary to sacrifice economy to get capacity.—*Transactions of the American Society of Mechanical Engineers,* January-April, 1928.

*The High Cost of Fuel Saving.*—W. Trinks.—A comparison of the progress in engineering with the tendency toward fuel saving is offered by the author. Some of the reasons for hesitating to adopt new equipment that will save a large percentage of fuel wasted by the older methods are pointed out. It is indicated that in most cases it is less expensive in the long run to retain the old equipment than to install the latest types with their economies. Mention is made of analogous practices in other fields.—*Transactions American Society of Mechanical Engineers,* January-April, 1928.

## *Units, Measurements and Instruments*

*The Flow of Viscous Liquids Through Pipes.*—A series of charts for use in examining the various factors involved in the flow of viscous liquids through pipes is presented in this discussion. One permits the determination as to whether the flow will be viscous or turbulent, another develops a stream-line consideration, and the other two, which are particularly applicable to turbulent conditions, may be applied to graphical determination of the several terms in the equation developed by Prof. C. H. Leeds for such work.—*Engineering (England),* April 27, 1928.

*Demand Metering Equipment.*—Stanley Stokes and Leslie V. Nelson.—The authors have considered the special applications involved in the development of demand metering equipment. Public utilities supplying electric power are continually finding themselves confronted by problems a little different from anything in the past. New interconnections with superpower plants, and transmission lines often present involved metering installations. The one herein described has to do generally with such a condition and specifically has to provide for metering the simultaneous composite demand of an ultimate installation of 48 separate feeder circuits. It is believed that this is the largest installation of its kind so far attempted. The importance of this particular job required a very exacting study of all of the factors and the operating results to date appear to be entirely satisfactory. A novel scheme has been incorporated in the daily routine of handling the demand meter tapes. A general description of this is given and a few details of the physical installation are cited, which show the extreme care used throughout the whole installation. While this application is specifically designed for metering, the principles involved are applicable to numerous other uses, some of which are mentioned.—*Journal of the American Institute of Electrical Engineers*, April, 1928.

### *Motors and Control*

*Power Requirements in Cotton Mills.*—H. H. Bodge.—The power requirements in the various phases of cotton mill activity are reviewed in connection with process characteristics. A tabulation of the power requirements for the many types of machines required for this work has been included.—*Electrical News (Canada)*, May 1, 1928.

### *Heat Applications and Material Handling*

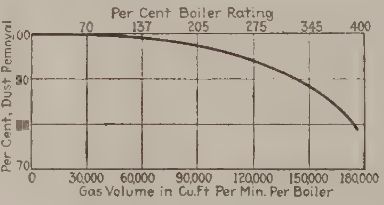
*Industrial Electric Heating Installations.*—The Industrial Heating Committee of the N.E.L.A. has issued a serial report superseding previous publications issued by the same division. The heating operation, product, plant, heating equipment, size, insulation, operating temperature, heating cycle, load in pounds, pounds per kilowatt-hour, the form of heating replaced by the electric application, the responsibility for the installation and the manufacturing results, user and central station factors, and several others, are considered for a number of installations dealing with the melting of metal, hardening and carburizing, annealing and normalizing, tempering, handling of vitreous enamel, baking of enamel and Japan and the baking of cores, and miscellaneous installations.—*Report National Electric Light Association*, April, 1928.

*Arc-Welded Steel-Frame Factory Building.*—Frank P. McKibben.—In connection with a description of the construction methods used in erecting an electrically welded steel-frame factory building, the author has suggested that this process is to be recommended for general use in the welding of bridges and buildings, but that application should be confined to responsible designers, fabricators and engineers who may apply it only where it has well-defined advantages over any other known method of building and who will exclude it where not suitable. Several problems arising in connection with such work are mentioned, including the necessity for securing building codes which will permit the use of welded construction, the need for a simple, practical series of accomplishment tests for use in employing welders on important work, more extensive use of jigs in fabricating shops to reduce cost of assembling, automatic welding machines depositing continuous or intermittent fillets which should be further developed to reduce construction cost and detail standardization which should be effected to facilitate the adoption of structural welding practices to general use.—*General Electric Review*, May, 1928.

### *Electrophysics, Electrochemistry and Batteries*

*Electroplating on Aluminum and Its Alloys.*—Harold K. Work.—It is stated by the author that electroplates of most metals on smooth aluminum surfaces are of doubtful value unless heat treated. Plating on a roughened surface is recommended as being a practicable procedure. Methods of plating the common alloys are given. A dip is described for commercially pure aluminum which roughens the aluminum and simultaneously forms an immersion layer on the surface. For alloys containing an eutectic network, a dip which attacks one constituent of the network is advised. Where strong alloys are plated an excellent product is easily obtained, providing the alloy has been subjected to the usual heat treatment to develop its strength.—*Report of American Electrochemical Society*, April, 1928.

*Electrical Precipitation.*—A. Grounds and H. W. C. Henderson.—A general outline of the several methods of securing electrical precipitation of solid material in gaseous suspension is considered by the authors. Practical applications to industrial problems and to the elimination of the dust from stack gases are given. The efficiencies and the practices adapted at the generating station of a large utility are outlined in connection with this discussion.—*Electrical Review (England)*, April 20, 1928.



*Efficiency of dust removal at pulverized fuel plant*

### *Telegraphy, Telephony, Radio and Signals*

*Propagation Characteristics of Sound Tubes and Acoustic Filters.*—W. P. Mason.—The process of measuring the propagation characteristics of uniform sound tubes and acoustic filters is complicated, according to the author, by the reflections which may occur at the ends of these structures. The present discussion applies some theoretical considerations in connection with the effect of these reflections. In making the measurements, the testing device involved is inserted in an acoustic transmission system, and the resulting changes in the magnitude and phase of the transmitted wave are measured. The actual observations are made in electrical circuits connected with the terminals of the acoustic system by loud speakers. The impedance of the acoustic system at the point of insertion is made an acoustic resistance. For measurement on straight tubes, these resistances as used are of such value as to prevent any appreciable reflections from the ends of the tubes. The results of the measurements indicate that the Helmholtz-Kirchoff law is invalid, while the results of measurements on acoustic filters are in good agreement with the theoretical results previously obtained.—*Reprint B-295, Bell Telephone Laboratories, Inc.*

*Electrical Measurement of Communication Apparatus.*—W. J. Shackelton and J. G. Ferguson.—A description of precision high-frequency measurements of a fundamental type, with special emphasis on measuring circuits rather than on the types of apparatus measured. Standards of frequency, resistance, capacitance and inductance are briefly discussed. Bridge measurements are described for the measurement of frequency, inductance, effective resistance, capacitance, dielectric loss, capacitance balance and inductance balance. Circuits for the measurement of other high-frequency characteristics such as attenuation, gain and cross-talk are included.—*Reprint B-294 Bell Telephone Laboratories, Inc.*

### *Miscellaneous*

*A Metallographic Study of the Path of Fatigue Failure in Copper.*—Herbert F. Moore and Frank C. Howard.—The study of the failure of metals under repeated stress, commonly known as fatigue, has usually been carried on by means of mechanical tests of strength. The present investigation involves the metallographic examination of the nature and mechanism of the progressive fracture which apparently constitutes fatigue failure. As a result of this investigation the authors conclude that etching with concentrated nitric acid brings out the intra-granular structure consisting of laminas separated by planes especially sensitive to chemical attack; specimens of rolled copper, subjected to repeated flexure until a fatigue crack develops, show a surface disturbance of the metal in the vicinity of the crack; the surface disturbance is visible in micrographs of unetched specimens by lines; the rolled copper tested had in it so few inclusions that any tendency of the crack to take a course from inclusion to inclusion was not in evidence, and that specimens of rolled copper etched after the development of a fatigue crack showed no evidence of any change in crystalline structure and that after the surface had been eaten away by the etching reagent the disturbed region in the vicinity of the crack was much less in evidence than on the unetched surface.—*University of Illinois Bulletin*, May 15, 1928.

# News of the Industry

## N.E.L.A. Program in Final Form

*O. W. Knauth, Department-Store Merchant, and C. E. Paige, Gas-Company Official, Added to Those Who Will Address the General Sessions*

COMPLETING the program of the National Electric Light Association as printed in the ELECTRICAL WORLD last week (page 1031), there will be two addresses not previously included—one on "Fundamentals of Electrical Merchandising," by Oswald W. Knauth, vice-president R. H. Macy & Company, New York, to be given at the second general session, on Wednesday morning, June 6, and the other on "Accident Prevention," by C. E. Paige, vice-president Brooklyn Union Gas Company, to be given at the third general session, on Wednesday afternoon. The address on "Government and Business," by John E. Edgerton, president National Association of Manufacturers, has been transferred to the third general session. It was previously scheduled for the first session.

The following titles have been selected for general-session addresses previously not designated otherwise than by the name of the speaker or by a general title since made more specific: Tuesday morning, "Radio's Relation to Electric Light and Power," H. P. Davis, chairman of board, National Broadcasting Company; Thursday morning, "The Decentralization of Industry," Governor Dan Moody of Texas; Thursday afternoon, "Labor's Part in Electrical Development," Hugh Frayne, American Federation of Labor; Friday morning, "The Power Industry in the Marketplace," James H. McGraw, president McGraw-Hill Publishing Company.

## Senator Wagner Introduces Anti-Federal Court Bill

Another bill has been added to those pending in Congress designed to restrict the jurisdiction of federal courts in cases affecting the rates charged by public utility companies. Senator Wagner of New York is the father of the new measure, which sprang from the decision of a United States statutory court allowing the Interborough Rapid Transit Company of New York City to increase its fare. The postponement last Monday until October by the United States Supreme Court of argument on the appeal from this decision will probably operate to prevent any vigorous agitation over the proposed legislation at this session of Congress.

Senator Wagner argued that the local utilities are created by the state and receive permission to do business and get their special franchise and monopoly privileges from the state or municipalities. He declared that the source and right of all the utility powers is in the state. "But," he added, "when their duties are in question the utilities are showing a marked preference for the federal courts and an antipathy to the jurisdiction of the state courts. Through their ability to raise the constitutional question local public utilities have been able to exercise choice and thereby to secure an advantage over the municipalities and residents of the communities wherein they do their business. There is to my mind no sound reason why a local public utility should have the advantage of a choice between two systems of law and two sets of judges."

## Conferees Agree on Muscle Shoals

### Their Bill Goes a Step Farther than the House Measure to Put Government Into Business—School Issue Looms Large in Trade Commission Inquiry

BY PAUL WOOTON
Washington Correspondent of the ELECTRICAL WORLD

SUCCESSFUL negotiation over the Muscle Shoals bills in conference between the two houses is announced by Senator Norris, father of the original Senate measure. After the House of Representatives had narrowed the scope of the business activities into which the government is launched by the proposed legislation, the conferees rewrote the bill in a form more objectionable to industry than the measure reported by the House committee. Under the conference bill the "Muscle Shoals Corporation of the United States" is directed "to operate existing plants" and to construct, maintain and operate experimental or producing plants at or near Muscle Shoals for the manufacture, distribution and sale of fertilizer or any of the by-products of the same.

As this is written, the general expectation on Capitol Hill is that the President will veto a measure which some of its opponents go as far as to term a "naked and unashamed attempt to establish communism in the United States as a national policy." The large vote for the measure in each house is explained on the ground that Congress is anxious to get rid of Muscle Shoals and on the ground that many votes were obtained through "trades" on flood control, farm relief, Boulder Dam and other measures.

Just as the legislation provides for the setting up of the government in the fertilizer and chemical businesses, it also thrusts Uncle Sam into the power business and introduces the Federal Power Commission as a regulating body in the several states where Muscle Shoals power will be sold. The new federal agency is directed to sell power to states, counties, municipalities, corporations, partnerships or individuals, and must give preference to "states, counties or municipalities purchasing said current for distribution to citizens and customers." The bill provides that power is to be distributed equitably among the states within transmission distance of Muscle Shoals. This insures its dissemination into a number of states. Wherever any Muscle Shoals power, regardless of how small the quantity may be, is intermingled with other power the Federal Power Commission is to determine a reasonable, just and fair price which the ultimate consumer is to pay.

The measure also authorizes the construction of the Cove Creek dam across Clinch River and the installation of equipment sufficient to generate 200,000 hp.

#### UTILITIES AND THE SCHOOLS

Testimony taken thus far before the Federal Trade Commission reveals that representatives of the public utilities have been extremely assiduous in getting views held by the industry before students in schools and colleges. Some take the view that certain of the methods employed in this connection were questionable. It was apparent, too, as concerns utility representatives' efforts in general to promote the cause of private ownership with the public and with legislators, that a particularly bad impression was made in the instance where no record of payments had been kept and in another instance where the records had been destroyed.

On behalf of the utilities it is explained that pamphlets furnished educational institutions are not textbooks in the usual conception of the term. Since an industry subject to public regulation is peculiarly dependent upon an intelligent understanding of its affairs by the public, it was felt that every effort should be made so that the rising generation would have a grasp of the complexities of this highly technical industry. In this connection it is contended that this constitutes a thoroughly ethical type of public relations, as is evidenced by the use of those methods by trade associations, banks, insurance companies and other commercial activities.

Attention is called to the fact that a few years ago the electrical industry necessarily was entering upon new forms of corporate, financial and industrial organization. It was new to the people, just as the chain-store problem, for instance, is today. It was necessary to acquaint the public with these departures before there could be hope of their favorable reception. Moreover, it was found that instructors in schools and in the academic classes generally were inclined to be ultra-conservative and disinclined to approve the methods that went along with the necessity of trebling the per capita production.

The testimony before the commission has been perfunctory, for the most part. Well-known facts and conditions have been reviewed so that they may be formally before the commission in the record. One of the outstanding developments of last week was the testimony of Representative Douglas of Arizona, who attempted to put into the record material indicating the extent of the activities of the Los Angeles Bureau of Power and Light in an effort to put forward the municipal point of view. The material was ruled out, but it is believed that before the case is closed there will be a comparison of the methods employed by the utilities and by the advocates of public ownership. As the commission is required to recommend remedial legislation, it is thought that the other side of the picture must be shown to enable it to judge the general situation.

## Trade Commission Investigation Resumes Monday

Nothing of a new or startling nature was developed at the utility hearing of the Federal Trade Commission last Thursday, May 17, when S. E. Boney of the North and South Carolina Public Utilities Information Bureau gave testimony on lines now familiar concerning the publicity and educational efforts of that body. When the inquiry resumes next week, after a ten-day recess, officials from the New York State, Minnesota and Colorado bureaus will be examined as well as C. H. B. Chaplin, secretary of the Empire State Gas and Electric Association, whose evidence is scheduled for Monday.

## Chicago Home Rule Bills Are Rejected, 49 to 17

The traction bills, to consider which the Governor of Illinois called a special session of the General Assembly, as reported last week, and which would have given Chicago home rule over its public utilities, were killed in the Lower House on Tuesday. A motion to postpone consideration was carried by 49 to 17. Declaring that there is no hope of giving Chicago public utilities home rule at this time, Representative Michael Igoe of that city denounced Governor Small and Mayor Thompson as those responsible for the failure.

## Felix Deutsch Dead

*Head of A.E.G. Expires Unexpectedly in Berlin Two Days After Celebrating His Seventieth Birthday—Forty-five Years in Electrical Manufacturing*

CABLE dispatches from Berlin received on Saturday, May 19, told of the sudden death from heart trouble on the day before of Dr. Felix Deutsch, head of the Allgemeine Elektricitäts-Gesellschaft, whose seventieth birthday anniversary on May 16 had brought forth congratulations from President von Hindenburg and Chancellor Marx of the German Republic and from prominent industrial leaders in Germany and other countries. At that time Dr. Deutsch was reported to be in excellent health. Only last October he visited the United States for the first time, and an interview with him on the progress of the German electrical industry was printed in the ELECTRICAL WORLD (Oct. 15, page 801).

*Felix Deutsch*

With Emil Rathenau, Felix Deutsch was one of the founders of the German Edison Company forty-five years ago, and his life career was bound up with the growth of the German electrical industry from the smallest of beginnings to its present magnitude. For years he himself traveled almost continuously in developing markets for the A.E.G., the great manufacturing company which grew out of the German Edison Company. He succeeded Rathenau as head of this company. To him was due in large measure its successful weathering of war and post-war conditions, and last fall Dr. Deutsch was able to report that the company had in hand orders for steam turbines with an aggregate rating of 1,000,000 kw.

Dr. Deutsch was a Privy Counselor of Defense for Germany. He won distinction outside of business circles through his love for music and other arts, to which he contributed time and money. His judgment was sought by his government in international affairs. He urged renewing relations with the United States immediately after the war and was a prominent adviser in Germany's trade relations with Russia. He was a member of more than forty executive committees of commercial enterprises.

## Congress Votes Gold Medal for Thomas A. Edison

A joint resolution authorizing the Secretary of the Treasury to strike off a gold medal in commemoration of the achievements of Thomas A. Edison was adopted by the House of Representatives last Monday. Duplicate medals in bronze are to be made and sold at a price sufficient to cover the cost.

In reporting the resolution, which was introduced by Representative Perkins of New Jersey, the House committee on coinage, weights and measures estimated the monetary value of industries entirely based on the inventions of Edison or materially stimulated by his inventions at $15,599,000,000, distributed as follows: Motion pictures, $1,250,000,000; telephones, $1,000,000,000; electric railways, $6,500,000,000; electric lighting, $5,000,000,000; electric supplies, $857,000,000; fixtures, $37,000,000; phonographs, $105,000,000; car shops, $109,000,000; dynamos and motors, $100,000,000; batteries, $5,000,000; concrete, $271,000,000; telegraph, $350,000,000; wireless telegraph, $15,000,000.

## Toronto Hydro Commission Defends New Rates

In a report submitted to Mayor McBride of Toronto in reply to queries from him regarding the increase and adjustments in the rates for electrical energy of the Toronto Hydro Commission, that body says among other things:

"The idea that the new rates penalize the small householder at the expense *(sic)* of the larger householder is erroneous. Under the new rates 65,500 consumers in six-room houses and under will pay on the average 22 cents per month more for their consumption; 17,500 consumers in seven-room houses will average 32 cents more per month; 17,200 consumers in eight-room and nine-room houses will average 37 cents more per month, and 5,500 consumers in ten-room houses and over will average from 52 cents to $1.28 more per month. In no case where a small consumer takes 30 kw.-hr. per month or less can he pay more under the new scale than under the old."

## Arkansas Utilities Association Elects Officers

The Hot Springs convention of the Arkansas Utilities Association, held last week and noted on page 1029 of the ELECTRICAL WORLD, came to a close on May 16, when the following officers were elected: President, W. E. Bann, general manager Western Gas & Elec-

tric Company, Texarkana; first vice-president, R. E. Ritchie, Pine Bluff; second vice-president, G. W. Skow, Huntington; secretary-treasurer (re-elected) Rex I. Brown.

Two speakers from outside the utility ranks were Joseph Leopold, manager Southern Central Division of the United States Chamber of Commerce, who charged the average business man with failure to do enough thinking on questions of vital national importance, and D. Hodson Lewis, manager of the Little Rock Chamber of Commerce, who urged the need of a research bureau to aid in the industrial development of the state. Harvey C. Couch, president Arkansas Power & Light Company, was the chief speaker at the banquet. He dwelt upon flood control, in which he is taking a prominent part.

## A.E.C. Board Acts on Boulder Dam and Other Matters

At a recent meeting in Milwaukee, the administrative board of the American Engineering Council indorsed the creation of a commission of engineers as proposed in the Douglas bill to investigate the physical problems connected with flood control and development of the Colorado River. The program contemplated by the Douglas bill was approved "subject to the report of the aforesaid commission," present expenditures on the Colorado River to be confined to flood protection.

Arthur W. Berresford, president of the council, reported to the board the council's activity in the Mississippi flood legislation and presented the report of the committee on Boulder Dam, headed by Francis Lee Stuart of New York, which unanimously decided against the engineering feasibility of the proposal outlined in the Swing-Johnson bill. President Berresford also told of the progress of the movement to transfer to the Department of the Interior the public works functions of the government. The council has been energetically sup-as the Wyant bill. Government officials and departments, especially the Engineer Corps of the army, are, however, strongly opposed to the bill, and it has little chance this session.

A proposed amendment to a joint resolution passed by Congress in 1919, "for the purpose of promoting efficiency, for the utilization of the resources and industries of the United States," was opposed. "This resolution," Executive Secretary L. W. Wallace explained, "has to do with the so-called Garabed free energy generator. This question has been before Congress in every session in some form or other during and since the war. The American Institute of Electrical Engineers from time to time has urged the council vigorously to oppose this. The council's committee on patents has likewise acted. The intent of this legislation, as expressed in bills in previous sessions of Congress, has been opposed by the council. In the light of such authorization, the executive secretary wrote to a number of the members of the House of Representatives pointing out the fallacy of granting such a privilege and seeking their active opposition. The resolution has been favorably reported by the patent committee of the House and is now on the House calendar."

## Revised Report on Muscle Shoals Measure

*Bill Recommitted by Senate to Conferees, Who Make Important Change in Provision Regarding Manufacture of Fertilizer—Power Clauses Unchanged*

DISPATCHES from the Washington correspondent of the ELECTRICAL WORLD received as it closes its forms and supplementing his letter on page 1113 (already on the press) say that after it had been found that the Senate would not approve the original conference report on the Muscle Shoals bill, which provided for the manufacture of complete fertilizer on a commercial scale, the confereees were instructed to bring in another report limiting operations to manufacture on an experimental scale. The authority to distribute and sell fertilizer, or any of the byproducts of its manufacture, was eliminated. The provision for the construction and operation of new plants and facilities was stricken out, and the policy of the government in the utilization of the Muscle Shoals properties was declared to be for the fixation of nitrogen for agricultural purposes. No change was made in the power provisions of the bill, and the construction of the Cove Creek reservoir is provided for in the second conference report, as in the first.

It was estimated that the conference bill first presented to the Senate could muster only twenty votes. In addition to the fertilizer and Cove Creek provisions, it is thought that many Senators had come to realize that it would be difficult to dispose of the surplus power to advantage under the terms of the resolution. Any lease of power would have to contain a clause providing for its recall, should it be needed for fertilizer production. Under the conditions set up by the bill it was evident that the surplus power would have to be sold at dump prices. There also was objection to the preference accorded municipalities. The bringing in of the Federal Power Commission as a regulatory authority also aroused opposition on the ground that it would infringe upon the regulatory activities of the several states. Despite all of these objections, however, the conferees, as just stated, made no changes in the power provisions of the bill, which now awaits a final vote.

# Debate Rages on Boulder Dam Bill

### Arizona's Congressmen Fight Valiantly Against Its Passage—Douglas Dwells Upon Engineering Difficulties and Economic Phases—Receives Ovation in House

DEBATE on the Swing-Johnson Boulder Dam bill raged in both the House of Representatives and the Senate on Tuesday, May 22. In the House chief attention was attracted to Congressman Leatherwood of Utah, who made a sensational speech, vigorously attacking the bill, the Los Angeles municipal government and William R. Hearst. The latter he accused of using his newspapers to misrepresent the Boulder Canyon project and in an attempt to benefit the Los Angeles Bureau of Power and Light, with which the Congressman said Mr. Hearst is allied, at the expense of the federal taxpayer. He called the Swing-Johnson proposal "an attempt at a deliberate steal for the benefit of a political group in southern California, for the benefit of the real estate speculator in California and for the benefit of newspapers owned by William Randolph Hearst."

In the Senate, after Senator Johnson, sponsor for the bill in that chamber, had paid his respects to Senator Smoot, a leading opponent, and charged him with obtaining some of his material from "the great power interests," Senator Hayden of Arizona made an extended speech, again advancing his three objections to the legislation. The bill, in his opinion, is an attempt to coerce sovereign states, provides for an unjust division of the waters in the lower basin and fails to compensate Arizona and Nevada for the use of their resources for the benefit of California.

Opponents of the bill were further cheered in the House on the following day when an ovation marked the conclusion of a speech by Representative Douglas of Arizona against the bill. Mr. Douglas made the point that insurmountable physical difficulties exist at the proposed site and urged that further engineering studies be made before public funds are wasted in an effort to accomplish an impossible task. He explained that the excavation would require a movement of material comparable with that handled in the operations of the Utah Copper Company. To accomplish that task under the limitations of the terrain and the short working season, he declared, would require a superhuman effort. Mr. Douglas also dealt at length with the economic phases of the problem and made the point that Secretary Hoover never had passed upon the cost estimates or the details of the project.

Effective speeches in favor of the bill were made by Representative Burton of Ohio, who argued that an improvement of such vast importance should not be delayed because of the failure of one state to join with the others in the basin, and by Representative Crail of Los Angeles, who declared that the coastal cities of southern California will enter into contracts with the government to purchase all of the power that can be developed at Boulder Dam and that every dollar would be returned to the Treasury. He took issue with the contention that Boulder Dam power would not be able to compete with that generated by steam, pointing out that the nearest coal fields are 800 miles from Los Angeles and maintaining that petroleum cannot be depended upon as a permanent source of boiler fuel.

## Hoosiers Discuss Vital Power Problems

*Joint Convention at Indianapolis Takes Up Questions of Policy—Opposition to Government Encroachment—Public Relations and Rural Service*

INDIANAPOLIS was the meeting place on Tuesday, Wednesday and Thursday of this week of the annual joint convention of the Indiana Public Utilities Association, the Indiana Electric Light Association and the Indiana Gas Association. These bodies united in a dinner on Wednesday evening, at which the chief address was made by William H. Onken, Jr., editor of the ELECTRICAL WORLD, who took as his themes the inability of the government to perform economic functions with any measure of profit or service to citizens, the national development and prosperity that have followed upon the enabling legislation of a generation ago as distinct from the hampering and crippling of business that he saw threatened by actual and impending disabling legislation of the present day, and the apparent incapacity of many people to discern the difference between political ambition and disinterested service. These points and others which he held to be vital and important to the country as a whole, as well as to the electric light and power industry, now under investigational fire, were effectively set forth by the speaker.

The meetings of the Electric Association got under way with an address by its president, R. M. Feustel of Fort Wayne, who asserted that the present occupation of this and similar bodies must be with matters of policy. This idea was amplified by T. F. English, president of the Great Lakes Division, N.E.L.A., who stressed the point that the electric utility business rests on a mutual interest of the public and the utilities, the one to be served fairly and economically and the other to enjoy freedom to work out its problems.

An opinion that farm service can be profitably undertaken on the basis of $120 per year from each customer was expressed confidently by G. C. Neff, who instanced the experiences of his own company in urging upon those present the necessity both social and economic for the development of this class of business. In the same strain C. V. Sorenson told of rural electrification progress and plans in Indiana. Specific instances of electrical applications to farm uses were discussed by T. E. Heinton of Purdue University.

A paper entitled in the program "A Few Comments on Commercial Activities," by W. H. Sammis, resolved itself into a comprehensive presentation of the aims and accomplishments of the Great Lakes Commercial Section. The session closed with a short but pertinent address by Harry Wenger, chief engineer of the Indiana Public Service Commission.

The second day of the convention, which was given over to the activities of the Indiana Public Utilities Association, was one of continuing interest. After the address of President A. W. Brady, advances in the art of accident prevention were described by W. R. Hirst. Harvey Harmon, a member of the Indiana Public Service Commission, then spoke on the subject of regulation. His remarks were pointed by the citation of manners and ways in which utility companies could improve their relations with the public.

Miss Theresa F. Carroll, chairman of the women's committee of the Great Lakes Division, outlined the work of this committee. Quoting President Coolidge's now historic remark concerning government in business, John B. Malling made a well-reasoned argument against public ownership based on the intention of the framers of the Constitution of the United States to fit that instrument to the changing conditions of future generations. Finally, Morse Dell Plain emphasized the need for proper training of those engaged in company management and supervisory functions. As management expects from workers a proper fulfillment of their duties, so the workers have a right to expect from management understanding supervision and control, he said.

New officers elected for the ensuing year by the Indiana Electric Light Association were: President, Norman A. Perry, president Indianapolis Power & Light Company; vice-president, C. V. Sorenson.

## Great Lakes Engineers Meet in Chicago

With a total attendance of 160 at the committee meetings, the Engineering Section, Great Lakes Division, N.E.L.A., met in Chicago on May 10-12. The committees that appeared to hold most interest, judging from the numbers trying to crowd into the rooms, were the electrical apparatus, underground, overhead lines and meter, although the inductive co-ordination, hydraulic power and accident prevention meetings were well attended also. The apparatus committee received two excellent reports on the current-carrying capacity of copper busbars and bus stresses under short-circuit conditions. These reports were compiled from tests made by the Commonwealth Power Corporation. A detailed report on the operation of high-voltage transmission lines, including tabulations of outages and their causes on 57 lines of above 100 kv., was presented to the overhead systems committee. The next revision of the National Electrical Safety Code was discussed in this committee, and action was taken to arouse interest in this subject among member companies so that present onerous requirements of the code may be corrected. At the general meeting, which was presided over by F. E. Andrews, chairman of the section, W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, made an address on "After the Coal is Gone—What Then?"

## Maryland Fight Ends

*Consolidated Gas, Electric Light & Power Company Buys Northern Maryland Power from Philadelphia Electric, Subject to Commission Approval—Price Said to Be $500,000*

CONTROL of the Northern Maryland Power Company, operating in Havre de Grace and neighboring territory, has, assuming the consent of the Maryland Public Service Commission, passed at last to the Consolidated Gas, Electric Light & Power Company of Baltimore, whose contest with the Philadelphia Electric Company over this property has for more than a year been keen. (See ELECTRICAL WORLD for April 14, page 779.) H. A. Wagner, president of the Baltimore company, issued a statement on May 16 saying:

"The directors of the Consolidated Gas, Electric Light & Power Company of Baltimore, at a meeting of the board held today, ratified an agreement between their company and the Northern Maryland Power Company providing for the acquisition by the Consolidated company of the property and business of the Northern Maryland Power Company in the whole of Harford County, excepting the Fifth election district, which is contiguous to the Conowingo power development."

It was understood that the Baltimore company paid more than $500,000 for the property, which was acquired by the Philadelphia Electric during the fight. The contest is believed to have assumed the proportions it did, not because of the unimportant territory directly involved, but in anticipation of the electrification of the Pennsylvania Railroad and because of strategical motives with respect to future industrial development.

## Purchases and Mortgages

The United Gas Improvement Company has disposed of its controlling interest in the Burlington Light & Power Company of Burlington, Vt., to the People's Light & Power Corporation. The sale is in accord with the company's policy to dispose of isolated properties and to group its holdings in public utilities so as to permit of the most economical operation.

The Pennsylvania Edison Company of Easton, Pa., has been merged into the Metropolitan Edison Company of Reading. Both are General Gas & Electric Company properties.

A petition for the incorporation of a second group of small light properties in the proposed Southeastern Indiana Power Company has been filed with the Indiana Public Service Commission by C. T. DeHore, president of the DeHore Management Corporation. These are the Milroy Light & Power Company, which serves Blue Ridge, Moscow, Clarksburg, Andersonville and Richland; the Atwood-Burkit Light & Power Company and the Battleground Light & Power Company. (See Electrical World for May 19, page 1033.)

A petition has been filed with the Indiana Public Service Commission by the Greendale Water & Electric Company for leave to purchase the utility holdings in Greendale, Ind., of the A. D. Cook Company of Lawrenceburg, Ind., for $75,000.

Shelbyville, Ill., has turned a deaf ear to tentative offers to buy its municipal electric light plant understood to have been made by the Central Illinois Public Service Company and will rehabilitate its plant at a cost of approximately $100,000.

Purchase of the South Sioux City (Neb.) municipal electric light plant by the Sioux City Gas & Electric Company and the grant of a 25-year franchise will be submitted soon to a vote. The company, which has made an offer of $75,000 for the plant, will pay costs of the special election.

Application has been made to the New York Public Service Commission by John D. Holmes for consent to transfer his electric plant in Downsville, Delaware County, to the New York State Electric Corporation.

The Atlantic City Electric Company has taken over the operation of the electric plant of Greenwich Township, Gloucester County, N. J. The company paid the township $31,870 for the property.

The Staunton (Va.) City Council is considering sale of the city's electric plant to the Virginia Public Service Company, which also has a plant in Staunton. A series of alternative proposals have been submitted to the company.

An offer from the Virginia Electric & Power Company of $35,000 for the lines and franchise of the Tarboro (N. C.) electric plant has been refused by the city commissioners.

By an overwhelming majority, the voters of Milton, Fla., on May 15 approved the sale of the municipal electric plant to the Gulf Power Company for $65,000, granting the company also a 20-year operating franchise.

The Southwestern Light & Power Company has purchased the privately owned light and power plant and distribution system in Davidson, Okla.

The Oklahoma Gas & Electric Company has purchased the 13,000-kw. Belle Island generating station of the Oklahoma Railway Company in Oklahoma City. This transaction follows the recent leasing of this station by the Oklahoma Gas & Electric together with transmission lines owned by Oklahoma Railway Company.

Operating in Crescent City, Calif., the Mountain Power Company has applied to the Railroad Commission for authority to sell its properties to the Public Utilities California Corporation for $85,000.

The Smith River Power Company, operating in Del Norte County in northern California, has applied to the California commission for authority to sell, and the Public Utilities California Corporation for authority to purchase, the properties of the former for $23,200 in capital stock.

## Montefiore Foundation Essay Award for 1929

Announcement is made by the association of electrical engineers composed of alumni of the Institut Electrotechnique Montefiore, Liége, Belgium, that the triennial prize awarded by the Fondation George Montefiore for the best original treatise (not of a popular character or a mere compilation) upon the scientific advance of electricity and its technical application in all domains will be again bestowed next year. This prize represents the accumulated interest on 150,000 francs invested in Belgian funds at 3 per cent and will amount to 29,000 francs.

Essays submitted must have been written in the three years preceding the award. They may be either in French or English, signed or anonymous, and must be printed or typewritten, twelve copies to be furnished. Five Belgian and five foreign electrical engineers, under the presidency of the director of the Montefiore institute, form the jury. The last day for the reception of papers submitted will be April 30, 1929. Further details of the competition will be supplied by the secretary-general of the Association des Ingénieurs Electriciens sortis de Institut Electrotechnique Montefiore—L. Calmeau, 31 rue Saint-Gilles, Liége, Belgium.

## Summer School for Engineering Teachers to Be Repeated

The Summer School for Engineering Teachers, open to all such teachers in the United States and Canada, which was established by the Society for the Promotion of Engineering Education in 1927, is to continue its sessions during the coming summer. Two schools will be held—one for teachers of physics and the other for teachers of electrical engineering. As in 1927, when mechanics was the subject studied, the purpose will be to study the principles and methods of teaching rather than to review actual content of subject matter.

The session on teaching physics will be at the Massachusetts Institute of Technology under the directorship of Dr. S. W. Stratton, president. The session on electrical engineering will be at Pittsburgh under the joint auspices of the University of Pittsburgh and the Westinghouse Electric & Manufacturing Company. Dr. F. L. Bishop of the University of Pittsburgh, secretary of the S.P.E.E., and Prof. Charles F. Scott of Yale University, chairman of the society's board of investigation and coordination, will serve as co-directors of the Pittsburgh session of the school. Prof. H. P. Hammond, associate director of the society's investigation of engineering education, is in general charge of the schools. Both sessions will be of three weeks' duration and will begin soon after July 4.

## Applications Before Federal Power Commission

The Niagara Falls Power Company has applied to the Federal Power Commission for the right to use all treaty water at Niagara Falls. At present that company is using 19,725 sec.ft. of the 20,000 sec.ft. available. The remaining 275 sec.ft. is being used by various licensees on Eighteen-Mile Creek, between Lockport and Lake Ontario, where it is transported through the State Barge Canal. These licensees have announced their willingness to surrender their licenses. The water can be used to develop virtually twice the amount of power at the Falls that it is now producing.

As reported last week, L. E. Bryant of Roberta, Tenn., has applied to the commission for a preliminary permit covering a project on the Rock Castle and Laurel Rivers near the boundary of Kentucky and Tennessee. It is planned to build a dam 190 ft. high on the Rock Castle River one mile above its mouth, where 20,000,000,000 cu.ft. of water would be stored. The dam on the Laurel River is to be 150 ft. high and would store 7,000,000,000 cu.ft. The power houses are to be below each dam and will be interconnected. Under such a plan it is estimated that 28,600 hp. of primary power can be made available. It is the intention of the applicant to install 39,300 hp. The power is to be used at coal mines in the vicinity of the sites.

The Kassan Gold Company of Seattle has applied for a preliminary permit covering a development on the east side of Prince of Wales Island, Alaska. It is proposed to construct a dam at the outlet of Little Salmon Lake so as to provide 10,000 acre-feet of storage. It is planned to install 1,500 hp. and to build a transmission line 10 miles long to the applicant's mine.

The Red River Lumber Company of Minneapolis has filed two applications for preliminary permits covering developments on Horse Creek at a point near Pittville, Calif., and on Lost Creek near Cassel, Calif. At the former project it is planned to make available 1,200 hp. of primary power and at the latter 4,800 hp. of primary power.

The Interstate Public Service Company of Indiana has withdrawn its application for a license covering a 6,000-hp. project on the East Fork of the White River. The company took this action on the ground that the project was not economically feasible under present conditions.

Fred and John Dover, who have been operating a project at U. S. Dam No. 6 on the Muskingum River, Ohio, have applied for a license under the water-power act. The War Department lease under which they have been operating has recently expired.

The Truckee River Power Company has applied for a license covering the erection of 28 miles of transmission line to connect an existing line with Durkee, Idaho, and to connect Tahoe City to Brockway.

# Briefer News

WATERBURY STEAM STATION ABANDONED.—The Connecticut Light & Power Company, Waterbury, Conn., has abandoned its Waterbury power station, erected twenty years ago, and will get its power for that city entirely from its hydro-electric plants.

NEW UNIT GOES IN FOR GULF STATES UTILITIES TEXAS SYSTEM.—A 35,000-kw. turbo-generator was placed in operation last week at the Neches power station of the Gulf States Utilities Company of Beaumont, Tex., which serves a territory extending for more than 250 miles along the Gulf Coast. Transmission lines are nearly completed connecting 23 communities north of Houston to this base-load plant, which has been more than doubled in size.

FIGHT OVER ABSORPTION OF MARYLAND UTILITIES RESUMED IN COURT.—The Electric Public Utilities Company has renewed its suit for the vacation of the Maryland Public Service Commission's order refusing to grant it authority to purchase the stock of the Home Electric Company of Lonaconing, the Emmitsburg Electric Company, the Antietam Electric Light & Power Company and the Midland Electric Light Company, all Maryland corporations. The commission's action was recorded in the ELECTRICAL WORLD for May 5 (page 927.)

CINCINNATI RATE BILL PASSES COUNCIL.—Cincinnati's City Council has passed the new electric rate bill (ELECTRICAL WORLD, April 21, page 826), and it will go into effect on Sept. 1. It is designed to cut off from $500,000 to $600,000 of the Union Gas & Electric Company's net annual profit from electricity on the basis of present consumption. One councilman opposed the measure, asserting that the city should continue its fight in the federal courts to make effective the first new ordinance proposed, which was designed to cut off $750,000 net profit.

OREGON COMMISSION LACKS FUNDS FOR RATE INVESTIGATION. — Estimates thought conservative place the number of electrical engineers necessary for a state investigation of the valuations of the widely ramified properties of the Portland Electric Power Company and the Northwestern Electric Company at a minimum of fourteen, and the expense of such a probe would possibly reach an almost prohibitive sum. At the present time the Oregon Public Service Commission has for its engineering personnel one chief and one assistant, and the funds with which to operate the department until the Legislature again meets next January are about exhausted. The commission on its own motion has ordered that the valuations of the two Portland utilities be undertaken at once, but whether it will be able to carry out this program is said to be doubtful.

PORTLAND COUNCIL ENGAGES TACOMA ENGINEER TO VALUE PROPERTY OF PORTLAND ELECTRIC POWER COMPANY.—Kenneth G. Harlan, Tacoma (Wash.), utility engineer, has been retained by City Council of Portland, Ore., to evaluate the property of the Portland Electric Power Company with a view to obtaining revision of electric rates. Mr. Harlan will be paid a flat rate of $48,000, hiring his own assistants. The work must be finished by Dec. 15. The council will present the data gathered in a petition to the Public Service Commission for new rates.

RESTRICTIONS ON KLAMATH RIVER MAY BE RECONSIDERED BY VOTERS.—To determine whether the Klamath River can be used both for the maintenance of industrial plants and as a recreational and angling stream, a study is to be started in the near future under the leadership of the California Development Association. If the finding is that the dual use is feasible, it is probable that the voters will be called on by initiative to reconsider the vote by which in 1924 the river was declared closed to industrial and power development.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

National Electrical Manufacturers' Association—Radio Division, Chicago, June 4-7.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Artistic Lighting Equipment Association—Hotel Sherman, Chicago, June 11-16. G. P. Rogers, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

American Institute of Electrical Engineers—Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

MORE INTERCONNECTION IN VIRGINIA.—Transmission lines of the Virginia Electric & Power Company will soon be extended 13 miles from Quantico to Occoquan, Va., connecting that point with the lines of the Virginia Public Service Company running south from Alexandria. The cost of the new extension is put at approximately $150,000. The line, to be completed probably by September, will carry 66,000 volts. Connections with the Virginia Public Service Company at Roanoke Rapids, N. C., will be made also.

TONAWANDA POWER COMPANY TO HAVE NEW OFFICE BUILDING.—Officers and directors of the Buffalo, Niagara & Eastern Power Corporation and the Tonawanda Power Company assembled at North Tonawanda, N. Y., on May 17 to take part in the ceremonies attending the laying of the cornerstone for an ornamental quarter-million-dollar two-story building to be occupied jointly by the Tonawanda Power Company and the State Trust Company. According to the designers, the lighting effects, exterior and interior, to be used for the new building will be "the best between New York City and Chicago."

HUGHES ELECTRIC WILL BUILD 225 MILES OF LINE IN NORTH DAKOTA.—Announcement that the Hughes Electric Company of Bismarck, N. D., will build 225 miles of transmission line during the summer of 1928, has been made by O. W. Mattison, new general manager of the company. Included will be a line from Beulah to Bismarck, a line connecting Elgin and Thunderhawk and a line from Sterling to Bismarck. The transmission expansion is in addition to plant improvements at Beulah increasing the plant capacity substantially. New-type boilers are being installed.

ARTISTIC LIGHTING EQUIPMENT CONVENTION.—In connection with an elaborate exhibition of lighting equipment to be held at the Sherman Hotel, Chicago, on June 11-16, by the Artistic Lighting Equipment Association, there will be a convention of that society, at which group meetings of manufacturers, distributors and dealers will be supplemented by open sessions. At one of these there will be a discussion on "meeting the problem of lower selling costs." At the first day's proceedings William R. Dawes, president of the Chicago Association of Commerce, will make an address.

SHAWINIGAN COMPANY CONTEMPLATES ADDING TO ITS RESOURCES.—It is likely that the Shawinigan Water & Power Company will soon increase its power resources in the Province of Quebec by the acquisition of sites having a total potential capacity of 500,000 hp. These sites are on the St. Maurice River above La Tuque. They are to be auctioned by the Quebec government on May 23, and it is conceded that Shawinigan will in all probability be the only bidder. It is altogether likely that the company will use these sites to serve the St. Maurice Valley territory or the more easterly sections of the Shawinigan system, rather than Montreal, which is about 250 miles from the additional source of power.

Duquesne Light Company Places Highland Substation in Operation.—Another substation has just been added to the chain of eight which serve Pittsburgh by stepping down 66,000-volt power from the Colfax generating station to 22,000 volts and then transmitting it to distribution stations. The new substation, known as the Highland, is rated at 30,000 kw. and is about nine miles from Colfax. At present only one circuit to it has been built, though it is designed for two. The connection necessitated an overhead crossing of the Allegheny River and the construction during the winter months of a steel-tower transmission line over rough, hilly country.

Work Starts on New Gorgas Unit for Alabama Power Company.—Construction work has started on the new Gorgas steam plant (Unit No. 4) of the Alabama Power Company, an announcement by the company says. Excavation will be completed in the early autumn. Steel erection is scheduled to begin about the middle of June and will be completed about the first of August. Condensers will be installed in October, the boilers in September and the turbines in December. The present schedule calls for completion of the plant about May 1, 1929. The plant will ultimately add 240,000 kw. to the Alabama Power Company's system in four units of 60,000 kw. each, of which the one under way will be the first.

Springfield, Mass., Going Ahead with City-Owned Hydro Plant.—Construction of the large dam and tunnel for the water system expansion and electric power development by the city of Springfield, Mass., in connection with its Little River supply will be started early this summer, according to present plans. A call for bids probably will be issued early in June. The water commissioners have authorized the city solicitor to make a contract with the Turners Falls Power & Electric Company for a lease of the power plant, at a rental price of $270,000 a year for 30 years (see Electrical World for Dec. 10, 1927, page 1216). A bond issue of $4,500,000 has been authorized by the city for the development.

Rate Reductions in Missouri and Arkansas.—Reductions in electric rates for residence consumers in 92 Missouri towns are provided in rate schedules filed with the Public Service Commission at Jefferson City, Mo., May 11 by the Missouri Public Service Company and the Arkansas-Missouri Power Company. Both have their headquarters in St. Louis and are controlled by the Insull interests. Power for industrial and commercial use is reduced in 30 of the towns under the new schedules. Similar reductions will be made in 27 towns in Arkansas served by the Arkansas-Missouri Power Company. The reductions in Missouri range from 5 to 25 per cent and approximate $100,000 annually. Prior to May 11 the Missouri Power & Light Company reduced rates affecting 94 towns and aggregating $127,000 and the Maryville Electric Light & Power Company cut its rates in Maryville.

Right of Owner of Apartment House to Retail Energy to Be Tested in Brooklyn.—Whether a landlord can compel the Brooklyn Edison Company to furnish energy wholesale to an apartment house so that electricity may be retailed to tenants instead of permitting them to deal with the electric company directly will be determined in a suit filed last week in the New York Supreme Court. The owner asserts that under rulings of the Public Service Commision a landlord has a right to buy energy at wholesale and retail it. He alleges that the electrical equipment in his apartment building is valued at $30,000 and that representatives of the Brooklyn Edison Company have notified him that they intend to deal with the tenants directly or else remove the meters from the building and suspend service for all purposes.

Indianapolis Company Completes New Administration Plant.—Centralization of the service operations of the Indianapolis Power & Light Company is made possible with the completion of a new million-dollar plant on Morris Street, covering a fourteen-acre tract. Officials of the operating and engineering departments have just moved into the three buildings composing it, which have been in course of construction for about two years. These are an administration building, with a storage building and a garage on either side. All are of brick and concrete. They house five hundred men and women. The administration building is one of the most complete of its kind. On the lower floor is a large lecture room with club facilities for employees.

Remodeling of Cahokia Station Includes New 75,000-Kw. Turbine.—The Union Electric Light & Power Company of St. Louis has made plans to

## New York Edison Adopts New Coal-Hoisting System

A NEW coal-hoisting system that unloads coal directly from ocean-going vessels into the power generating station of the New York Edison Company on the East River at Thirty-eighth to Fortieth Street has been put into operation with the unloading of the Pocahontas Steamship Company's collier *Bristol* from Norfolk. The effect of the new system, an official of the New York Edison Company said, is to broaden the company's coal market, so that now coal may be obtained either by oceangoing colliers or by rail. Moreover, by the new system coal can be unloaded from moored colliers into barges for transport to the other power-generating plants owned by the company.

In the new system the bucket hoist is only 60 ft. The clamshell buckets place the coal on belt conveyors, one of which is 395 ft. long, for the remaining elevation of 100 or more feet to the bunkers. These long conveyors reach out to 30-ft. deep water, where ocean-going vessels can be moored. Two steel towers for hoisting the grab buckets travel on rails, permitting the buckets to be dropped into the various hatches without moving the vessel. The two buckets have a capacity of 350 tons an hour each. The *Bristol*, the first collier to be unloaded by the new system, carried 6,600 tons.

remodel and expand its Cahokia station, on the Illinois side of the Mississippi. The plans include the installation of a 75,000-kw. General Electric turbo-generator. Space for it will be provided by removing a 30,000-kw. machine. Foundations will be strengthened to suit the larger unit and the condenser altered. The unit which is removed will be installed in the Venice station of the company, adjacent to Cahokia. The new turbine will be a single-cylinder, 1,800-r.p.m. machine receiving steam at 315 lb. gage, 300 deg. superheat, and will operate against a back pressure of 1 in. absolute. The generator will be rated at 60 cycles, 13,800 volts, three-phase, and 90 per cent power factor.

New Offer for Purchase of Elephant Butte Power.—The Texas-Louisiana Power Company has submitted a proposal to the boards of directors of the irrigated districts of the upper Rio Grande Valley for the development and utilization of electric power from the Elephant Butte reclamation dam in New Mexico. There is already pending before the boards of directors a similar proposal from the El Paso Electric Company. The proposal of the Texas-Louisiana company is to construct and operate a hydro-electric plant at the dam and pay to the water users a minimum of $86,000 yearly with no investment on their part. The $86,000 would be based on an output of 40,000,000 kw.-hr. or less, and in addition $6,000 would be paid for each 5,000,000 kw.-hr., extra up to 68,000,000 kw.-hr., after which the company would pay 1¼ mills additional for each kilowatt-hour generated at Elephant Butte Dam. The proposed contract between the irrigation districts and the Stone & Webster interests, which control the El Paso Electric Company, is based on construction by the water users of the hydro-electric plant at the dam. The El Paso company would then purchase the energy, for which it would pay an annual minimum charge of $180,000 for 36,000,000 kw.-hr. The districts would have to issue bonds to raise money with which to build the plant.

Water-Power Site Filings in Oregon.—Albert Anderson of Grant's Pass, Ore., has filed an application with the State Engineer for a permit to construct a reservoir for the storage of 18,700 acre-feet of water from the South Fork of the Coquille River and to appropriate 75 sec.-ft. of such stored water and the natural flow of the river for the development of 13,261 theoretical horsepower. The site is in Coos County, the operating field of the Mountain States Power Company, which maintains priority rights. An application was filed also by W. E. Green, Portland, for a permit to appropriate 2,500 sec.-ft., from the Deschutes River in Sherman County for the development of 420,000 theoretical horsepower. This site is in territory now served by the Deschutes Light & Power and the Pacific Light & Power Companies. E. G. Hopson of Portland has filed application for a permit to appropriate 5,000 sec.-ft. of water from the Deschutes River for the development of power in Sherman County. A. L. Shreve of Mapleton has filed on waters in Berkshire Creek for light and power development purposes in Lane County, and D. P. Slater of Dallas asks permission to appropriate water from Rock Creek for power supply in Lincoln County.

Tennessee Commission Valuation Contested.—Valuation by the State Railroad and Public Utilities Commission of Tennessee of the Tennessee Eastern Electric Company at $2,500,000 and of its subsidiary the Johnson City Traction Corporation at $225,000 is being contested in the Circuit Court at Nashville by the utilities, which claim a joint value of $6,695,000. A special commissioner appointed by the court has placed the value at $3,500,000. He rates the physical value of the hydro-electric developments and the steam plant of the petitioners at $2,925,000. The companies claimed a "water-power value" of $2,000,000, which the commission refused to recognize at anything, but which Commissioner Kirkpatrick set at $200,000. The companies claimed a "going value" of $750,000 which the commission set at $240,000 and the Kirkpatrick report raised to $275,000. Commissioner Kirkpatrick allowed a "working capital" of $100,000, but agreed with the state authorities in refusing any allowance for "cost of financing and organizing" and "added risk in developing."

## Commission Rulings

Customer-Owned Meters Excluded from Rate-Fixing Valuation.—A former rule of the Colorado Public Utilities Commission requiring utilities to own and maintain meters and incidental connections has been permanently suspended by it, with the express restriction that such equipment owned by consumers shall not be valued as useful utility property in any valuation for rate-making purposes.

Consumer Has No Right to Hamper Regular Reading of Meter.—Although holding that discontinuance of service to enforce the payment of a bill disputed in good faith is not justified until the question of indebtedness has been settled in a court of law, the New Jersey Board of Public Utility Commissioners blamed a customer of the Public Service Electric & Gas Company for rendering it difficult for the company to make regular monthly meter readings, saying: "This case differs from the usual complaints received by the board in that the meter, through the fault of the complainant, was not read monthly. If the readings had been made monthly, the trouble might have been averted. The testimony shows that the complainant's house was frequently closed when the meter reader called and that regular readings were impossible; also it appears that the complainant is the owner of several police dogs, which he keeps on the premises, and warned the meter reader to beware of them. The company is fairly entitled to have the meter at complainant's premises read monthly by its meter reader. It cannot be reasonably expected to make a special or unusual effort to obtain readings. If the complainant refuses or neglects to maintain a condition at his residence admitting of regular meter readings without hazard or threat of same to the reader, the company will be justified in discontinuing service and refusing to resume the supply until such condition is corrected."

## Recent Court Decisions

Company Responsible for Injury to Boy Who Climbed Father's Tree, Through Which Company's Wire Ran.—Damages were affirmed in Anstead vs. Pacific Gas & Electric Company by the Supreme Court of California. This suit was brought because of injury to a nine-year-old boy who climbed a tree on his father's ranch to pick apples and came in contact with a high-tension wire belonging to the company and passing through the tree. The allegation that it was the custom for power companies to run their wires through fruit and shade trees did not excuse the defendant, the court said, unless this practice was shown to be consistent with due care. The accident itself showed that the insulation was not sufficient. The boy had a right to be in the tree. Errors in the admission of evidence had not prejudiced the case, the court held also, and the verdict for $15,000 for permanent injury was not excessive as a matter of law. (265 Pac. 487.)*

Supreme Court Finds Special Tax for Recording Long-Term Mortgages Unconstitutional.—A tax of 20 cents upon each hundred dollars of mortgage indebtedness recorded in Kentucky where the indebtedness does not mature within five years has been declared unconstitutional by the United States Supreme Court in Louisville Gas & Electric Company vs. Coleman, State Auditor, and it has reversed the action of the lower court in sustaining the law. "It seems clear," the Supreme Court says, "that a circumstance which affects only taxable values has been made the base of a classification under which one is compelled to pay a tax for the enjoyment of a necessary privilege which—aside from the amount of the recording fee which is paid by each—is furnished to another as a pure gratuity. Such a classification is arbitrary. . . . The effect is to deny plaintiff the equal protection of the law in violation of the equality provision of the Fourteenth Amendment." In a dissenting opinion by Justice Brandeis, concurred in by Justices Holmes and Stone, it was said: "There is abundant proof that the Legislature was justified in thinking that the bulk of the long-term loans would escape the general property tax, while most of those for a short term would not. . . . The equality clause would not prevent a state from confining the recording tax to deeds of trust given to secure bonds of a public service corporation. . . . If the statute as applied does not in fact discriminate in favor of any property of a like nature, there is not inequality in treatment."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *Dwight Heads Boston Section A.I.E.E.*

Prof. H. B. Dwight of the Massachusetts Institute of Technology was elected chairman of the Boston section of the American Institute of Electrical Engineers at the annual meeting last week, the new vice-chairman being Wellen H. Colburn of the Edison Electric Illuminating Company of Boston and the secretary and treasurer George J. Crowdes of the Simplex Wire & Cable Company, Boston.

ELMER A. SPERRY, chairman of the board of directors of the Sperry Gyroscope Company, Brooklyn, N. Y., was nominated for the presidency of the American Society of Mechanical Engineers at a recent meeting of the nominating committee held at Pittsburgh, Pa., during the spring meeting.

NICHOLAS M. DU CHEMIN has been placed in charge of the West Lynn works of the General Electric Company during the illness of Frank P. Cox, manager. Mr. Du Chemin has been in the employ of the company for nearly fifteen years, having passed through the company's apprentice course at the River Works, Lynn, Mass., and risen to the post of general superintendent at West Lynn. The many friends of Mr. Cox in the electrical industry will be glad to learn that he is on the road to full recovery.

M. V. WATSON, manager of the Arizona Power Company, Prescott, Ariz., for seventeen years, has been appointed general manager of the Peoples West Coast Hydro-Electric Corporation, Portland, Ore. Mr. Watson's early experience was obtained in the employ of electrical contractors of Kansas City, Mo., and the U. S. Reduction & Refining Company's plant in Colorado Springs. Subsequently he served as superintendent of the Guanajuato Power Company's plant in Zamorra, Mexico, and in the engineering department of the Central Colorado Power Company, Denver.

JOHN W. LIEB, vice-president of the New York Edison Company, sailed for Europe, May 19, aboard the liner *Hamburg*. His first objective will be England, where he is planning to obtain a much-needed rest. While in London Mr. Lieb, as an official delegate of the American Institute of Electrical Engineers, will attend the centenary of the Institution of Civil Engineers (British). Later he will attend the inauguration of the Library, University of Louvain, as an official delegate of the American Engineering Societies, during which there will be presented the clock and carillon, the gift of the Engineering Foundation. Before returning to New York Mr. Lieb will visit Paris and as vice-president and representative of the National Electric Light Association attend the meeting of the International Union of Producers and Distributors of Electrical Energy. Mr. Lieb will arrive in New York late in July.

## *R. T. Smalley President of Middle West Division*

R. T. Smalley, who was elected president of the Middle West Division of the National Electric Light Association at its recent convention in St. Louis, Mo., as announced in the May 19 issue of the ELECTRICAL WORLD, is vice-president of the Kansas Electric Power Company with headquarters at Lawrence, Kan. Mr. Smalley is a graduate of the College of Emporia and entered the employ of the Kansas Electric Power Company in 1919 as meter reader and repair man. He later became assistant manager of the Emporia district and in 1921 was transferred to the Parsons, Kan., district of the same company. In 1923 he returned to Emporia as district manager and in 1926 was transferred to the general offices of the company at Lawrence as assistant general manager. Early this year Mr. Smalley was elected a vice-president of the Kansas Electric Power Company. He has been an active figure in association work in Kansas, directing his attention especially to the Kansas Public Service Association, the Kansas Section and the Middle West Division of the National Electric Light Association and the Information Bureau of Kansas Public Service Companies.

*R. T. Smalley*

RAY BAUMGARDNER of Dallas has been appointed director of public information for the Central & Southwest Utilities Company to succeed the late George McQuaid. Mr. Baumgardner has been state manager of the Associated Press for the past seven years. In his new position he will be responsible for the direction of information services of several operating companies in Texas, Oklahoma and Arkansas, including the Southwestern Gas & Electric Company, the Central Power & Light Company and the West Texas Utilities Company.

H. EDMUND MACHOLD, president of the Northeastern Power Corporation, has been elected president of the Northern New York Securities Corporation, Watertown, N. Y.

# Obituary

JAMES W. BULLOCK, until several years ago an officer of the Bullock Electric Manufacturing Company, Cincinnati, died May 9 at his home in that city following two weeks' illness of pneumonia. Though an officer and director of a number of Cincinnati corporations at the time of his death, Mr. Bullock retired from active business about two years ago.

ROY B. MCPHERSON, general superintendent of the electrical department of the Utica (N. Y.) Gas & Electric Company, died at his home in that city May 14 after a short illness. Mr. McPherson was born in New York Mills, N. Y., in 1894. In 1915 he became associated with the Utica Gas & Electric Company, eight years later being made acting assistant superintendent. In 1924 he was named general superintendent.

CHARLES W. MULLEN, at one time a member of the Public Utilities Commission of Maine, died at his home in Bangor, May 18. Following graduation from the University of Maine in 1883, he entered upon a career that embraced railroad building, the development of hydro-electric power and the construction of pulp and paper mills in New England and Canada. Mr. Mullen was also prominent politically, having been Mayor of Bangor in 1911 and 1912 and a former state senator.

DALE PETERS, manager for the Southern California Edison Company at Huntington Beach, Cal., died May 7 from the effects of an apoplectic stroke, sustained while playing golf. Mr. Peters had been manager at Huntington Beach for more than four years.

DONALD KEMP PROSSOR, an electrical engineer attached to the Pittsfield (Mass.) Works of the General Electric Company, was accidentally killed recently at Durham, N. C., by an electric shock received on a construction job for the Carolina Power & Light Company. He was 29 years of age, a graduate of New York University in 1921 and was favorably known through his connection with the 132-kv. cable installation lately made in New York City.

# Financial and Statistical News

## *Market Prices Recover Several Ten-Point Losses*

POWER and light stocks participated very actively in the sharp market decline which brought averages down several points this week from previous high levels. Although losses were not as heavy among utility stocks as in some other groups, ten-point losses during the decline were not at all exceptional, while fifteen and twenty-point declines took place in isolated cases. With the combination of high money rates and the reaction from an unusually buoyant market the previous week, the stage was in every way set for a successful bear movement and the one which took place was the most important selling movement for some months.

Among the stocks which reacted sharply from recent high prices were American Gas & Electric, Southeastern Power & Light, Public Service of New Jersey, Philadelphia Electric, Pacific Gas & Electric, Brooklyn Edison, Middle West Utilities. Utility stocks, however, were among the first to recover after the selling movement.

## Two New German Loans Floated

Twenty-year 6 per cent gold sinking fund debentures of the Allgemeine Elektricitäts Gesellschaft (General Electric Company, Germany) have just been offered to the amount of $10,000,000, the price being 94½ and interest to yield 6.50 per cent. These debentures were dated May 1, 1928, and mature May 1, 1948.

A five-million-dollar offering was made by the Unterelbe Power & Light Company (Elektricitätswerk Unterelbe, Aktiengesellschaft) in the form of 25-year 6 per cent sinking fund mortgage gold bonds, priced at 93 and interest to yield over 6.55 per cent.

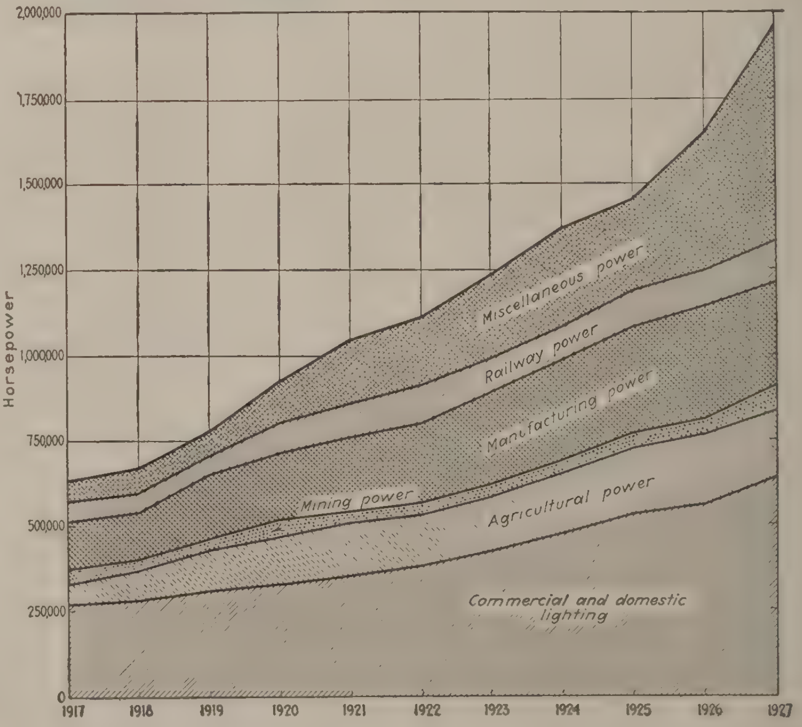
RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of 532,000 additional shares of common stock of the Engineers Public Service Company on official notice of issuance in exchange for bankers' interim receipts for $5 dividend preferred stock, or in exchange for $5 dividend preferred stock when issued, making the total amount applied for 1,649,905 shares. The New York Exchange has also authorized the listing of 1,127,459 shares of common stock of the Pacific Lighting Corporation without par value and of $5,482,850 additional common stock (par $25) of the Southern California Edison Company, making the total amount applied for $56,807,050. The securities of foreign companies were also authorized for listing. Refunding gold bonds of the Norwegian Hydro-Electric Nitrogen Corporation were authorized for listing to the amount of $20,000,000 and first mortgage sinking fund bonds of the Shinyetsu Electric Power Company, Ltd. (Japan) were authorized for listing to the amount of $7,650,000.

NEW CINCINNATI GAS ELECTS DIRECTORATE.—Following the consummation of the merger of the Columbia Power Company, the Cincinnati Gas & Electric Company and the Union Gas & Electric Company into a new company called the Cincinnati Gas & Electric Company, Charles D. Jones, president of the old Cincinnati company, was elected chairman of the board of directors. The following directors have been elected: Samuel Assur, H. C. Blackwell, Alfred C. Cassatt, Fred W. Crawford, W. W. Freeman, Philip G. Gossler, James M. Hutton, Charles D. Jones, Polk Lafoon, Lawrence K. Langdon, John C. Pew, Edward Reynolds, Jr., Charles P. Taft and Frank M. Tait.

## Pacific Gas & Electric Earns $2.66 on Common

CONCENTRATED into the prosperous and rapidly developing upper half of the state of California, Pacific Gas & Electric System has shown a steady annual growth in earnings to last year's $54,719,227 gross. The system has followed the policy of absorbing the properties of smaller companies until its plants and properties, with those of closely affiliated companies, today stand at the huge total of $300,434,894.

Last year's financial progress involves a 7.4 per cent rise in gross revenues and an 18.5 rise in net income. Operating costs and maintenance, taken jointly, were held practically unchanged over the previous year. The operating ratio was reduced from 57 in 1926 to 53 last year. Furthermore, the balance available for common stock was 30.4 per cent greater than in 1926, although dividends required by preferred stock were up about half a million. The balance after common stock was up almost 70 per cent. The company pays $2 on its $25 par common stock, or 8 per cent. Earnings last year on common amounted to $2.66, against $2.54 in 1926. At a current price of around $50 the stock is worth about nineteen times earnings, which is somewhat above the average. The system's property investment is about $5.45 per dollar of gross revenue. Bond interest was earned 2.8 times. Interest charges have been earned at least twice for the past fourteen years.



*Growth of connected load in horsepower*

### TEN YEAR ANALYSIS OF GROWTH

| | Actual Increase | Percentage Increase |
|---|---|---|
| Gross revenue | $34,905,846 | 176.17 |
| Electric sales (kw.-hr.) | 1,070,821,000 | 182.38 |
| Gas sales (cu.ft.) | 11,676,909,000 | 136.77 |
| Consumers | 517,060 | 37.927 |
| Stockholders | 37,927 | 465.88 |

Large investors today thoroughly examine the background of a company in which they propose to invest. Pacific Gas & Electric checks up very satisfactorily in this regard. A ten-year analysis shows the growth as given in the accompanying table.

Hartford Utility Changes Set-Up. — Stockholders of the Hartford Electric Light Company have approved a reduction in par value of the stock from $100 to $25 and an increase in shares from 180,000 to 720,000. The directors have been authorized to issue 80,000 shares of $25 par stock in substitution for the authority to issue 20,000 shares of $100 par value granted in February.

## New Capital Issues

During the week ended May 24 the Allied Power & Light Corporation issued 150,000 shares of first preferred stock, $5 series, each share being accompanied by one share of common stock. Proceeds from the sale of this first preferred stock, together with the proceeds from the sale of preference stock and common stock, will be used in the acquisition of stock interests in and other assets of companies acquired and for general corporate purposes.

The American Gas & Power Company, which last week made an offering of gold debentures, issued 40,000 shares of first preferred stock, $6 series, at $96 a share and accrued dividends, to yield 6.25 per cent. Proceeds from the sale of this stock and the gold debentures referred to will be used to reimburse the company in part for the cost of its holdings.

Two additional offerings of the Texas-Louisiana Power Company were made during the week under review, one in the form of fifteen-year 6 per cent sinking fund gold debentures and the other in the form of 7 per cent cumulative preferred stock. The debentures totaled $1,700,000 and the stock $1,000,000. Proceeds are to reimburse for improvements and for general corporate purposes.

Buffalo Utility Elects New Directors.—At the annual meeting of the Buffalo, Niagara & Eastern Power Corporation Lewis G. Harriman, Walter W. Huntley and Hans Schmidt were elected directors to fill vacancies.

New York Power & Light Reclassifies Stock.—At a meeting of the stockholders of the above company a resolution was adopted reclassifying the capital stock of the company to provide for the elimination of the 30,000 shares of 8 per cent preferred stock authorized and to increase the authorized $6 preferred stock by 30,000 shares. The outstanding 8 per cent preferred was called for redemption Jan. 1, 1928.

Connecticut Power Splits Shares. —Stockholders of the Connecticut Power Company have ratified the change in common stock from 60,283

## Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday May 22 | Low 1928 | High 1928 |
|---|---|---|---|
| **ABITIBI PWR. & PAPER, com., new — no par** | 75¾ | 72 | 85 |
| Ala. Pwr., $7 cum. pf.—no par | k115 | 114½ | 115½ |
| Allis Chalmers Mfg.,6% com. | 123 | 115½ | 129¼ |
| Aluminum Co. of Amer., com. | 163 | 120 | 197⅞ |
| Aluminum Co. of Amer., 6% pf. | 109¾ | 105½ | 110¼ |
| Amer & Foreign Pwr., 7% pf.— no par | 109½ | 105¼ | 109⅞ |
| Amer. & Foreign Pwr., com.—no par | 34¾ | 22⅝ | 38⅞ |
| Amer. Bosch Magneto, com.—no par | 35 | 15⅞ | 35 |
| Amer. Brown Boveri Elec.† | 25 | 10⅞ | 26½ |
| Amer. Brown Boveri Elec., pf. $7 | 64 | 40½ | 65⅝ |
| Amer. Gas & Elec., 6% pf.—no par | k109 | 105 | 108⅞ |
| Amer. Gas & Elec., com. †—no par | 168¾ | 117½ | 184 |
| Amer. Lt. & Trac., 6% pf. | 115¾ | 114¾ | 118 |
| Amer. Lt. & Trac., new com. | 225 | 170 | 249 |
| Amer. Pwr. & Lt., 6% pf. | 107⅞ | 104 | 109½ |
| Amer. Pwr. & Lt., com. †—no par ev.div. | 85½ | 62½ | 95 |
| Amer. Pub. Serv., 7% pf. | a102½ | 97½ | 102½ |
| Amer. Pub. Serv., com. † | k 65 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | a 96¾ | 87½ | 97 |
| Amer. Pub. Utilities, 7% pr. pf. | k101 | 94 | 101 |
| Amer. Pub. Utilities, com. | k 55 | 60 | 65 |
| Amer. States Sec., A | a 12 | 4 | 13½ |
| Amer. States Sec., B | k 14½ | 4⅞ | 17½ |
| Amer. Superpwr., 6% 1st pf. | l 104 | .... | .... |
| Amer.Super pwr., Class A†—no par | 42½ | 36¾ | 56 |
| Amer.Super pwr., Class B†—no par | 45½ | 37 | 56½ |
| Amer. Wtr. Wks. & Elec., 6% pf. | 105½ | 101½ | 106 |
| Amer. W.W. & E., com. new—no par ex.div. | 62 | 52½ | 70⅞ |
| Anaconda Copper cap. $3 | 70 | 53¼ | 74⅞ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr., & Lt. 7% pf | 108 | 107⅞ | 111 |
| Assoc. Gas & Elec., $3.50—50 | 54½ | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 97 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 49 | ... | ... |
| **BABCOCK & WILCOX, 7% com.** | 123 | 117½ | 127 |
| Binghamton L., H. & P., $6 pf. | 107½ | 102 | 109¼ |
| Birmingham Elec., pf.—$6—no par. | 107 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf. | k109 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | k170 | 135 | 170 |
| Blaw-Knox, com.† | i 99½ | 91 | 105 |
| Brazilian Trac., Lt. & Pwr.,com.,new | f 61 | .... | .... |
| Broad River Pwr., 7% pf. | 106 | 105 | 108½ |
| Brooklyn Edison, 8% com. | 249 | 206⅞ | 268¼ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | l 26 | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | i 42½ | ..... | .... |
| **CALIFORNIA ELEC. GENERATING, 6% pf.** | 99 | 98 | 101 |
| Carolina Pwr. & Lt., pf.—$7—no par | l111 | 109 | 111 |
| Central & S. W. Util., $7 pf.—no par | a104 | 99½ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a110 | 103½ | 112 |
| Central Ark. Ry. & Lt., 7% pf. | 106½ | 105 | 107½ |

| Companies | Bid Price Tuesday May 22 | Low 1928 | High 1928 |
|---|---|---|---|
| Central Ill. Pub. Serv., $6 pf. | a 99¾ | 97⅞ | 100½ |
| Central Ind. Pwr., 7% pf. | a101¾ | 95 | 101¼ |
| Central Maine Power, 6% pf. | 97 | 96 | 98½ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 110½ | 104½ | 110 |
| Central States Elec., 7% pf. | 117 | 104¼ | 121⅞ |
| Cincinnati Gas & Elec., 5% com. | g100½ | .... | .... |
| Cities Service, $6 pf.—no par | l 103½ | 94½ | 103½ |
| Cities Service, pf. B—no par | l 9⅝ | 8½ | 9⅝ |
| Cities Service, pf. BB—no par | l 97 | 88½ | 97 |
| Cities Service com.—20 | l 67¾ | 54 | 70½ |
| Cities Service, Bks. Shrs.—10 | l 33¾ | 26½ | 34½ |
| Cities Service Pwr. & Lt., 7% pf. | 108½ | 105¼ | 109 |
| Cities Service Pwr. & Lt., 6% pf. | 102 | 95½ | 102 |
| Cleveland Elec. Illg., 6% pf. | 113 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 425 | 350 | 425 |
| Columbia Gas & Elec., 6% pf. | 108 | 107½ | 110½ |
| Columbia G. & E. com. $5—no par | 111½ | 89½ | 118⅞ |
| Columbus Elec. & Pwr., $2 com.—no par | k 79 | 66 | 79½ |
| Columbus Elec. & Pwr., 7% | 109 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 109½ | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 109 | .. | .... |
| Columbus Ry., P.& Lt. com. no par | 125 | 120 | 125 |
| Commonwealth Edison, 8% com. | a186½ | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 103½ | 102½ | 104½ |
| Commonw'th Pwr., $2, com.—no par | 84 | 62½ | 87½ |
| Conn. Lt. & Pwr., 8% pf. | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117½ | 118 | 121 |
| Cons. Gas of N. Y., pf. | 103½ | 101½ | 105 |
| Cons. Gas of N. Y., com. $5—no par. ex.div. | 152 | 119⅞ | 170½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111 | 110 | 114½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e105 | 100½ | 105½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | e 85 | 67½ | 93 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | ... | .... |
| Consumers Pwr., 6% pf. | 104½ | 106 | 107 |
| Consumers Pwr., 6.6% pf | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108½ | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par | k240 | 240 | 265 |
| Crocker Wheeler, com.† | 54 | ... | ... |
| Crocker Wheeler, 7% pf. | 95 | ... | ... |
| **DALLAS PWR. & LT., 7% pf.** | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 109⅞ | 108½ | 110½ |
| Derby Gas & Elec., 7% pf. | 102 | 96 | 100½ |
| Detroit Edison, 8% com. | 191 | 166½ | 195 |
| Dubilier Condenser, com.—no par | 4½ | 2⅞ | 5½ |
| Duke Pwr., cap | 144 | 130 | 145 |
| Duquesne Lt., 5% pf. | 105 | 104⅞ | 105½ |
| **EASTERN NEW YORK UTIL., $7 pf.** | k110½ | 111 | 112½ |
| Eastern States Pwr B | 23 | 11½ | 26½ |
| Eastern States Pwr., pf | h100 | 98 | 100½ |
| East Tex. Elec., 7% pf | 108 | 106 | 109 |
| Edison Elec.of Boston, $12 com. | d297½ | 252 | 301 |
| El Paso Elec. 7% pf. | 110 | 110 | 112½ |

| Companies | Bid Price Tuesday May 22 | Low 1928 | High 1928 |
|---|---|---|---|
| Elec. Bond & Share, 6% pf. | l110 | 108½ | 111¾ |
| Elec. Bd. & Sh. Sec., com. $1—no par ex. rights | l110½ | 76 | 127½ |
| Electric Household Util.† | a 22¾ | 13½ | 25 |
| Elec. Investors, 6% pf.—no par. | 104½ | 101 | 104½ |
| Elec. Investors, com.†—no par | 68¾ | 40½ | 79¼ |
| Elec. Pwr. & Lt., ctfs. pf. | 109¾ | 106½ | 110½ |
| Elec. Pwr. & Lt., ctfs., 40% pd | m127 | 120¾ | 129¾ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 40 | 28¾ | 45½ |
| Elec. Ry. Securities, com.—no par | 6½ | ... | ... |
| Elec. St. Battery com. $5.25—no par | 80⅞ | 69 | 84½ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 105 | 104 | 107 |
| Empire Pwr., ptc.† | 37½ | 27½ | 39½ |
| Engr. Pub. Serv. $5, pf.—no par | k100 | 99½ | 102 |
| Engr. Pub. Serv., com.—no par | 42 | 33 | 46½ |
| Eureka Vacuum Cleaner, com. $4—no par | k 74⅞ | 69 | 79 |
| **FAIRBANKS MORSE, 7% pf.** | k111 | 104 | 114¾ |
| F.-M., com.—$3—no par | 44¾ | 32½ | 54 |
| Federal Lt. & Trac.,com $1.40 | 54⅞ | 42 | 56½ |
| Federal Lt. & Trac., $6 pf.—no par ex.div. | k107¾ | 98 | 109 |
| Florida Pwr. & Lt., 7% pf. | k107½ | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf. | l114 | 113 | 114½ |
| **GALVESTON-HOUSTON ELEC. 6% pf.** | 80 | 75 | 85 |
| Galveston-Houston Elec., com. | 33 | 31⅞ | 42½ |
| General Cable, Cl.A | 75¾ | 56 | 84¼ |
| Gen. Elec. $3 com.—no par | 159¾ | 124 | 174½ |
| Gen. Elec., special—6% | 11½ | 11½ | 11¾ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par | 46 | 35½ | 50¾ |
| Gen. G. & E. (Del.) pf. A $8—no par | 135 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par. | 118 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 | 112½ | 105½ | 114¼ |
| Gen. Pub. Serv., $7 pf. | 98 | .. | ... |
| Gen. Pub. Serv., com., no par | 26½ | 16⅞ | 29 |
| General Public Utilities, $7 pf. | k102½ | 98 | 101 |
| Ga. Lt., Pwr. & Rys., com. | k 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | h105½ | .... | .... |
| **IDAHO PWR., 7% pf.** | 110 | 109 | 111½ |
| Ill. No. Utilities, 6% pf. | k 99 | 96 | 100 |
| Ill. Pwr. & Lt., 7% pf. | 105½ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 106½ | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf. | 102 | 100 | 105 |
| Ingersoll Rand com. | k 96 | 90 | 98 |
| Int. Combus. Engr., com. $2—no par | 56¾ | 45¾ | 65⅞ |
| Int. Combustion Engr.,7% pf. | k105½ | 103 | 109 |
| Int. Util., Class A—$3.50—no par | 48 | 44½ | 52 |
| Int. Utilities, Class B—no par | 16½ | 6¾ | 17½ |
| Interstate Pwr., pf.—$7—no par | 104½ | 99 | 103¼ |
| Interstate Pub. Serv., 7% pf. | 106 | 103 | 106½ |
| Iowa Ry. & Lt., 7% pf. | 101 | 102 | 103 |
| **JERSEY CENTRAL PWR. & LT. CO., 7% pf** | 107½ | 106 | 107½ |
| Johns-Manville com †—no par | 123¾ | 111½ | 134 |
| Johns-Manville, 7% pf | m122½ | 119½ | 121½ |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, May 19. lBid price Wednesday, May 23. mLatest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday May 22 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY POWER & LIGHT pf. $7 | k109 | 109 | 114 |
| Kansas Gas & Elec. 7% pf. | l110 | 107 | 110 |
| Kelvinator Corp. | 19 | 11½ | 22⅞ |
| Kentucky Hydro-Elec., 7% pf. | a104 | 102 | 104⅞ |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 105 | 100 | 105 |
| LACLEDE GAS LT., 10% com. | k 210 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 37 | 19⅞ | 40 |
| Long Island Ltg., 7% pf. | k111 | 109⅜ | 112½ |
| Long Island Ltg., 6% pf. | k108½ | 107 | 109 |
| Long Island Ltg., com.†—no par | k250 | 170 | 250 |
| Los Angeles Gas & Elec., 6% pf. | 112 | 105½ | 112½ |
| Louisville Gas & Elec., cl. A. $1.75 | 37¼ | 28 | 4[illegible] |
| MAN. ELEC. SUPPLY, cap. $5—no par | 57⅞ | 50 | 61 |
| Maytag Co., com. 50—no par | 36⅜ | 30 | 40¼ |
| Memphis P. & L., pf.—$7—no par | 110 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 107½ | 103 | 109½ |
| Metropolitan Ed., pf.—$7—no par | 109½ | 109 | 111½ |
| Metropolitan Ed., com. $8—no par | k170 | 125 | 185 |
| Middle West Utilities, 6% pf. | a 99⅞ | 93½ | 100½ |
| Middle West Util., 6% pr. lien | a107 | 99 | 108 |
| Middle West Util., com. $7—no par | a152 | 123¾ | 169 |
| Midland Utilities, pr. ln. 6% pf. | a 96½ | 94½ | 97 |
| Midland Utilities, 6% pf. A | a 90⅞ | 89⅞ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 100 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | l108½ | 107 | 109 |
| Miss. River Pwr., 6% pf. | k112 | 94 | 112½ |
| Miss. River Pwr., 3% com. | 112 | .... | .... |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | k107 | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | k105 | 100 | 110 |
| Mohawk Hudson Pwr., com.—no par | 45 | 29½ | 53 |
| Montana Pwr., 5% com. | 169 | 102¼ | 175 |
| Montreal Pwr., 7½% com. | f110 | .... | .... |
| Mountain States Pwr., 7% pf. | k104 | 97 | 105 |
| Mountain States Pwr., com.† | 18 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110½ | 98 | 110½ |
| National Carbon, 8% pf. | m136½ | 136½ | 139⅞ |
| National Elec. Pwr., A† | a 37 | 27½ | 42 |
| National Lt., Ht. & Pwr., com | m 24 | 20 | 30 |
| National Pwr. & Lt., pf.—7% | 109½ | 108½ | 111 |
| National Pwr. & Lt., com.†—no par. ex.div | 32 | 21¾ | 36⅜ |
| National Pub. Serv., 7% pf. | 102½ | 99 | 103 |
| National Pub. Serv., 7% ptc., pf. | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 28 | 22 | 29⅜ |
| National Pub. Serv., B com.—no par | 33¾ | 24⅞ | 34½ |
| Nebraska Pwr., 7% pf. | l110½ | 110 | 111½ |
| Nevada-Calif. Elec., com. | 42⅞ | 33¼ | 42 |
| New Brunswick Pwr., 4% pf. | 64 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 110 | 98½ | 110½ |
| New Eng. Pub. Serv., pf. $7 | 98 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108¼ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 102 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | 105 | 101 | 105½ |
| New York Power & Light 7% pf. | 114½ | .... | .... |
| Niagara Falls Pwr., 7% pf.—25 | 28¾ | 27¾ | 29 |
| No. Amer., 6% pf.—50 | 55 | 53¼ | 55⅝ |
| No. Amer., com.—10 | 72⅞ | 58⅞ | 78⅞ |
| No. Amer. Edison, $6 pf.—no par. ex. div | 103½ | 102½ | 105⅜ |
| Northeastern Pwr., com. | 29½ | 19⅞ | 31 |
| No. N. Y. Utilities, 7% pf. | 108 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 28¾ | 18 | 32 |
| Northern Ohio Pwr. & Lt., 6% pf. | 100 | 90 | 99 |
| No. Ont. Lt. & Pr. 6% pf. | k100 | 94 | 100 |
| No. Ont. Lt. & Pwr., 4% com. | m 72 | 73 | 78 |
| No. States Pwr. (Del.), 7% pf. | 109 | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 144½ | 123 | 152 |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par. | 93 | 89 | 100⅜ |
| Ohio Brass, 6% pf. | k105 | 106 | 111 |
| Ohio Pwr., 6% pf. | 108 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | 104 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 112 | 107 | 112 |
| Ohio River Edison, 7% pf. | 109 | 106 | 109⅞ |
| Oklahoma Gas & Elec., 7% pf. | 114½ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 28½ | 25¾ | 23 |
| Pacific Gas & Elec., 8% new com. | 50½ | 43½ | 53¾ |
| Pacific Pwr. & Lt., 7% pf. | l110 | 106 | 110 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 81 | 79⅞ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 98½ | 93½ | 100 |
| Penn-Ohio Edison, 7% pf. | 108 | 97½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 111 | .... | .... |
| Penn Pwr. & Lt.—$7—no par. | l110 | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 85½ | 68 | 90 |
| Phila. Co., 5% pf.-50 | k 46½ | 45½ | 48½ |
| Phila. Co., 6% pf. -50 | 55 | 52 | 57 |
| Phila. Co., com.—50 | k170 | 145 | 174⅞ |
| Phila. Elec, 8% com.—25 | c 69½ | 55½ | 74¾ |
| Portland Elec. Pwr., 7% pf. | 105 | 100 | 104¼ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 45 | 42¼ | 52 |
| Potomac Elec. Power, 6% pf. | j111⅝ | .... | .... |
| Pwr. Sec., pf.—no par | 60 | 50 | 68 |
| Pwr. Sec., com.—no par | k13½ | 11¼ | 14¼ |
| Public Serv. of Colorado, 7% pf. | 108 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 112 | 103⅞ | 115 |
| Pub. Serv. of N. J., 7% pf. | 126½ | 118 | 129⅞ |
| Pub. Serv. of N. J., $2 com.—no par | 58⅞ | 41½ | 66⅞ |
| Pub. Serv. of No. Ill., 6% pf. | a110½ | 110 | 115 |
| P. S. of No. Ill., com. $8—no par | a189 | 159½ | 189 |
| Pub. Serv. of No. Ill., $8 com. | a186½ | 159⅞ | 186½ |
| Pub. Serv. of Okla., 7% pr. ln. | 109¾ | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | k109¾ | 108 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | k110 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 102 | 92 | 105⅞ |
| Puget Sound Pwr. & Lt., com. | 70 | 34⅞ | 84⅞ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | k 59⅞ | 54⅞ | 60 |
| Radio Corp. of Amer., com.—no par. | 180½ | 85¾ | 211 |
| Rochester Gas & Elec. 6% pf. D | 107⅞ | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107⅞ | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | 106 | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 117 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | k 75 | 70 | 75 |
| Servel, Inc. | k 15½ | 4½ | 16⅞ |
| Sierra Pacific Elec., 2% com. | k 39 | 29 | 40½ |
| Sioux City Gas & Elec., 7% pf. | 106½ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 109 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf | l 89⅞ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 55½ | 40⅞ | 61 |
| So. Calif. Edison, 8% pf. | 49 | 38½ | 41 |
| So. Calif. Edison, 7% pf. | 30 | 28½ | 30 |
| So. Calif. Edison, 6% pf. | 27 | 25⅞ | 28 |
| So. Calif. Edison, 8% com. | 50 | 43½ | 53¼ |
| Southern Cities Utilities, 7% pf. | 83 | 75 | 92 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 70 | 60 | 65 |
| Southwestern Lt. & Pwr., $6 pf. | 95½ | 88 | 96¾ |
| Southwestern Pwr. & Lt., 7% pf. | k112 | 103 | 115 |
| Standard Gas & Elec., 8% pf. | 71½ | 65 | 71½ |
| Standard Gas & Elec., 7% pr. pf. | 114½ | 110½ | 115 |
| Standard G. & E., com. $3.50 | k 69½ | 57⅞ | 74⅞ |
| Standard Power & Light, com. | k 53 | 29⅞ | 53 |
| Standard Pwr. & Lt., 7% pf. | h107 | 103⅞ | 107⅞ |
| Staten Island Edison, pf.—$6—no par | 102½ | 99 | 103½ |
| Superheater, $6 com.—no par | 154 | 155 | 178 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 112½ |
| Syracuse Lighting, 8% pf. | k117½ | 114 | 119 |
| TAMPA ELEC., com. $2 | k 68½ | 62 | 71 |
| Tenn. Elec. Pwr., 6% pf. | 103 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109 | 107 | 110 |
| Tex. Pwr. & Lt., 7% pf. | l114 | 113½ | 115 |
| Tide Water Pwr., 8% pf. | 111[illegible] | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 123½ | 112⅞ | 134 |
| Toledo Edison, 7% pf. | 109½ | 108 | 111 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | k145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 96 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c140½ | 114½ | 149⅞ |
| United Lt. & Pwr., pf.—$4—no par | k 56½ | 49 | 56½ |
| United Lt. & Pwr., pf.—$6.50—no par | 101½ | 94⅞ | 103½ |
| United L. & P., com. A .48—no par. | h 24 | 13⅞ | 26⅞ |
| United L. & P., com. B .48—no par. | k 26 | 16 | 30 |
| Utah Pwr. & Lt., 7% pf. | l112 | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | k200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 102½ | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 40¾ | 28½ | 44⅞ |
| Utilities Pwr. & Lt., com. B $1—no par | 28¾ | 18½ | 30⅞ |
| VERMONT HYDRO-ELEC., 7% pf. | 99 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | k110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102½ | 97 | 103½ |
| WAGNER ELEC., 7% pf. | b106 | 96½ | 106 |
| Wagner Elec., com.—no par | b 85 | 37 | 120 |
| Washington Ry. & Elec., 7% com | j450 | .... | .... |
| Washington Ry. & Elec., 5% pf. | j100½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | 225 | 175 | 235 |
| West Penn Elec., 7% pf. | 114 | 109½ | 115 |
| West Penn Elec., Cl. A $7 | 109½ | 106½ | 112 |
| West Penn Pwr., 7% pf. | 115⅞ | 114⅞ | 117 |
| West Penn Pwr., 6% pf. | 110½ | 108⅞ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf. | 104 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | k104 | 100 | 106 |
| Western States Gas & Elec., com. | m 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 102½ | 88½ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | k 33 | 30½ | 34½ |
| Weston Elec. Instrument, com.—no par | 16 | 12½ | 18¼ |
| Wheeling Elec., 6% pf. | 106 | 95 | 109 |
| Worthington Pump, 7% pf. A | k 52 | 46½ | 58½ |
| Worthington Pump, 6% B | k 47½ | 41 | 51 |
| Worthington Pump, com. | 33 | 28 | 36⅞ |
| YALE & TOWNE com. $5—25. | 75 | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, May 19. *l*Bid price Wednesday, May 23. *m*Latest quotations available. †Dividend rate variable.

shares of $100 par value to 241,132 shares of $25 par value and the distribution of four new shares for each share now held. They also voted to authorize the creation and issuance of 120,000 additional $25 par common shares to be sold to common stockholders of record May 8 at par in the ratio of one new share for each five shares held.

CONSUMERS POWER ELECTS NEW DIRECTORS.—At a meeting of the board of directors of the Consumers Power Company R. P. Stevens and T. A. Kenney were elected members of the board.

MASSACHUSETTS LIGHTING ELECTS NEW TRUSTEES.—Philip Young of the banking house of Baker, Young & Company, Boston, and George F. Howland, treasurer of the Massachusetts Lighting Companies, were elected trustees of the last-named organization at the recent annual meeting in Boston. Philip Childs and Henry I. Harriman were re-elected trustees.

METROPOLITAN EDISON STOCK ON NEW BASIS.—The Metropolitan Edison Company declared a quarterly dividend of $2 a share on the common stock payable March 24 to holders of record March 15. This places the stock on an $8 basis, compared with $7 previously.

JAPAN UTILITY TO REFUND.—The Tokio Electric Light Company is planning a refunding operation that will involve $24,000,000 by offering new securities, proceeds from the sale of which will be used to retire 6 per cent notes maturing in August. Part of the issue will be offered in Japan.

NIAGARA UTILITIES PREPARE FOR MERGER.—The Tonawanda Power Company, the Niagara Falls Power Company and the Niagara, Lockport & Ontario Power Company have called their outstanding preferred stocks. The class A and class B preferred stocks of the Tonawanda company will be redeemed July 2 at $27.50 and $25.50 a share and accrued dividends; the Niagara, Lockport & Ontario preferred will be redeemed June 30 at $26.25 a share and accrued dividends and the Niagara Falls preferred will be redeemed on June 30 at $27.50 a share and accrued dividends. Holders of these various stocks may exchange them until June 1 for first preferred stock of for Buffalo, Niagara & Eastern Power Corporation, with which company the other companies are presently to be merged.

## The Electrical Industry in Europe

Per capita expenditures for electrical goods and estimates of energy generated—in most instances during 1925—in various European countries have recently been published by the Department of Commerce and are here reproduced. The figures were obtained from the Documentation on the Electrical Industry at the Geneva Conference of 1927.

PRODUCTION OF ELECTRICITY IN EUROPEAN COUNTRIES

| Country | Per Capita, Expenditure for Electrical Goods | Generation of Electrical Energy Annually, Millions of Kilowatt-Hours |
|---|---|---|
| Germany | $6.72 | 22,000 |
| France | 2.31 | 9,800 |
| Belgium | 2.52 | 1,700 |
| Great Britain | 6.26 | 11,000 |
| Italy | 1.02 | 7,600 |
| Spain | 0.86 | * |
| Netherlands | 1.26 | 900 |
| Switzerland | 4.90 | 3,900 |
| Austria | 3.48 | 1,600 |
| Czechoslovakia | 1.33 | 850 |
| Hungary | 1.10 | 710 |
| Russia | 0.14 | 4,100 |
| Poland | 0.23 | 1,300 |
| Finland | 1.95 | 233 |
| Sweden | 2.64 | 3,500 |
| Norway | 2.69 | 6,200 |
| Denmark | 2.00 | 350 |

* No statistics available.

Public Service to Double Preferred Shares.—The Public Service Corporation of New Jersey has called a special meeting of stockholders for May 28 to vote on a proposed increase in the authorized preferred stock from 2,000,000 shares to 4,000,000 shares, the additional shares to be no-par $5 dividend stock. This is the first preferred stock issue of the company without par value. The preferred stock now authorized consists of 250,000 shares of 8 per cent cumulative preferred, 500,000 shares of 7 per cent cumulative preferred and 1,250,000 shares of 6 per cent cumulative preferred stock, all of $100 par value. There are also 10,000,000 shares of no-par common stock authorized.

Ingersoll-Rand Extra Dividend.—The Ingersoll-Rand Company recently declared an extra dividend of $1 in addition to the regular quarterly dividend of 75 cents on the common stock.

# World's 33,000,000 Hydraulic Horsepower

The developed water power of the world, according to estimates of the U. S. Department of the Interior through the Geological Survey, was about 23,000,000 hp. in 1920, 29,000,000 hp. at the end of 1923 and 33,000,000 hp. at the end of 1926, an increase of 43 per cent in six years. About three-fourths of the increase for the last three years has been in the English-speaking section of North America.

The estimates here given are considered sufficiently accurate to afford a rough idea of the potential water-power resources of the world and the extent of their development, although it is difficult to co-ordinate estimated water power for the several countries, particularly estimates of potential water power, because of differences in their elements and character and in the completeness and accuracy of the data on which they are based. The figures for the developed water power represent the rated capacity of waterwheels or turbines installed, and the figures for the potential power represent the total power that could be obtained at ordinary low water, including the power already developed. The installed capacity usually amounts to two or three times the power available at low water.

TABLE I—THE WORLD'S WATER POWER BY CONTINENTS

| Continent | Developed Horsepower | Potential Horsepower |
|---|---|---|
| North America | 16,800,000 | 66,000,000 |
| South America | 750,000 | 54,000,000 |
| Europe | 13,100,000 | 58,000,000 |
| Asia | 2,100,000 | 69,000,000 |
| Africa | 14,000 | 190,000,000 |
| Oceanica | 240,000 | 17,000,000 |
| Approximate total | 33,000,000 | 454,000,000 |

The figure for the developed water power in the United States includes only plants having a capacity of 100 hp. or more and is based on excellent data; the corresponding potential power is the amount available 90 per cent of the time at 70 per cent efficiency.

*Table II—Summary of Potential and Developed Water Power in 1926, by Countries*

(Estimated by the United States Geological Survey)

| Country | Developed Horsepower | Potential Horsepower |
|---|---|---|
| **North America** | | |
| Mexico | 300,000 | 6,000,000 |
| United States | 11,721,000 | 35,000,000 |
| Alaska | 43,000 | 1,000,000 |
| Newfoundland | 160,000 | 400,000 |
| Canada | 4,556,000 | 18,250,000 |
| Costa Rica | 15,000 | 1,000,000 |
| Guatemala | 4,000 | 1,500,000 |
| Honduras | 3,000 | 1,000,000 |
| Nicaragua | 400 | 800,000 |
| Salvador | 2,700 | 200,000 |
| Panama | 13,300 | 500,000 |
| West Indies | 19,350 | 150,000 |
| Approximate total | 16,800,000 | 66,000,000 |
| **South America** | | |
| Argentina | 25,000 | 5,000,000 |
| Bolivia | 13,500 | 2,500,000 |
| Brazil | 500,000 | 25,000,000 |
| British Guiana | ......... | 2,500,000 |
| Dutch Guiana | ......... | 800,000 |
| French Guiana | ......... | 500,000 |
| Chile | 114,000 | 2,500,000 |
| Colombia | 25,000 | 4,000,000 |
| Ecuador | 5,500 | 1,000,000 |
| Paraguay | 200 | 2,000,000 |
| Peru | 55,000 | 4,500,000 |
| Uruguay | ......... | 300,000 |
| Venezuela | 13,000 | 3,000,000 |
| Approximate total | 750,000 | 54,000,000 |
| **Europe** | | |
| Sweden | 1,350,000 | 8,000,000 |
| Norway | 1,900,000 | 9,500,000 |
| Finland | 220,000 | 1,800,000 |
| Russia | 230,000 | 3,000,000 |
| Esthonia | 16,950 | 125,000 |
| Latvia<br>Lithuania | 5,000 | 100,000 |
| Poland | 90,000 | 1,400,000 |
| Ukraine | 40,000 | 425,000 |
| Region of the Caucasus | 5,000 | 5,000,000 |
| Hungary | 3,000 | 175,000 |
| Czechoslovakia | 155,000 | 1,000,000 |
| Yugoslavia | 180,000 | 3,000,000 |
| **Europe (continued)** | | |
| Austria | 325,000 | 1,660,000 |
| Rumania | 30,000 | 1,600,000 |
| Bulgaria | 18,000 | 1,200,000 |
| Greece | 8,000 | 250,000 |
| Turkey | ......... | Small |
| Albania | 1,000 | 500,000 |
| Italy | 2,300,000 | 3,800,000 |
| Switzerland | 1,850,000 | 2,500,000 |
| Germany | 1,100,000 | 2,000,000 |
| France | 2,000,000 | 5,400,000 |
| British Isles | 250,000 | 850,000 |
| Belgium | 700 | Small |
| Denmark | 11,000 | 9,000 |
| Netherlands | 150 | Small |
| Spain | 1,000,000 | 4,000,000 |
| Portugal | 10,000 | 300,000 |
| Iceland | ......... | 500,000 |
| Approximate total | 13,100,000 | 58,000,000 |
| **Asia** | | |
| Chinese Republic | 1,650 | 20,000,000 |
| India | 200,000 | 27,000,000 |
| Asia Minor | 500 | 500,000 |
| Arabia | ......... | ......... |
| Persia | ......... | 200,000 |
| Afghanistan | 2,000 | 500,000 |
| Siberia | 90,800 | 8,000,000 |
| French Indo-China | ......... | 4,000,000 |
| Siam and Malay States | 4,500 | 4,000,000 |
| Chosen | 18,300 | 500,000 |
| Japan | 1,750,000 | 4,500,000 |
| Approximate total | 2,100,000 | 69,000,000 |
| **Africa** | | |
| Tangier | ......... | 50,000 |
| Morocco | ......... | 250,000 |
| Algeria | 130 | 200,000 |
| Tunisia | ......... | 30,000 |
| Tripoli | ......... | Small |
| Eritrea | ......... | Small |
| British Somali | ......... | Small |
| Italian Somali | ......... | Small |
| Gold Coast and British mandate in Togo | ......... | 1,450,000 |
| **Africa (continued)** | | |
| Liberia | ......... | 4,000,000 |
| Sierra Leone | ......... | 1,700,000 |
| Senegal | ......... | 250,000 |
| Rio de Oro | ......... | Small |
| Gambia | ......... | Small |
| Portuguese Guinea | ......... | Small |
| Union of South Africa | 5,000 | 1,600,000 |
| Angola | 4,000 | 4,000,000 |
| Southwest Africa (Union of South Africa mandate) | ......... | 150,000 |
| Belgian Congo and Belgian mandate | 250 | 90,000,000 |
| French Congo | ......... | 35,000,000 |
| French mandate in Cameroon | ......... | 13,000,000 |
| Nigeria and British mandate in Cameroon | ......... | 9,000,000 |
| Rhodesia | 2,500 | 2,500,000 |
| Tanganyika (British mandate) | 800 | 2,700,000 |
| British Central Africa | ......... | 1,200,000 |
| British East Africa | 900 | 4,700,000 |
| Portuguese East Africa | ......... | 3,700,000 |
| Bechuanaland | ......... | 20,000 |
| Abyssinia | ......... | 4,000,000 |
| Egypt | ......... | 600,000 |
| Ivory Coast, Dahomey, and French mandate in Togo | ......... | 2,850,000 |
| French Guinea | ......... | 2,000,000 |
| French Sudan | ......... | 1,000,000 |
| Madagascar | 100 | 5,000,000 |
| Approximate total | 14,000 | 190,000,000 |
| **Oceanica** | | |
| Australia | 2,000 | 600,000 |
| New Zealand | 60,000 | 2,500,000 |
| Philippine Islands | ......... | 1,500,000 |
| Sumatra | 20,000 | 2,000,000 |
| Java | 60,000 | 750,000 |
| Borneo, including New Guinea and Papua | ......... | 7,500,000 |
| Tasmania | 75,000 | 700,000 |
| Celebes | 500 | 1,000,000 |
| Hawaii | 25,000 | 100,000 |
| Approximate total | 240,000 | 17,000,000 |

## Operations Materially Increase During April

### Rate of Production in Electrical Manufacturing Plants 18 per Cent Over April of Last Year—Smaller Manufacturers Report 16.4 per Cent Gain During April Over March

During April the electrical manufacturing plants of the nation reported that productive operations as indicated by the consumption of electrical energy were materially above those of March and only slightly below the record peak of activities recorded in October last year. A radical upward turn in the rate of operations in these plants was hardly to be expected at this season of the year, if the operations of past years is to be taken as a criterion. April rate of operations, after corrections are made for the number of working days, was about 11 per cent above that reported for March and about 18 per cent above that of April last year. The average rate of operations of these electrical manufacturing plants during the first quarter of the current year was about 5 per cent above that for the same period last year.

The smaller electrical manufacturing plants reported a much greater increase in rate of operations during April than was reported by the larger companies. The April rate of production by the smaller plants was 16.4 per cent over that of March, a large number of these companies reporting a greater consumption of electrical energy during April than during March, in spite of the fact that April had two less working days than March. The larger companies reported a rate of production during April only 1.4 per cent above that of March.

The index of activity in the electrical manufacturing industry based on the consumption of electrical energy stands at 128.4 for April, as compared with 115.3 for March and 131.3 for the record month of October, 1927. Comparative indexes of productive activity referred to the average productive activity for the period 1923-25 as 100, and adjusted for number of working days, are as follows:

| | |
|---|---|
| April, 1928 | 128.4 |
| March, 1928 | 115.3 |
| February, 1928 | 121.8 |
| October, 1927 (peak month) | 131.3 |
| April, 1927 | 108.9 |
| April, 1926 | 107.8 |

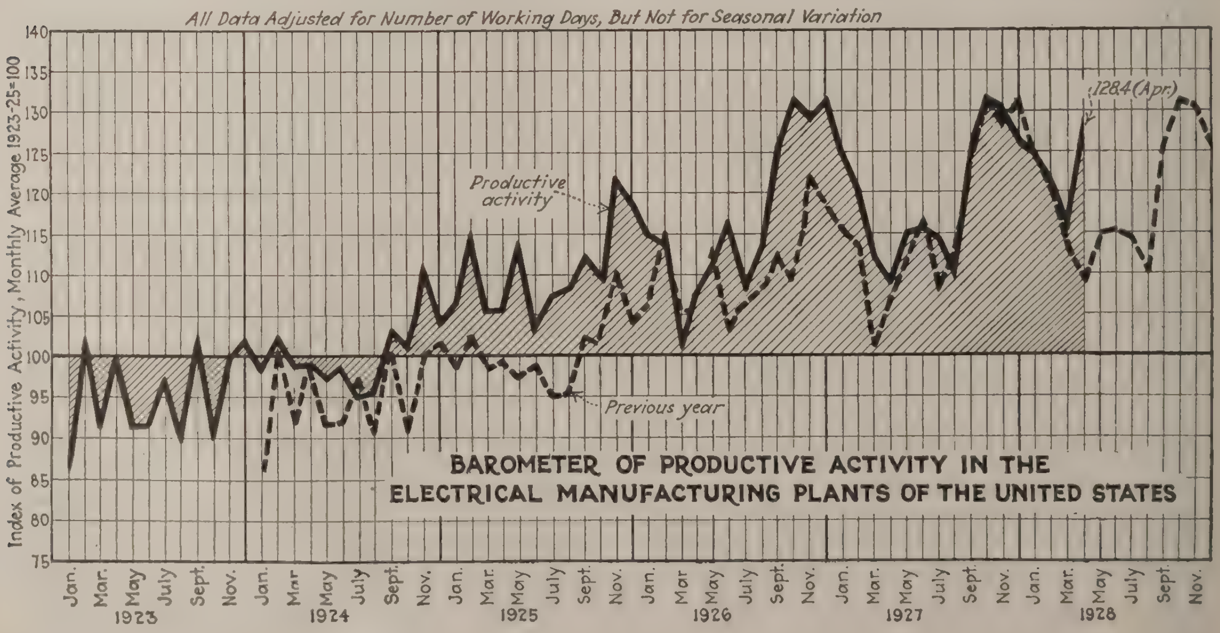
General industry also recorded an upward swing in the rate of operations during April. The April rate of general industrial operations for the country as a whole was close to 1 per cent greater than that witnessed in March and was about 2.2 per cent over April of last year. Industrial operations are being well sustained, some of the outstanding industrial groups recording increased operations, when a slight seasonal decrease would be expected normally. The favorable industrial situation is reflected by the fact that during the first four months of the current year the average rate of activity of general industry was about 3.7 per cent above that during the same period in 1927.

## Building Industry to Stabilize Credit Conditions

To correct improper practices and to stabilize credit conditions in the building construction industry, representative sub-contractors and general contractors have joined in the Allied Construction Industries Committee, a new body recently formed at a meeting in Washington, D. C. Members of the committee, representing thirteen national associations, are to meet at Detroit next month to advance the work already accomplished and to give a more definite form to the program for future activities. The organization includes members of the executive committee of the Associated General Contractors of America and two representatives from a number of trade organizations including the Elevator Manufacturers' Association and the Association of Electragists, International.

George B. Walbridge, Detroit, former president of the Associated General Contractors of America and chairman of the committee, presided at the organization meeting and submitted a report of that session to the full conference.

In addressing the conference, Mr. Walbridge declared "hundreds of concerns operating in the construction industry are in a state of perpetual insolvency. They secure materials and



equipment under loose credits, reaping their profits by failure to pay their bills and by using inferior materials and workmanship." Foremost among the measures to be given consideration at the Detroit meeting next month will be the formulation of rules of ethical practices. Establishment of a rational credit system also will be undertaken as a primary move.

# Market Conditions

SLOW but steady progress is registered by the electrical industry so far in 1928, although sales have been spotty in some districts. In fact, some manufacturers have even termed business as slow, yet they are optimistic. There appears to be a definite trend to greater activity on the part of industrial plants, and much electric railway business is in sight. The inquiries in the market and the active projected business bear out an optimistic feeling.

In New England the sales volume is expanding. A number of orders for heavy industrial equipment are pending. Industrial business is becoming more active in the Eastern district. Major industrial projects include a cement mill in Ohio, to cost $1,000,000; an automobile assembling plant in Missouri, to cost $1,500,000; an aircraft plant in Ohio, to cost $1,200,000. A soap manufacturer in Baltimore plans the purchase of considerable equipment for a factory to cost $3,000,000. Central-station purchases are limited to immediate requirements. Volume of business as well as prospects look good in the Southeast district. An order was placed for oil circuit breaker equipment amounting to $40,000. A central-station company closed a contract for 45 electric refrigerators for an apartment house installation, while many street-lighting projects are reported. A slight improvement is noted in the St. Louis district. Better business is reported in the Middle West. Maintenance purchasing of central-station companies are quite heavy. A prominent utility company is buying at the rate of $92,000 per day. On the Pacific Coast a good deal of construction work is planned, although buying is comparatively slow. A large paper plant will be built in Port Townsend, Wash., at a cost of $3,000,000.

## *Non-Ferrous Metals Strong in Sellers' Market*

Metal producers are well satisfied with the trend of the market during the last week. Copper sales have dropped off to close to average in the domestic market, but the price has advanced and sellers have little to offer. Zinc has been exceedingly quiet, but the metal is so firmly held that prices have advanced a few points further. Lead and tin prices show little change, but the activity in each of these metals has been greater than last week.

NEW YORK METAL MARKET PRICES

| | May 16, 1928 Cents per Pound | May. 23, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic..... | 14.15–14.175 | 14.375 |
| Lead, Am. S. & R. price | 6.10 | 6.10 |
| Antimony.............. | 11⅛ | 11.125 |
| Nickel, ingot............ | 35 | 35 |
| Zinc spots.............. | 6.40 | 6.475 |
| Tin, Straits............. | 52¾ | 51.625 |
| Aluminum, 99 per cent... | 24.30 | 24.30 |

Base copper wire price May 23, 1928, 16⅜ cents.

## *Volume of Business Increasing in the Southeast*

While the past week witnessed an increase in the volume of small business in the Southeast, a few large orders were reported. One order was for oil circuit breaker equipment amounting to $40,000. An order for three 500-kw. and six 150-kw. transformers will probably be placed shortly. A central-station company closed a contract for 45 electric refrigerators for an apartment house installation, while another company has closed twelve apartment house jobs ranging from six to 24 units per installation, and several other similar installations are pending.

A cotton mill in Georgia will build an addition to its warehousing facilities and a contract will probably be let within a few weeks. Wiring supplies aggregating $4,000 will go into this job. A municipality in Louisiana ordered "white-way" equipment amounting to $4,000, while towns in Alabama and Georgia ordered similar equipment amounting to $3,500 and $2,000, respectively. Two $3,000 "white-way" orders from Georgia towns are in immediate prospect. Jobbers report good business, particularly in supply lines. Construction projects are as follows:

Swift & Company, Chicago, plan a vegetable oil refinery at Jacksonville, Fla., to cost $200,000. Miami, Fla., plans a municipal airport to cost $1,000,000. The C. J. Patterson Corporation, Kansas City, Mo., will build a baking plant at Atlanta, Ga., to cost $100,000. The Georgia Power Company, Atlanta, Ga., has acquired municipal power plant at Winder, Ga. Paducah, Ky., plans the installation of a municipal power plant and has authorized surveys.

The Mississippi Power Company, Gulfport, Miss., plans a transmission line from Richton to McLain and vicinity, 20 miles, and from Richton to Hattiesburg, 25 miles, and will install substation equipment. The Southern Public Utilities Company, Charlotte, N. C., is negotiating for the purchase of the municipal power plant at Huntersville, N. C. The Carolina Cement Company, New Bern, N. C., plans a power plant of 5,000-kva. capacity in connection with a proposed cement mill. Miami Beach, Fla., will receive bids until June 6 for an ornamental lighting system.

## *New England Sales Volume Expands*

Not only is the current trend of sales steady in New England but the outlook for increasing business during the next month is encouraging. Orders for small motors are normal. A number of sales for 50-hp. motors are of interest. Pole line material, wire and cable are in good demand. Several service extensions provide interesting prospects for transmission line equipment. Heavy industrial equipment business is quiet, but a number of orders are pending, one of which includes a complete motor-generator set. Sales of power equipment for freezers, ice crushers and ice-making machinery are active. A prominent preparatory school in Massachusetts is planning to install equipment whose consumption will be 100,000 kw.-hr. annually. Equipment for fish freezers was recently placed in Gloucester, Mass. Construction projects are as follows:

The Twin Gas & Electric Company plans to build 6 miles of 66,000-volt transmission line in Pownal, Vt., at a cost of $30,000. The Bangor Hydro-Electric Company, Maine, will expend $50,000 for service extension. This company will make additions to the Ellsworth plant, including several 1,000 kva. transformers, rebuilding transmission lines in Washington county and on Mount Desert island. The town of Hudson, Mass., will erect a municipal power plant and has purchased three Diesel engines costing $162,000, but has not yet ordered the generating equipment.

## *Industrial Account Active in Eastern District*

Expanding industrial business is reported in the Eastern district. Several extensive projects are soon to mature, while present commitments have reached sizable levels. A cement company is completing plans for a mill in Cuyahoga County, Ohio, to cost more than $1,000,000, while a similar project will soon mature in Illinois. An automobile assembling plant will be built in Missouri to cost upward of $1,500,000, while an aircraft plant is contemplated in an Ohio city to cost approximately $1,200,000. A sulphur company operating in Texas has placed an order for two 750-kw. turbo-generating units. An iron and steel mill in the vicinity of Trenton, N. J., is contracting for motors, control equipment and other apparatus for a new addition.

A manufacturer of soap will ask bids in about four weeks for considerable equipment for a factory at Baltimore to cost upward of $3,000,000. Fractional-horsepower motor business continues satisfactory, with a fair volume of inquiries. Substation apparatus, including switchboard panels and instruments, is being purchased by new office buildings in the metropolitan district; a recent order for this account totaled about $16,000.

Central-station purchases are being limited to immediate requirements and the bulk of transactions is centered in substation apparatus. A manufacturer of transformers states that current trade is satisfactory and that the heaviest commitments are being secured from light and power companies in the metropolitan district, with inquiries exceptionally good at the moment. A producer of wire and cable reports equally encouraging accounts from metropolitan utilities, covering both substation and transmission line operations.

Transactions in the electrical appliance field show little change and continue on a reduced scale. Vacuum cleaner business has fallen off a little, but electric refrigerator account looms as an important feature of spring sales. Electric supplies for domestic service and insulating products are recording a fair volume of business. Immediate construction activities in the Eastern district include the following:

The New York Central Railroad Company, New York, will receive bids June 1 for a 2,000-kw. rotary converter and a 2,100-kva. transformer, for substation service. The New York Power & Light Corporation, Albany, N. Y., has secured permission to make extensions in transmission lines to Wells, Hope, Benson and vicinity. The Cheektowaga Crushed Stone Corporation, Cheektowaga, N. Y., plans a plant to cost $100,000. The Transogram Company, New York, will build a toy-manufacturing plant at Haskell, N. J., to cost $100,000. The Niagara, Lockport & Ontario Power Company, Batavia, N. Y., has plans for a storage plant at Angola, N. Y., to cost $45,000.

The Western Electric Company plans an addition to its plant at Kearny, N. J., to cost $1,250,000. The Philadelphia Electric Company, Philadelphia, has secured permission to install steel towers for a line in the vicinity of Fox and Westmoreland Streets. The Overbrook Hosiery Mills, Reading, Pa., plans an addition to cost $180,000. The Danville Structural Steel Company, Danville, Pa., will build two additions to cost $300,000. Baltimore, Md., plans an ornamental lighting system. The Consolidated Gas, Electric Light & Power Company, Baltimore, plan extensions in recently acquired property at Havre de Grace, Md. The General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until June 7 for electrical supplies (Panama Schedule 1878).

### *Sales in St. Louis District Show Slight Improvement*

A slight improvement is noted in the St. Louis district. Manufacturers of appliances say that the demand is holding up above that of last year, especially for ranges and other cooking appliances. Stock sizes of motors are in better demand and orders are coming in steadily. An order for substation equipment for south Missouri was placed at a cost of $3,600 and a lot of motors from 5 hp. to 25 hp. amounting to $1,800. Construction projects are as follows:

The Arkansas Power & Light Company, Little Rock, Ark., plans transmission lines at Melbourne, Ark., and vicinity. The Atchison, Topeka & Santa Fe Railway plans a power house at shops at Emporia, Kan., to cost $85,000. Chalona Brothers Packing Company, Buras, La., plans a power plant in connection with its packing house to cost complete $50,000. The Empire District Electric Company, Joplin, Mo., has applied for a permit to construct a hydro-electric plant on the White River. The Inland Utilities Company, Kansas City, Mo., has acquired the municipal power plant at Hooker, Okla. The Harrison-Smith Company, Oklahoma City, Okla., manufacturer of automobile accessories, will build a plant to cost $90,000.

The United States Zinc Company, New York, plans a mill at Amarillo, Tex., to cost $100,000. The Beaumont Import & Export Company, Beaumont, Tex., plans a lumber mill, to cost $100,000. The Valley Bonded Warehouse Company, Brownsville, Tex., plans a cold storage plant to cost $200,000. Denton, Tex., plans a municipal power plant to cost $38,000. The Burford Oil Company, Shreveport, La., plans an oil refining plant at Pecos City, Tex., to cost $600,000. Stamford, Tex., plans extensions in its municipal power plant.

### *Better Business Outlook Noted in Middle West*

While no unusual activity of business is apparent in the Middle West it is generally admitted that business is better, although not up to expectations at the beginning of the year. The automotive, steel and railroad industries are prospering and better business is in view. Maintenance purchasing is quite heavy. Purchases of one utility company average $92,000 a day. Interesting orders include: Complete condensing equipment for use with a 55,000-kw. turbo-generator, soot blowers for six boilers, economizers and air heaters, six forced-draft fans, 500,000 lb. weatherproof wire and cable and 50,000 lb. of busbar copper. There has been a good demand for pole line hardware, one manufacturer reporting last month's sales as the largest in his history. Construction projects are as follows:

The Chicago Rivet & Specialty Company, Chicago, plans a plant to cost $85,000. The Robert O. Law Company, Chicago, will soon take bids for a printing plant to cost $350,000. The Sears Paper Box Company, Danville, Ill., plans a factory to cost $100,000. The Marquette Cement Manufacturing Company, Chicago, plans a mill at Oglesby, Ill., to cost $1,000,000. The Columbia Mills, Inc., West Pullman, Ill., plans addition to textile mill to cost $100,000. The Cleveland, Cincinnati, Chicago & St. Louis Railroad, Cincinnati, Ohio, plans an engine house and shops at Beech Grove, Ind., to cost $200,000. Edinburg, Ind., will receive bids until June 4 for a municipal power plant.

Deer & Company, Moline, Ill., plans an agricultural machinery plant at Waterloo, Iowa, to cost $200,000. Parke, Davis & Company, Detroit, plans additions to drug and chemical works, to cost $2,000,000. The Chevrolet Motor Company, Flint, Mich., plans a group of five plant units at Saginaw, Mich., to cost $10,000,000. The Consumers Power Company, Jackson, Mich., plans a power plant at Grand Rapids, Mich., to cost $500,000. The Dominion Electric Company, Minneapolis, Minn., plans a factory to cost $100,000. The Dayton Power & Light Company, Dayton, Ohio, will soon begin construction of an auxiliary power plant to cost $300,000.

The Ohio Public Service Company, Cleveland, will build an addition to its Edgewater generating plant at Loraine, Ohio, to cost $450,000. The Libbey-Owens Sheet Glass Company, Toledo, Ohio, plans an addition to its plant to cost $750,000. Blair, Wis., plans a municipal power plant. Mankato, Minn., plans extensions in its municipal lighting system. Champaign, Ill., Cedar Rapids, Iowa, and Madison, Wis., plan ornamental lighting systems.

### *Much Construction Planned on Pacific Coast*

Buying is comparatively slow on the Pacific Coast, although projected construction is excellent. Power company purchases have included two carloads of pole line hardware, an indicating voltage regulator for the Bay district, at an installation cost of $12,500, and about 400 assorted small transformers for the week's aggregate business. Arizona construction prospects are very good. Bonds amounting to $4,000,000 were voted for the irrigation and electrification of the Salt River area.

Government construction includes a submarine overhauling plant and battery storage building for Marine Island and the alteration and redistribution of electric and telephone systems in the marine barracks at San Diego. Dealers' business has been only fair. Contracting business has been good, particularly in conduit and boxes.

Immediate construction of the second unit of a Kraft paper plant in Port Townsend, Wash., costing $3,000,000, has been announced by the National Paper Products Company, a Zellerbach subsidiary, and the purchase of two 3,500-hp. turbines was reported. About 100 motors were reported sold by Seattle jobbers. A turbine and fire control equipment was sold to a Grays Harbor mill at a cost of $5,000. Contracts let include approximately $18,000 worth of weatherproof wire by the city of Seattle and an $18,000 street lighting system in Bremerton.

The city of Tacoma is planning a 50,000-volt transmission line between Lake Cushman and the Nisqually substation and extension of distribution lines at an estimated cost of $63,000. Industrial construction announced includes a 250,000-ft. daily capacity sawmill at Klamath Falls, Ore., with a 6,000-hp. power plant by the Weyerhaeuser Timber Company, and a 100,000-ft. daily capacity electrified mill in Centralia by the Centralia Lumber & Manufacturing Company. Construction projects are as follows:

The Los Angeles Gas & Electric Corporation, Los Angeles, plans a storage plant at Alhambra, to cost $55,000. The H. C. Smith Company, Los Angeles, manufacturer of oil well equipment, plans a new plant to cost $100,000. Uttley & Kleindenst, Oakland, engineers, are drawing plans for a cold storage plant to cost $400,000. Eugene, Ore., will receive bids until June 5, for the Leaburg unit of the municipal hydro-electric project, to cost $1,500,000. Ellensburg, Wash., plans addition to its municipal lighting plant. Long Beach, Santa Ana, Los Angeles, Bakersfield, Burbank and Oroville, Calif., plan installation of ornamental lighting systems. The county supervisors, Los Angeles, will receive bids until June 4 for an ornamental lighting system on Whittier Boulevard, estimated to cost $54,500.

# Activities of the Trade

## General Electric Welding Two New Factory Buildings

Two new factory buildings, all the structural work of which will be arc welded instead of riveted, are now being erected by the General Electric Company. One of these will be an addition to the General Electric plant in Bridgeport, Conn., and the other will be located at the company's Pittsfield, Mass., plant. These mark a second step in the General Electric program, recently announced, of utilizing welding in the construction of its new buildings.

The first General Electric welded building was erected in Philadelphia, as an addition to the switchgear manufacturing plant there. This structure, approximately 140 ft. wide, 600 ft. long and 50 ft. high, contains about 1,000 tons of welded structural work, and is chiefly notable because of the large number of welded trusses used in the roof structure, and the fact that it is the heaviest and largest steel structure thus far welded. The new building at Bridgeport is to be a small, single-story structure, 64 ft. wide and 42 ft. long. The Pittsfield building will be a two-story structure of beam and column construction, about 40 ft. wide by 280 ft. long, and containing about 250 tons of steel. It will be used in the manufacture of molded products.

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The James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis, manufacturer of overhead and underground utility equipment, announces that Joseph D. P. Hoffman has joined its engineering staff as assistant designing engineer. Mr. Hoffman was formerly with the Southwestern Bell Telephone Company as field exchange engineer.

Servel Sales, Inc., 51 East 42d Street, New York City, has concluded a contract with the Commercial Investment Trust Corporation of New York City whereby there is available for all Servel and "Electrolux" dealers a modern financing plan for both wholesale and retail refrigerator sales.

The Roller Bearing Company of America, Newark, N. J., announces that it has concluded the purchase of the plant of the Mercer Motor Car Company in Trenton, N. J. The Mercer plant occupies 11½ acres and the buildings have 175,000 sq.ft. of floor space.

Tork Clocks, Inc., 12 East 41st Street, New York, have placed on the market a line of electrically operated clocks that can be furnished for any voltage for either alternating or direct current use and which have a reserve of 24 hours to take care of possible interruptions to current. They are guaranteed for unusual timekeeping accuracy under all ordinary temperature conditions. The line includes wall clocks for stores and offices, double faced hanging clocks, and double faced street clocks. There is also a program signal wall clock which will ring a program of bells on any daily schedule desired.

The Kuhlman Electric Company, Bay City, Mich., manufacturer of power, distribution and street lighting transformers, announces the appointment of the Enterprise Electric Company, 1425 M Street, Lincoln, Neb., as its representative. The Enterprise company will carry a stock of transformers.

The Joslyn Company, Chicago, manufacturer of pole-line material and wiring equipment, has appointed J. J. Costello of 201 Devonshire Street, Boston, as its New England selling agent. Mr. Costello also represents the Electric Power Equipment Corporation and the Philadelphia Electric & Manufacturing Company, both of Philadelphia.

The Consolidated Electric Lamp Company, Danvers, Mass., has purchased the plant of the A. M. Creighton Company, Broad Street, Lynn, Mass. It is announced that the Danvers organization will start operations in Lynn about July 1 with the installation of new machinery in the new plant and the gradual abandonment of the Danvers location. The new plant has a floor space of 100,000 sq.ft.

The National Lamp Works of the General Electric Company, Nela Park, Cleveland, has developed a two-filament incandescent lamp for miners. The two filaments operate at different intensities. The major filament, giving 14 beam candlepower of light, is used until it fails. Then a simple switch, attached to the side of the lamp, is turned to throw the current into the low-candle power emergency filament.

The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, announces that Gordon E. Bloom has been appointed field sales director of its refrigerator division. Mr. Bloom was formerly with the Copeland Products Company at Chicago. The company also announces that A. W. Kakitty has joined the illuminating engineering department.

The Rome Wire Company, Rome, N. Y., a division of the General Cable Corporation, announces that L. A. Zima has joined the staff as district engineer in the New York office. Mr. Zima was formerly cable engineer with the Brooklyn Edison Company.

The Fitzgerald Manufacturing Company, Torrington, Conn., manufacturer of "Star-Rite" electrical appliances, announces that it has placed on the market the new "Star-Rite Empress" waffle iron exclusively equipped with a heat indicator. The company also has placed on the market the "Star-Rite Hand Vac," a light hand-held vacuum cleaner.

## Armstrong Company Adds Directors and Changes Name

C. C. Armstrong of the Armstrong Manufacturing Company of Huntington, W. Va., announces that the company's name has been changed to the Armstrong Electric & Manufacturing Corporation. With this change a number of new directors have been brought into active participation in the company. Mr. Armstrong states that the company will now be able to concentrate new manufacturing, financing and merchandising facilities on Armstrong products while at the same time developing new products. The first of these new products is expected to be ready for formal announcement during the summer and for delivery in the early fall. The company is now producing its table stove in bright colors in addition to white.

At the meetings of the new Armstrong board of directors there now appear the following new directors: Thomas E. Spence; William S. Yerkes, vice-president and director of the General Outdoor Advertising Company; William C. Beckers, director of the Allied Chemical & Dye Corporation; J. Roy Allen, director of the American Hide & Leather Company; C. R. Berrien, vice-president of the Central Union Trust Company, New York; Hubert K. Dalton, president of the Dalton Tool Corporation; Gardner B. Perry; Harold Will, vice-president of the Will & Baumer Candle Company, and W. R. Westerfield, director of R. F. Westerfield & Company.

Thomas E. Spence, who has been an official of a public utility company and who has more recently been associated with the Hamilton Beach Company, has been elected president of the Armstrong corporation. Mr. Armstrong will be personally in charge of research and development of new products and equipment, and in addition to the active services of the directors named above the corporation will have the close co-operation of a number of important associates, each of whom has taken a financial interest in the business.

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Fostoria, Inc., New York City, manufacturer of lighting fixtures and electrical supplies, has leased the building at 59 West Fourteenth Street. The company has installed modern showrooms where it will display its complete line of merchandise.

The Union Electric Manufacturing Company, Milwaukee, manufacturer of control equipment, announces that it has appointed the Frederick Rall Company, Inc., 52 Warren Street, New York City, as successor to Curtis & Carhart, Inc., who retired from active business on May 1. The company also is establishing at 52 Warren Street, New York, a direct factory representative, Frank P. Caproni, who will take care of all direct factory business and service, particularly drum-type apparatus and special types of electric motor control equipment.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued May 1, 1928)

1,668,197. Suspension Tower; G. R. Falkiner-Nuttall, San Francisco, Calif. App. filed June 2, 1926.

1,668,199. Automatically - Controlled Electric Heating System; E. L. Fonseca, Newark, N. J. App. filed Jan. 19, 1927. Applicable to hair waving machines.

1,668,201. Current-Rectifying Unit and Method of Preparing the Same; E. R. Gill, Sr., Yonkers, N. Y. App. filed Sept. 25, 1926.

1,668,249. Automobile Riding Amusement Device; F. S. Rich, Los Angeles, Calif. App. filed Dec. 13, 1926.

1,668,250. Electric Laundry Iron; E. J. Rohne, Minneapolis, Minn. App. filed March 23, 1926.

1,668,251. Gas-Burner Control; E. H. Ryon, Pasadena, Calif. App. filed Oct. 29, 1924.

1,668,253. Safety Grounding Connection; R. A. Schmitt, San Diego, Calif. App. filed April 28, 1926.

1,668,272. Synchronous Motor; V. A. Flynn, St. Louis, Mo. App. filed Aug. 2, 1926. Which possesses the mechanical features of an asynchronous motor and are adapted to carry variable load at synchronous speed.

1,668,273. Synchronous Motor; V. A. Fynn, St. Louis, Mo. App. filed Aug. 11, 1926. In which a flux revolving synchronously with respect to the primary is produced at sub-synchronous speeds.

1,668,278. Reciprocating Electric Motor; J. D. Langdon, Los Angeles, Calif. App. filed Oct. 8, 1926.

1,668,285. Electric Power - Generating System; J. Pope, Brookline, Mass. App. filed Jan. 17, 1923.

1,668,293. Apparatus for Electrically Treating Liquids; F. F. Van Tuyl, Ann Arbor, Mich. App. filed Oct. 1, 1925.

1,668,310. Lightning Arrester; G. R. Folds, Evanston, Ill. App. filed May 28, 1923. For low voltage electric circuits, such as telephone, telegraph and signal systems.

1,668,343. Signal; W. Sparks, Jackson, Mich. App. filed July 16, 1920. Motor driven or other type of horn.

1,668,346. Suspension Link for Overhead Contact Wires and Method of Using Same; T. Varney, Sewickley, Pa. App. filed May 2, 1925.

1,668,365. Self - Starting Synchronous Motor; C. I. Hall, Fort Wayne, Ind. App. filed Feb. 5, 1925. Having a disk rotor.

1,668,366. Compensated Asynchronous Machine; L. Hartwagner, Dresden, Germany. App. filed Aug. 9, 1923.

1,668,377. Transformer for Electric-Arc Cutting and Welding Apparatus; F. C. Owen, Fayetteville, N. C. App. filed Nov. 12, 1925.

1,668,381. Electrical Connecter; C. A. Schild, Ft. Wayne, Ind. App. filed Oct. 30, 1923.

1,668,404. Separator and Plate Holder; F. E. Hollen, Chippewa Falls, Wis. App. filed April 30, 1926.

1,668,417. Heating Apparatus; S. M. McConnell, Tampa, Fla. App. filed April 28, 1927. With forced air draft.

1,668,434. Liquid-Testing Apparatus; E. W. Todd, Mitchell, Neb. App. filed Nov. 23, 1926. For electrically determining the hydrogen ion concentration of liquids.

1,668,450. Cut-Out; J. M. Fried, Vicksburg, Miss. App. filed Oct. 27, 1922. With means for preventing short-circuiting or overfusing.

1,668,457. Rate-of-Flow Indicator with Electric Integration for Fluids and Gases Flowing Through a Venturi Tube; W. Kath, Berlin-Friedenau, Germany. App. filed Aug. 24, 1921.

1,668,463. Trolley Head; C. Pandolfo, Montevideo, Uruguay. App. filed March 28, 1927.

1,668,477. Heating Element; H. Westergaard, Solvang, Calif. App. filed Nov. 19, 1926.

1,668,513. Protector; G. A. Millward, Brownsville, Pa. App. filed June 12, 1926. For inclosing a live electric conductor wire, for the protection of workmen.

(Issued May 8, 1928)

1,668,554. Asynchronous Polyphase Electric Motor; F. Ernstein, Roubaix, France. App. filed May 28, 1923. With means for operating it at two or more speeds.

1,668,581. Electrical Insulating Knob; D. McI. Brown, Prince Rupert, B. C., Canada. App. filed Sept. 24, 1925. For low-tension wiring.

1,668,587. Electrical Apparatus; E. Dickey, Dayton, Ohio. App. filed Dec. 18, 1922. Farm-lighting unit.

1,668,605. Trip Mechanism for Oil Burners; C. A. Reif, Buffalo, N. Y. App. filed Sept. 24, 1926.

1,668,606. Connecter Plug; T. C. Roberts, New York, N. Y. App. filed Aug. 18, 1921.

1,668,615. Device for Controlling and Adjusting the Current Passing Through an Arc Fed with Alternating Current; P. M. G. Toulon, Puteaux, France. App. filed June 29, 1926.

1,668,636. Display Sign; O. C. Duryea, Knoxville, Tenn. App. filed July 1, 1924. Designed to be illuminated intermittently by the movement of a door.

1,668,654. Direct-Current-Transforming Apparatus; C. R. Moore, Maplewood, N. J. App. filed March 23, 1927.

1,668,699. Flexible Conduit for Electric Wires; F. D. Saylor, Detroit, Mich. App. filed July 20, 1925.

1,668,707. Air-Conditioning Humidifier; C. J. Allen, Minneapolis, Minn. App. filed Jan. 23, 1924.

1,668,711. Regulation of Electric Circuits; C. T. Evans, Milwaukee, Wis. App. filed Aug. 2, 1923. Intensity control of alternating current circuits for lighting as with regulators of the variable inductance type.

1,668,731. Electromagnetically-Operated Switch; G. E. Perry, Chicago, Ill. App. filed July 12, 1920.

1,668,735. Circuit Breaker Control; W. M. Scott, Tredyffrin Township, Chester Co., Pa. App. filed May 12, 1924.

1,668,740. Battery Electrolyte Compound; L. R. Steele, Boulder, Colo. App. filed March 2, 1922. Comprising a suspension in water of a powdered compound formed from a soluble silicate and ammonium sulphate.

1,668,741. Method of Making Storage Batteries; L. R. Steele, Boulder, Colo. App. filed Feb. 28, 1923.

1,668,752. Electromagnet; A. E. Anderson, Milton, Mass. App. filed April 23, 1925.

1,668,783. Electric Welding Apparatus; W. E. Rupley, Los Angeles, Calif. App. filed April 13, 1925.

1,668,789. Lighting Fixture; W. Symmes, G. H. Harman and C. F. Duval, San Francisco, Calif. App. filed June 9, 1926.

1,668,798. Electric Meter; H. R. Bartlett and H. J. Blakeslee, West Hartford, Conn. App. filed May 26, 1927. Portable rotating standard meter with means for using as a watt meter for indicating the power or load on a circuit.

1,668,801. Storage-Battery Plate; J. H. Calbeck, Joplin, and J. A. Schaeffer, St. Louis, Mo. App. filed July 26, 1924.

1,668,828. Electrical Switch; A. G. Steinmayer, Chicago, Ill. App. filed Jan. 19, 1924.

1,668,831. Automatic Clamping Ceiling Fixture; A. K. Sutherland, Milwaukee, Wis. App. filed July 31, 1925.

1,668,847. Means Adapting Electric Flash Lights for Testing Electric Circuits; L. T. Hook, Seattle, Wash. App. filed Jan. 29, 1927.

1,668,859. Furnace-Ignition Device; D. H. McCorkle, Berkeley, Calif. App. filed June 8, 1925.

1,668,863. Electrolytic Device; W. Morrison, Chicago, Ill. App. filed Sept. 15, 1924. Rectifier type.

1,668,880. Door or Curtain Operating Mechanism; E. J. Vallen, Akron, Ohio. App. filed June 3, 1927.

1,668,925. Liquid-Level Indicator; C. W. Schirmer, Yonkers, and H. P. Wood and DeW.D. Wood, Poughkeepsie, N. Y. App. filed Dec. 3, 1921.

1,668,929. Theater-Seat Annunciator; G. W. Westervelt, Webster Groves, Mo. App. filed Jan. 14, 1926.

1,668,953. Molding for Electric Cables; F. W. Erickson, Larchmont, N. Y. App. filed April 10, 1926.

1,668,973. Thermostatic Regulator; A. J. Mottlau, Pittsburgh, Pa. App. filed July 11, 1924.

1,668,974. Snap Switch; A. J. Mottlau, Pittsburgh, Pa. App. filed March 12, 1926.

1,669,005. Heating Element for Tempering Machines; P. Hustadt and K. Hustadt, Remscheid-Hasten, Germany. App. filed April 28, 1927.

1,669,028. Radio Battery Charger; A. Soberg, Mohall, N. D. App. filed June 11, 1926. Actuated by wind power.

1,669,038. Extension-Cord Connecter; L. S. Brach, East Orange, N. J. App. filed Aug. 1, 1925. For use in telephone or radio work.

# New Trade Literature

DIESEL-ELECTRIC DRIVE FOR MARINE EQUIPMENT. — The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-867 describing and illustrating the Diesel-electric drive. The company also is distributing the following bulletins: GEA-447B, in which it gives illustrations and data on tugboats equipped with the Diesel-electric drive; GEA-868, covering Diesel-electric drive for ferryboats; GEA-870, covering Diesel-electric drive for passenger and cargo vessels and ships of special type; GEA-871, covering Diesel-electric drive for tankers; GEA-886, describing electric motor and control equipment for deck auxiliaries, and GEA-946, describing electric motor and control equipment for under deck auxiliaries.

ELECTRIC RAILWAY ACCESSORIES. —Supplement No. 1 to catalog No. 20 issued by the Ohio Brass Company, Mansfield, Ohio, describes its new electric railway devices such as clamps, bonds, headlights, frogs, etc., brought out since the issuing of its catalog No. 20.

LIGHTNING ARRESTERS.—"We Know —They Believe—Now They Know" is the title of booklet No. 252, the eighth of a series covering the technical features of the crystal valve lightning arrester as they apply to modern lightning protection and which is being issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia.

COUNTERS. — The Bristol Company, Waterbury, Conn., has issued bulletin No. 365 describing the different types of Bristol counters for use in automatic machines of all kinds as punch presses, printing presses, conveying machinery, pumps, textile machinery, etc., and wherever there are mechanical operations to be counted. It contains illustrations and also a few methods of installing the counters.

STEEL POLES.—Catalog No. 130 issued by the Truscon Steel Company, Youngstown, Ohio, describes and illustrates the Truscon copper bearing "Weltrus" steel poles. The catalog contains data and information on weight, strength, and dimensions of standard types of "Weltrus" steel poles.

CRANE.—The Whiting Corporation, Harvey, Ill., is distributing bulletin No. 185 describing its hand power crane.

AIR COMPRESSORS AND TURBINES. —The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-588A describing and illustrating its geared centrifugal air compressors. The company also has issued bulletin GEA-197A covering its type D-54 mechanical drive turbines.

FUSED SWITCHES.—A bulletin issued by the W. N. Matthews Corporation, St. Louis, covers the different types of Matthews "Fuswitches." Illustrations are given showing various installations.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Santiago, Chile (No. 31,220), for electrical appliances.

An agency is desired in Berlin, Germany (No. 31,244), for electric hand and face drying machines and household motor-driven appliances, and another (No. 31,243), for electric hair and hand driers.

An agency is desired in Vienna, Austria (No. 31,292), for electric heating and cooking apparatus and household electrical appliances.

An agency is desired in Munich, Germany (No. 31,241), for household electrical appliances, especially washing machines, resistance wire and electric refrigerators.

Purchase is desired in La Guayra, Venezuela (No. 31,285), of electric refrigerators.

Purchase is desired in Nuremberg, Germany (No. 31,286), of telephones.

Purchase is desired in Leipzig, Germany (No. 31,242), of electric washing machines.

An agency is desired in Leipzig, Germany (No. 31,245), for small electric washing machines.

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## *How Can Utility Companies Help Stabilize State Commissions?*

GENERAL satisfaction with regulation, and more especially with the personnel of the public service commissions, is perhaps too much to expect. Yet something should be done to offset the political moves made just before state political conventions to dispense with the commissions. Until greater faith is shown in the commissions by the general public it must be expected that the commissions will have a political rather than a judicial and economic aspect. This does not augur well for stability or steadfastness of purpose, does not assure the public of righteous judgment in disputes, and means continued inroads on the time of utility executives that ought to be devoted to the business itself.

We realize, of course, that any attempt at co-operation between the utilities and the commissions would be misinterpreted to the detriment of the commissions. However, if the utilities will obviate as much as possible any cause of complaint, there would be little occasion for the public or the politician to harass the commissions. The less of law or supervision business has, the better for business and the greater its opportunity to render satisfactory service. Therefore the utilities should make regulation successful by not meriting much of it. Then the life of commissioners would be more pleasant and their relations with the public more agreeable and satisfying.

* * * *

## *An Official Viewpoint That Should Be General*

COMMENTING upon reported showings of twenty-three California cities operating municipally owned light and power systems, State Controller Riley made the following very pertinent statement: "The accounting system of municipally owned public service enterprises is of a character that prevents the controller from giving adequate information covering their operation. It is impossible to ascertain whether there is a loss or a gain, as the statements furnished are in the main 'flow of cash.' Each year shows a tendency on the part of municipalities in this direction, and the Legislature should require proper accounting methods for the protection of the taxpaying public. Governmental agencies might well set an example by the adoption of sound accounting methods and thereby definitely dispose of the controversy regarding costs that now exist as between publicly and privately owned utilities."

We have contended that all public utility service, no matter by whom rendered, should be subject to regulation as to rates and quality of service. In some states, notably Wisconsin, such regulation obtains; but in most of the states the municipalities have been successful in their efforts to keep their affairs free from state scrutiny. That is the reason so little is known of municipal operations and why so much that may not be so is spread broadcast by municipal ownership zealots. When more state officials and legislatures show a disposition to ferret out the truth, as has the State Controller of California, for example, the real facts on municipal ownership will become known.

* * * *

## *Cheer from Battle Creek*

AMONG the very many men who see a brilliant future for the electrical industry, none is more optimistic and none more qualified to speak from experience than Henry L. Doherty. At a time when men are asking, "What of the future? Who will carry on when the pioneers drop out?" there comes a refreshing and inspiring message from Battle Creek. There, watching as it were from the side lines while gradually recovering from a rheumatic ailment, Mr. Doherty sees "nothing but expansion and still further expansion ahead."

Mr. Doherty's message to the ELECTRICAL WORLD, printed in our news columns this week, reflects the sane optimism and the well-based confidence of a man who has lived with and for the industry through the generation in which it has made industrial history. Through his prophecy sounds, not the note of doubt that could easily be pardoned to a leader temporarily inactive because of ill health, but a ringing challenge to all doubters from a leader longing to be back on the field. When he feels this way, it is no wonder that other leaders in full strength and vigor echo his enthusiasm.

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## *Congress Investigates Superpower Finance*

INVESTIGATORS will find that some one has made money out of central-station tie-ups. By far the most guilty culprit will be found to be the American power consumer, who is getting electrical energy at steadily decreasing cost. Intelligent elimination of waste and unnecessary human labor always produces large profits. In the case of electric power, enormous savings have been made by group operation of properties and the installation of the most efficient generating equipment. Wealth has been created by conservation rather than by extortion.

If a few hundred men of courage and energy have made fortunes for themselves by making these savings for the consumer of electricity, it will not be held against them. The fortunes are more respectable than many which were founded before the day of the great central-station companies. It is not a crime in the United States of America to get rich selling people what they need at rapidly decreasing prices.

## *Low-Voltage Neon Tubes*

DEVELOPMENT of the hot cathode has made possible the use of low-voltage neon tubes. One of these tubes, recently described by C. G. Found and J. D. Forney before the American Institute of Electrical Engineers, gives an output of 10,000 lumens. This tube was rated at 220 volts and was 2.2 cm. in diameter and 125 cm. long. Measurements of the over-all efficiency of direct-current tubes give 12 to 15 lumens per watt and of alternating-current tubes give 10 to 12 lumens per watt. These efficiencies compare favorably with those of 100-watt tungsten-filament lamps.

Further developments in glow-discharge lamps may be expected now that the cathode drop has been reduced. Investigations of color emanations from various gases and of better methods for starting tubes offer attractive possibilities. The voltage necessary to ionize a gas is never greater than 25, and from the point of view both of efficiency and of luminosity prospects are good for a great commercial development in glow lighting.

* * * *

## *Aspects of the Problem of Radio Interference*

PUBLIC relations and residential service expansion are closely associated with the use of radio in the home. This justifies individual and concerted attack by power companies upon the problem of radio interference. The outlook for further progress is encouraging, and the technique of suppression has advanced to the point where perhaps 50 per cent of the legitimate complaints can be met without the drastic step of replacing the apparatus unit (be it wire or device) diagnosed by the skilled maintainer as the seat of trouble. The manufacturer of radio sets and accessories is likely to come into the picture as a more active influence toward the improvement of reception conditions, and recent advances in the design of insulators, power noise traps and voltage regulators look very promising.

The precision of voltage control feasible at the household outlet in central-station service without the investment of considerable totals in newly designed devices is far below the requirements of some of the latest alternating-current tube sets. It has been suggested that the incorporation of such devices into the assemblies of high-grade receiving sets may well be considered by the radio manufacturer as a betterment, the cost of which should be absorbed by the selling price without adding unduly to the purchaser's outlay. The manufacturers of heavy-duty electrical equipment for home service, like automatic-control push-button elevators and grouped refrigerators for apartment-house use, are also confronted by the possibility of being asked to provide in their future designs for the inclusion of suppressive devices by whose use the high-grade sets within reach of occupants of such buildings can in many cases be made to render far better service, especially in installations operated by direct-current motors.

In the long run, there is no need to say, the consumer of high-grade service must pay its cost, and if purchasers of space radio sets continue to demand extreme sensitivity in distance reception and minimum interference from local or territorial disturbances, the industry will have to co-operate still more effectively in working toward these objectives. Progress in the elimination of line disturbances has now attained a high degree of success, and the power companies are liberally meeting this cost. The allocation of the cost of preventive measures internal to household service devices remains to be considered and applied along the lines of a standard industry procedure, so to speak. The spread of radio network broadcasting and outlook for wired-wireless service over local distribution systems bid fair to contribute toward the solution of many problems in interference through a growing popular appreciation of the superior quality of reception attainable in this way.

* * * *

## *Census Data Needed*

THE electrical industry, like any other element of American business, believes in statistics and has come to rely upon the government's census data as authoritative. Census figures on operations of the electrical industry constitute an essential part of that pool of information to which not only all Americans but indeed all civilized men in whatever country contribute and on which they are in turn able to draw. We all profit from it—directly in business, indirectly in the general advancement that flows from a greater fund of facts.

In the light of these things it comes as a surprise to learn that only 50 per cent of the returns have thus far been received by the Bureau of the Census for the electric light and power census of 1927 as against nearly 75 per cent for the biennial census of manufacturers, though both canvasses began in January.

True, the electrical schedule is complex; to fill it out entails a great deal of work especially on the part of companies responsible for returns on many individual properties. But there is a strong probability that the laggards are not those on whom the heaviest burden falls. The bureau cannot proceed with its tabulation until all returns are in. Every delay in reporting delays the publication of the result. It is not good business to wait until 1929 for 1927 statistics, and it is to be hoped that responses will be made promptly to the Census Bureau.

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## *Does the Contractor Need Relief or Reform?*

IN A WAY the electrical contractor seems to be in about the same position today as the American farmer. He is demanding relief, but what he really needs is reform. Business has been bad with him. He has been working hard and doing good work, but he has not made money. He is economically sick. That makes him unhappy, which naturally warps his judgment. He is sorry for himself. He maintains that something should be done about it, but he does not recognize and assume his inescapable responsibility to do this "something" for himself.

In vetoing the McNary-Haugen bill President Coolidge pointed out in vigorous terms that what the farmer needs is not the crutch of subsidy and price fixing but the courage to face the economic facts of his business and reform his methods of marketing. The same answer could well be recast for the contractor. It is his own business methods that have led him into grief. The power company or the jobber or the manufacturer may be able to improve some of the conditions that embarrass him, but nothing that they can do will correct his own bad practices. This he must accomplish for himself.

The contractor is extremely important to the electrical industry right now, for the vital need is for more adequate wiring installations to provide for more complete equipment in home, store, office and factory. But there are too many contractors and they are fighting for business by destructive price competition. To get the price low they keep the job small, and this restricts the whole market for electrical energy and products. They do this not because they want to, but because the large number of wiremen working "on their own" with no thought of overhead has forced the business to a condition of "squeeze-price" paralysis.

In considering what should be done two points stand out. First, the American people are willing to pay a fair price for wiring. Whatever adequate wiring is worth it will bring. It need not be given away; it needs to be sold. Second, the contractor himself must put his trade in order and lift it to a prosperous economic plane. The chief trouble with the contractor is that he provides himself with no margin to cover development and sales expense. Sooner or later he must face that natural necessity. He must add something, say, to the labor charge on every job to provide funds with which to build up a public appreciation of the importance and value of adequate wiring and to establish his own reputation for work of high quality. In this way the contractors of the community might well set up in the league a co-operative fund for use in raising the local standards of the wiring business. It is futile to hope that such a situation will right itself. The contractor will have to reform his own business.

* * * *

## *Free Speech and the Point of View*

FREE speech is a text in the gospel of democracy, but the interpretation of this text depends upon the point of view. It seems to have become a special privilege for a few favored idealistic college professors, radical literary writers, yellow newspaper editors, day-dreaming pacifists, fanatical reformers and country-saving politicians. The free-speech privilege claimed by all these cults imparts a note of humor to an otherwise drab existence and introduces just sufficient vitriol to burnish the products of those who are carrying on constructive activities.

Free speech should also be granted to American business. Yet some recent happenings in this country and especially the utility investigation in Washington introduce the doctrine that business must remain mute at all times; that it must make no effort to protect the interests of its security holders or of the customers that rely upon its service even when attacks are made upon it. Priately owned and operated business should not be muzzled. It should be able to address, educate or persuade the public, and it should be wise enough to do this by using facts. Alleged exposures of bad practices and improper activities by corporation lobbies and publicity agents should not be made the reason for a doctrine that denies free speech to business. Yet this is what many politicians, editors and publicists seem to desire, according to comments and actions in recent days. The free-speech cult can send out pamphlets, maintain lobbies, write editorials and publish distorted statements with immunity, but the business it attacks must be silent.

The great national game of a certain group of citizens is to investigate private business. The specialists in free speech refuse to investigate or attack any anti-capitalistic, labor, social, municipal or governmental business enterprise, but hover like vultures above private corporations only. Unless business can and does speak, there is evidence that a revival of professional muckraking will occur, for already war has been declared against publicity about business, against economic education, against addresses by business men and against every legitimate tool of free speech that does not conform to opinions of the self-constituted "free-speech" cult which dwells as a parasite on the makers of national prosperity. Business should use its privilege of free speech now, because the "tearers down" believe their day has dawned again.

* * * *

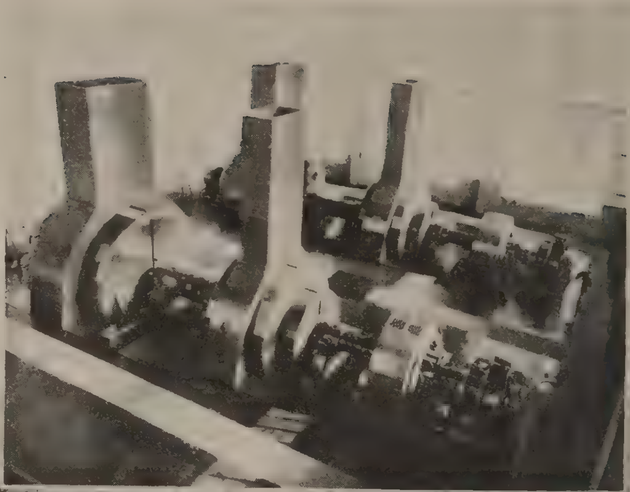
## *Technique of Interconnection Is Improving*

GRATIFYING gains in the handling of interconnected systems are apparent to those privileged to go behind the scenes at important operating centers and to hear engineers and load dispatchers discuss their problems without thought of publication. Great improvement has lately been attained in the maintenance of first-class frequency regulation on systems made up of hydro and steam plants serving extensive regions often involving several states. Load control is also making better headway, although the problem of forecasting the effect of load transfers between neighboring companies has not as yet been reduced to a simple one in relation to either local or distant networks of plants and transmission lines. Perhaps it would be fair to put it down that the more carefully operated interconnections are constantly attaining and holding to standards of service above the requirements of their customers and that many such systems are, for the time being at least, more concerned with the economic aspects of load transfer than with the solution of the frequency problem *per se*.

Experience shows that in a typical interconnection including generating plants of 1,500,000 kilowatts rating and embracing several thousand miles of transmission lines it is now possible to keep the frequency of the whole region within one-twentieth of a cycle at all times when the conditions warrant. This can be done by either hand or automatic regulation. It is at times necessary to disturb the scheduled distribution of load. Excellent automatic regulation is apparently to be counted upon in this system, even though the regulating hydro station represents only a small percentage of the combined plant kilowatts. The close regulation attained is extremely desirable for the proper distribution of loads over the various ties and, of course, to keep down large undesirable transfers between companies. With systems spread out over territories of increasing size and with so many independent companies interconnected as is often the case, more or less reaction is bound to occur at different points when trouble arises in any section. It appears on some system log sheets that thus far the transfer of load from steam to hydro plants in cases of outages on particular sections has caused the most widespread tripping of circuit breakers, but that automatic regulation indicates possibilities of improvement along the line indicated.

Plenty of troubles can be unearthed at the price of a little skillful digging, and some engineers are lukewarm advocates of tie-in operation except in emergencies; but the amount of engineering thought now being devoted to realizing the economic potentialities of interconnection justifies a liberal degree of optimism.

# *Purchased Power Serves Railroad Trunk Line*



APPROXIMATELY one-third of the 200,000,000 kw.-hr. annually required for operation on the New York, New Haven & Hartford electric trains is purchased from central-station companies. This energy is supplied at several points in addition to those receiving power from the road's own station at Cos Cob, Conn. One of the latest "points of contact" between the railroad and venders of power is the 10,000-kw. variable-ratio frequency-changer installation at Devon, Conn.

Top—Variable-ratio frequency changers at Devon, Conn.

Center—Various types of N.Y., N.H.&H. electric motive power on exhibition.

Bottom — Boston-Washington "Colonial Express" on Hell Gate Bridge.

# Selling Power to Railroads

### Liberal treatment of demand conditions essential. Examples of recent contracts for supplying heavy service to trunk lines, including the Wilmington division of the Pennsylvania Railroad

THE stage is set for negotiations of far-reaching importance between power companies and railroads in connection with the supply of energy to electrified sections of lines hitherto served by steam locomotives. Transportation men are asking the power companies to "meet them half way" in regard to terms of contracts covering this class of service, and while the advance of railroad electrification is gradual, for reasons beyond the control of its most active advocates, the railroads are looking more favorably upon the policy of buying power than ever before. At the recent regional convention of the A.I.E.E. in New Haven a session devoted to electrification problems emphasized various aspects of selling power to railroads which should not be overlooked by executives and commercial departments of power companies in territories where this class of business is either being handled today or is in prospect for the near future.

## ILLINOIS CENTRAL PRACTICE

In a paper on "The Chicago Terminal Electrification of the Illinois Central Railroad" R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, and W. M. Vandersluis, electrical engineer of the railroad, pointed out that the power contract* which was entered into in 1924 and under which operations began in May, 1926, calls for the delivery of energy from the substations of the power company at 1,500 volts direct current for traction and 2,300 volts alternating current for signaling. Three-phase energy at 4,000 volts is also provided for light and power service in the stations and shops. The charges for electricity follow the proved Hopkinson method with a "primary" in recognition of the power company's investment and a step rate "secondary" to cover the operating and service costs. To take account of variations in coal cost there is a provision for a change in secondary charges if the cost and heat content of the coal used fall outside certain limits.

The primary charge is based on the maximum amount of energy drawn under normal operating conditions. In order that the railroad company may have the advantage of the power company's large reservoir of energy and without the payment of the regular primary charge for additions required in emergencies only, abnormal demands due to such emergencies are excluded in determining the maximum demand for billing. The recognized emergencies are: (1) Abnormally heavy traffic resulting from failure of other transportation lines, unless continuing for more than ten consecutive days; (2) traffic arising from extraordinary assemblages, such as fairs, race meets, ball games, conventions, etc., unless continuing for more than ten consecutive days; (3) congestion of traffic arising from a railroad accident, derangement of power supply or other emergency conditions; (4) other excessive traffic beyond that usually carried and caused by some unusual circumstance or condition; (5) hours during which the temperature is plus 5 deg. F. or lower (the suburban cars are all electrically heated).

The limit to which electricity may be drawn under these emergencies is the capacity of the power company's equipment which may be usable for railroad service during such emergencies. This is one of the features of the contract which makes central-station service of so much greater advantage to the railroad than would be that from its own separate plant, the authors state. To insure a reasonable, continuing return on the investment made by the power company the railroad guarantees that the maximum demand that it will pay for in any month will be not less than 70 per cent of the highest demand established during the last preceding twelve months. A minimum monthly load factor of 30 per cent is also guaranteed.

One of the railroad's requirements which was finally accepted by the power company, but with some misgivings, relates to regulation of the feeder pressure. The high-speed suburban service with short intervals between trains requires a close adherence to running schedule, and this, in turn, was felt to demand close voltage regulation. The permitted variation is from 1,400 to 1,500 volts on the feeders at the point of delivery on the railroad right-of-way, which is practically at the substation.

Provision is included for additional capacity in new or existing substations as the increase in load requires. The power company may install additional equipment in its substations for uses other than this electrified railroad, and also use its equipment to serve other electrifications.

## PURCHASED POWER ADDS RELIABILITY

Sidney Withington, electrical engineer New York, New Haven & Hartford Railroad, declared that by purchasing a considerable portion of its power the company's service in the electrified zone between New Haven and New York has been made more reliable, and this has justified the extra expense in comparison with further enlarging the Cos Cob plant. He pointed out that as a rule a railroad can purchase coal on more favorable terms than power companies and that it can hire capital at lower rates. Transportation companies, he said, should not be penalized in power contracts because of emergency conditions beyond their control. G. I. Wright, engineer of electric traction Reading Railroad, stated that the power companies hardly realize what the railroads are facing in trying to handle suburban service economically and maintained that the load-factor problem and the possibilities of off-peak business should be considered.

Henry Craig Sutton, electrical engineer United Gas Improvement Company, Philadelphia, pointed out that trunk line electrification improves load-factor conditions on the power system, as the peak load of the railroad traffic may easily occur in the middle of the night. The isolated generating plant of the railroad rapidly grows out of date, whereas the modern power system keeps its generating facilities in line with the latest progress, expanding plants and bringing down the cost of power by continually making new and better installations.

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*For details see ELECTRICAL WORLD, Jan. 10, 1925.

E. R. Hill of Gibbs & Hill, consulting engineers, New York, said that probably the most unusual feature of the Illinois Central power contract is the supply by the power company of converted current at the seven substations located along the railroad. It is most usual for the power company to supply alternating current at a single point and for the railroad to transmit and convert or transform this power itself. "The Schuchardt-Vandersluis paper," said Mr. Hill, "calls attention to a practice which has now become quite general and which is required as absolutely necessary in railroad electrification work, i.e., for the power company to supply excess demand in railroad emergencies without affecting the demand charge. In other words, the demand charge is determined by the railroad's power requirements under normal conditions and emergency drafts of power do not affect the demand billing. This is very important and really essential in railroad operation because of the fact that abnormal and emergency conditions occur much more frequently in railroad operation than in probably any other industry, and it is impossible for the railroad to control or prevent the occurrence of such exceptional demands.

### Most Recent Electrification Contract

"The most recent large power contract for railroad electrification that I have knowledge of was negotiated and consummated last year between the Pennsylvania Railroad and the Philadelphia Electric Company at Philadelphia. This is a continuation of an earlier contract covering the supply for the Pennsylvania Railroad's suburban service in Philadelphia, intended to provide for all traction requirements in that territory, including through electrification connecting New York, Washington and elsewhere if and when carried out, for a period of twenty years.

"The power company contracts to supply the power at 25 cycles, single phase, 13.2 kv. at certain main supply points in the vicinity of Philadelphia or elsewhere as may be arranged from time to time. The railroad steps up the voltage to 132 kv. and transmits at this pressure to its various transformer stations along the line.

"The outstanding feature of this power agreement is that the charges or rates are based on the actual cost to the power company of producing power in its generating stations, transmitting and converting it at the supply points. This actual cost includes fixed charges, general expenses and all other items properly entering into the total cost. In order that the railroad may be protected against any unforeseen high cost of producing power, the power company guarantees that the demand charges and the energy charge shall not exceed certain stipulated values that were estimated and set up at the time of the negotiations. Such guarantees are based on specific costs of coal and labor. Maximum rates for fixed charges are also stipulated. Some other features of the contract are: (a) Demand determined monthly based on three maximum normal clock hours per month; (b) demand may not be less than 75 per cent of any previous maximum demand; (c) guaranteed monthly load factor, 30 per cent; (d) guaranteed power factor, 55 per cent; (e) if lower rates are subsequently made to other consumers under similar conditions of supply the railroad shall be entitled to the same rates.

"At a load factor of 55.5 per cent, a coal cost of $5 per net ton, present labor rates and guaranteed maximum demand and energy costs the average cost of energy to the railroad at the supply point or points under this contract works out at 0.75 cents per kilowatt-hour."

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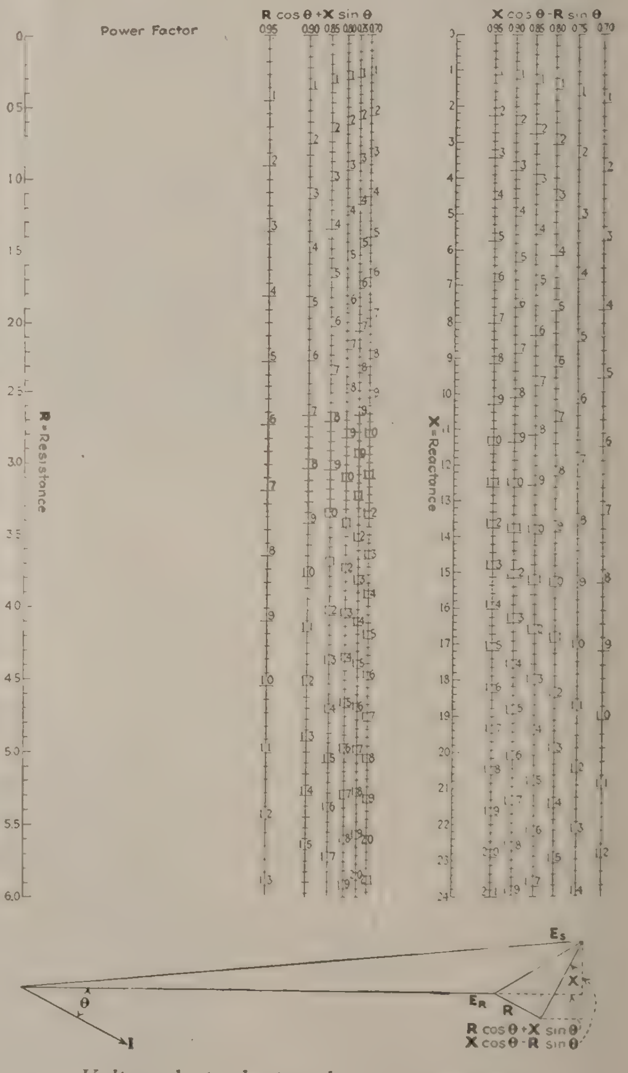
# Rough Check for Voltage-Drop Components

By Raymond C. R. Schulze

*Public Service Electric & Gas Company*

The accompanying chart provides a quick way to determine roughly the in-phase and quadrature components of the voltage drop along a transmission line. The chart actually gives the voltage drop per ampere for known values of resistance, inductive reactance and power factor, or $R \cos \theta + X \sin \theta$ and $X \cos \theta - R \sin \theta$. The first is, of course, the component of the



*Voltage-drop chart and vector components to which it applies* voltage drop in phase with the receiver voltage, while the second is the component of the voltage drop 90 deg. out of phase, or in quadrature, with the receiver voltage. This relationship is easily seen by referring to the vector diagram given here.

In order to obtain the total drops it is necessary to multiply the values obtained from the voltage drop chart by the number of amperes flowing in the line.

## Essential Features of Interconnection Contracts*

IT IS desirable generally to frame the rate clause so that each element is dealt with individually rather than collectively and then to simplify by the omission of such elements as are not important in the specific instance under consideration. The rate structure should be built up to contain the following elements or provisions:

1. A fixed charge for capacity reserved exclusively for the use of any one party.
2. An energy charge covering energy capacity. This may be a flat rate or a step rate, or may be modified by special rates for dump power or for off-peak power.
3. A power-factor clause.
4. Provision for emergency service.

Fundamentally, the demand billing of one system to another should be equivalent to the maximum requirements of the user minus the useful generating capacity of the latter, taking into consideration the physical condition and the degree of obsolescence of the generating equipment itself, together with the number, type and capacity of generating station tie-lines. This useful capacity is generally referred to as "relayed capacity" and consists of the total useful capacity available with the largest generating unit out of service, provided that all of the capacity has sufficient transmission line connections to render it available at all times. It is possible to simplify the demand billing by one party contracting with the other for a stipulated amount of capacity with no attention to the respective requirements of the two systems except that the generating company may require the purchasing company to hold its demand within the amount contracted for at such times as it is not expedient to allow the purchaser to exceed it. This sort of arrangement is flexible and simplifies the system operations and the billing to the greatest extent.

In the event of interconnection between two companies at several points it is helpful to system operation generally to base the demand billing upon the simultaneous demands at all metering points, using the algebraic sum and imposing few or no limitations upon the power to be taken at each metering point.

Energy should be sold at a price equivalent to average production cost within the limits of the average system load factor, plus the desired profit. It is often feasible to offer a step-rate as an inducement to the purchaser to increase his energy requirements. It may be possible to offer, advantageously, a dump-power rate for any energy used in excess of the basic block of energy contracted for. This so-called dump energy may be sold at "increment production cost plus a margin of profit" to the advantage of both parties concerned, provided it is understood that this supply of energy may be curtailed whenever the generating company deems it necessary or desirable. The modification of the energy rate may be introduced as a bonus or special rate for all energy used during specified hours of each day or specified periods of the year. The energy rate should in every instance incorporate a fuel cost.

The power-factor clause is usually incorporated in order to insure legally certain limits in the proper disposition of wattless current. Each system should take care of its own wattless current. In the event that either party to the contract consistently falls below the limit, said party is requested to improve operation or provide such equipment as is necessary to permit fulfilling the conditions.

In order to insure against impairment of the quality of service and to simplify billing, it is usual to specify that emergency service will be obtained only when requested formally, either by writing or verbally, and confirmed by writing and permission to make use of the facilities formally granted. The charge for this service should be based upon energy uses only, with no reference to the demand unless the emergency requirements should extend over a considerable period, in the event of which an agreement should be worked out between the two contracting parties to cover the specific case.

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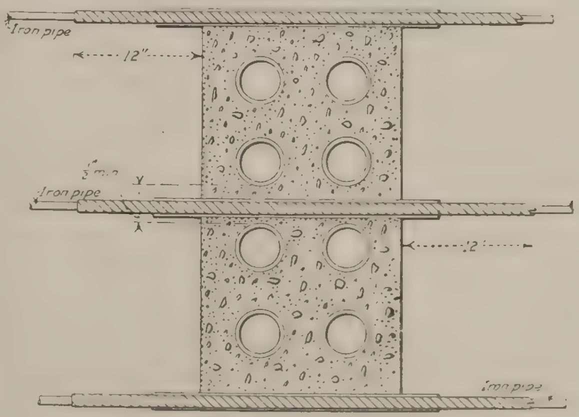
*Abstract of a report by H. E. McDowell, Texas Power & Light Company, at the eighth annual convention of the South-western Geographical Division of the National Electric Light Association.*

## Iron Pipes Through Conduit Lines

IN THE underground system of the Kansas City Power & Light Company, in which a large amount of fiber conduit laid in concrete is used, the method here illustrated for carrying iron pipes through the duct structure is used. These pipes may be gas or water services from mains paralleling the duct line. Before the concrete is poured the pipes are wrapped with one layer of paragon impregnated tape half lapped for a distance extending 12 in. on each side of the completed duct structure. Over the paragon tape are wrapped three layers of building paper so that if the pipe is later to be removed it may be pulled out of the concrete with reasonable ease. To avoid weakening the duct structure a minimum of ½ in. is set as the clearance distance between the outside of the wrapped pipe and the nearest fiber ducts in the run. The same method applies where pipes come into contact with duct lines but do not cross them.



*Method for pipe crossings of duct lines*

# Computing Compensator Settings for Automatic Voltage Regulators

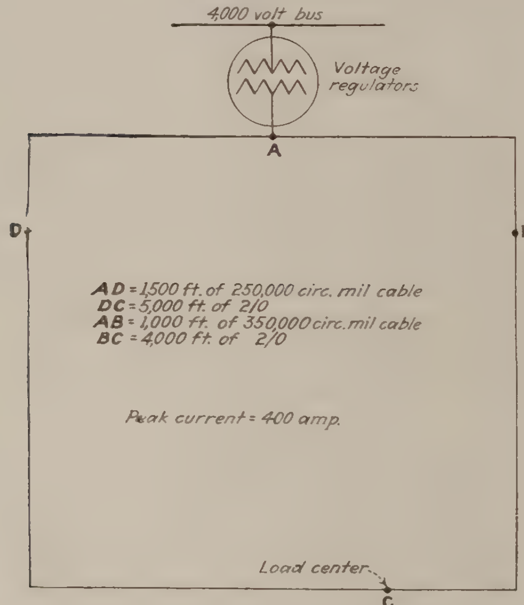
SECOND ARTICLE

By V. W. Palen

LOOP CIRCUITS.—Where there is one loop or more the first step consists in computing the resistance, reactance, and impedance values to the load center of each individual loop. For such a condition as that indicated in the accompanying figure the following procedure would obtain:

| Half of loop *ABC* | Resistance | Reactance | Impedance |
|---|---|---|---|
| (*AB*) 1,000 ft. of 350,000-circ.mil underground cable | 0.0345 | 0.0369 | 0.0508 |
| (*BC*) 4,000 ft. of 2/0 overhead wire | 0.3160 | 0.5280 | 0.6150 |
| (*ABC*) Total | 0.3505 | 0.5649 | 0.6658 |

| Half of loop *ADC* | Resistance | Reactance | Impedance |
|---|---|---|---|
| (*AD*) 1,500 ft. of 250,000-circ.mil underground cable | 0.0646 | 0.0568 | 0.0855 |
| (*DC*) 5,000 ft. of 2/0 overhead wire | 0.3950 | 0.6600 | 0.7700 |
| (*ADC*) Total | 0.4596 | 0.7168 | 0.8555 |



*Loop circuit for illustative calculation*

Combining the two halves of the loop:

$$\text{Resistance } (AC) = \frac{0.3505 \times 0.4596}{0.3505 + 0.4596} = 0.1990 \text{ ohms}$$

$$\text{Reactance } (AC) = \frac{0.5649 \times 0.7168}{0.5649 + 0.7168} = 0.310 \text{ ohms}$$

$$\text{Impedance } (AC) = \frac{0.6658 \times 0.8555}{0.6658 + 0.8555} = 0.374 \text{ ohms}$$

Since the primary current at the peak is 400 amp. and the ratio of the current transformer is usually 20 to 1:

$$\text{Resistance drop } (AC) = \frac{0.1990 \times 400}{20} = 3.98 \text{ volts}$$

$$\text{Reactance drop } (AC) = \frac{0.310 \times 400}{20} = 6.2 \text{ volts}$$

$$\text{Impedance drop } (AC) = \frac{0.374 \times 400}{20} = 7.48 \text{ volts}$$

The compensator in this case, therefore, would be set for the values $IR = 3.98$, $IX = 6.2$ and $IZ = 7.48$.

Computations for the double loop and triple loop circuits will appear in later articles.

# Operator Discusses Motor Bearing Experience

IN DISCUSSING his experience with sleeve- and ball-bearing motors in a steel fabrication plant the superintendent made the following comments to a representative of ELECTRICAL WORLD:

"It is difficult to make recommendations or draw conclusions as to the better type of bearing—each has a definite field. We have in our shop about 63 motors (exclusive of overhead cranes), of which 54 are sleeve bearing and nine are ball bearing. The nine ball-bearing motors have been in service from one to three years and have never given any trouble. They are greased with Alemite every four months.

"We have found that sleeve-bearing motors are more or less subject to bearing and armature trouble, due to the weight of the armature wearing the bearing on the bottom side, which causes a rub on the field coils and burns out the armature. Ball bearings, on the other hand, wear evenly all around and the life of the bearing is increased considerably. In making repairs to the sleeve-bearing motors there will, of course, be interruptions, but it is difficult to state just how much loss of time this has caused. Winding burnouts occur too frequently and I would hate to hazard a guess as to the power factor, but I feel that the ball-bearing motor is the more efficient."

# Single-Circuit, 19-Mile, 110-Kv. Line Cost Estimate

IN CONNECTION with the construction of a single-circuit, 110-kv. transmission line from Ayer to Tewksbury, Mass., the New England Power Company filed the accompanying cost estimate with the Massachusetts Department of Public Utilities, based on 1927 conditions. The right-of-way acquired was wide enough to permit the ultimate erection upon it of three 110-kv. or two 220-kv. circuits. The towers are spaced 6.8 per mile with 1.8 strain towers per mile. Eight- and nine-disk insulators are provided.

ESTIMATED COST OF 110-KV. LINE, SINGLE CIRCUIT
(Length, 18.96 Miles)

| | |
|---|---|
| Clearing and burning brush | $26,000 |
| Towers: | |
| Excavation | 20,500 |
| Setting footings | 13,400 |
| Distribution of steel | 7,000 |
| Erecting | 12,600 |
| Distributing miscellaneous material | 2,800 |
| Stringing power and ground wires | 14,000 |
| Towers, 50-ft. flexible steel | 49,400 |
| Power wires, one three-phase circuit, No. 4-0 copper, 13-ft. 6-in. horizontal spacing | 36,400 |
| Overhead ground wires, two ⅜-in., crucible steel | 5,300 |
| Power insulators and hardware | 13,900 |
| Tie wire, protecting and splicing sleeves | 200 |
| *Right-of-way, 250 ft. wide; 125 ft. cleared | 96,700 |
| Total | $298,200 |
| Contractor's expenses, 10 per cent | 29,820 |
| Total | $328,020 |
| Engineering expense, 5 per cent | 16,410 |
| Grand total | $344,430 |
| Per mile | $18,166 |

*Sufficiently wide for additional lines.

# Railroad Electrification

### Causes for retarded application of electricity as motive power. Factors slowly forcing use, especially in population centers. Economy of purchased power through load diversity on central stations

By N. S. HINMAN
*Commonwealth Edison Company, Chicago, Ill.*

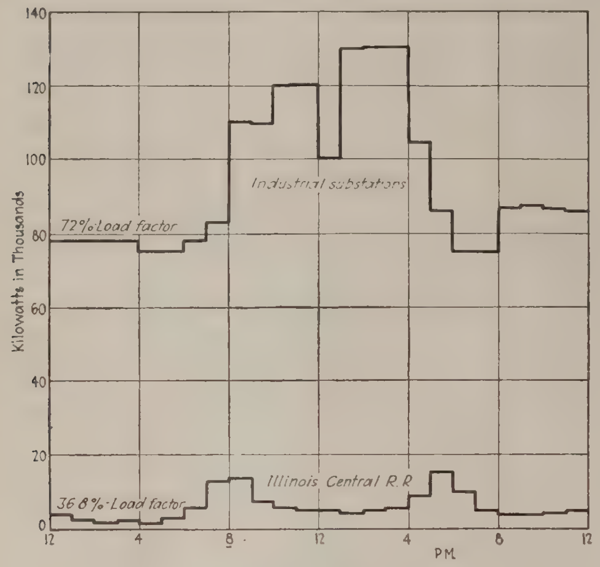
*Curve-catenary construction Philadelphia-Wilmington division. Pennsylvania Railroad*

SINCE 1895 there have been about eighty instances of steam railroad electrification in all parts of the world. The development, however, has not kept pace with the increasing volume of the transportation load and the tremendous strides made, through the invention and improvement of apparatus, in the effectiveness of electrical energy for all kinds of power use. With an ever-growing intensity of traffic, with increasing values of land at terminals, of air rights and rights-of-way in the vicinity of population centers, with city governments crying against the nuisances of smoke and noise and with the constant demand for more speed and comfort on passenger trains, the days of the steam-drive locomotive, at least near population centers, would appear to be numbered.

Increasing capacity, both track and terminal, has its main importance in large city terminals, on main line heavily traveled roadbeds, and in particular in connection with suburban service. Thus the necessity for relieving congestion led to the electrification of the Pennsylvania stations in Philadelphia and New York and the Grand Central Terminal in New York. The acceleration of train movement was greatly increased, turning movements eliminated and switching greatly reduced. As cities increase in size and population density, the districts immediately surrounding them increase in population in an augmented ratio, making the demand on suburban train movement during morning and evening rush hours extremely heavy, while simultaneously the acquiring of additions to rights-of-way becomes an extremely costly and often physically impossible solution of the problem.

The use of multiple-unit electric trains has created a flexibility of suburban operation unattainable with steam. The lengths of trains are limited only by the lengths of station platforms, while the acceleration possible with these units greatly increases the average speed throughout the run. These two factors alone may make possible an increase in handling capacity of 50 per cent. To the people of Chicago the comparison between the suburban service of the Illinois Central under the old steam operation with that under present electrification affords a striking example of the possibilities of the latter. When congested terminals and heavy suburban services provide a high load factor on track and equipment the economy of electrification, particularly when savings due to increased capacity and to air rights are considered, is very material. The outstanding present-day example of favorable utilization of air rights made available by electrification through smoke abatement is to be found in the Grand Central station in New York, where it is claimed that the revenue derived from this source is equivalent to the fixed charges on the cost of electrification. The electrification of the suburban service of the Illinois Central out of Chicago has, through the increase of passenger-carrying capacity, reduced the cost per passenger mile very materially.

The swift development of electricity and the increasing traffic problems of the railroads, both so recent and so filled with new questions of uncertain solution, are themselves reasons for the hesitation on the part of roads to electrify. The expense entailed in making a trial step in electrification is very high, and the results of an error in judgment or a new development in equipment requiring replacement might seriously affect the finances of the pioneering railroad. The development of electrical equipment for applying energy to railroading is not yet standardized except as to basic principles, and systems now in use vary greatly. Both direct and alternating current have their advocates, conversion apparatus is just emerging from the experimental stage, while voltages in use vary from 600 to 22,000. Furthermore, the future tendency as to size, weight and speed of trains is not clearly defined. This inability to forecast the future development of electrical equipment and train operation constitutes a retarding influence against electrification, as railroad officials are naturally reluctant to face possible later changes necessitated by varying future standards.

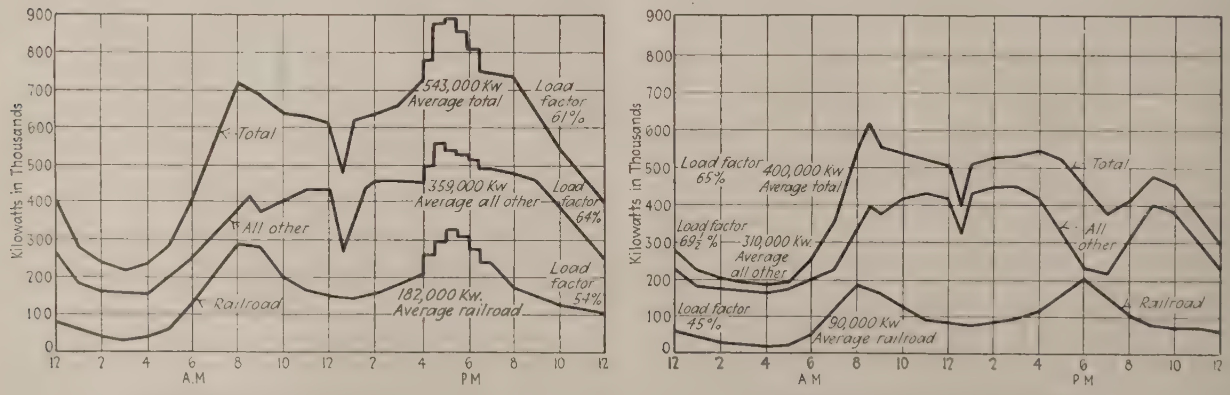


*Typical daily load curves*

Note that the "valleys" of the Illinois Central load curve coincide in general with the peaks of the industrial substation load curve, illustrating very favorably the advantages of the diversity between these two loads.

Although railroad equipment may not yet be perfectly standardized, electrical energy in ample quantity and at a low price is already available, particularly in and around large centers of population. The advantages of mass production and diversified markets permit great operating savings through fuel economies, improved efficiency of generating equipment, reduced fixed charges and, most important of all, through high load factor resulting from diversity of load. These make available near all large centers of population a motive power more advantageous in respect to both price and quality than is obtainable through the employment of steam locomotives.

A major central-station company generates such great amounts of energy that the railroad load is but a small portion of the total. Its entire staff is trained in the business of producing and marketing energy. It is possible for the central station to use more efficient, because larger, prime movers than are available to the railroad alone. Large size in units and concentration of power reduce operating costs considerably. But the strongest argument in favor of the central-station company as against the isolated plant for railroad operation is the much lower fixed charges per kilowatt-hour which result from the diversity of the central station. This generally applicable business principle of diversity is nowhere so vital as in the business of producing electrical energy because of two inherent conditions: First, the high investment required per unit of capacity, and, second, the short duration of peak loads and the ordinarily large difference between maximum demand and average demand. In the production of energy for but one class of use this latter condition is aggravated to a point where the investment layout necessary to carry the maximum constitutes a very heavy burden, since it must be carried by a much smaller average demand.



Annual peak, winter day, Dec. 15, 1926.

Average summer day, Aug. 3, 1926.

*Typical load curves of Commonwealth Edison Company illustrating advantages of diversity*

In the left-hand graph, depicting load curves on a winter day, the load factor of "all other" is 64 per cent, compared to 54 per cent for the railroad load, while in summer the load factor on the day shown for "all other" is 65 per cent and that of the railroads 45 per cent.

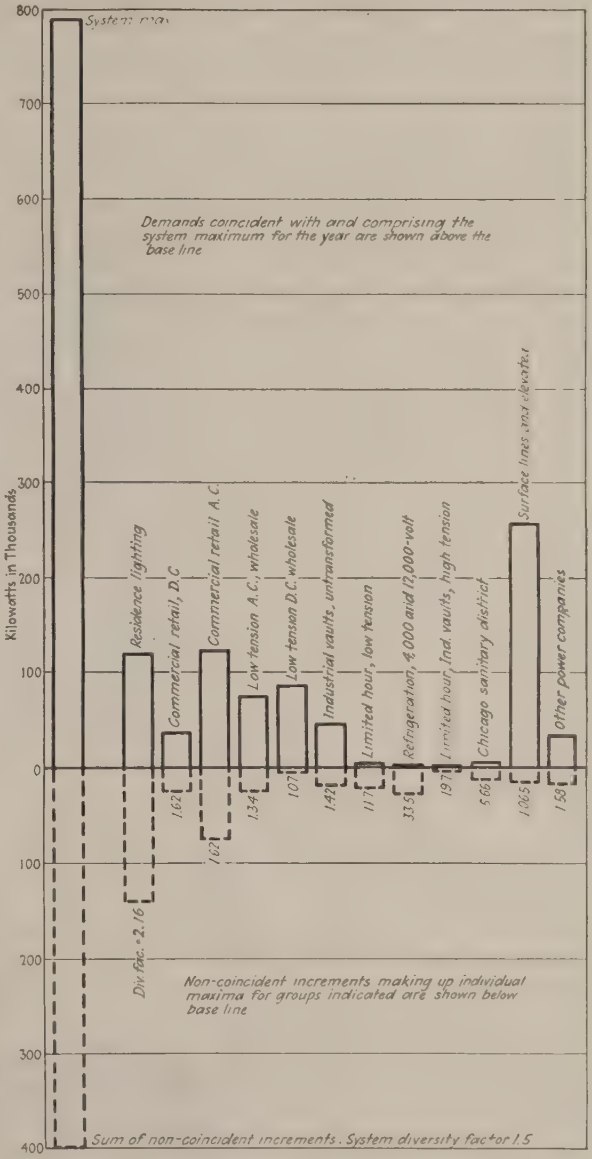
The seasonal drop in the daily average load between the winter day and the summer day is only 13 per cent for "all other," as compared to a drop of 50 per cent for the railroad load. The railroad curve represents the sum total of the surface lines, the elevated and the Illinois Central electrification.

Variation in demand is an hourly, daily and monthly variation. It is the aim of central-station companies to build up demand during off-peak periods by connecting on to the system loads whose maxima do not coincide with the system maximum. Thus, by combining the requirements of a great variety of customers, an increasing diversity of load is obtained, the use of the investment increased and the fixed charge per unit of production materially decreased. Such a procedure is impossible, or possible only within very narrow limits, when a single user or class of users are connected to the generating center. If railroad maximum demand came at the same time as the total maximum and if the load did not vary from hour to hour during the day and with the changing seasons there would be no advantage in central-station power other than the advantages of low operating costs, as distinguished from fixed charges, due to mass production. But experience indicates that the peaks of various loads do not coincide.

In general, it can be said that the morning domestic light and power load is declining, while the suburban and street railway load is increasing toward its morning peak at around 8 o'clock, as the population is carried to factory and office. Following this, the railroad load declines sharply, but the total is held up by the rise in the industrial load. In the evening the industrial load abates before the sharp evening peak on the railroad load. As this falls off the lighting load sustains that of the system. During the late evening and the early morning hours it is possible to add a special controlled load, such as ice manufacturing and other industrial uses, to build up the load factor.

The foregoing and the accompanying load curves indicate in a broad way the use of investment which can be obtained only through the connection of a varied load onto central stations. It can be readily understood that not only in technical and constructive problems, but also in the question of scientific employment of the necessary equipment through the economics of marketing, the central-station business is a very highly specialized one, requiring the utmost efforts of those engaged therein. Both the problem of obtaining energy at low operating costs through mass production and interconnection and that of increasing the use of the investment through diversity are possible only with the large diversified business of the central-station company.

In solving the many perplexing questions of railroad electrification, a mutual understanding of each other's problems by the railroads and the central-station companies is essential. Thus the nature of the railroad load curve, with its hourly and seasonal peaks and valleys, can be studied simultaneously with the load curves of other businesses supplied by the central station, with the end in view of building up load factor. In this connection the possibilities of developing the country adjacent to the rights-of-way through the availability of energy to farms and small communities are important. It is certain that to a large extent the investment in generating stations and some other equipment, especially near centers of population, has already been made and is available to the railroads. A survey of the total railroad requirements in any particular locality to learn the extent to which available generating stations can absorb the railroad load and what additional equipment may be necessary is a matter for joint action between the two industries. The question of transmission lines and equipment and distribution facilities along the rights-of-way can best be decided upon through co-operation, particularly where the distribution of energy to the adjacent countryside is a consideration. The standardization of equipment and apparatus is best approached through the combined efforts of the railroads, the electrical manufacturers and the central-station companies in order that the performance requirements desired by the roads be synchronized with the design of equipment for generation, transmission conversion and motive power.



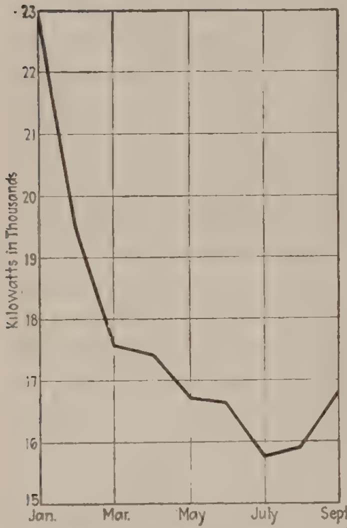
*Diversity chart—making $1 do the work of $1.50*

Showing the diversity of large groups of customers on the Commonwealth Edison Company system for 1925 and illustrating the investment saving due to this diversity of business, which at $100 per kilowatt capacity for generating equipment alone approximates $40,000,000.

No more outstanding example of the success of electrification wisely instituted through the co-operation of the railroad and the central-station company, resulting in minimized investment and power cost, can be found than in the case of the Illinois Central electrification in Chicago. During most of the year 1926 the Illinois Central operated its suburban service by steam at a loss of

$337,000. In 1927, operated exclusively by electricity, it is estimated the line will show a profit of almost half a million dollars. Simultaneously it has increased the number of trains 33 per cent, slightly reducing commuting rates, and enjoys a 20 per cent increase in patronage. Running time has been reduced from 10 to 22 per cent.

That the central-station company was able to deliver the required energy with no more than the normal increase in generating capacity is evidenced by the fact that maximum requirements of the electrification are around 23,000 kw., which come non-coincidentally with a maximum demand of the company's system of upward of 900,000 kw., while the total annual consumption of the railroad is estimated at 55,000,000-kw.-hr., as against 3,500,000,000 kw.-hr. for the whole system. From these figures it can further be ascertained that while the load factor on the entire central-station system was approximately 47 per cent, that on the 23,000-kw. maximum requirement of the railroad approximates only 27 per cent. The added utilization of required capacity as between the entire central-station system and that part necessary for the railroad alone brings out clearly the advantages of the diversity obtained through central-station generation of railroad supply power.



*Illinois Central Railroad load curves*

Average hour maxima for each month of the first nine months of 1927, illustrating month to month fluctuation of load.

The accepted basis on which the services of both the railroad and the central-station company are furnished being cost and not value, and the accepted policy of each being to sell its services at the lowest price compatible with a fair return on invested capital, their customer viewpoints coincide. Therefore, each party is seeking the same end and both can best solve their common problems through co-operation and a frank laying of cards on the table, to the end that these problems may be considered from all angles, present investment utilized to the maximum and future growth developed along sound, economic lines. This spirit of co-operation, if present in the negotiations of individual power companies and railroads, will do much toward the satisfactory solution of railroad electrification.

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## Truck-Mounted Gin Pole Reduces Pole-Setting Costs

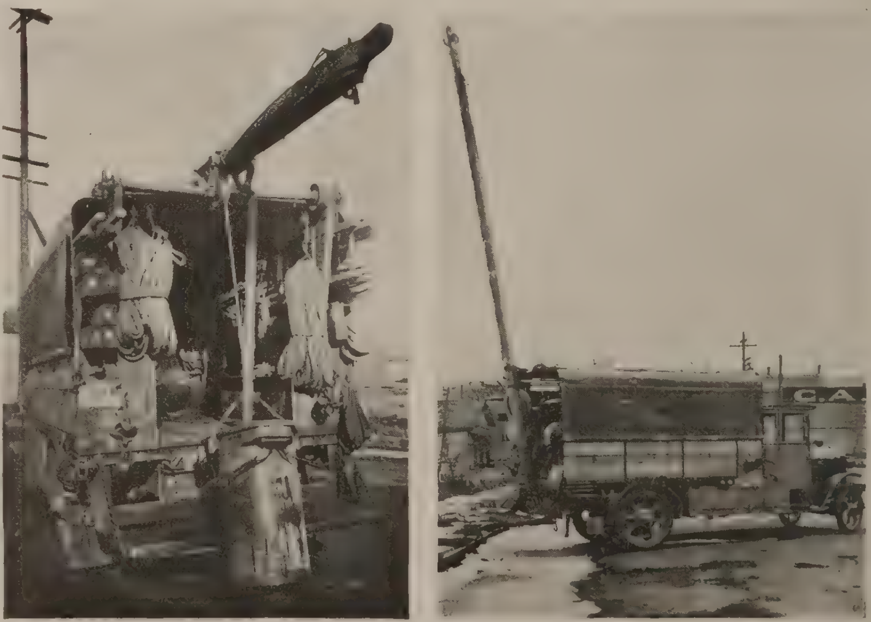
By D. A. Hord

*Superintendent of Distribution Northwestern Electric Company, Portland, Ore.*

Hand setting or similar methods of raising poles have been displaced by the Northwestern Electric Company, Portland, Ore., by a gin pole mounted on a line truck. While many utilities are now using equipment of this general character, the interesting feature of this truck is the method of mounting and supporting the gin pole and the fact that it is carried on an unusually well-equipped line truck instead of on a separate vehicle, as is so often done in similar practices.

The gin pole is shown in a lowered position for traveling and the overhead cross-shaft for hinging the pole is clearly indicated. Two lead sheaves are provided. When the one in the center is used for lifting transformers or other equipment the brace shown is used to prevent bending the shaft. Either sheave may be used for the pull line leading to a power-driven winch on the right front side of the truck. When traveling the upper end of the gin pole rests in a leather saddle at the forward end of the truck roof.

The gin pole is also illustrated in position with the four permanently connected guy cables tightened. The bottom of the gin pole fits into a socket on the rear center of the truck bed. Adjustable stiff-legs, at each rear corner of the truck chassis, are not lowered into position in the picture. The advantages of this equipment and the saving in cost of setting poles over former methods are so obvious that no comparative costs have been completed.



*Combination line truck and pole-setting rig minimizes equipment and labor costs*

# Financing Power Projects*

### Utility executive constantly faced with financial and economic questions which are just as urgent as his technical problems

By C. W. Kellogg
*President Engineers Public Service Company*

*C. W. Kellogg*

THE fact that the problems of design and construction which are involved in good engineering often require the overcoming of great physical difficulties or the exercise of a very high degree of mental training, ingenuity and courage is quite likely to lead the engineer to feel that when these difficulties have been surmounted his problem has been solved. While undoubtedly there have in the past been many cases where the skill and ingenuity of some engineer has made possible the accomplishment of some useful work which would not have been done but for the engineer, yet I believe by far the most common case nowadays is one where the engineer cannot apply his skill and knowledge until first the money to pay for the work has been raised. And raising money involves not only ascertaining by study and analysis what the economic results of a given engineering project may be, but of showing those results to the people who have spare capital in such a convincing way that they will voluntarily invest their savings therein. In other words, even after the engineer can answer affirmatively the question "Can it be done?" he must still be able to answer satisfactorily the question "Will it pay?" and this answer must be in terms that will be clear and convincing to the untechnical business man. The larger the project the longer and more difficult the solution of the economic factors tends to become.

In the case of the Conowingo hydro-electric development it is a fair statement to say that it had been a definite project for 44 years before its final realization. The economic soundness of the enterprise could not be demonstrated until high-tension transmission was developed to the point of being able to carry the large output to market without excessive loss, until the market itself had developed an absorptive capacity sufficient to utilize the output and until there existed a steam-generated system large enough to relay the hydro plant during low flow.

The great project of a deep waterway from the Great Lakes to the sea, one of the greatest of our times, depends primarily on economic considerations. No one questions the ability of engineers to construct the dams, locks and power plants necessary or incidental to this project, or to estimate with reasonable closeness what they will cost, how much power and energy they will produce, how long they will take to build, but there is a great deal of question in various people's minds about the economic effects of making the huge investment which would be necessary. This project, instead of affecting 3,000,000 people, as does Conowingo, would affect more like 50,000,000 people, and, what is more, it would not affect them all the same way, which adds another very complicated feature to the subject. To my mind the economic limits of engineering are not a narrowing force for the engineer, but just the reverse. They are a challenge to his human as contrasted with his purely intellectual faculties. They oblige him to apply his skill and knowledge for the good of the community in its broadest aspects and thus make him a more useful citizen. The age in which we live is primarily one wherein nature's forces so long unused are being harnessed for man's benefit. It is not mere chance, but a sign of the times, that the man who during the last fifteen years has done more than any other individual for the benefit of mankind is its most eminent engineer, Herbert Hoover. It is also in line with my thesis that one of his most conspicuous services during the last five years has been along the economic lines of saving waste in industry.

## Does it Pay?

Lest it might be felt from the examples I have mentioned that I have reference only to great public works in considering the economics of engineering, I have only to remind you that the principle applies even to the smallest matters and even applies in the specific questions of effecting economies. In steam power plant design, for example, we all know that it is possible to produce a kilowatt-hour from less fuel than is now being done in any existing plant, but we also know that no sensible person is going to spend the money in investment to make that further possible fuel saving unless it pays to do so.

In this matter of fuel saving the economic questions far outweigh the purely engineering ones. For example, with a low load factor and cheap fuel it might be shockingly bad economics to attempt to get even ordinary fuel economy. In northern Louisiana recently a power plant was erected at a point where approximately 300,000 B.t.u. in natural gas could be bought for one cent. Obviously any expenditure in plant investment to save fuel would be foolish, and what, in fact, was done was to utilize the cheap fuel to effect a saving in plant investment by cutting out every piece of equipment not absolutely needed. A very low investment cost per kilowatt was thus secured and still the fuel cost was less than one mill per kilowatt-hour.

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*Read before the Boston Section, A.I.E.E.

The opposite extreme exists in one section of the country, where fuel is relatively high priced and system load requirements such that now stations can be operated at very high load factors. In such a case the relatively high investment cost necessary to secure the very latest developments for improved economy may be wisely made, not for the feat of beating a record for B.t.u. per kilowatt-hour but because, with the load factor and fuel cost obtaining, it pays to do so.

In the early days of engineering many problems of design and construction had not been solved. They were baffling and difficult, and when some of them had been solved the engineer might properly rest on his oars for a bit. Now, however, there are so many important ways in which engineering attainment has outstripped economic ability to utilize it that, whether he will or no, the engineer is forced into considering continuously the economic aspects of his business.

### Railroad Electrification

One of the great developments of the future is railroad electrification. Past engineering design and experience have absolutely answered the question "Can it be done?" It remains in each new project an economic question. In each case there is involved the great task of exposition of the advantages of electrification to officials drilled with decades of steam locomotive operation; there is also the question of railroad credit to finance these great electrification programs — the latter now happily much nearer solution than a decade ago—but both of these matters are essentially economic.

A special angle of the economic aspect of engineering is the matter of raising the money to pay for large construction projects, commonly called financing. While this is in the last analysis the problem of the investment banker, since his is the risk in buying the securities and his the responsibility in selling them to his clients, on the other hand the engineer should be familiar with the requirements of the situation, since it is one of the links in the chain connecting his conception with the actual carrying out thereof. Weakness in this link has been a frequent cause of good plans failing to come to fruition. The investment banker is used as representing the investing public, since his requirements merely represent what he knows his clients will demand before they will buy and because raising funds by direct public solicitation is usually quite impracticable.

Merely financing extensions of moderate size to an existing property need not concern the engineer. The new money is raised by a going concern either to pay for economies greater than the cost of the new money or to care for growth of business; in either case the money is raised on the company's own credit.

All financing is based on credit, and for a brand new project the establishment of the necessary credit is a matter in which the engineer plays an essential rôle. Investors are accustomed to buying securities on the basis of past earning power, based preferably on many years' record of performance; so that securities of a "construction project," not only without any earnings record but facing a year or two of construction period without any earnings, naturally meet with a good deal of what is commonly known as "sales resistance."

### Buyer's Credit May Be Used

This difficulty can be overcome by utilizing the credit of the company which is going to buy the output of the project, as was done with the credit of the Philadelphia Electric Company in the case of Conowingo, or through a contract or contracts for the purchase of the output, as was done through the Union Electric of St. Louis and other prospective customers in the Keokuk development.

Briefly, the method followed with the Conowingo project was this. The hydro companies, two in number, each owning the property respectively in Pennsylvania and in Maryland, were leased for 45 years to the Philadelphia Electric Company or subsidiaries owned by it at rentals sufficient to pay charges on the securities required to finance the project. In this way the credit of the project was as firmly established before construction began as though the water-power development were in fact one of the Philadelphia company's own power stations. In addition, the electric company definitely pledged itself to put up any money over and above that raised by the sale of securities that might be needed to finish the construction work. Through the arrangements mentioned Conowingo's credit was about as perfect as that of any privately built project could well be. A weaker credit position, paying more for the money, of course, would suffice, but in any case the credit must be there, either direct or remote, and it is impossible for the engineer to put his project through until it can be given a credit standing satisfactory to the investment banker.

This makes the establishment of earning power a problem the engineer must solve. It involves a study of markets and rates and often lengthy negotiations with consumers. The Keokuk project was authorized by act of Congress in 1905 and five years of study and negotiation for the establishment of the market for its output were required before the project could be financed. Even when the act of Congress was passed 60 years had elapsed after the original reconnaisance of Robert E. Lee, then a captain of engineers in the army, before the arrival of economic conditions made the development feasible.

Millions of horsepower in water power in this country have been surveyed, analyzed and studied by engineers and are now waiting the development of markets for their product satisfactory as to size and location before they can be developed. They are feasible as engineering projects, but the sun of economic need has not yet risen for them.

Engineering will continue for an indefinite future to concern itself with applying scientific knowledge to human use. During the last 50 years the engineering difficulties of working out these applications were so great that they required all the energies and ingenuity of the engineer. Latterly, however, I believe, as I stated at the outset, that the emphasis is shifting to the problem of applying them on sound economic lines. The effect of this latter development is greatly to broaden and to humanize engineering. No longer is the engineer merely the designer of structures and machines and the builder of great works. In future he must to an ever-increasing extent co-ordinate his expert knowledge and experience with the economic requirements of the body politic.

# Non-Supervised Substations

### Economic and public relations considerations. Steel structures for 22 kv., 33 kv. and 44 kv. used by the Alabama Power Company are simple in design and operation

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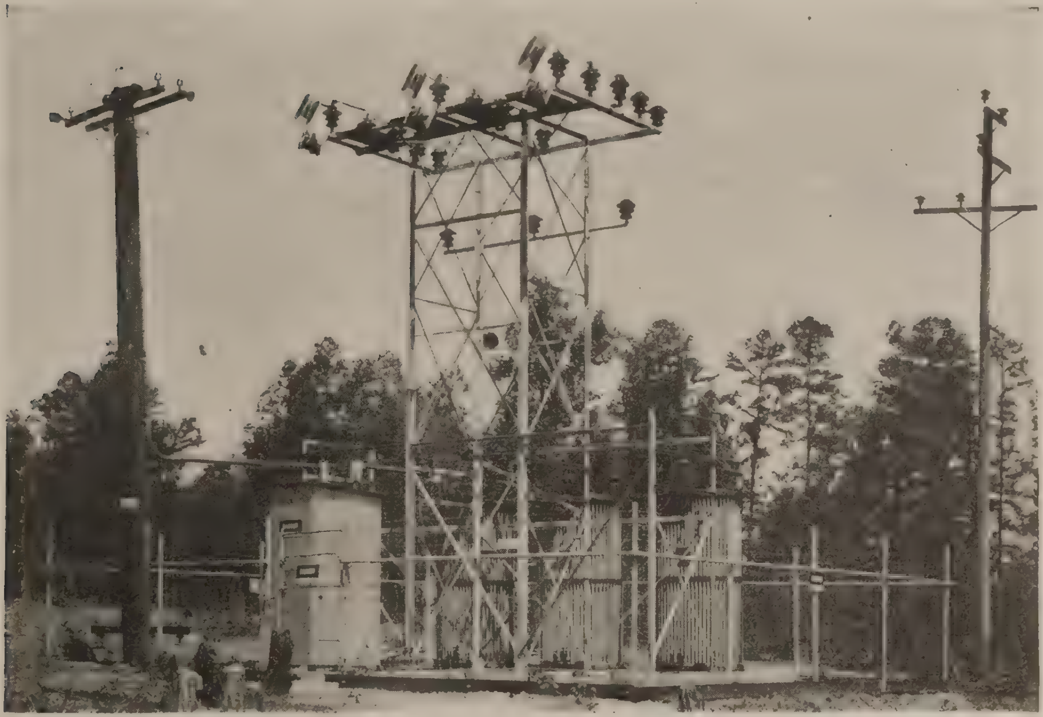


*Fig. 1—Non-supervised outdoor substation used by the Alabama Power Company*

MANY factors enter into the design of non-supervised distribution substations other than merely securing the maximum use of the equipment necessary to meet a specific set of conditions. The chief factors to consider are the policies and practices of the particular utility, the economic phases and the effect on public relations and on electrical construction carried on by the customer. Local conditions, load density, character of load and accessibility are the most important factors in determining the policies and practices of any one utility. Any one of these may be the determining factor in setting the policies and practices in connection with any individual substation. However, all of these factors must be considered jointly in order to arrive at a general policy and to determine what general practice must be followed.

The economic phase is usually the one factor that should receive the most consideration, quite often to the exclusion of all others. The initial cost must have a place in the economic phase, but against this must be balanced the cost of maintenance and operation. Different designs will necessitate different expenditures for maintenance and operation. As is well known, the cheapest design is seldom the most economical, since the difference in the cost of maintenance and operation of a cheaply built and a higher priced substation will often more than cover the overhead expense on the difference between the initial cost of the two substations. In case the added initial expenditure greatly benefits the service obtained from the higher priced substation the expenditure is justified.

Public relations can be greatly improved by careful selection of substation apparatus by appealing to community pride through the visible property. Any community appreciates the effort made by a public utility to uplift a district through pleasing construction work. The quality of service to the customers also pays good dividends in public good will. Any substation must be so constructed that service is interrupted only under extraordinary conditions and then with the least possible outage.

Consideration must also be given to the influence

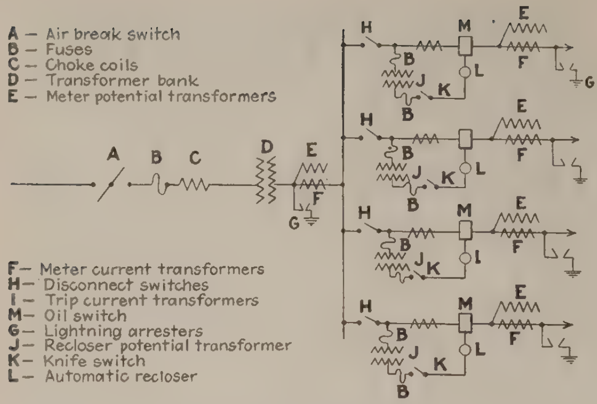


*Fig. 2—Wiring diagram of typical 44-kv. unit type step-down substation*

of the utility's construction work on similar work done within the plant of the customer. In many cases a customer will try to duplicate construction work done by the utility serving him. For the benefit of service to any customer the example set by the utility should be of the highest practical standard.

### Standard Customer Substation Used

In the development of the standard customer substation for the Alabama Power Company's system all of these points have been considered. It will be noted from the accompanying illustrations that steel has been used almost exclusively so as to obtain a permanent substation and also secure a high salvage value. These substations are very simple in design and operation. The greater number of the non-concentrated loads of this utility consist of comparatively few customers and a substation having highly flexible switching facilities is not necessary. It is, however, necessary to provide a substation that can be adapted to almost any available location. It was for loads of this class that the unit type substation treated herein was developed.

This substation is adaptable where it is desired to install outdoor high-voltage equipment and either indoor or outdoor low-voltage equipment. Because of the many applications and arrangements of the low-voltage equipment, only the outdoor low-voltage arrangement will be considered here, together with the 22-kv., 33-kv. and 44-kv. high-voltage side.

The complete outdoor substation installed for 44 kv. is shown in Fig. 1. When used for 33-kv. or 22-kv. service only the insulators and switching equipment need be changed. The substation shown has but one low-voltage circuit, but four duplicate low-voltage circuits may be fed from this substation without any alteration. Outdoor type regulators may be installed on each outgoing circuit. A typical single-line diagram for a four-circuit substation with metering equipment on each circuit is shown in Fig. 2.

The structure is made entirely of galvanized steel and can be used for a high-voltage line pulling in on the structure from the transformer side or from the opposite side. The arrangement with the line coming in from the transformer side is shown in Fig. 3. When the line comes in on the opposite side, the air-break switch at the top is reversed and the two outside phases drop directly to the transformers and the middle phase to the long delta bus at point *A*. The side on which the line comes in depends upon the arrangement required for the low-voltage circuits. It will be noted that the

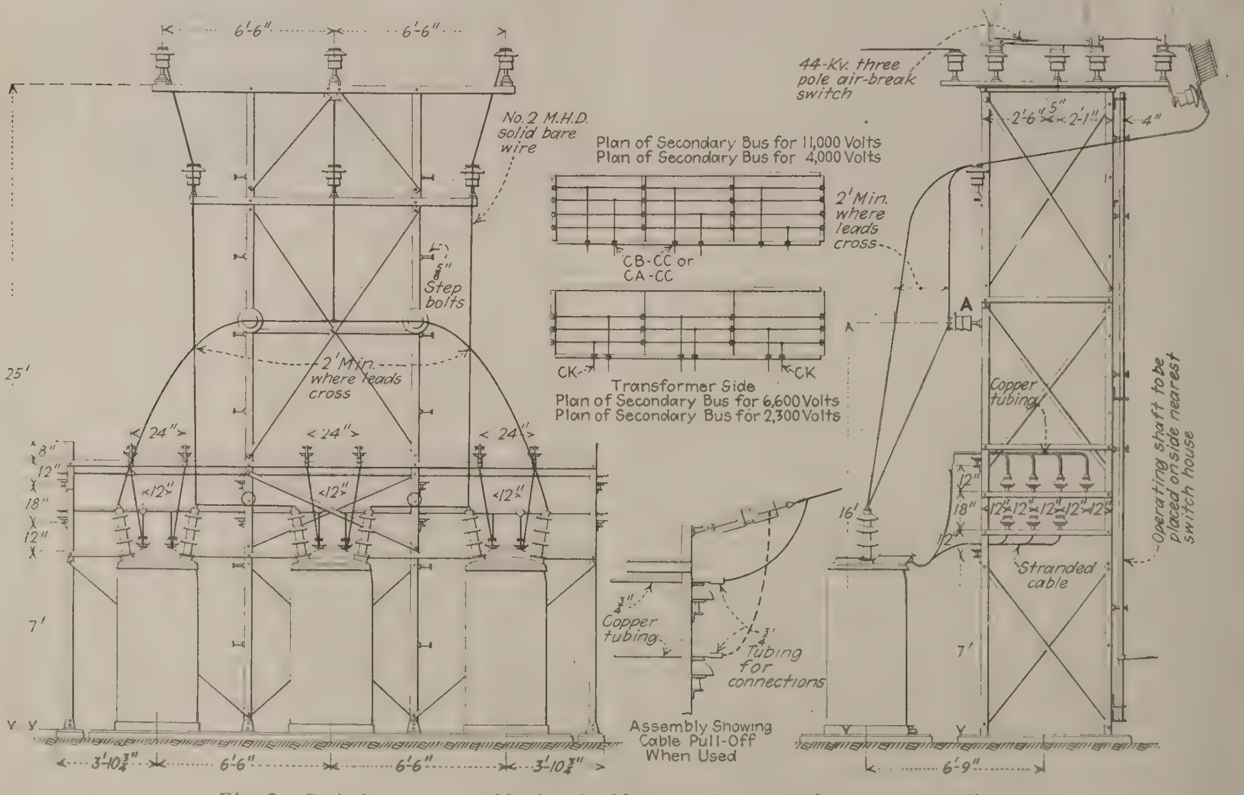

6'-6"
6'-6"
No. 2 M.H.D. solid bare wire
5" Step bolts
2' Min. where leads cross
25'
24"
24"
24"
8"
12"
18"
12"
<12"
<12"
<12"
7'
3'-10¾"
6'-6"
6'-6"
3'-10¾"
Plan of Secondary Bus for 11,000 Volts
Plan of Secondary Bus for 4,000 Volts
2' Min. where leads cross
CB-CC or CA-CC
CK
CK
Transformer Side
Plan of Secondary Bus for 6,600 Volts
Plan of Secondary Bus for 2,300 Volts
44-Kv. three pole air-break switch
2'-6"
5"
2'-1"
4"
A
A
Copper tubing
12"
18"
12"
12" 12" 12" 12" 12"
16'
Stranded cable
Operating shaft to be placed on side nearest switch house
7'
6'-9"
¾"
Copper tubing
¾"
Tubing for connections
Assembly Showing Cable Pull-Off When Used

*Fig. 3—Switch-gear assembly for double secondary transformers under line*

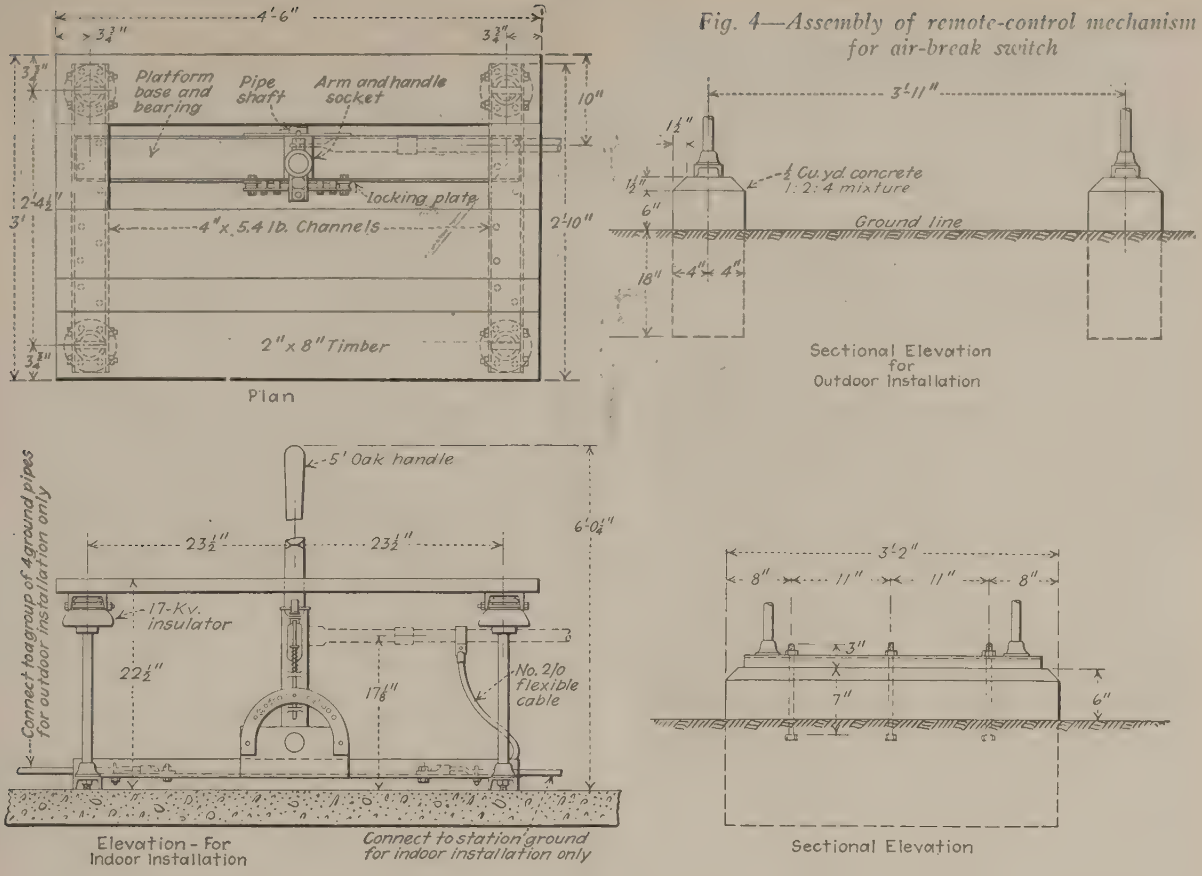


Fig. 4—Assembly of remote-control mechanism for air-break switch

4'-6"
3¾"
3¾"
Platform base and bearing
Pipe shaft
Arm and handle socket
10"
locking plate
2'-4½"
3'
4" x 5.4 lb. Channels
2'-10"
2" x 8" Timber
Plan
3'-11"
1½"
½ Cu. yd. concrete 1:2:4 mixture
6"
Ground line
18"
4"
4"
Sectional Elevation for Outdoor Installation
5' Oak handle
6'-0¼"
23½"
23½"
17-Kv. insulator
22½"
17⅛"
No. 2/0 flexible cable
Connect to a group of 4 ground pipes for outdoor installation only
Elevation - For Indoor Installation
Connect to station ground for indoor installation only
3'-2"
8"
11"
11"
8"
3"
7"
6"
Sectional Elevation

structure has a double low-voltage bus, which makes it possible to serve two voltages by using triple ratio transformers. When one voltage is all that is required, the double bus feature can be used to facilitate the installation of the totalizing metering equipment when this is used. The height of the transformers is not a limiting factor in the application of the structure, since there is no obstruction above the transformer foundation.

The high-voltage switching and protective equipment consists of an air-break switch, fuse and choke coil, all mounted as a unit on a single channel, which not only reduces the cost of the equipment to a marked degree but also facilitates construction considerably. The switch is controlled from the ground by the remote operating mechanism shown in Fig. 4, installed adjacent to the structure. This type of operating mechanism was adopted as a safety measure in order to remove the operator from the range of falling porcelain and to insulate his body from ground in case of the failure of an insulator on the switch while being operated.

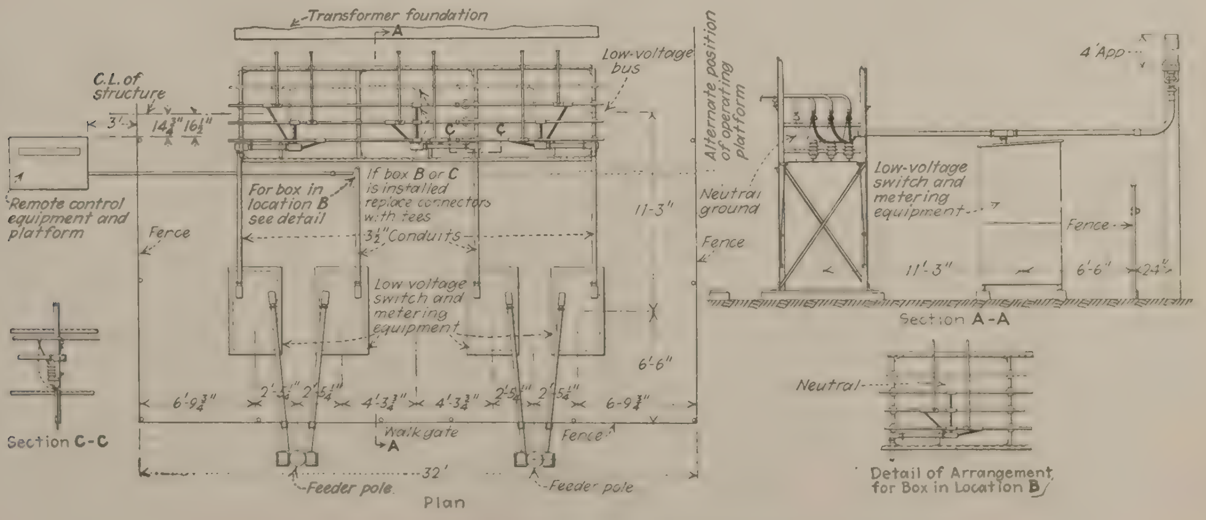
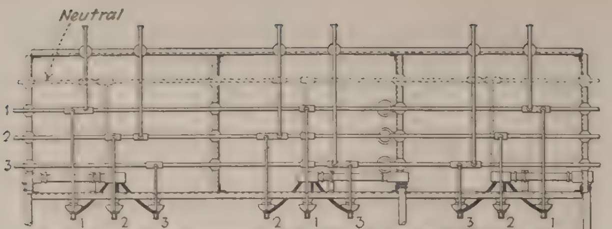
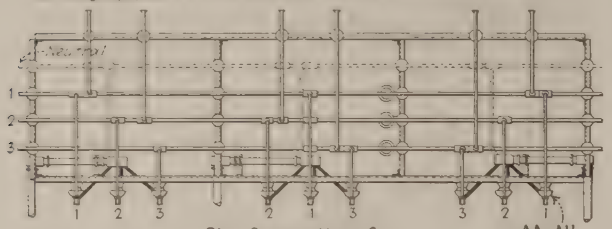


Fig. 5—Arrangement of low-voltage feeder switching and metering equipment

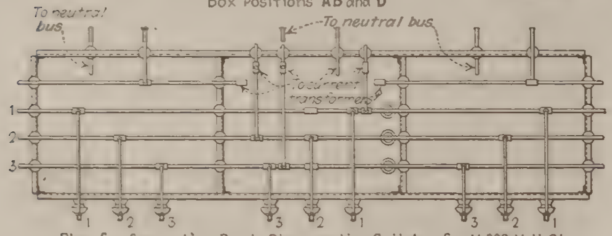
Transformer foundation
A
Low-voltage bus
Alternate position of operating platform
C.L. of structure
3'
14¾"
16½"
C
C
Remote control equipment and platform
For box in location B see detail
If box B or C is installed replace connectors with tees
11'-3"
Fence
3½" Conduits
Low voltage switch and metering equipment
6'-6"
6'-9¾"
2'-5¼"
2'-5¼"
4'-3¾"
4'-3¾"
2'-5¼"
2'-5¼"
6'-9¾"
Walk gate
A
Fence
32'
Feeder pole
Feeder pole
Plan
Section C-C
4' App.
Neutral ground
Low-voltage switch and metering equipment
Fence
Fence
11'-3"
6'-6"
24"
Section A-A
Neutral
Detail of Arrangement for Box in Location B



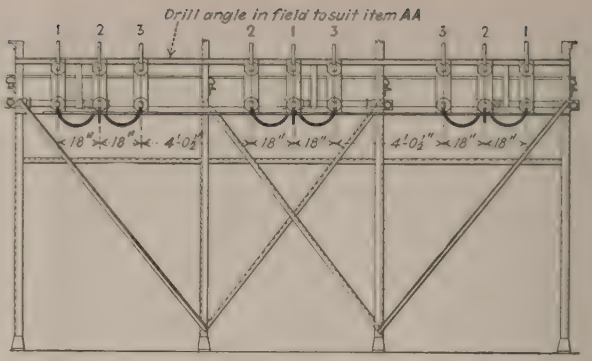
Plan for Connecting Disconnecting Switches to Bus for 6,600-Volt Delta with or without Metering Equipment and 11,000-Volt Star without metering Equipment for Box Positions **A, C** and **D**



Plan Same as Above for Box Positions **AB** and **D**



Plan for Connecting Bus to Disconnecting Switches for 11,000-Volt Star with Metering Equipment



Typical Front Elevation

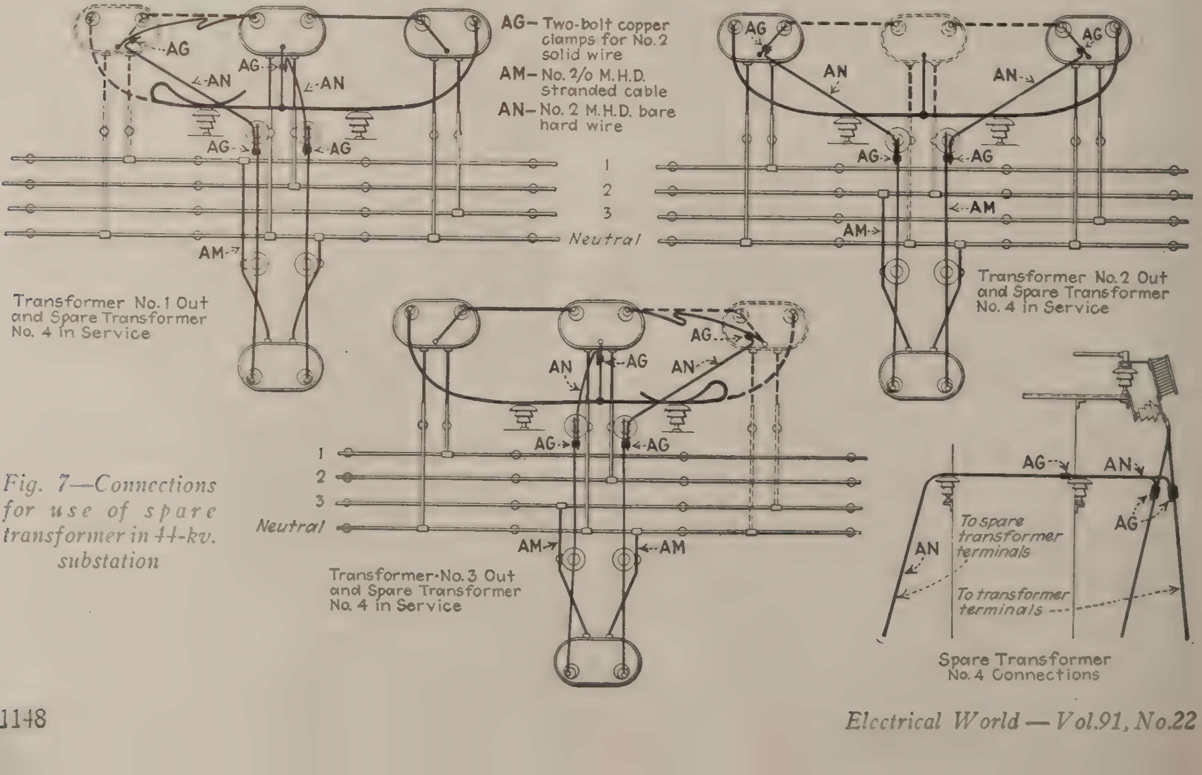
*Fig. 6—Mounting of disconnecting switches used when low-voltage side is 6,600 or over*

The fuse in the protective unit is of the expulsion type and uses copper wire within a micarta tube for the fuse link. When the fuse link melts under overload, the micarta tube automatically opens, thus preventing the re-establishment of an arc across the tube after the fuse arc is ruptured. The tower is provided with steps and a platform on top to facilitate the replacement of fuses. This type of high-voltage equipment is sturdy and has given service commensurate with many other more expensive types of equipment used to secure similar results.

Open delta capacity is ordinarily provided at substations of this type, but where it is deemed advisable to provide a spare transformer, it is installed on the opposite side of the structure from the main bank and a quick method of connection is provided as shown in Fig. 7.

### Low-Voltage Bus Installation

The lower part of the high-voltage structure serves as a support for the low-voltage bus. This bus and bus structure are so constructed as to facilitate the connection of the individual circuits. The bus proper is made of copper tube and is supported on porcelain insulators. When it is desired to totalize the energy output of the station, the current and potential transformers of the outdoor type are conveniently located on the structure. When it is desired to meter the output of a bank connected in star on the low-voltage side, the double bus feature is used. The neutral bus is carried



AG—Two-bolt copper clamps for No. 2 solid wire
AM—No. 2/0 M.H.D. stranded cable
AN—No. 2 M.H.D. bare hard wire

Transformer No. 1 Out and Spare Transformer No. 4 in Service

Transformer No. 2 Out and Spare Transformer No. 4 in Service

Transformer No. 3 Out and Spare Transformer No. 4 in Service

Spare Transformer No. 4 Connections

*Fig. 7—Connections for use of spare transformer in 44-kv. substation*

in the lower bus position in the star connection. The metering equipment, which is ordinarily composed of a watt-hour and demand meter, is installed in the meter box mounted below the low-voltage bus, the leads from the instrument transformers being carried to the box through conduit.

The low-voltage switching and metering equipment is located adjacent to the high-voltage structure, as shown in Fig. 5 and is housed in a steel cabinet. Each cabinet contains all equipment necessary for an unregulated circuit except the lightning arresters, which are mounted on the pull-off pole. The connection from the bus to the cabinet is made with cable in conduit.

This cabinet can be equipped for all voltages up to 13,200. Cabinets to operate at voltages less than 4,000 can be equipped with disconnecting switches. When cabinets are used for voltages ranging from 6,600 to 13,200, it is necessary to mount the disconnecting switches on the structure as shown in Fig. 6, on account of the greater size of the potential transformers. Each cabinet is fitted with an oil switch, watt-hour meter, demand meter, curve-drawing voltmeter, current and potential transformers for the meters, current transfomers for tripping, disconnecting switches in cabinets except for 6,600 to 13,200 volts, automatic reclosing device and a 200-volt-ampere potential transformer for operating the recloser.

The metering equipment, disconnecting switches, voltmeter and automatic closing device are optional and may be left out of the assembly if desired. To make the oil switch manual it is necessary only to remove the recloser and in its place install a boiler steel plate and face plate as shown in Fig. 8. A 600-volt assembly with the sheet-steel covering removed is shown in Fig. 9 This is complete with all possible equipment with the exception of the curve-drawing voltmeter. The disconnecting switches are equipped with barriers. The recloser is completely automatic and in case of trouble locks out the circuit after one, two, three or four predetermined reclosings. If the trouble clears before the recloser has made the predetermined number of reclosings, the mechanism resets and is ready for another cycle. The recloser is fitted with a trip-free attachment and also with series-tripping equipment. The tripping equipment may be fitted with either an instantaneous or an inverse time limit attachment.

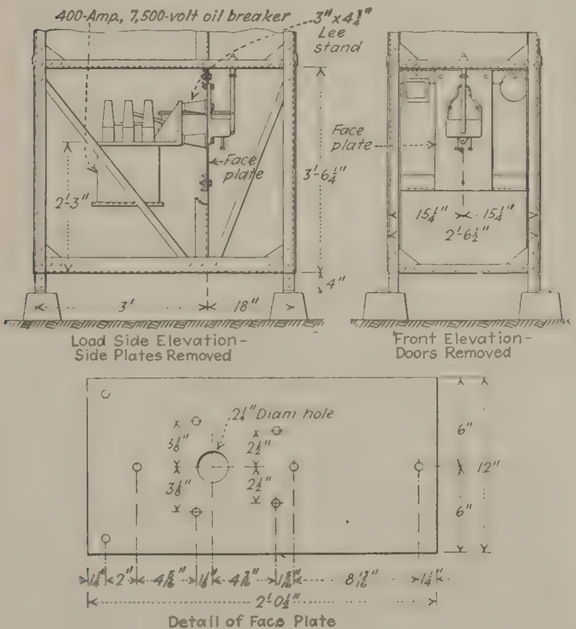


Fig. 8—Feeder switching and metering box without recloser

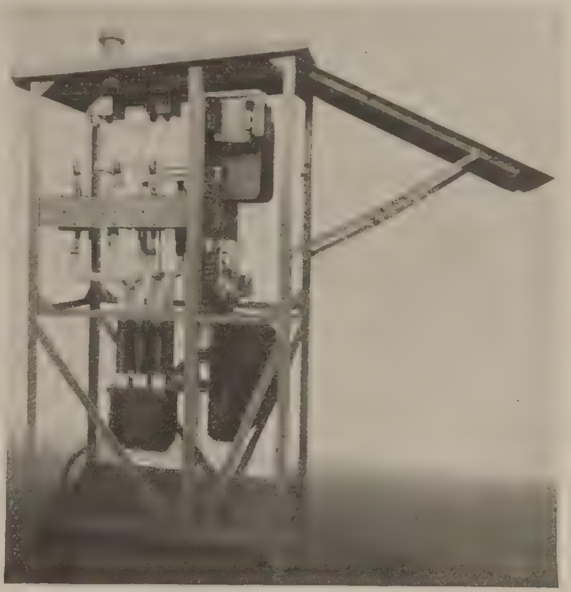


Fig. 9—A 600-volt metering and switching assembly

If it is desired to open the switch by hand, it is necessary only to turn a small lever at the top of the recloser, which trips out the switch and opens the motor circuit, thus preventing it from reclosing. The switch can then be reclosed automatically or by hand. If it is necessary to reclose the switch by hand, this is done by a hand lever at the side of the reclosing mechanism.

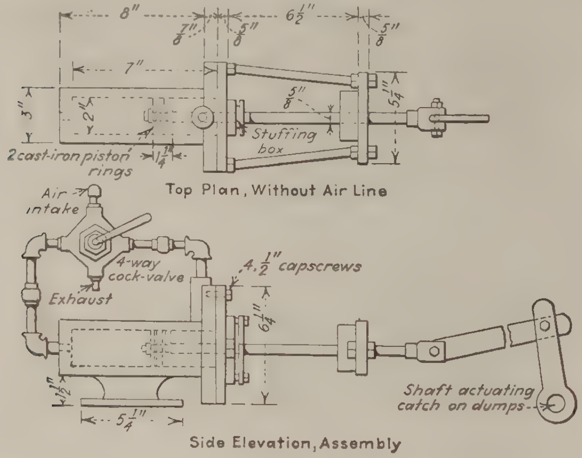
The outgoing feeder is pulled through conduit, Fig. 5, to the first distribution pole, where the lightning arrester protection is installed. In the case of a four-circuit substation two poles are used, allowing the conduit runs to be decreased to a great extent.

This type of substation has proved very economical in that it has a very high salvage value, field construction costs are a minimum, since practically everything used in its construction is fabricated in the shops before being shipped to the job, maintenance is low due to the permanent character of the installation and operating costs are low, since the automatic recloser takes care of all trouble beyond the low-voltage oil switch. Any trouble between the high-voltage fuse and the low-voltage oil switch will blow the fuse on the high-voltage structure.

A substation of the type discussed with an all-steel fence inclosing it has a very pleasing appearance. The public respects clean-cut and well-designed construction work such as is employed in these substations. Customers also find in this work a model for any electrical construction work they may be doing and often ask for engineering assistance from the utility organization on the strength of a piece of construction work done by the utility forces. This, of course, should be encouraged rather than discouraged.

## Air-Tripped Steam Dumps Prevent Accidents

EIGHT 750-hp. boilers at the plant of the Salem Electric Lighting Company equipped with mechanical stokers are operated on a schedule requiring the use of steam dumps more than 40 times a day. The dumps are tripped by levers projecting up from the side of the boiler setting and in the past caused a number of accidents to the operator's hands resulting from the short leverage of the control and occasional failure of the locking dogs to function properly, when the levers would fly back with great force and strike the operator. These accidents have been eliminated by cutting off the upper portion of the lever and actuating the lever and dump by the pressure cylinder mechanism illustrated, which utilizes compressed air at 90 lb. per square inch. The device was designed by Owen A. Jackson, chief engineer of the Salem company, and built by James O'Donnell, boiler room engineer, and Thomas E. Moose, machinist of the station staff.



*Top and side views of dump control cylinder*

## Merchants' Association Formed to Sell Appliances

By G. A. Kumler
*Assistant Merchandising Manager*
*Portland Electric Power Company, Portland, Ore.*

FAILURE of appliance campaigns to produce the desired volume of sales led the Portland (Ore.) Electric Power Company and the Northwestern Electric Company, the two central stations serving Portland, to conclude that either the public had been campaigned to death or that their merchandising departments were at fault. A plan is now being tried out which it is hoped will bring about increased sales.

It was found that there were about fifteen merchants in Portland dealing in electrical appliances and that three or four of this number were as good merchandisers as the power companies, if not better. Eleven of the merchants were invited to a dinner and after a frank discussion of the situation it was decided to form an association, which was called the "Electrical Appliance Retail Association," to bring about more ethical selling practices and greater co-operation. The association meets once a month and has an executive committee, composed of seven members, which does most of the work. The power companies send out notices and there are no dues. When a campaign is to be carried on all members tie in on several large advertisements, with each member's name appearing. In addition, advertisements will appear in other parts of the paper by individual members. Only approved merchandise will be sold.

The plan has been in effect too short a time to judge of its effectiveness, but it is felt that fifteen retail appliance outlets, all working together, will be able to do a much better selling job than the two power companies working alone.

## Operating Costs of Electric and Gasoline Trucks Compared

DURING preparations early in the spring of 1927 for the Christmas business in December, 1927, the management of the Eleto Company estimated, according to Joseph Husson, president of that organization, that it would require six more ¾-ton gasoline trucks for the delivery of Lord & Taylor and James McCreery & Company's packages in the suburban territory beyond the limits of New York City. This company was operating six ¾-ton gasoline trucks entirely within the city limits and the average mileage of any one of these trucks did not exceed 28 miles per day. The problem was one of purchasing additional gasoline trucks and assigning them to work in the suburban territory and leaving the existing gasoline trucks on the 28-mile city routes, or purchasing electric trucks for city routes and transferring the existing city gasoline trucks to suburban territory.

The problem was solved by purchasing six new electric trucks and transferring the existing short-route gasoline trucks in city work to the suburban territory. The justification for this procedure was based on operating savings of the electric trucks, as given in detail in the accompanying table. A close study of the tabulation shows that all items which would remain the same whether gasoline or electric trucks were used are not tabulated, but are considered to balance off in the comparison. The comparison of the totals of columns (2) and (5) with the total of column (3) led to the purchase of six new electric trucks, four of ½-ton capacity and two of 1-ton capacity. The four ½-ton electrics were used to replace ¾-ton gasoline trucks in package delivery work and the two 1-ton electrics were used to replace ¾-ton gasoline trucks for hotel special deliveries.

The estimated difference in the cost between the ½-ton electric and the ¾-ton gasoline truck in the package delivery service, as previously outlined, is $1.54 per day in favor of the electric. The difference in cost between the 1-ton electric and the ¾-ton gasoline truck on hotel special deliveries is $1.28 per day less in favor of the electric truck. At an estimated approximate saving in favor of the electric of $1.50 per day, the total saving in favor of the electrics would be $9 per day or $2,700 per year of 300 service days.

While this saving led to the purchase of two types of electric trucks, it will not provide any net saving until five years have elapsed on account of the increased initial cost of the electrics as compared to the gasoline trucks. The ½-ton electrics average $3,540 each. For four such vehicles the total cost was $14,160. To this must be

COMPARATIVE DATA FOR ELECTRIC AND GASOLINE TRUCKS

Cost items which remain the same whether gasoline or electric trucks were used are not tabulated, but are considered to balance after the comparison.

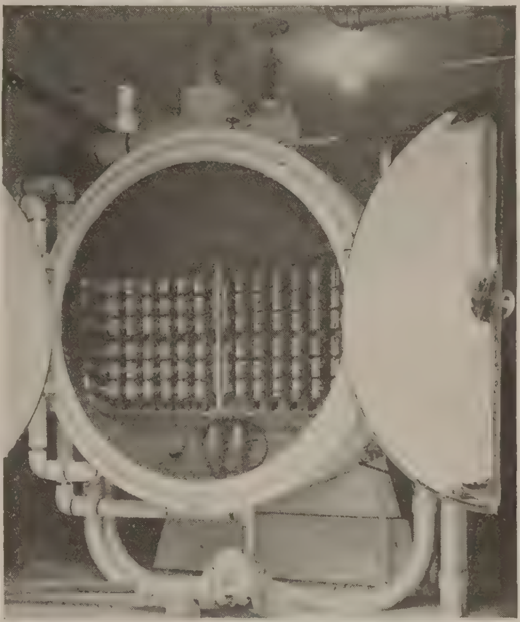
| | Present Out-of-City Electrics ¾-Ton (1) | Estimated Cost New Electrics ¾-Ton (2) | Estimated Cost Second-Hand Gas Trucks ¾-Ton (3) | Present Gas Trucks ¾-Ton (4) | Estimated Cost New Electrics 1-Ton (5) |
|---|---|---|---|---|---|
| 1926 Costs per Day | | | | | |
| Operating charges | | | | | |
| Gas | ...... | ..... | $0.74 | $0.74 | ..... |
| Oil | ...... | ..... | 0.07 | 0.07 | ..... |
| Electric charging | $0.84 | $0.84 | ..... | ...... | $0.84 |
| Tires | 0.15 | 0.15 | 0.37 | 0.37 | 0.15 |
| Drivers | 5.47 | Same | Same | 5.50 | Same |
| Helpers | 3.26 | Same | Same | 4.45 | Same |
| Ferriages | 0.45 | None | None | ...... | ..... |
| Liability insurance | 0.53 | 0.53 | 0.71 | 0.71 | 0.53 |
| Total operating charges | $11.00 | $1.52 | $1.89 | $11.84 | $1.52 |
| Maintenance Charges | | | | | |
| Electric mechanics | 0.72 | 0.72 | ..... | ...... | 0.72 |
| Mechanical repairs: Labor | ...... | ..... | 0.22 | 0.22 | ..... |
| Material | 0.13 | 0.13 | 0.38 | 0.38 | 0.13 |
| Body repairs: Labor | 0.16 | 0.16 | 0.49 | 0.49 | 0.16 |
| Material | 0.07 | 0.07 | 0.18 | 0.18 | 0.07 |
| Greasers and oilers | ...... | ..... | 0.78 | 0.78 | ..... |
| Washing | 0.17 | Same | Same | 0.53 | Same |
| Garage rent | 0.45 | Same | Same | 0.45 | Same |
| Maintenance overhead: | | | | | |
| Foreman and assistants | 0.15 | 0.15 | 0.65 | 0.65 | 0.15 |
| Garage general | 0.22 | 0.22 | 0.54 | 0.54 | 0.22 |
| Porters and watchman | 0.04 | Same | Same | 0.30 | Same |
| Miscellaneous | 0.19 | Same | Same | 0.57 | Same |
| Total maintenance charges | $2.32 | $1.45 | $3.24 | $5.09 | $1.45 |
| Fixed Charges | | | | | |
| Interest | ...... | 0.07 | 0.03 | ...... | 0.08 |
| Depreciation | 1.28 | 1.04 | 0.51 | 0.91 | 1.31 |
| Fire insurance on trucks | 0.02 | 0.04 | 0.02 | 0.02 | 0.05 |
| Fire, fidelity and miscellaneous insurance | 0.14 | Same | Same | 0.21 | Same |
| Total fixed charges | $1.44 | $1.18 | $0.56 | $1.14 | $1.44 |
| Business Overhead Charges | | | | | |
| Office overhead | 2.00 | Same | Same | 2.68 | Same |
| Vacation and bonus reserve | ..... | ..... | ..... | . | .... |
| Officials, delivery superintendents and assistants | 1.24 | Same | Same | 1.44 | Same |
| Clerks and cashiers | 0.98 | Same | Same | 1.06 | Same |
| Porters and watchmen | 0.11 | Same | Same | 0.35 | Same |
| Routers and assorters | ...... | ..... | ..... | ...... | ..... |
| Office sundries | 0.92 | Same | Same | 1.17 | Same |
| Rent of store premises | 0.40 | Same | Same | 0.42 | Same |
| Warehouse expense | 0.08 | Same | Same | 0.28 | Same |
| Group life insurance | 0.07 | Same | Same | 0.09 | Same |
| Rent of warehouse | ...... | ..... | ..... | ...... | ..... |
| Suburban night transfer | ...... | ..... | ..... | ...... | ..... |
| McCreery transfer and return | 0.75 | Same | ..... | ...... | Same |
| Total business overhead charges | $6.55 | ..... | ..... | $7.46 | . . |
| Total costs | $21.31 | $4.15 | $5.69 | $25.53 | $4.41 |
| | | | $4.15 and $4.41 | | |
| Less cost per day with electrics | | | $1.54 and $1.28 | | |

added the cost of two 1-ton trucks at $4,395 apiece. This gives a total investment for the six electric trucks and bodies of $22,950. The cost of the gasoline truck equipment, figuring $800 for a second-hand ¾-ton truck put in first class shape and $700 for the body, gives a total cost per vehicle of $1,500 or $9,000 for the six. The cost of the gasoline equipment is thus $9,000, as against $22,950 for the electric truck equipment, making the electric truck equipment cost $13,950 more. At an operating saving of $2,700 per year it will take five years before this difference in cost is balanced off to show net savings in favor of the electric trucks.

A tabulation of maintenance costs, covering a period of seven years and presented by Mr. Husson at the Electric Truck Conference recently held in New York City, will appear in an early issue.

## Electric Boiler Uses Hydro Surplus

FOUR months' experience with an electric boiler at Lewiston last winter proved to the Central Maine Power Company that surplus hydro power from Gulf Island could be economically utilized in the company's auxiliary steam plant for heating its office building and an adjacent hotel and theater. Set against the operating cost of heating by fuel oil at 5 cents per gallon, this hydro-electric energy had a value of from 3.02 to 3.84 mills per kilowatt-hour. Data on the operation of this unit are given herewith, the returns being weighed in the absence of a steam flow meter which will be available for next winter's runs.



*Heating units applied to steam boiler allow flexible operation*

The boiler consists of an International Engineering Works unit 66 in. in diameter x 19 ft. over all, containing 72 tubes 3 in. x 16 ft. each. It was built for a working pressure of 125 lb. and is rated at 120 hp. It is equipped with 1,200-kw. heating units divided into four 440-volt circuits and automatically controlled by four pressure governors and a Copes water regulator. The General Electric Company furnished the electrical equipment. A saving of about $25 per day over fuel oil, including labor economies, is being attained, according to R. D. Morrison, industrial engineer of the utility.

*Value of Surplus Hydro Power vs. Fuel Oil for Steam Heating, Lewiston, Me.*

| Month | Temperatures, Fahrenheit: Average | Temperatures, Fahrenheit: Average per Day Maximum | Temperatures, Fahrenheit: Average per Day Minimum | Kw.-Hr.: Maximum per Day | Kw.-Hr.: Minimum per Day | Kw.-Hr.: Total Month | Water Lb. Return | Lb. Return per Kw.-Hr. | Cost per Month* with Fuel Oil | Value Surplus Energy per Kw.-Hr. |
|---|---|---|---|---|---|---|---|---|---|---|
| December, 1927 | 28.9 | 38.8 | 13.5 | 16,800 | 9,900 | 414,700 | 957,000 | 2.33 | $1,601.70 | $0.00387 |
| January, 1928 | 22.7 | 37.5 | 2.5 | 18,500 | 11,300 | 502,900 | 1,100,000 | 2.22 | 1,675.85 | 0.00334 |
| February, 1928 | 22.7 | 39.3 | 6.3 | 18,600 | 12,000 | 469,900 | 1,025,000 | 2.20 | 1,415.80 | 0.00302 |
| March, 1928 | 30.3 | 39.5 | 16.5 | 17,400 | 10,600 | 410,300 | 840,000 | 2.05 | 1,575.90 | 0.00384 |

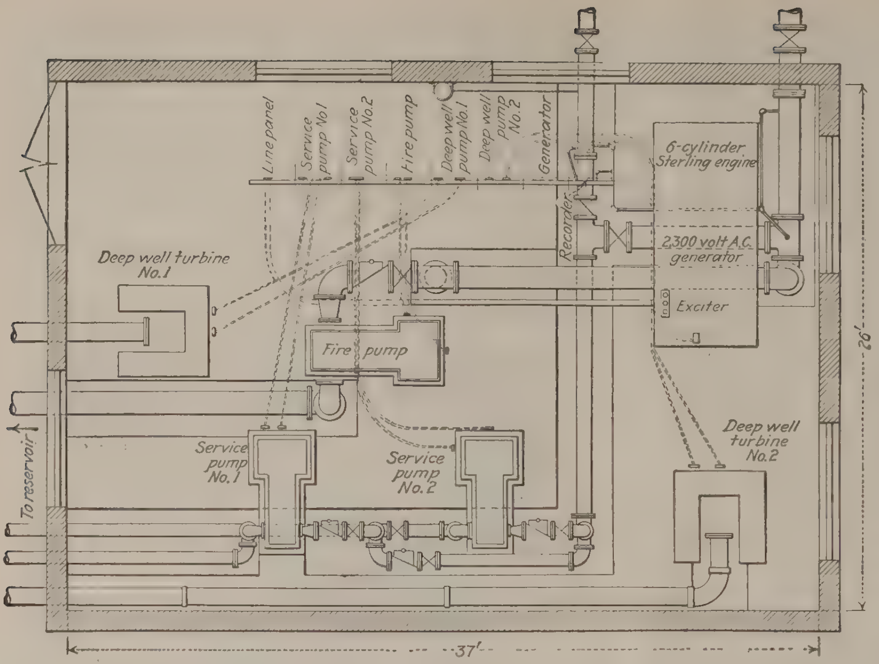
* Fuel oil operating costs per month are those of December, 1925; January, February and March, 1926.

# Automa

## for Water

By H. A. Tolburg

*Superintendent of*
*Water Department, Kewanee, Ill.*



*Plan of Monmouth pumping station*

IN DESIGNING and building the new municipal water plant for the city of Monmouth, Ill., it was decided to make the installation as nearly perfect as possible in order to free the public from all unnecessary expenses in future operation and at the same time place the city in a lower class of insurance risks as classified by the Illinois Inspection Bureau. Another aim was to remove the water department from the curse of local politics as much as possible by reducing the labor requirement in operation. This was all accomplished by the installation of full automatic electrical control of all pumps and motors.

The pumping plant includes two deep-well turbine pumps, two 3-in. horizontal centrifugal service pumps, one 6-in. horizontal centrifugal fire pump, all pumps being driven by 2,300-volt, slip-ring induction motors. Stand-by equipment consists of a 90-kw., 2,300-volt, 60-cycle, three-phase generator direct connected to a 225-hp. Sterling gasoline engine having starter, oil gages and speed controls.

The two deep-well pumps deliver 1,000 gal. per minute each into a 750,000-gal. reservoir, the service pumps deliver 450 gal. per minute each into the system and the elevated tank, which tank has a capacity of 125,000 gal. with a total head of 140 ft. The fire pump delivers out of the reservoir into the system at two speeds, the first 1,000 gal. per minute at 80-lb. pressure and the second speed 1,500 gal. per minute at 105-lb. pressure. The fire pump is served by two control panels, one panel being full automatic, started from either the central fire station or the pumping station by push-button controls, the central fire station being ½ mile from the pumping station. The other panel which controls this pump is a manually operated one of special design and is used in case of failure in the automatic control circuits. The piping from the fire pump to the mains is so arranged that as soon as the pressure is raised above the elevated tank pressure a swinging check valve closes and cuts out the elevated tank, and as quickly as the pressure is cut down to the elevated tank pressure the check opens and the tank is again floating on the distribution system. The switchboard was designed by the Sundh Electric Company, Inc., Newark, N. J.

The automatic features are controlled by pressure regulators and float switches placed in the reservoir and on the distribution system. The float switches are arranged to give a 4-ft. regulation in the reservoir and these switches control the two deep-well pumps. The pressure regulators on the service pumps are so arranged that should the demand be greater than the capacity of the No. 1 pump, then the No. 2 pump will cut in automatically and stay on the line until the elevated tank is full. These pumps are arranged on the board so that they can be alternated and either of them be used as a stand-by. The piping of the service pumps is laid out in such a manner that they can be operated in series to assist the fire pump in case of an extraordinary demand. The elevated tank is protected from being exhausted of its water supply by a pressure regulator on the switchboard so that an alarm will ring should the water supply become dangerously low.

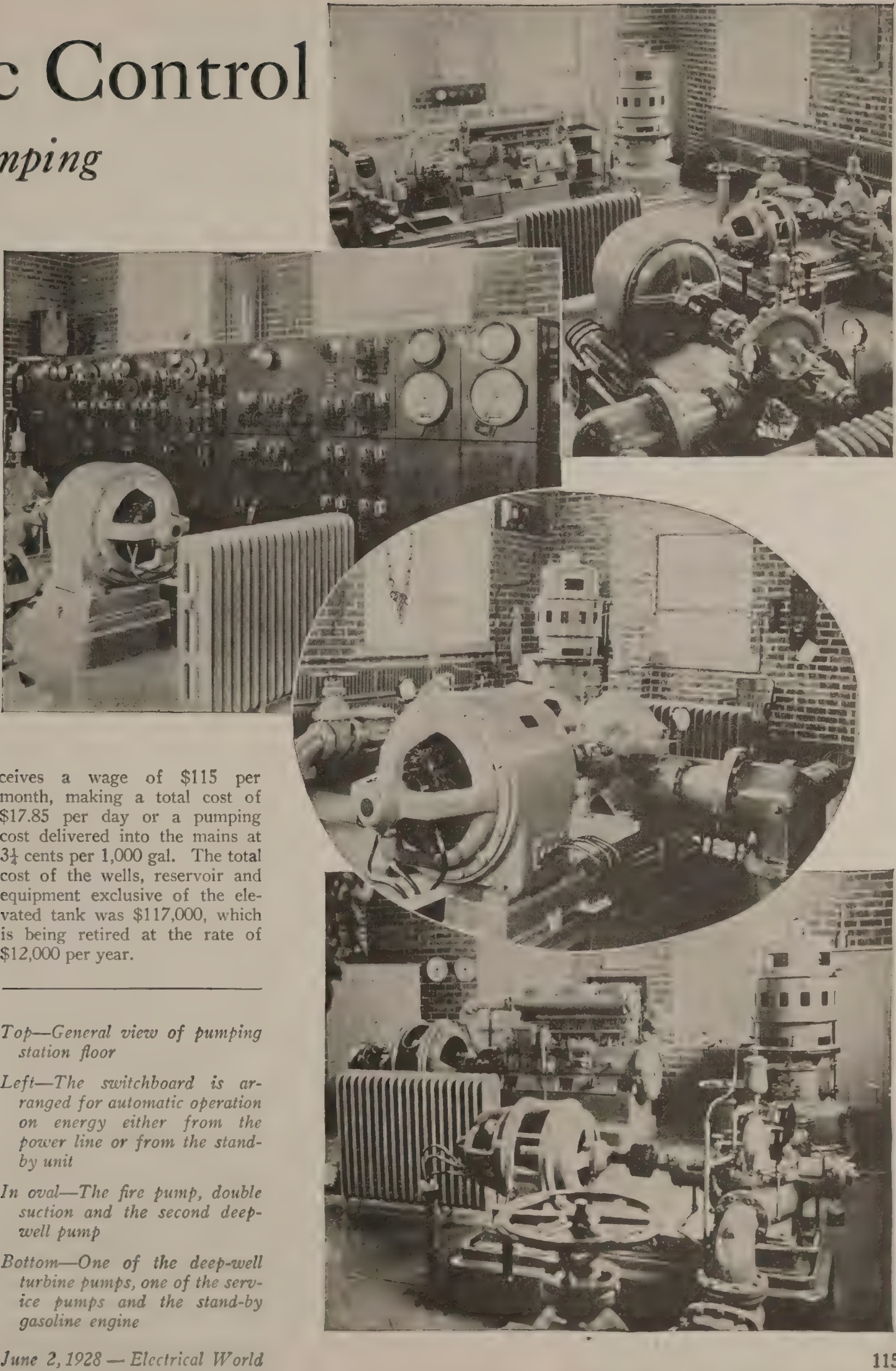
### Protected by Interlocking Relays

The switchboard in all consists of ten panels arranged as shown on the drawing. The incoming line panel is provided with one three-pole, double-throw oil circuit breaker equipped with inverse time-limit overload in each phase, undervoltage release and auxiliary contact to close and ring the alarm on panel No. 4 when the breaker opens on either side; this switch is interlocked so that it is impossible to put the line and generator on the buses at the same time. There is also provided on this panel one reverse phase relay of undervoltage release type with necessary interlock relays to open the oil circuit breaker in case of reversal or failure in line voltage. There are mounted on panels Nos. 9 and 10 two General Electric flow meters, indicating, recording, and integrating gallons per minute.

Prior to the installation of this equipment in the pumping station it was costing the city of Monmouth $45 per day for fuel and labor, pumping 490,000 gal. per day from three wells with air compressors. Today it is pumping a total of 550,000 gal. at a power cost of $14 per day and one attendant part time, who re-

# tic Control

## *Pumping*



ceives a wage of $115 per month, making a total cost of $17.85 per day or a pumping cost delivered into the mains at 3¼ cents per 1,000 gal. The total cost of the wells, reservoir and equipment exclusive of the elevated tank was $117,000, which is being retired at the rate of $12,000 per year.

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*Top—General view of pumping station floor*

*Left—The switchboard is arranged for automatic operation on energy either from the power line or from the stand-by unit*

*In oval—The fire pump, double suction and the second deep-well pump*

*Bottom—One of the deep-well turbine pumps, one of the service pumps and the stand-by gasoline engine*

# Buyer and Seller—
## *A Partnership*

Successful principles upon which the purchasing of a prominent electrical manufacturing company has been organized with price cutting eliminated

By Edward L. Johnson
*Purchasing Agent Black & Decker Manufacturing Company, Towson, Md.*

BECAUSE of the general interest which has been developed in the subject of price cutting and in the ethics and economics of purchasing, in the series of articles that have been appearing in the Electrical World, I believe that a statement of the policies of a manufacturer's purchasing department might be of interest. It may serve to contribute another sidelight on this discussion.

In establishing purchasing principles for this company, we have strongly adhered to the policy that the supplier of any commodity we use is entitled to a fair margin of profit, even as we, as manufacturers, expect a fair profit on merchandise we sell to our customers. In the selection of material for our own products we have always endeavored to consider first and foremost the quality of these materials in relation to their application and requirements, letting the cost to us be the secondary factor. We think this policy, together with the proper manufacturing equipment and labor, is responsible for the general reputation of our product.

### Studying Sources of Supply

Furthermore, we have always paid considerable attention to the sources of supply with which we deal or wish to deal, making special efforts to cultivate the friendship and good will of our suppliers. We have not confined this practice to their sales forces alone, but, by frequent plant visitations, have made the acquaintance of their factory organizations, whom we consider the men behind the guns. In other words, we look upon our main sources of supply as departments of our own business. Merely because their plant is in another city, operating under another name, does not eliminate the fact that they are producing parts for use in Black & Decker tools. By this practice we are able to gather quite a good deal ot knowledge concerning materials and parts purchased for our tools, as well as the conditions and difficulties surrounding the manufacture of them.

If a purchaser knows the commodities he is buying and the factories producing them, he knows when he has prices that are in keeping with production costs and a fair amount of gross profit and it is not necessary to follow the practice of securing competitive bids on a wholesale scale. When we feel that the price of a commodity which we have been buying from an old source of supply is too high, considering market conditions, we take the question up immediately with this source, rather than go out after competitive bids and remove the business to a new source. In such cases, we very often visit the plant of the seller, at which time all cards are laid on the table, cost figures gone over and usually an agreement reached that is satisfactory to both parties. Our suppliers welcome this policy, as they realize that we are willing to work along with them and are playing the game on the Golden Rule basis.

We want all our suppliers to make a fair profit, but, at the same time, hold costs down to a minimum. We often help them accomplish this by suggesting different means of handling and routing our work and by increasing schedules, so as to enable the seller to buy or contract for raw materials in larger quantities. These methods have generally resulted in economies to us as a purchaser without affecting the gross profits of the seller. When the purchaser and seller have the proper contact with and confidence in each other, there is not very much need of competitive bids, or business being awarded on a cold-blooded price basis. Furthermore, changing sources of supply with every order placed or requirement released is costly to both the seller and the purchaser. Neither one has had the opportunity to learn much about the personnel, plant operation, etc., of the other, and without this knowledge they cannot work together to the best advantage.

In many cases, we have been dealing with the same companies supplying us with certain commodities for a period of ten years and more, yet have been able consistently to produce our own equipment at lower costs and market it at a lower price each year to our customers. This is due, in a measure, to our ability to lower our own production costs from time to time, but we have also been aided materially by our suppliers working with us in an effort to furnish our materials at the lowest possible price, consistent with quality of material and their making a fair profit on the sale of same. No business relations can be profitable unless both parties reap benefits from the transactions.

### Fairness Insures Co-operation

We have dealt with some foundries for years without moving a pattern and feel confident we have fared better than if we had followed a policy of shifting our work from place to place, merely because some one else offered a little cheaper price than we were paying. We know, nearly as well as the foundries, what it costs to produce our work, the amount of metal required, the number of molds it is possible to get from a machine per day and the approximate amount of foundry rejects. From what they tell us and what we see by visiting their plants, we know what their overhead is and can tell when they are selling at the right price with due regard for their profits.

Through this policy with our suppliers we have got co-operation and assistance in emergencies which we could not demand or hope to get on short acquaintance from companies which we were making fight to the last ditch to get our business. In many cases our principal sources have worked overtime and Sundays to get our stuff out and help us out of a jam, without raising prices a penny. Why? Because we play the game fairly with them and they are above taking an unfair advantage of us in such emergencies.

### Mutual Protection

There is another angle to this co-operative procedure which bears consideration. Whenever we reach a point where competitive conditions arise in our own field and we have to alter prices on our products we feel that the first move is to study our own equipment and facilities, to see what can be done toward effecting economies in our own plant. The results and benefits of these studies are very often passed on to our suppliers and aid them in their own production methods, which, in turn, reacts to our adavntage as well as the sellers'.

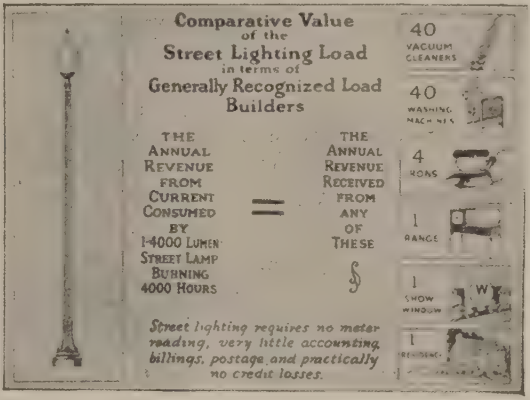
Today we are in the midst of a buyer's market, but this condition will not last forever. Sooner or later we are going to have a return of the seller's market, the same as existed not so very long ago. It is then that we expect to reap the real benefits of our Golden Rule policy and fair play toward our sources of supply. When material and shipments are hard to get and we need prompt deliveries, we believe most of our suppliers will be glad to come through and help us out, not forgetting our treatment of them during the buyer's market period. The purchaser who runs a regular auction sale with his buying is sooner or later going to get it in the neck, because those sellers who are now being ridden over roughshod are not going to forget. When the seller's market returns, these auction sale operators, as well as the companies they represent, are surely going to pay the freight, reaping as they have sown. We may be all wrong, we may find that we have overestimated the value of a policy such as we have fostered, but certainly it has not been proved to us yet, and past history does not indicate that it will.

### Profitless Operation Disastrous

I consider it very poor practice for manufacturers to cut their prices deliberately to secure business, with no regard for profit. These fellows are, as I call it, buying business, with no profit to themselves, and are inevitably headed for receivership and, ultimately, the rocks. The successful manufacturing plant must, in figuring its prices, take into consideration material costs, labor costs and factory overhead, as well as general sales and administrative expenses. It owes this not only to itself, but to the stockholders of the company, to whom it must ultimately answer. In the final analysis, the officers of any company are only men who are intrusted with stockholders' money which they must invest profitably, and unless they give proper consideration to this fact and can show a certain percentage of profit on each sale they can never hope to build up a healthy financial condition within their organization and increase the value of their company's stock or other securities. Unless this is accomplished, they must eventually come to grief.

## Revenue Value of Street Lighting

ADEQUATE street lighting was stated by L. A. S. Wood, at the recent annual convention of the Missouri Association of Public Utilities, to be the proper remedy for the crimes and accidents occurring during the hours of darkness. It was pointed out that with a well-balanced rate schedule and suitable methods of finance the sale of street-lighting service is a profitable branch of the public utility company's business and that the value of the street-lighting load is constantly increasing. Although the hours of burning may vary with the seasons, they total 4,000 per year, which is undoubtedly a longer period than any other load, except a few of special nature which exist in some metropolitan areas. The load factor, said Mr. Wood, is approximately 46 per cent for a 4,000-hour schedule, and while it may include part of the evening peak, it also ranges through the midnight to morning valley. Revenue from street lighting is assured through periods of industrial depression, as well as prosperity. There are rarely any bad debts or loss of revenue from this source.


Comparative Value of the Street Lighting Load in terms of Generally Recognized Load Builders
The Annual Revenue from Current Consumed by 1-4000 Lumen Street Lamp Burning 4000 Hours
=
The Annual Revenue Received from any of These
40 Vacuum Cleaners
40 Washing Machines
4 Irons
1 Range
1 Show Window
1 Residence
Street lighting requires no meter reading, very little accounting, billings, postage and practically no credit losses.

*Comparative load value of street lighting*

The scope of the street-lighting load was foreseen as becoming continually wider, since in addition to street lamps the modern city requires traffic signals, warning beacons, underpass and viaduct lighting and highway lighting, all of which present additional and constantly increasing opportunities for augmenting the central station's revenue. More show-window lighting invariably follows improved street lighting. Inadequately lighted stores are dim and unattractive in comparison with the well-illuminated streets, and thus a source of additional revenue is added when an improved street-lighting system is installed. "When compared with other load-building services which the central stations are aggressively promoting street lighting is in a class by itself," Mr. Wood concluded.

## Loads to Be Expected from Radio Equipment

HOW much does radio reception contribute to the per-customer usage of electrical energy? This is a question which has probably arisen in the mind of every commercial department head who is seeking ways of making his domestic customers bring a bigger return on the investment and operating expense required to serve them. In the past several evidences have been presented to indicate how radio reception has increased use of lights in the home. Following are some figures that have just been collected by *Radio Retailing* from radio manufacturers which may be the basis for calculating the direct effect of radio equipment on energy consumption:

> For example, the average demand of eight different competitive receivers is 65 watts. Set A requires approximately 40 watts; set B (six-tube), 34 watts; set C, 45-50 watts; set D (six-tube), 50-55 watts. Sets E and F, using one of the original alternating-current tubes, require considerably more power and bring the average up to the figure quoted.
>
> Power speakers, of which three well-known types were investigated, draw even more current. Type A power cone demands 100 watts and type B around 190 watts.
>
> The average A power unit takes 110 watts, the average trickle charger uses 20 watts, "socket-power" B units average 25 watts. Receivers using battery tubes with rectifying equipment for A, B and C supply average 100 watts.

As *Radio Retailing* points out, "It can easily be seen that it is not safe to multiply the total number of receiving sets by one average figure because of the differences in demand." The type of equipment and hours of usage must be taken into account.

# Letters from Our Readers

## *Reinvesting Called Preferreds*

*To the Editor of the* ELECTRICAL WORLD:

I want to congratulate you on your editorial entitled "Reinvesting Called Preferreds." It has seemed to me that utilities, which are dependent on the good will of the general public, make a mistake in calling their preferred stocks without at least permitting the owner to participate in the new preferred issue.

There are several cases in hand, one of which is Duquesne. Duquesne called its 7 per cent preferred and issued a new 5 per cent preferred without any chance for the owner of the old preferred to exchange for the new preferred. The same action is being taken by Engineers Public Service, and presumably will be taken by Niagara Falls Power.

While I can appreciate that it may cause delay and book-keeping, it would seem comparatively simple to state to an owner of a preferred which is to be called that the amount due him at the called price of the old stock will, upon request, be applied on the purchase of shares of the new issue at the price at which it is to be marketed. If a fraction of a share results, the owner of the old stock should be given the privilege of making up the difference so that he would receive whole shares. This would benefit the owner of the preferred stock in several ways:

First—He would be saved the immediate payment of income tax on the appreciation of the old stock.

Second—It would save the owner of the old stock the broker's fees in purchasing the new stock.

Third—It would enable him to get the new stock at the issue price, which often jumps before the old owner has a chance to get a whack at it.

It should save the utility some of the cost of the bonus which it allows the broker who handles the entire issue. Certainly such action would create good will, whereas the present method is creating more bad will than the utilities appreciate.

H. R. SARGENT.

Bridgeport, Conn.

## *Opposes Trading After Receipt of Bids*

*To the Editor of the* ELECTRICAL WORLD:

I have been reading the various articles on price cutting in the ELECTRICAL WORLD. I do not think a purchasing agent, if he buys on an ethical basis, can initiate price cutting. This responsibility rests entirely with the manufacturer or jobber, as the case might be. My idea of ethical purchasing methods is to give all manufacturers or jobbers who are qualified to supply the material wanted an opportunity to quote. When quotations are received and tabulated the lowest bidder, quality of material considered, should be given the business.

A purchasing agent should never give any one bidder an opportunity to revise his prices or trade in any way in an attempt to throw the business to one particular man or manufacturer. Should this practice be pursued the purchasing agent's firm will eventually pay higher prices for the material. After the business has been placed I do not think it is the prerogative of the purchaser to tell the losing bidders why they lost the business.

The above is in direct conflict with the recommendations in your article and no doubt you have good reasons for your recommendations, but why should the purchaser act as a police officer in detecting the whys and wherefores of lost business for the manufacturer?

When a manufacturer quotes a price on his products I assume that the price is based on his manufacturing cost plus development or research and sales expense plus a legitimate profit. Therefore, when business is lost it can be assumed that the price quoted was out of line with other bidders. It is, therefore, the problem of this company to ascertain what is wrong within its organization. Information regarding the price paid to the successful bidder and the firm's name, as I see it, can be of no value to it.

Price cutting and price profiteering are as old as the ages. I believe they will always be with us, and their extent will be limited only by the law of supply and demand. However, I believe that the ethics of purchasing as a whole can be greatly improved by the elimination of trading after bids are received, and the seller can aid materially by refusing to adopt a trading attitude.

The manufacturer, in my opinion, is solely responsible for these trading or price-cutting tactics. I will venture that there is not a purchasing agent in the country who does not hear daily this remark from salesmen submitting bids: "If my prices are not in line, please give me a chance to revise them." This immediately gives the purchaser the idea that this particular bidder has not submitted prices to which the purchaser is justly entitled.

How much better it would be to all concerned if the seller would not request an opportunity to revise prices, and if such requests are made the purchaser should firmly state that no revisions would be accepted after bids were tabulated. The pursuance of such policies by seller and purchaser would put every one on an equal basis.

I might add that the purchasing policy as outlined above has been followed satisfactorily for many years by the two companies I represent as purchasing agent and I have yet to find a manufacturer who does not agree with us that it is equitable to all concerned. F.

[The recommendation referred to was that where bidders are called back and asked to reduce the price the salesman should demand that he be shown the other bids as evidence that he is really high. "Firm bidding" has been urged, however, as the only effective cure for price cutting, a steadfast one-price policy, the business to be placed to the lowest figure on the original bids.—EDITOR.]

# Digest of Electrical Literature

## Hydro-Electric Development and Steam Equipment

*Combustion and Heat Transfer.*—R. T. HASLAM and H. E. HOTTEL.—The transmission of heat at moderate temperature levels is considered by the author to represent a fairly complete chapter in the subject of engineering design. This discussion endeavors to present a record of the present status of knowledge on heat transmission by radiation, including some recent developments in the theory of non-luminous gas radiation and some new ideas on radiation in powdered coal plants. A mathematical discussion is offered of the theoretical factors involved. The treatment covers radiation from suspended matter in powdered coal flames, from non-luminous gas, from luminous gas flames, between finite and solid surfaces, simultaneous radiation of gases and suspended solids, application of mechanisms described to furnace design and several methods for the solution of furnace problems. Emissivity of the flames due to suspended coal particles, to gas radiation and to the presence of solid carbons are covered also.—*Transactions of the American Society of Mechanical Engineers,* January-April, 1928.

*The Yokawa Automatic Hydro-Electric Power Station.*—U. VETSCH.—This hydro-electric generating station is a part of an extensive power supply scheme in Japan and may be started up or shut down by switching in or tripping the transmission line connecting it to the main power station. Periodic inspections are made, but other attention is unnecessary. The control arrangement by means of which the generator and switching operations may be performed and the provision for unusual conditions necessitating the automatic shutdown of the plant are given. External and internal disturbances have been fully allowed for in the planning of this station.—*Brown Boveri Review (Switzerland),* May, 1928.

*The Clinkering of Coal Ash as Related to Laboratory Fusibility Determinations.* — A. C. FIELDNER, W. A. SELVIG and P. NICHOLLS.—As the result of an investigation of 21 kinds of coal with fusion temperatures from 1,990 to 2,930 deg. F. and including determinations as to composition, distribution and fusibility of ash, conclusions regarding the clinkering characteristics of these coals were made by the authors. Float-and-sink tests were made with the coal, sulphur forms were determined, analyses of the ashes prepared and the results checked. It is concluded that the quantity of clinker formed decreases as the rate of combustion increases, although the density and fusion of the clinker pieces are greater at the higher rate. The rate of decrease in quantity with rate of burning becomes less when the coal ash and fusion temperatures are low. The quantity of clinker formation has a fairly definite relation to the softening temperature of the coal ash as determined by the standard gas furnace method. No distinct relation was found between the shortening of the flowing temperature interval and the formation of clinker scale.—*Transactions of the American Society of Mechanical Engineers,* January-April, 1928.

## Generation, Control, Switching and Protection

*Stress Analysis in Electrical Rotating Machinery.*—M. STONE.—The continuous trend toward larger and higher speed power generation units has, according to the author, required detailed attention to new design problems predominantly of a mechanical nature. Improvements in the knowledge of the behavior of the materials of construction and a more accurate estimation of stress conditions by detailed analysis have been accomplished in recent years. In this discussion the author has considered the methods available for stress analysis. The experimental lack of coincidence of the calculated critical speed and the observed vibration peaks is said to be affected by any flexibilities in the vibrating structure that are not properly evaluated, and the flexibility of bearings and bearing pedestals may be sufficient to lower the calculated critical speed by as much as 50 per cent.—*Sibley Journal of Engineering,* April, 1928.

## Transmission, Substations and Distribution

*Large Single-Phase Transformers.*—A. WINIGER.—The author offers a detailed description of the transformers used to step down the 132-kv., single-phase supply of the Swiss railways to 66 kv. At 16⅔ cycles the continuous rating of each transformer is 9,000 kva. at 0.75 power factor. A ten-minute overload with 13,000 kva. is permissible. The machines are of the two-legged circular coil type, with the 132-kv. winding next to the core and the 66-kv. winding with its five middle taps per leg on the outside. The laminations of the core are paper insulated, the legs have smooth ends for butt-joints with the extra heavy yokes, and the finished core is completely lacquered to avoid any action between the steel and the oil and to prevent rusting in the shops. Heavy nickel-steel press bolts hold the core structure together and extend on top to engage with the domed cover, making the entire active part of the transformer cover-suspended. The winding is made of multi-layer paper insulated copper strip, but to give the coils greater stability and to avoid shrinkage the wire insulation is impregnated with artificial resin. The end turns will stand line voltage for five seconds. The oval, all-welded tank is heavily reinforced to stand either an internal pressure of 28 lb. or a vacuum of ¼ in. mercury. The oil conservator is mounted on the tank, but is clear of the cover, making it possible to untank the transformer with a minimum of trouble. Some distance away from the tank is installed a large battery of tabular radiators, and a 4-kw. motor pump circulates the oil between transformer and cooler. — *Bulletin de l'Association Suisse des Electriciens,* April 22, 1928.

*Short-Circuit Risks on High-Tension Networks.*—J. BIERMANNS. — A theoretical consideration of the electrodynamic forces encountered in short-circuit conditions on high-tension networks has been offered by the author and supplemented by practical observations regarding such phenomena. The short-circuit forces on conductors, heating of conductors carrying the short-circuit current, oil circuit breaker stresses due to switching out a short circuit, devices utilized to limit the magnitude of the short-circuit current and similar pertinent factors have been considered.—*A.E.G. Progress,* April, 1928.

## Units, Measurements and Instruments

*Bridge for Measuring Small Time Intervals.*—J. HERMAN.—A bridge circuit for measuring time intervals from about one ten-thousandths of a second up to several seconds is described and its operation explained. The device is said to be fairly accurate and easy to operate and gives the results of measurements in fractions of a second directly. The operation consists merely of opening or closing a key repeatedly and securing a balance by observing a meter. The balance is secured by turning one or more dials which are calibrated in fractions of a second. Suggested applications include: Measuring the functioning times of electromagnetic switching arrangements; measuring propagation time at different frequencies; studying the operation of a machine with a view to improving its speed; maintaining proper adjustment of relays, cicruit breakers, etc., in power circuits; determine rate of acceleration of motors, and in psychological tests, the response of individuals to certain stimuli.—*Bell System Technical Journal,* April, 1928.

*Magnetic Leakage and Fringing Flux Calculations.*—WALTER L. UPSON and ERNEST L. FURTH.—The authors have endeavored to develop an empirical method for determining leakage and fringing fluxes in an electromagnetic system. Certain assumptions are made in regard to the reluctance of the iron parts of the magnetic circuit and the leakage and fringing components of the flux following the paths of geometric shape. Formulas are derived for leakage and fringing fluxes as percentage of the main flux which crosses the gap from the pole face for two cases, that of a pole core of circular section and of one of rectangular section. Calculations of these fluxes in percentage of the main flux are given over a convenient range of gap lengths, coil lengths and distance of coil from pole face. It is demonstrated that both leakage and fringing depend to a considerable extent on all these factors. Calculations are made to determine the flux density at various points along the core length and these show a wide variation in density in accordance with the dimensions of the magnetic circuit. An experimental check was made of certain of the calculated results.—*Journal of the American Institute of Electrical Engineers,* May, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*The Aluminum Electrolytic Condenser.*—H. O. Siegmund.—After outlining the development of the valve or polarizing effect of aluminum metal, when operated as an anode in certain electrolytes, the author discusses the operating characteristics of the aluminum condenser. There are two common conditions affecting the life of these devices that must be controlled, the chemical action of the electrolyte on the electrodes and the film, and the corrosion of the anodes. An ammonium borate solution having a specific resistance of 225 ohms per cubic-centimeter has proved to be satisfactory. The author has given consideration to the electrical qualities of films on aluminum, capacity of aluminum films, effect of impressed voltage on capacity, losses in aluminum cells and their effect on electrical impedance, commercial applications and designs of electrolytic condensers, the anode construction and material, the negative electrode, the prevention of contamination in manufacture and installation, the composition of the electrolyte, the relation between voltage of film formation and operating voltage, capacity and resistance characteristics, corrosion of condenser anodes, and the life of aluminum condensers. *Report of American Electrochemical Society,* April, 1928.

*The Effect of Trivalent Chromium and Iron on Chromic-Acid Chromium Plating Baths.* — R. Schneidewind, S. F. Urban and R. C. Adams, Jr.—It has been found that the current efficiency of chromium deposition from chromic acid baths is a straight line function of the logarithm of the current density. The slope and position of this line are affected by the temperature and composition of the baths. In baths containing chromic acid and sulphate ion bright deposits are obtained on copper between limits corresponding to certain current efficiencies. In cases of other metals the range of current efficiencies yielding bright plate may be narrower than that for the baths mentioned. Heavy deposits on all metals are best obtained at 12 to 14 per cent current efficiency. Other things being equal, increasing the concentration of trivalent chromium and iron does not appreciably change the relationship of current density to current efficiency. However, the range of current densities producing bright plate is markedly contracted.—*Report of American Electrochemical Society,* April, 1928.

## *Traction*

*Locomotive with Vertical Motors.*—H. Furst.—The Austrian Federal Railways operate a novel type of express locomotive on their electrified valley lines, which has given unusually good performance. The new feature is that of individual motor drive for each axle by means of four vertical shaft motors, transmitting their power over spiral type bevel gears and special flexible couplings to the drivers. Each motor is rated 410 kw. at 855 r.p.m. and operates on 385 volts, 16⅔ cycles, giving the engine a top speed of 53 miles per hour. An oil-cooled transformer of 1,550 kva. output, 15,000 volts primary, with sixteen secondary voltage taps, is mounted midway between the solid frame of the locomotive. On each side of the transformer are arranged eight compressed-air-actuated contactors to regulate starting and running voltage without current interruption.—*Elektrotechnik und Maschinenbau,* April 8, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*Grid Current Modulation.*—Eugene Peterson and Clyde R. Keith.—The term grid current modulator as used in this article refers to those vacuum tube circuits in which modulation is initially produced in the grid circuit of the three-electrode vacuum tube due to the non-linear grid-current grid-voltage relation. Comparison with a representative plate current modulator using the same tubes and the same plate potential shows that by modulating at maximum efficiency in the grid circuit and using the plate circuit solely for amplification the maximum power output is increased about eight times, the power efficiency is increased about five times and the ratio of sideband output to signal input is increased approximately three times. Under these conditions it is said that more carrier input power is needed for the grid than for the plate modulator. This improved performance has been made possible by a detailed study of the fundamental processes involved and by a design of the tubes and associated equipment such as transformers and filters to permit these fundamental processes to operate to their best advantage. The article concludes with an application of the fundamental principles involved to an experimental carrier telephone system in which the operating features of tubes, filters and transformers are discussed.—*Reprint B-292 Bell Telephone Laboratories, Inc.*

## *Miscellaneous*

*Pipe Bends Made by New Process.*—Production of short-radius pipe bends by a new and unusual process has recently been inaugurated by an American manufacturer. The bends are really short arcs of pipe made on a production basis in a standard series of sizes, and can be made of any bendable material in any thickness. It is stated that the manufacturers anticipate a definite series of bends of long and short radii to be capable of taking care of practically every requirement in the way of a fitting for welded piping. A standardized shape makes available to the consumer the advantages incident to mass production, including quick delivery, low cost and small inventory. The manufacturing process involves a furnace, special mandrels and a hydraulic press. The ram from the press travels over a long steel shaft, fixed into the stationary head of the hydraulic cylinder. Over this shaft a straight length of pipe is slipped until it strikes a flat ring fixed on the nose of the ram. After the straight pipe is placed on the shaft a horn-shaped mandrel is attached to the forward end of the shaft by a double-threaded turnbuckle coupling. The ram then moves the pipe onward until the forward end binds against the turn at the base of the mandrel. A gas furnace is used in this process to render the pipe plastic. The pipe is pushed over the mandrel as fast as it is hot enough to work. The design of the mandrel determines the curvature of the bend and the wall thickness, and variations from a straight bend to a wide coil are obtained by the location of the heat during the operation.—*Iron Age,* April 5, 1928.

*Tensile Properties of Soft Rubber Compounds.*—R. F. Tener, S. S. Kingsbury and W. L. Holt.—The results of tensile tests upon six rubber compounds when subjected to temperatures ranging from minus 70 deg. to plus 147 deg. C. are reported by the authors. These investigations indicate that temperature has a pronounced influence upon the tensile properties of the rubber. Within the lower limits rubber becomes rigid with an increased tensile strength, while at high temperatures it possesses practically no tensile strength whatever. This behavior was characteristic of all the specimens investigated. Differences due to compounding ingredients are, according to the authors, differences in degree rather than in kind. The magnitude of the changes in rubber compounds due to temperature shows that the effect of temperature should be given consideration in the design of rubber articles which are to be used at other than normal ranges.—*No. 364 Technologic Papers of the Bureau of Standards.*

# News of the Industry

## All in Readiness for the Big Atlantic City Convention

With hundreds of delegates from distant points already on their way and with the manufacturers' exhibition receiving its finishing touches, everything as the week closes points to a crowded and most successful convention of the National Electric Light Association at Atlantic City next week. Monday will be given over mainly to registration and greetings, with the reception to President and Mrs. H. T. Sands at 9 p.m. in the Million-Dollar Pier ballroom, followed by dancing. On Tuesday, Wednesday, Thursday and Friday mornings at 9.30 o'clock and Wednesday and Thursday afternoons at 2.30 the general sessions will be held on the Million-Dollar Pier. On Tuesday afternoon the four national sections meet—the Accounting at the Hotel Traymore, the Commercial at the Chalfonte-Haddon, the Engineering and Public Relations on the pier, while the public policy committee will have its open meeting on Wednesday evening at 8.30 in the ballroom, with music by B. A. Rolfe's orchestra and Richard Crooks, a well-known tenor.

The program of the business sessions was printed in the ELECTRICAL WORLD for May 19 (page 1031). Among the entertainment provided are included a ladies' card party on Tuesday afternoon at the Traymore, dancing on Tuesday and Thursday evenings, golf, croquet and dart throwing for "ladies' day" at the Seaview Golf Club grounds on Wednesday, and a special entertainment on Thursday evening in connection with the dances. Thursday afternoon has been left open.

The manufacturers' exhibition has increased in size from 41 participating companies in 1908 to 209 this year and from 3,650 sq.ft. to 81,082 sq.ft., with the size of displays limited and some manufacturers unable to get space.

News has been received at headquarters that Governor Dan Moody of Texas will not be able to make the announced address on "Decentralization of Industry."

## New York Water-Power Act Is Sustained

A decision handed down at Albany, N. Y., on Tuesday of this week by the Court of Appeals, the highest state tribunal, in Horton vs. the Public Service Commission and the Niagara, Lockport & Ontario Power Company, sustains the constitutionality of Section 624 of the state conservation law. This was a part of the original water-power legislation passed under the administration of Governor Nathan L. Miller in 1921 and in effect provides that a corporation organized for the production of heat, light or power owning the major portion of the head and volume of the usable flow of a stream and wishing to make a power development may acquire by eminent domain such additional property as may be needed to complete its project. This provision was held to favor large power companies at the expense of small ones.

The law was attacked on the ground that it was unconstitutional. The matter had been pending since 1924, at which time application was first made to the Public Service Commission to take advantage of the provisions of the law, and the decision is regarded as a most important one in utility circles.

With the Horton case disposed of, the Public Service Commission may now place upon its calendar and take testimony in the matter of the application of the Rochester Gas & Electric Corporation for a determination of the commission that certain property is necessary to the improvement and full development and utilization of petitioner's water-power site on the Genesee River in the city of Rochester, where the major part of the head and volume of the usable flow for power is now owned by the petitioner. This application, filed with the Public Service Commission a few weeks ago, had been held up pending the determination of the Court of Appeals in the Horton case, now made.

## Muscle Shoals Act in President's Hands

### "Pocket Veto" Expected at Washington—He Approves Resolution Forbidding Private Development at Gorge of Potomac Until Further Action by Congress

BY PAUL WOOTON

Washington Correspondent of the ELECTRICAL WORLD

CONGRESS adjourned on Tuesday afternoon, May 29, with the Muscle Shoals bill still unsigned. As it was stated at the White House that the President was waiting for certain reports on the bill, it is assumed that he did not want to sign or to veto the measure until he had had an opportunity to study these recommendations. The general expectation in Washington on Thursday, as this dispatch is filed, is that he will not sign the bill.

The conference report was adopted by 43 to 34 in the Senate and by 211 to 146 in the House. Obstruction and filibustering in the Senate, led by Senator McKellar of Tennesse, whose determined opposition was based on the inclusion in the final draft of the bill of the provision for government construction of a dam at Cove Creek in his state, brought an all-night session. Mr. McKellar, who termed the Cove Creek clause "incomprehensible" and thought it would unfairly deprive Tennessee of rights and revenue, finally gave up, exhausted, and the bill was passed at 11.50 a.m. after the Senators who had absented themselves from the night sitting reappeared.

In this connection question has been raised as to the effectiveness of the so-called "pocket veto" at the close of a session of Congress. Some argue that failure to sign a bill delivered to the President less than ten days before adjournment of any but the last session of a Congress automatically makes it a law. No ruling on this question has been handed down by the Supreme Court, but a case involving it is now going through the legal machinery. The prevailing opinion, however, is that by any reasonable interpretation of the constitutional provision a bill left unsigned under such conditions at the end of a session dies just as certainly as does one left unsigned at the final session of a Congress. It is generally accepted that the President is privileged to sign a bill after adjournment. A notable example of the exercise of this power was had in the signing of the water-power act by President Wilson in 1920.

#### RESOLUTION ON THE POTOMAC

Among the bills signed by the President at the Capitol just before adjournment was the joint resolution directing the Federal Power Commission to issue no permit to any private interest for the development of water power on the Potomac in the Washington area until further action by Congress after considering reports that will be made by the National Capital Park and Planning Commission and the Federal Power Commission as to the best utilization of the gorge of the Potomac for the public benefit.

The President also signed at the Capitol the resolution providing for the striking of a medal commemorative of the achievements of Thomas A. Edison "in illuminating the path of progress through the development and application of inventions that have revolutionized civilization in the last century." Passage of the resolution was stopped in the Senate for a time by objections of

Senator La Follette. When assured that, before reporting the resolution favorably, the banking and currency committee had investigated claims that Mr. Edison had been given credit for inventions really made by others, the Wisconsin Senator withdrew his objection.

## Boulder Dam Bill Gets Preferred Status

*Will Be "Unfinished Business" When Congress Reassembles in December—Hot Fight in Senate—Resolution for Further Engineering Investigation Becames Law*

After having provided the pyrotechnics which so frequently characterize the sessions of the Senate as adjournment approaches, the Boulder Dam bill failed of passage, but it remains the unfinished business of the Upper House. This agreement followed a filibuster precipitated by Senator Johnson's determination to reach a vote. In an all-night session starting on Monday the Arizona senators talked against the project, helped by other opponents. Excitement grew so high that the Senate finally went into executive session on Tuesday to calm down. Consideration of the measure—which was passed by the House on May 24 without a rollcall, a previous motion to recommit, made by Representative Douglas of Arizona, having been defeated by 219 to 139—will be resumed on the convening of the December session.

Senator Bruce of Maryland objected strenuously to the continuation of the Boulder Dam bill as the unfinished business. The Senator from California, he said, "did everything in his power to bring this bill—highly obnoxious to me and to other members of this body—to a vote. He failed and he should take the consequences of failure. I can see no reason why his bill should enjoy a privileged status at the beginning of the next session, only to be again an obstruction to other legislation, as it has been during the present session."

### Engineering Investigation Sure

Before the adjournment Congress passed and the President signed a joint resolution, introduced by Senator Pittman of Nevada, insuring a further engineering investigation of the project. This resolution reads as follows:

> The Secretary of the Interior is hereby authorized and directed to appoint a board of five eminent engineers and geologists, at least one of whom shall be an engineer officer of the army on the active or retired list, to examine the proposed site of the dam to be constructed under the provisions of H.R. 5773, Seventieth Congress, first session [the Swing-Johnson bill], and review the plans and estimates made therefor and to advise him prior to Dec. 1, 1928, as to matters affecting the safety, the economic and engineering feasibility and adequacy of the proposed structure and incidental works, the compensation of said board to be fixed by him for each respectively, but not to exceed $50 per day and necessary traveling expenses, including a per diem of not to exceed $6, in lieu of subsistence, for each member of the board so employed for the time employed and actually engaged upon such work. Provided further that the work of construction shall not be commenced until plans therefor are approved by said special board of engineers. No authority hereby conferred on the Secretary of the Interior shall be exercised without the President's sanction and approval. The expense herein authorized shall be paid out of the reclamation fund established by the act of June 17, 1902.

## "Platform of American Industry for 1928"

A full meeting of the Platform of American Industry Committee was held in New York City recently under the auspices of the National Association of Manufacturers, of which John E. Edgerton is president. This committee formulated a platform for 1928 for submission to the Republican and Democratic national conventions in the same way that former platforms were submitted in 1920 and 1924. The platform indorsed for this year contains planks on agriculture, the Federal Reserve system, flood control, foreign trade policies, government and business, immigration, international relations, judiciary, merchant marine, private employment relations, regulation of combinations, reorganization of government departments, tariff, taxation, transportation, and women in industry. M. S. Sloan, president Brooklyn Edison Company, was a member of the drafting committee. Following is the paragraph on "government and business":

> The function of our government is political—not economic. It was neither conceived nor fashioned to engage in competitive enterprise with its citizens, nor to administer the tasks of production and distribution, nor to substitute the judgment of its agents for that of responsible and experienced management in the direction of business operations. It is the servant and not the master of the citizen. It was established by him, under definitely limited authority, to protect and promote the pursuit of his chosen effort, assuring him security in the fruit of his endeavor, subject only to equal and impartial restraint essential to the maintenance of like opportunity and liberty for all.
>
> We urge more reliance upon private energy and character and less upon public law and appropriations. The interdependence and complexity of modern life make necessary new limitations upon individual liberty, but these are justifiable only as they are demonstrated to be necessary and practically effective to accomplish their purpose. Self-government is self-support. To discourage initiative and lessen self-reliance destroys the dynamic force of the individual. Our government must rely upon the support of the citizen; the citizen must learn not to lean upon the government.

## New York Activities Delved Into

### Empire State's Utility Information Committee's Practices in the Promotion of Good Public Relations Investigated, as Are North Central Bureau's

When the utility-industry investigation was resumed by the Federal Trade Commission on Monday, May 28, Fred W. Crone, director of the New York State Committee on Public Utility Information, took the stand and was examined on the public relations activities of that bureau. He testified that about $227,000 had been spent since 1922 for its purposes. Two booklets had been published purporting to state the attitude of the state's public utilities with respect to water-power development. One, entitled "Water Power in New York State," attained a circulation of 196,000 among newspapers, libraries, public officials, college professors, commercial and banking houses and civic organizations, Mr. Crone testified. The other, entitled "River Regulation in New York State," had a circulation of 40,000. These publications were frankly against power development by the state.

Pamphlets prepared by Mr. Crone and intended to present the case for privately owned utilities "in a matter-of-fact light" had been distributed to the number of 106,000 copies, 491 high schools being made the agencies for distribution. In a survey made by Mr. Crone for the educational committee of the National Electric Light Association, he described fourteen out of twenty-five books used in New York schools as, in his opinion, unfair to the utility companies. He favored liberal advertising by the companies in newspapers, but expressed indignation at the idea that the representatives of the industry designed in this way to insure the insertion of favorable reading matter.

C. H. B. Chapin, secretary of the Empire State Gas and Electric Association, gave testimony along similar lines. He said his association was in no way connected with the distribution of propaganda against the Boulder Dam project and declared that it had nothing to do with state legislation. Judge Healy asked Mr. Chapin if the purpose of publishing the pamphlets on state water power was to offset Governor Smith's theory of development of water-power resources. "That was partly the purpose," said Mr. Chapin.

On Tuesday John W. Lapham of Minneapolis, head of the North Central Public Utility Information Bureau, testified regarding the enlistment of the aid of University of Minnesota professors in rural electrification projects. A payment of $5,000 a year is made to the university. Payments of traveling expenses of college professors were also acknowledged. Mr. Lapham testified that his bureau spent from $15,000 to

$18,000 a year on its activities in Minnesota, North and South Dakota.

Telegrams subpœnaed from the files of the Postal Telegraph Company which were sent by Josiah T. Newcomb, counsel of the Joint Committee of National Utility Associations, to utility company heads and others interested in the committee's work contained nothing new or that invited suspicion of improper activities.

No session of the investigating body was held on Wednesday—Memorial Day. On Thursday morning Colorado public utilities men were to take the stand. There will be no hearings next week on account of the N.E.L.A. convention, which will be attended by persons who otherwise might be called as witnesses. It is expected that the hearings will be resumed the week of June 10.

## Operation at and Near Philadelphia Consolidated

Operations of the Philadelphia Electric Company, the Delaware County Electric Company and the Philadelphia Suburban-Counties Gas & Electric Company were to be consolidated June 1, President Taylor of the first-named company announced. The consolidation of operations does not constitute a merger nor does it entail any change in the financial status of the companies concerned. The purpose is to enable logical expansion of service in the Philadelphia metropolitan district and to give the communities served the advantages made possible through unified operation. In order to put the new plan into effect, the new territory has been divided into five major divisions as follows: Philadelphia and its various district offices; Delaware Division, headquarters at Chester; Main Line Division, headquarters at Ardmore; Schuylkill Division, headquarters at Norristown, and Eastern Division, headquarters at Jenkintown.

## New Jersey Public Service Rounds Quarter Century

Attainment of a quarter century of existence by the Public Service Corporation of New Jersey was to be celebrated on Friday evening, June 1, at the Robert Treat Hotel, Newark, by a banquet which was designed also to mark the completion of 25 years in service as head of the parent company and its subsidiaries by Thomas N. McCarter. Those who were to speak had not been announced as the ELECTRICAL WORLD went to press, but among the 600 guests expected were, in addition to the directors and officers of the companies, such prominent political, industrial and utility leaders as Senator Edwards and Governor Moore of New Jersey, E. T. Stotesbury, A. W. Thompson, O. D. Young, John B. Miller of Los Angeles and President J. F. Autenrieth of the New Jersey Board of Public Utility Commissioners.

## New Honor for Edison

*Gold Medal Awarded Him by Society of Arts and Sciences at Large Gathering Addressed by Public Utility Men and Educators*

IN RECOGNITION of his superservice to mankind, the Society of Arts and Sciences bestowed its gold medal for sciences upon Thomas A. Edison on Thursday, May 24. The presentation dinner was held in the Hotel Astor, New York City. Mr. Edison, who has not yet returned North from his Florida home, asked that his son, Charles Edison, might represent him, and the latter accepted the medal on behalf of his father and read a letter of appreciation from the great inventor. Men and women prominent in educational, industrial, public utility and other fields gathered for the dinner to the number of six or seven hundred, a few among them, in addition to the speakers named below, being President James R. Angell of Yale University, President S. W. Stratton of the Massachusetts Institute of Technology, Dr. John H. Finley, Dr. Willis R. Whitney, and diplomatists and consuls-general from many foreign countries.

*Souvenir plaque of Edison dinner*

In making the presentation, President Walter Russell of the Society of Arts and Sciences paid a rhetorical tribute to Edison as a man as well as an inventor, dwelling on modesty and unselfishness as traits that endeared him to the fellow men for whom he had accomplished so much.

Dr. Frank B. Jewett, vice-president American Telephone & Telegraph Company, spoke of Mr. Edison as a great engineer whose imagination and skill have correlated the fragments of science and research for the purposes and benefits of mankind. Dean William F. Russell of Teachers' College, Columbia University, made mention of the debt that education owed this inventor who had increased the wealth of a nation, thus providing the economic bases on which schools can be supported. Dr. John Campbell Merriam, president Carnegie Institution of Washington, in considering the value of Mr. Edison's work, said that the world as transformed by machinery and science may not in the abstract be a better one, but that it is a more comfortable one in which to live and that life in it is more effective and satisfactory. Dr. Howard McClenahan, secretary of the Franklin Institute, expressed the feeling that Mr. Edison marked the passing of the earlier type of inventor—that of the great individualist—who is being replaced by great corporations and associations. Arthur Williams, vice-president New York Edison Company, recounted some intimate reminiscences of the early days of the career of the man honored. Prof. Karl T. Compton of Princeton University eulogized the medalist as a scientist, scouting invidious whisperings that he is "only an inventor."

Entertainment features of the evening followed closely the spirit of the occasion. Thomas Wilfred's color organ and Leon Theremin's "ether music" were among the numbers.

## New York & Queens Company Reduces Rates

Officials of the New York & Queens Electric Light & Power Company, serving Queens Borough in Greater New York with electricity, announced on Thursday morning a further reduction in the maximum rate to its consumers from 8½ to 8 cents per kilowatt-hour. The new rate will go into effect on July 1. This reduction, Vice-President H. L. Snyder said, will mean an annual saving to customers of approximately $700,000 and constitutes the fourth in a series of reductions in the past three years.

## Power Companies Aid New England Growth

Nearly ninety power companies in New England have lately established industrial development departments and have assigned members of their organizations to carry forward the work of bringing industries into areas suited to their activities in the six Northeastern States. These departments are co-operating with the New England Council, local chambers of commerce, railroads and other organizations interested in promoting the growth of diversified industries in this territory. During the next few months the committee on industrial development of the power industry, which is co-operating with the council, will undertake a study of industrial surveys, their purposes and uses, and as a result it is expected that a standard form of industrial survey will be made available to electric service companies.

Another study is being made of the use and results of paid advertising by power companies throughout the country as a means of promoting industrial growth.

# Henry L. Doherty Sees "Nothing But Expansion"

A MESSAGE to the Electrical World from Henry L. Doherty, head of Henry L. Doherty & Company and the Cities Service Company, sent from Battle Creek, Mich., where he is convalescing from his recent illness, strikes a note of firm faith in the future growth of the industry. Mr. Doherty says:

*H. L. Doherty*

In my many years of experience in the central-station business I do not remember that there ever was a time when some one was not predicting that we had about reached the point of saturation for the use of electrical energy. In my earlier years, and especially when I was trying to induce all of the central stations to inaugurate intensive sales campaigns, I earned the reputation of being very visionary, because it was believed that my prophecies as to the amount of business we could develop were wildly optimistic. Since then I have lived to see all of the figures I had ever made look so small in comparison with actual results that the same people who once called me visionary would with these figures and actual results before them say that I was a piker. I know that we have not only not reached the saturation point for the use of electrical energy, but I know that we are not even approaching near to that point.

New uses for electrical energy keep springing up even faster than we can supply the need for the previously known uses. The investing public has been brought to the point where many of its members regard the securities of our electric supply companies as the most desirable form of investment, and I think we shall see more and more people turn to electrical securities and more and more of them regard them as the best possible type of investment. The wide distribution of our securities has been a most important factor in popularizing our companies, and this factor would alone justify our customer-ownership campaigns.

I am able to see nothing but expansion and still further expansion ahead of us. If you were to ask me what was the greatest asset the industry had I would tell you that I believe it is the trained men that conduct every branch of our business. I do not want to make any unpleasant comparisons, but if there is any industry that can rank with the electrical industry in this important particular, I don't know what it is.

## Purchases and Mergers

The Connecticut Power Company of New London will take over control of the Union Electric Light & Power Company of Unionville, Conn., through an exchange of stock. The territories served by the two companies are adjacent. The Union Electric Light & Power Company serves Avon, Canton, Burlington, New Hartford and Farmington, and its properties are valued at $1,750,000.

Petition for the purchase of the Genesee Valley Power Company of Fillmore, N. Y., has been filed with the New York State Public Service Commission by the Rochester Gas & Electric Corporation.

The transfer to the Annapolis & Chesapeake Bay Power Company of the Herald Harbor Lighting & Power Company and of the Severna Electric Company is announced. The purchasing company is a subsidiary to the Consolidated Gas, Electric Light & Power Company of Baltimore. The companies acquired are in Anne Arundel County. Approximately $10,000 was paid for the Severna Park company and about $4,650 for the Herald Harbor company.

Application to the Dauphin County Court by the Hummelstown (Pa.) Water & Power Company for permission to surrender its charter has been made. This is preliminary to a separation of the two departments of the company and the merging of the electric end with the Pennsylvania Power & Light Company.

The municipal electric lighting plant at Dahlgren, Ill., has been purchased by the Central Illinois Public Service Company, which will build a transmission line there.

The Union Power Company of Drumheller, Alberta, Canada, a subsidiary of the International Utilities Corporation, has acquired at a cost of $80,000 the plant at Three Hills which supplies electric light to Three Hills and Trochu.

The Islands Edison Company (formerly the Manila Gas Company) is about to acquire the entire capital stock of the Compañia Electrica de Santo Domingo, which furnishes light and power to the cities of Santo Domingo and San Pedro de Macoris in the Dominican Republic.

## Cooper Assails New York for Hydro-Electric Failure

Thirty millions of dollars annually is the cost to New York State of its failure to develop potential water powers, Colonel Hugh L. Cooper, engineer and authority on hydro-electric development, asserted in an address delivered at the annual meeting of Associated Industries of New York State at Syracuse on May 25.

Mr. Cooper, who designed and now is engaged in constructing an eight-million-dollar hydro-electric plant on the Dneiper River, in the Ukraine, for the Soviet government, criticised the business men of the state "for their indifference and their failure" to develop the three million available horsepower which he said is now being wasted. Such development, he declared, would cost $570,000,000, "but such an investment would support a new and existing industrial development of approximately three and a half billions of dollars in New York State. "Within the last three years," said Mr. Cooper, "new industries that would have used more than 400,000 hp. have knocked at your doors for cheap energy and have been denied."

Mr. Cooper characterized inability to decide whether to develop the state's water powers by government or by private agencies as "a miserable admission of lack of intelligence." He then reviewed the history of governmental development and control of water power, citing specific examples to prove that private development and control provided cheaper power. "Because of the procrastination in the State of New York that has prevailed in the last ten years," he said, "the St. Lawrence is in actual danger at this time of being developed in a manner and according to plans that are far from being in the interest of the people of the state."

## Thousands View Illumination of Great Shoshone Falls

A crowd of automobilists and others estimated at ten thousand persons witnessed on May 24 the illumination of the Great Shoshone Falls, on the Snake River in southern Idaho, by 30 floodlamps with a total rating of 25,000,000 cp. The lighting system was installed on a shelf in the canyon. The spectacle lasted from 9 o'clock until midnight, with alternate flashes of rainbow hues and colored squares upon the foaming water and the lava rock walls of the canyon.

W. R. Putnam, Boise, vice-president and general manager of the Idaho Power Company, told of his company's plans to make Shoshone Falls as great a natural attraction for the West as Niagara is for the East. The lighting is to continue every night from dusk until midnight. the colored illumination being used on special occasions.

# Denver A.I.E.E. Convention Promises Well

*Well-Varied Program of Technical Papers and Discussions—One Day to Be Spent in Exploring Mountain Parks—Yellowstone Trip*

SURGE-VOLTAGE investigations on transmission lines, control and protection of feeders for electrified railways, alternating-current elevator motors, electric welding of pipe lines, telephony, transmission experiences, extinction of alternating-current arcs, high-frequency supervisory control and geophysical prospecting are the main topics that will be treated in the papers and discussions at the summer convention of the American Institute of Electrical Engineers at Denver. This convention is to be held from June 25 to June 29, and headquarters will be at the Cosmopolitan Hotel.

The annual dinner-dance will be held on Wednesday evening. Attractive journeys arranged, in addition to the customary sport and recreation, include an all-day trip through Denver's mountain parks and the Bear Creek Canyon and a tour of Yellowstone Park. The former will occupy the morning and afternoon of Thursday, June 28, and be followed by a theater party in the evening. The latter will start immediately after the convention closes. Tuesday and Friday afternoons will be devoted to golf and tennis tournaments. The tentative technical program follows:

MONDAY, JUNE 25

Registration, section delegates' and branch delegates' meetings.

TUESDAY, JUNE 26

*Morning.*—President's address; session A, Surge-Voltage Investigations: "Surge-Voltage Investigation on Transmission Lines," W. W. Lewis, General Electric Company; "Lightning Investigations on New England Power Company's System," E. W. Dillard, New England Power Company; "Surge-Voltage Investigation on 140-Kv. System of Consumers Power Company," J. G. Hemstreet and J. R. Eaton, Consumers Power Company; "Surge-Voltage Investigation on 132-Kv. Transmission Lines of American Gas & Electric Company," Philip Sporn, American Gas & Electric Company; "Surge-Voltage Investigation on 220-Kv. System of Pennsylvania Power & Light Company," N. N. Smeloff, Pennsylvania Power & Light Company.

*Evening.*—Lecture, "Geophysical Methods of Prospecting," Dr. C. A. Heiland, Colorado School of Mines.

WEDNESDAY, JUNE 27

*Morning.*—Sessions B and C, technical committee reports (two simultaneous sessions).

*Afternoon.*—Session D, Electrified Railways, Feeder Control: "High-Speed Circuit Breakers," J. W. McNairy, General Electric Company; "High-Speed Circuit Breakers for Railway Electrification," H. M. Wilcox, Westinghouse Electric & Manufacturing Company; "Operating Experience with High-Speed Circuit Breakers," B. F. Bardo, New York, New Haven & Hartford Railroad; "Arrangement of Feeders and Equipment for Electrified Railways," R. B. Morton, of Gibbs & Hill; "Protection of Electric Locomotives and Cars to Operate with High-Speed Circuit Breakers," E. H. Brown, Pennsylvania Railroad; "High-Speed Circuit Breaker in Railway Service," W. P. Monroe and R. M. Allen, Illinois Central Railroad.

FRIDAY, JUNE 29

*Morning.*—Sessions E and F (two simultaneous sessions). Session E: "A Formula for Minimum Horizontal Spacing of Transmission-Line Conductors," P. H. Thomas, consulting engineer; "Transmission Experience of the Public Service Company of Colorado," M. S. Coover, University of Colorado, and W. D. Hardaway, Public Service Company of Colorado; "Alternating-Current Elevator Motors of the Squirrel-Cage Type," E. E. Dreese, Lincoln Electric Company; "Electric Welding of Pipe Lines," J. D. Wright, General Electric Company. Session F: "Utilization of Lodge-Pole Pine as Pole Timber," R. W. Lindsay, Mountain States Telephone & Telegraph Company; "Carrier Systems on Long-Distance Telephone Lines," H. A. Affel and C. S. Demarest, American Telephone & Telegraph Company, and C. W. Green, Bell Telephone Laboratories; "Superimposed High-Frequency Currents for Circuit-Breaker Control," L. R. Ludwig, Westinghouse Electric & Manufacturing Company; "Extinction of an Alternating-Current Arc," Joseph Slepian, Westinghouse Electric & Manufacturing Company.

# American Papers for Tokyo Congress Discussed

Adequate presentation of America's engineering and industrial story at the sessions of the World Engineering Congress to be held in Tokyo next year was discussed at a meeting of the executive committee of the American general committee for the congress held in New York on May 18. Hospitality to be extended in the United States to European delegates in their movement from the Atlantic to the Pacific on the way to the Tokyo congress was another subject which came up at the meeting. The entertainment committee reported that local engineering societies already have volunteered their services as hosts to the delegates from Europe.

The importance of careful selection of papers which will collectively reflect the status and tendencies of each of the major branches of engineering in this country, rather than cover unrelated miscellaneous topics, was stressed in the report of the technical program committee, headed by Prof. Dugald C. Jackson, who announced the following as members, with himself, of the technical program committee: Allen Hazen, vice-chairman; H. Foster Bain, Alex Dow, W. F. Durand, J. R. Freeman, Bancroft Gherardi, George W. Fuller, F. L. Hutchinson, Major General Edgar Jadwin, Dean Dexter S. Kimball of Cornell, A. D. Little, Fred R. Low, O. C. Merrill, Prof. Michael I. Pupin, Calvin W. Rice, George T. Seabury, George Otis Smith and W. E. Wickenden.

# Stratton Doubts Wisdom of Exporting Maine Power

Remarks made by President S. W. Stratton of the Massachusetts Institute of Technology at an industrial conference held recently in Maine have encouraged the opponents of the exportation of surplus hydro-electric energy. As reported, Dr. Stratton said: "The restriction that confines the use of water power to Maine may be a blessing to the state in the long run. Wherever water power has been long developed it has proved advantageous to bring manufacturers close to the power." He went on to cite aluminum manufacture at Niagara Falls as a parallel instance and drew the conclusion that "these new water-power plants of Maine will in time become veritable gold mines."

An Augusta report says that as a result of President Stratton's remarks it is believed there that the chances that the Legislature will lift the power ban are not so favorable as they would have been if his views had coincided with those of many other engineers. Governor Ralph Brewster, who is seeking Senator Frederick Hale's seat in the United States Senate, has during his two terms in office opposed strongly the lifting of the ban against the exportation of power. William Tudor Gardiner, who will possibly be the Republican candidate for Governor, believes that the matter should be settled by a referendum vote. He is said to be more favorable to the power interests as far as exportation goes than any of the other candidates.

Although the platform of the state Democratic party declares for exportation of power, conditioned with certain safeguards for the home consumers, Edward C. Moran, Jr., who will be the Democratic candidate for Governor, declared in Portland that he does not favor exportation of surplus hydro-electric power and is opposed to any legislation which would permit such traffic.

# Progress Toward International Technical Co-ordination

A recent notification from the central office in London of the International Electrotechnical Commission concerning the co-ordination of international technical meetings, in accordance with the movement initiated in Italy last September, says:

In January of this year a first meeting of the unofficial "comité d'entente," as it was suggested it should be called, was held in London at the offices of the I.E.C., when representatives were present from the International Illumination Commission, World Power Conference, International Consultative Committee on Long-Distance Telephony, International Union of Producers and Distributors of Electrical Energy, International Standards Association (in process of formation) and the International Electrotechnical Commission. Prof. Clarence Feldmann of Holland, the new president of the I.E.C., was in the chair, and an interesting exchange of information took place regarding dates of future meetings and in one or two cases on the preliminary programs. It was felt that if information of such a character regarding dates and programs could be exchanged at infrequent intervals, say once annually, it would be bound gradually to lead to most helpful co-operation and be of advantage to the delegates attending the many international meetings as well as probably to enhance the value and usefulness of the meetings themselves.

The question of co-operation between international organizations by joint international committees as well as by observers was also touched upon. Finally it was decided to keep the unofficial committee in being, with the I.E.C. as convener, and to call another meeting a year hence by which time the various organizations represented would have had time to give their official decision—which in most cases, it is anticipated, will be favorable—regarding the permanent establishment of such a committee. It is also hoped that other international organizations in the technical field will be interested in this co-operative idea, which, while leaving each organization entirely free, yet provides a kind of clearing house through which information may be exchanged and administrative matters discussed in a free and friendly manner.

## Radio Corporation Accused by Trade Commission

Charges that the Radio Corporation of America has violated the laws against "unlawful restraints and monopolies" were made by the Federal Trade Commission on May 23, and July 23 was fixed as the date for a hearing at Washington. The charges are directed against a "license agreement" made by the Radio Corporation with about twenty-five of the principal manufacturers of radio receiving sets, representing approximately 95 per cent of production, under which agreement a three-element vacuum tube essential to the sets must be purchased from the Radio Corporation, no opportunity for competition by other tube manufacturers being allowed. These tubes were formerly protected by General Electric, Westinghouse and American Telephone & Telegraph patents, but since the expiration of these patents in 1924 and 1925 their manufacture has been open to any one. The Radio Corporation is the exclusive distributor for receiving sets and vacuum tubes made by the General Electric and Westinghouse companies.

## Upper Rio Grande Exploration Shows Possibilities

Co-operating with and accompanying several members of the joint commission of water conservation and power possibilities of the Rio Grande, the Texas State Board of Water Engineers, with ten engineers and other irrigation and hydro-electric experts, has just completed a tour of the international boundary stream along its remote upper course. At points in the Big Bend region, 80 to 100 miles from the nearest railroad point, they selected sites for three dams which would impound a total of approximately 10,000,000 acre-feet of water and provide energy for generating an enormous supply of hydroelectric power.

C. S. Clark, chairman of the Board of Water Engineers, stated that by constructing a dam 250 ft. high across Boquillas Canyon 4,000,000 acre-feet of water would be impounded. Similar dams in Mariscal Canyon and Santa Helena Canyon would impound an additional 6,000,000 acre-feet of water, Mr. Clark said. The constructing of these dams would insure a permanent water supply for irrigating vast areas of rich lands on the American and Mexican sides of the Rio Grande and would enable the generation of electric power for supplying towns and industries for three hundred miles around. As a result of the investigations and surveys, a report favorable to the carrying out of the projects will be made to the United States and Mexican governments.

# Briefer News

ANOTHER CALIFORNIA UTILITY TO REDUCE RATES—The Coast Counties Gas & Electric Company, with headquarters at Santa Cruz, Calif., has asked the California Railroad Commission for authority to reduce its rates for electric service and place them on a parity with rates of the Pacific Gas & Electric and Great Western Power companies in the same general territory.

PHILADELPHIA ALSO PLANS AN INDUSTRIAL MUSEUM.—The Franklin Institute has $1,900,000 available toward the fund needed for building a great museum of industry and physical science on the Philadelphia Parkway and is "confidently expecting to build it," Dr. Howard McClenahan, secretary of the institute, told the Philadelphia Engineers' Club last week. No such museum as yet exists in the United States, Dr. McClenahan said, but New York, Chicago and Detroit have funds available and are expecting to build such museums in the near future. He described the museums of this type in London, Paris, Munich and Vienna.

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]**

**National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.**

**American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.**

**National Electrical Manufacturers' Association—Radio Division, Chicago, June 4-7.**

**Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.**

**National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.**

**Artistic Lighting Equipment Association—Hotel Sherman, Chicago, June 11-16. G. P. Rogers, 420 Lexington Ave., New York.**

**Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.**

**Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.**

**Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.**

**Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.**

**American Institute of Electrical Engineers—Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.**

**Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.**

**American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.**

**Public Utilities Advertising Association—Detroit, July 8-12. T. P. Pfeiffer, Byllesby Engineering & Management Corp., Chicago.**

**East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.**

**National Electric Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.**

**Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.**

ROCHESTER (N. Y.) GAS & ELECTRIC'S TWENTY-SEVENTH SUBSTATION. — Land for a new substation, the twenty-seventh in the Rochester Gas & Electric Corporation's chain within the city limits, has been acquired in the southeast section of Rochester. This station will be completed in another year. It is designed to provide for a rapidly growing residential section.

NEW UNIT FOR DUBUQUE, IOWA.—Extensions and improvements are being made at the Dubuque plant of the Interstate Power Company which will increase its capacity to more than three times that of three years ago. The work includes the installation of a 15,000-kw. generating unit with its accessories and of a larger water-pumping system and the building of additional transmission lines. The extensions are expected to be completed in a few months.

GAS-ELECTRIC CARS TO REPLACE STEAM LOCOMOTIVES ON A MOBILE & OHIO DIVISION.—Plans for the replacement of steam locomotives by gas-electric-operated trains in the passenger service on its 181-mile Montgomery-Artesia division have been announced by the Mobile & Ohio Railroad. The new trains consist of two coaches, one a combination car and the other a standard passenger coach of the type built for the gas-electric railroad service. Steam trains will continue to be operated for freight service.

NEW HYDRO PLANT FOR PHILIPPINES SUGGESTED.—A trip over the southern islands in the Philippines by Vice-President L. P. Hammond of the Electric Bond & Share Company, New York, to determine economic possibilities there is understood to have led to a report that the Agos Falls, on the Agos River in Lanao, Mindinao, could be utilized to supply all the power needed in that territory for a long time to come. The falls have a drop of 2,300 ft. and are capable of generating about 32,000 hp., but a market is lacking.

RICHMOND TO TAKE OVER WATER-POWER RIGHTS ON THE CHESAPEAKE & OHIO CANAL.—An agreement with the Virginia Electric & Power Company whereby the city of Richmond and the company can exchange power for five years on a new price basis has been reached in connection with negotiations by the city for water rights on the Chesapeake & Ohio Canal. The proposed contract provides that the city may take over all the water-power rights of the power company on the Haxall Canal, provides for a power exchange contract with a five-year term and new exchange prices and clears the way for the city's use of 88 cu.ft. of canal water per second for power as well as for water supply. Agreements whereby the city will take over the Atlantic Coast Line Railway's water rights on the Chesapeake & Ohio Canal have also been reached. Both these agreements must be confirmed by the City Council.

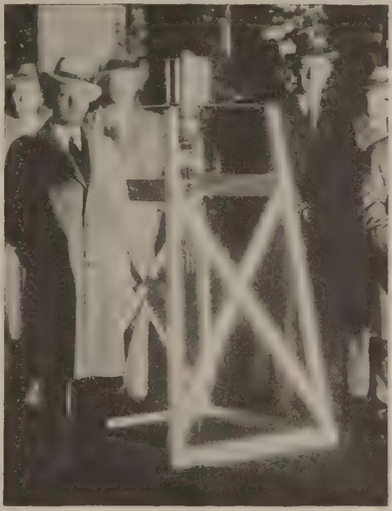
Mouth-of-Mine Plant in Saskatchewan. — Work will commence soon on the first unit of the Montreal Engineering Company's plant to generate electrical energy at the mouth of the coal mines in the Canadian province of Saskatchewan. The plant as designed will eventually cost $750,000, but for the present a third of that sum will be spent on building, machinery and equipment. The plant will be located between Bienfait and Estevan, and the company will distribute power wherever economic distribution will permit.

Plan for Government Hydraulic Laboratory Loses.—Not only did the rivers and harbors committee of the House of Representatives refuse to approve the bill passed by the Senate authorizing the establishment of a hydraulic laboratory in the Bureau of Standards, but it also refused to approve the bill with an amendment which would permit the Corps of Engineers to establish its own hydraulic laboratories at river sites. As there were only four votes in the committee for the bill as amended, it is apparent that no further progress can be made with it unless a change of reference is obtained next session.

Empire District Electric Company Prepares to Build Table Rock Dam. —The Empire District Electric Company of Joplin, Mo., has filed an application with the Missouri Public Service Commission for a certificate of convenience and necessity to construct and operate its long-projected hydro-electric power plant and dam at Table Rock in Taney County on the White River. The dam will be 1,924 ft. long and 197 ft. above bedrock and will be able to furnish power for four 37,000-kw. generators and have an ultimate annual production energy of 410,000,000 kw.-hr. Cost of the project will be $16,700,000 when it is finally completed, according to estimates. The company has a preliminary permit from the Federal Power Commission and has applied for the final license.

Ohio Utilities to Provide Work for Ten Thousand Men. — Public utility companies in Ohio will provide employment for approximately ten thousand men on new construction projects in 1928, according to announcement by the Ohio Committee on Public Utility Information. In addition to very large telephone undertakings, the Cleveland Illuminating Company will employ 1,100 men on the erection of two 132-kv. power lines, at an estimated cost of $11,500,000; the Dayton Power & Light Company will need 450 men in completing construction work estimated to cost $2,500,000, and the Union Gas & Electric Company will use 600 men in work to cost $7,800,000. Other light and power utilities planning expenditures are: Toledo Edison Company, $2,250,000; Ohio Public Service Company, $2,000,000; Ohio Edison Company, $270,575; Columbus, Delaware & Marion Electric Company, $235,000, and Southern Ohio Public Service Company, $260,000.

Nela Park Celebrates Manufacture of 50,000-Watt Lamp.—The first public showing of the new 50,000-watt incandescent lamp constructed by engineers of the General Electric Company was held at Nela Park in Cleveland a week or two ago, and many citizens gathered to see it. A 30,000-watt lamp furnished the necessary light for the photograph, which was taken outdoors during a blinding rain. The new lamp is of the gas-filled tungsten-filament type, with a tall chimney-like extension of the bulb equipped with radiating disks.



Canadian Supreme Court Defers Argument on Provincial Power Rights. — According to a decision handed down by the Chief Justice of the Supreme Court of Canada, the argument between the Dominion government and the provinces on questions respecting power and property rights on navigable streams will not be heard until September. The issue was to have been joined on June 28. The seven questions submitted to the Supreme Court by the Dominion government were criticised by Eugene Lafleur, counsel for the province of Quebec, when he appeared before the court on May 21 to urge the postponement of the hearing. The questions were so general and so abstract, he said, that it was imposible to forecast what the real issues were going to be. They should be in some concrete form, but as they stood they could not be intelligently answered by any court. Mr. Lafleur said he had the support of British Columbia and Manitoba in his contention.

Eel River Hydro Site Sought.—An application for permission to divert 137,385 acre-feet and 189 sec.-ft. of water from the North Fork of the Eel River near Mina,. Mendocino County, for power and domestic purposes, was filed with the California State Division of Water Rights on May 16 by Frederick C. Rockwell of Carmel, Calif. The project will produce 24,431 hp. and will cost approximately $1,500,000, he says. Construction is to begin six months after the permit is issued, and the project will be completed within three years.

Movement for State Ownership of Hydro Resources in Oregon Gains No Momentum.—No further actions have been taken by the Oregon Berry Growers' Association in connection with a resolution adopted last March which had for its purpose the launching of a campaign in behalf of state ownership and operation of hydro-electric utilities. This association proposed to circulate an initiative petition for public ownership and the development of natural resources by the state, but no such measure will appear on the May ballot, nor are there any developments to indicate that an amendment of the kind will be submitted to the electorate next November despite the organization's March resolution.

Shawinigan Company Gets St. Maurice Rapids Sites.—At a public auction conducted by the Quebec government on May 23 the Shawinigan Water & Power Company, as predicted last week, obtained the rights of developing a series of rapids on the St. Maurice River, which it has been estimated will mean an additional possible supply of power for that company reaching more than 500,000 hp. Shawinigan was the only bidder, and its bid of $5 over the upset price of $25,000 resulted in the company obtaining the lease. Preliminary investigation by the Quebec Streams Commission has shown that there are three principal sites for the construction of dams—Blanc Rapids, 172,000 hp.; Allard Rapids, 50,000 hp.; Secours Rapids, 85,000 hp. The company must start construction not later than July 1, 1930, and is also under obligation to have 100,000 hp. developed by July, 1933, expending in the undertaking at least $10,000,000.

Aylesworth Sees Bright Future for Radio.—Progress and possibilities of future development of radio broadcasting, radio and the electrical industry were described and outlined by M. H. Aylesworth, president of the National Broadcasting Company, in an address before the seventh quarterly luncheon of the Electric Association at the Palmer House, Chicago, May 24, at which more than six hundred representatives of the various divisions of the electrical industry were present. There are twelve million radio sets in the United States, two million of which, said Mr. Aylesworth, are small crystal sets and useful only for local reception. Several million sets will soon be replaced with modern equipment. He declared that the electrical industry has in radio an opportunity to render an outstanding public service in placing in the homes of all of the American people an indispensable equipment within the reach of rich and poor alike.

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West Texas Service Still Expanding.—A new 8,500-hp. gas-burning generating unit at San Angelo, Tex., has begun serving customers of the West Texas Utilities Company. The distribution system at San Angelo was changed over from 2,300 volts to 4,150 volts, increasing the capacity of the system threefold. This change was made necessary by the phenomenal growth of San Angelo as a result of oil development. The new unit will supply all the needs of drilling and producing companies, refineries and pipe lines for electric power. It is the second to be built at San Angelo within the past year.

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Utility Company and Indiana Tax Commission $7,300,000 Apart on Valuation. — For the Indianapolis Power & Light Company a tax valuation of $24,592,530 has been fixed for 1928, by action of the Indiana Board of Tax Commissioners, or an increase of $984,930 above the valuation for 1927. Harley L. Clarke, chairman of the company's board, a few days before had asked the commissioners for a reduction of $6,400,000. An opportunity to appeal from the board's appraisement will occur. An increase of $4,033,970 over the 1927 taxation valuation of the gas and electric properties of the Interstate Public Service Company of Indianapolis has also been made, bringing the total assessment of the company to about $25,000,000.

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Iowa Hydro-Electric Projects.—The Cedar River water-power plant of the Iowa Public Service Company at Charles City, Iowa, will be rebuilt and improvements made at a cost of $100,000, according to Don Sterns, president. Contracts are to be let this month and the work completed by Nov. 1. The expansion of the Charles City power unit is designed to make commercial consumers in the territory independent of the Waterloo high-tension line.——The Central States Electric Company, which will complete a power dam at Iowa Falls, Iowa, within the next three months and has a petition before the Iowa Railroad Commission for authority to build a hydro-electric plant near Dolliver Park, Fort Dodge, Iowa, is contemplating an extensive power distribution program in the industrial region about Fort Dodge, its officers say. As a first step in this program petition has been filed with the state commission for authority to construct transmission lines in the Fort Dodge area to connect, eventually, with the proposed Dolliver Park dam.

# Commission Rulings

Allocation of Customer Costs. — In adjudicating proposed rate changes for the St. Joseph Gas Company, the Missouri Public Service Commission held that a rate structure theory claiming to give consideration to the rates charged the large consumers in order to increase sales and then proceeding to justify a proposed increase to 57 per cent of the small consumers by the use of an allocation of costs made upon the theory that all consumers may be taken as one class, the smaller class, is inconsistent and unfair.

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Leased Property Not a Proper Item for Inclusion in Rate-Fixing Valuation.—Leased property, the Oregon Public Service Commission holds, is not a subject for consideration in the determination of a valuation of an electric utility for rate-making purposes. This decision was rendered in connection with the investigation of the valuation of properties owned by the People's West Coast Hydro-Electric Corporation, and the commission says: "The utility claims that the land which is leased, including the right to use water . . . and land upon which is located the substation and general office, . . . should be valued upon the same basis as property owned. The leases are for a limited term and the titles are held by others than the operating company. The lessee pays a rental which is included in operating expenses in accordance with the 'uniform classification of accounts' prescribed by this commission."

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Arizona Corporation Commission Takes Jurisdiction Over Hydro-Electric Corporations.—Declaring that "the bestowing of legal rights and privileges and franchises authorizing the operation by public service corporations of natural water powers situate within the state, by means of certificates of public convenience and necessity, which may not be obtained elsewhere or otherwise, is the only manner in which the commission, in the exercise of its full powers to safeguard the rights of the state and fully protect its people, may impose the restrictions and limitations contemplated by the state constitution and the pursuant statute," the Arizona Corporation Commission has issued an order requiring all corporations engaged in hydro-electric development to obtain a certificate of convenience and necessity before engaging in such activity within the State of Arizona and assuming full jurisdiction, subject only to the limited sovereign powers of the federal government.

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Rights and Obligations of Franchise Cannot Be Separated.—The Wisconsin Railroad Commission, rehearing a case in which the obligation of the Eagle River Light and Water Commission to give electric service to the town of Cloverland was concerned, because of new evidence brought out at an action in the County Court to set aside its decision, this evidence conflicting with the original evidence before the commission, reaffirmed its first decision, saying: "The franchise granted by the town of Cloverland to the village of Eagle River clearly gives the village of Eagle River an exclusive permit to operate in that town and includes the indeterminate permit defined by the statutes and with it the obligation to serve the public in that town. As stated in our former decision: 'The public utility cannot accept only such parts of the franchise as convey rights without assuming the obligations imposed by other parts of the same instrument. . . . It is neither equitable nor was it within the contemplation of the parties to the franchise that the grantee might segregate its parts and exercise rights under only a portion of it. By such exercise the utility must be deemed to have accepted the entire franchise with its burdens as well as its benefits.'"

# Recent Court Decisions

Company Holding City Franchise Cannot Refuse Service to Outlying Customer on Ground of Expense.—Confirming the trial court in Brown vs. Arkansas-Missouri Power Company, the Supreme Court of Arkansas has decreed that damages were properly awarded to the plaintiff because of the refusal of the company to serve him with electricity on the ground that the remote situation of his filling station would make doing so too expensive. The building in question was in the city of Pocahontas, south of the Black River, the improvements in the city being virtually all north of the river and a mile distant. The court held that the franchise accepted by the company made it compulsory to serve the applicant, regardless of loss, and the fact that since the judgment was rendered the territory in question had been detached from the city by the alteration of the latter's boundaries did not nullify the obligation assumed under former conditions so as to invalidate the award of damages, whatever the determination as to an existing obligation to serve—on which the court did not pass—might be. (4 S. W. [2d] 15.)*

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Contributory Negligence of Children a Question for Jury.—Affirming judgment for the defendant in Wallace vs. Great Western Power Company, a damage suit brought because of the death of a twelve-year-old boy who climbed 33 ft. on an electric tower and received a fatal shock from high-voltage wires, the Supreme Court of California said that the question of contributory negligence is generally one of fact for the jury and that this principle applies in the case of children. None the less, the appellate court refused to upset the granting by the trial court of a motion for nonsuit, saying: "Assuming the defendant herein to have been guilty of negligence in the maintenance of this electric tower in an open and unguarded state within the limits or vicinity of a populous city [Oakland] and without the presence of signs or devices which would give warning to persons who might be tempted to play upon or ascend the tower, the trial court was still in a position, upon motion for nonsuit, to determine from all of the circumstances of the case whether the deceased boy, though a minor, was sufficiently intelligent and sufficiently familiar with the dangers incident to contact with high-power electric lines that his action in ascending this tower by the difficult means of ascent afforded, and to the height and place of danger to which he did thus succeed in climbing, was to be held negligence as a matter of law." (266 Pac. 281.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *F. B. Lewis Elected to Vice-Presidency*

Fred B. Lewis, assistant general manager of the Southern California Edison Company, has been honored with the title of vice-president and in that capacity will assume greater responsibilities. In his new office he is to be vice-president and assistant general manager in charge of operation.

*F. B. Lewis*

Having joined the Edison company in 1905, following the completion of his engineering studies, Mr. Lewis has made steady progress from the position of meter reader to his present executive position.

During the 1924 power shortage Mr. Lewis, as chairman of the power committee, composed of representatives of all the power companies in the State of California, was very active in bringing about the interconnection of the physical systems of the electric utilities in California. One of his outstanding achievements during the four years in which he has been assistant general manager has been the inauguration of a system of budgets for operation of all departments.

During the nineteen years in which Mr. Lewis was associated with the Edison company, before being made assistant general manager, he had built up a background of steady and reliable performance. His first service with the Edison company was in the capacity of meter tester, which position he took after being graduated from Rose Polytechnic Institute at Terre Haute, Ind. He was advanced to the position of engineer of underground distribution, superintendent of the Los Angeles district, manager of operation and in 1924 to assistant general manager.

Joseph Insull, who has been assistant to the manager of the Pittsfield works of the General Electric Company since 1903, has just retired from active service at the age of 70. Mr. Insull has been connected with the General Electric organization for 41 years, starting in Schenectady. Later he became treasurer and manager of the General Incandescent Lamp Company in Cleveland and subsequently was named production manager of the General Incandescent Arc Light Company. Mr. Insull is a native of London, England. A gold watch was presented to him on his last day at the office by his associates.

James P. McKearin of the United Electric Light Company, Springfield, has been elected president of the Engineering Society of Western Massachusetts.

Dr. Vannevar Bush of the Massachusetts Institute of Technology was made the recipient of the Louis Edward Levy Medal by the Franklin Institute for two papers on electrical power transmission contributed to the Institute's journal.

Dr. Michael I. Pupin, professor of electromechanics at Columbia University and past-president of the American Institute of Electrical Engineers, has been made the recipient of the Washington award for 1928. This annual prize was founded in 1917 by John W. Alvord, consulting engineer of Chicago, for presentation to engineers who have rendered pre-eminent service in promoting the public welfare.

## *H. M. Sawyer Elected to New Executive Position*

H. M. Sawyer, general contract agent of the American Gas & Electric Company, has been elected vice-president. Mr. Sawyer was graduated from Cornell University in 1911, following which connection he joined the Scranton Electric Company as junior power engineer. In 1912 he went to Wheeling as power engineer for the Wheeling Electric Company and in 1920 he removed to New York as assistant general contract agent, being made general contract agent in 1924.

*H. M. Sawyer*

## *J. A. Longley Assumes New Duties in Tennessee*

James A. Longley, for the past several years manager of the production and transmission department of the Tennessee Electric Power Company, has been appointed assistant to the general manager of that company and assistant to the president of the Nashville Railway & Light Company. Mr. Longley is a native of Massachusetts and received his engineering education at Massachusetts Institute of Technology. His first connection with the electrical industry was in 1910 when he went to Portland, Ore., on power plant construction work for the Portland Railway, Light & Power Company. In 1913 he removed to Columbus, Ohio, just after the Dayton flood to work on location and construction of a power plant in that city, later transferring his interests to Nashville on the construction of the Nashville steam plant.

*J. A. Longley*

In October, 1914, he was transferred to Chattanooga as assistant general superintendent of the Tennessee Power Company and since that time he has been connected with the local utility interests with the exception of a year spent with the Arkansas River Oil & Gas Company in Kansas and Oklahoma. As manager of the production and transmission department of the Tennessee Electric Power Company Mr. Longley has been responsible for the operation of all power plants and the construction, operation and building up of the vast system of transmission lines throughout the territory of the company in middle and eastern Tennessee.

Vernon W. Palen, formerly assistant engineer in the engineering bureau of the New York & Queens Electric Light & Power Company, is now connected with the engineering department of the National Electric Light Association, New York. In his new position Mr. Palen will engage in work dealing with problems related to and directly concerning overhead lines and construction. During his affiliation with the New York & Queens utility he directed his attention especially to the design of new primary feeders, secondary design work and the preparation of budget details. Mr. Palen was formerly affiliated with the Commonwealth Edison Company of Chicago.

A. V. Bennett, who has been connected with the West Penn System since 1918, has been elected vice-president of the West Penn Power Company. Before joining the West Penn organization Mr. Bennett was affiliated with the American Water Works & Electric Company, Inc.

H. S. Kerr, chief engineer of the Utah State Road Commission, has been elected president of the Engineering Council of Utah. Mr. Kerr takes a very active interest in the affairs of the engineering fraternity in Utah and has been chief engineer of the Utah State Road Commission since 1926. For the most part his activities have been centered in railroad and railway engineering.

Richard B. Parsons has been appointed underground engineer of the Narragansett Electric Light Company, Providence, R. I., in charge of underground transmission and distribution.

Signor Guido Semenza, general president of the Italian Association of Electrical Engineers, has recently been appointed an officer of the French Legion of Honor, as a mark of appreciation of his work as Italian commissioner at the Hydro-Electric Exhibition at Grenoble in 1925.

Loyall A. Osborne, president of the Westinghouse Electric International Company, has been re-elected chairman of the National Industrial Conference Board at the recent annual meeting held at the Hotel Astor, New York. This will be the third year that Mr. Osborne has held the chairmanship of the board.

## Obituary

Signor Francesco P. Jaccarino, chief electrical engineer of the Società San Georgio of Sestri, Genoa, recently died. He was a leading Italian authority on transformer design and construction.

Ira H. Spencer, president of the Spencer Turbine Company and previously head of the Spencer Turbine Cleaner Company and the Spencer Organ Blower Company previous to their consolidation with the first-named company, died April 28, at the Hartford Hospital, Hartford, Conn. He was an authority on compressed air machines and turbines and an inventor of some note. Mr. Spencer was born in Barkhamsted, Conn., 54 years ago.

John Martin, a pioneer in California hydro-electric development, died in San Francisco, May 23, after a brief illness. He was born in Indianapolis in 1858 and removed to California in 1891. He was identified with a number of the early hydro-electric developments in northern California and was active in organizing gas and electric properties, culminating in the consolidation of many of these into what is now the Pacific Gas & Electric Company. At the time of his death he was chairman of the board of the Mid-Continent Utilities Corporation, serving a large territory between Illinois and Alabama.

William H. Yawger, for many years a vice-president and treasurer of the Weston Electrical Instrument Corporation, Newark, N. J., has resigned from active duty in order better to conserve his health. Mr. Yawger became associated with the Weston company in 1892, just four years after it was organized. His period of active service was 36 years and he still remains on the board of directors with the title of vice-president. Mr. Yawger was born in Lockport, N. Y., and was formerly associated with the Cowles Electric Smelting & Aluminum Instrument Company.

Charles G. Washburn, for many years chairman of the board of trustees of the Worcester Polytechnic Institute and one of the most distinguished citizens of Massachusetts, died suddenly at Lenox, Mass., May 25. He was educated at the Institute and at Harvard College, being a classmate and biographer of the late Theodore Roosevelt, and was a former member of Congress and a manufacturer of prominence at Worcester.

M. Crescitz, formerly vice-director of the Bureau Internationale de l'Union Telegraphique of Berne, Switzerland, died at Chelles, Seine-et-Marne, France, April 19, at the age of 72. It was only last November that he retired owing to ill health, after having been associated with the governmental department of post and telegraphs for more than 50 years.

Arthur D. Dana, organizer and formerly president of the Chicago Fuse Manufacturing Company, died May 25 at his home in New York after a long illness. A native of Marietta, Ohio, and a graduate of Marietta College, Mr. Dana removed to Chicago, where he joined the Linkbelt Machinery Company, of which he was treasurer until 1896. The Chicago Fuse Manufacturing Company, which he formed, became one of the largest manufacturers of electric protecting materials and allied products and Mr. Dana continued as president and chairman of the board until 1924, when he retired because of ill health. He was an intimate friend of Elmer A. Sperry, the inventor, and was associated with him in the formation of the Sperry Electrical Company about 35 years ago, later becoming a director of the Sperry Gyroscope Company. Mr. Dana was actively identified with other industrial enterprises, having been formerly owner of the Moore Drop Forging Company, Springfield, Mass., and a member of the executive committee of the Goodman Manufacturing Company of Chicago before he relinquished his business activities.

Arthur W. Gucker, for several years manager of the Iowa Public Service Company plant in Carroll, Iowa, died suddenly May 6 in his home in that city at the age of 47.

L. J. Kimmel, engineer-inventor, died in Spokane, Wash., April 17 in his forty-eighth year. Mr. Kimmel was the inventor of the Electro-Kold refrigerator and a co-inventor of the No-Kold automatic oil burning furnace. At the time of his death he was vice-president and factory superintendent of the Electro-Kold Corporation in Spokane.

Raleigh C. Thomas, 51 years old, an electrical engineer, was found dead in his sister's apartment in Washington, D. C., May 1. Until recently he was employed by the United States Shipping Board. Formerly Mr. Thomas was prominently identified with the Baltimore city government. He was graduated from Princeton University, where he took an engineering course. After serving as assistant engineer in the Electrical Subway Department of Baltimore he was elected, in 1903, city surveyor. He became chief engineer of the Electrical Commission in 1910, which position he held until 1917, when he received a commission in the Engineer Corps.

John C. Hatzel, president of Hatzel & Buehler, Inc., electrical engineers and contractors, died May 25 at his home in New York in his 69th year. Mr. Hatzel was a native of New York City and was educated at the College of the City of New York. He became an associate of Thomas A. Edison in the early days of electrical development in this country and after serving for four years in the construction department of the Edison Electric Company, in the fall of 1885 he engaged in electrical engineering and contracting, installing central stations and isolated plants and constructing electric railways in various parts of the country. Subsequently he became president of the Western Edison Company, representing the Edison interests in Colorado, Utah and New Mexico. Returning East, he formed a partnership with Joseph Buehler in the fall of 1889, this partnership continuing until 1911, when Mr. Buehler retired. The business was continued by Mr. Hatzel under the old firm name. In the course of his career he was active in the American Institute of Electrical Engineers, the Illuminating Engineering Society, the Electrochemical Society, the New York Electrical Society and the Engineers' Club.

# Financial and Statistical News

## New Capital Issues

During the week ended May 31 the Indiana Hydro-Electric Power Company made an offering of first mortgage 5 per cent gold bonds, series A, to the amount of $3,000,000, the price being 99½ and interest, to yield over 5 per cent. These bonds, dated May 1, 1928, mature May 1, 1958. Proceeds from the sale of these bonds will be applied toward the retirement of all outstanding bonds of the company carrying higher interest coupons.

Thirty-year 6 per cent sinking fund gold debentures, series A, of the Southern Cities Utilities Company were offered at 99½ and accrued interest, to yield over 6 per cent, a piece of financing involving a total of $3,000,000. These debentures, dated Feb. 1, 1928, will mature Feb. 1, 1958. Proceeds from the sale of these debentures and of other securities now being issued will be or have been used to retire outstanding funded debt of the company, to acquire or redeem funded debt and preferred stocks of certain subsidiary companies, to acquire through a subsidiary certain electric properties located in the Dominican Republic and for other corporate purposes.

## March Operations Trend Upward

MARCH operating revenues of electric light and power companies amounting to $157,300,000, expenses aggregating $65,100,000 and an energy production of 6,742,681,000 kw.-hr. are indicated for the country as a whole by monthly reports received and compiled by the ELECTRICAL WORLD. The revenue in December exceeded that of the corresponding month of the preceding year by 6.5 per cent. This was followed by 6.7 per cent in January, 7.9 in February and 7.6 in March. The upward trend seems clear. Slightly irregular figures in February are to be expected in view of the extra day.

Compared with the winter months there was, of course, the usual seasonal decrease both in energy output and in revenue, but in both respects operations were fairly close to the estimated normal based on past growth and observed seasonal variations. The average daily revenue for March was $5,080,000; the normal would have been $5,230,000. Not only has the usual increase occurred, therefore, but it has carried the revenue within 3 per cent of what might have been expected had the rapid expansion of the past five years continued unchecked. The average daily energy production, 217,000,000 kw.-hr., misses the estimated normal by about 1 per cent.

Approximately 40 per cent of the energy came from water power. This is more than the yearly average and reflects the effect of spring stream flow; compared with last year the increase was small—only 6.1 per cent—while the

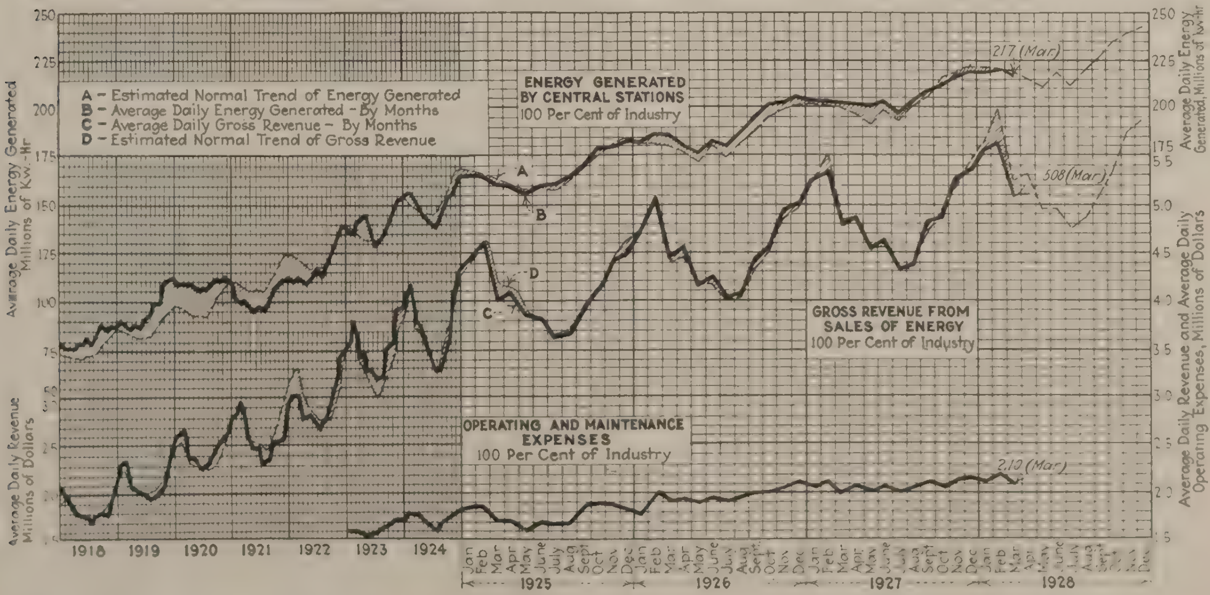
*Table I—Generation and Distribution of Central-Station Energy in the United States*

(100 Per Cent of the Industry)

| Month | Kw.-Hr. Generated Monthly * | | | Estimated Distribution of Energy Generated | | | | | | | | | | Energy Purchased by Public Utilities for Resale, Kw.-Hr. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total Energy Consumption by Central-Station Customers, Kw.-Hr. | | Energy Consumed for Lighting, Kw.-Hr. | | Energy Consumed for Power, Kw.-Hr. | | Energy Sold to Electric Railways, Kw.-Hr. | | Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr. | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Dec... | 6,811,347 | 6,375,500 | +6.8 | 5,605,347 | 5,247,500 | 1,500,000 | 1,400,000 | 3,475,347 | 3,226,500 | 630,000 | 621,000 | 1,206,000 | 1,128,000 | 1,220,000 | 1,120,000 |
| | 1928 | 1927 | | 1928 | 1927 | 1928 | 1928 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 |
| Jan... | 6,767,866 | †6,303,199 | †+7.4 | 5,582,866 | 5,188,199 | 1,493,000 | 1,395,000 | 3,514,866 | 3,170,199 | 575,000 | 623,000 | 1,185,000 | 1,115,000 | 1,244,000 | 1,090,000 |
| Feb.... | 6,411,996 | †5,706,468 | †+12.4 | 5,281,996 | 4,696,468 | 1,395,000 | 1,210,000 | 3,376,996 | 2,928,468 | 510,000 | 558,000 | 1,130,000 | 1,010,000 | 1,211,000 | 1,017,000 |
| March | 6,742,681 | †6,314,272 | †+6.8 | 5,547,681 | 5,194,272 | 1,400,000 | 1,305,000 | 3,617,681 | 3,304,272 | 530,000 | 585,000 | 1,195,000 | 1,120,000 | 1,283,000 | 1,101,000 |

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.



## *Table II—Central-Station Financial Operations for Four Months in the United States*

(100 Per Cent of the Industry)

| Month | Total Gross Revenue from Sale of Energy† | | | Estimated Distribution of Gross Revenue | | | | | | | | Total Operating and Maintenance Expenses‡ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lighting Customers | | Power Customers | | Electric Railways | | Other Public Utilities | | | |
| | 1927 Thousands | 1926 Thousands | Per Cent Inc. | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands | 1927 Thousands | 1926 Thousands |
| Dec...... | $165,100 | $155,000 | +6.5 | $95,900 | $90,800 | $52,200 | $48,100 | $5,200 | $5,000 | $11,800 | $11,100 | $67,900 | $63,200 |
| | 1928 | 1927 | | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 |
| Jan...... | 171,800 | 161,100 | +6.7 | 101,500 | 95,400 | 53,400 | 49,300 | 5,600 | 5,600 | 11,300 | 10,800 | 65,650 | 63,400 |
| Feb...... | 163,100 | 151,100 | +7.9 | 96,000 | 89,800 | 50,500 | 45,700 | 5,500 | 5,400 | 11,100 | 10,200 | 63,500 | 60,200 |
| March.... | 157,300 | 146,200 | +7.6 | 92,200 | 88,100 | 49,200 | 41,900 | 5,100 | 5,300 | 10,800 | 10,900 | 65,100 | 62,400 |

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

## *Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

| Month | Energy Generated | | | | | | Fuel Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hydro-Plants | | | Fuel Power Plants | | | Coal | | | Oil | | | Gas | | |
| | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Thousands of Kw.-Hr. | 1926 Thousands of Kw.-Hr. | Per Cent Increase | 1927 Short Tons | 1926 Short Tons | Per Cent Increase | 1927 Barrels | 1926 Barrels | Per Cent Increase | 1927 Thousands of Cubic Feet | 1926 Thousands of Cubic Feet | Per Cent Increase |
| Dec....... | 2,697,770 | 2,377,175 | +13.5 | 4,113,577 | 3,998,325 | + 2.9 | 3,340,137 | 3,406,140 | —1.9 | 624,276 | 769,518 | —18.9 | 4,805,064 | 3,685,611 | +30.4 |
| | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | | 1928 | 1927 | |
| Jan....... | 2,609,283 | 2,331,140 | +11.9 | 4,158,583 | 3,972,059 | + 4.7 | 3,321,568 | 3,365,461 | —1.3 | 560,871 | 786,062 | —28.6 | 4,955,262 | 3,900,868 | +27.0 |
| Feb....... | 2,463,046 | 2,172,740 | +13.4 | 3,948,950 | 3,533,728 | +11.8 | 3,126,830 | 2,958,797 | +5.7 | 516,557 | 646,558 | —20.3 | 4,896,497 | 3,859,791 | +26.8 |
| March .... | 2,708,730 | 2,551,792 | + 6.1 | 4,033,951 | 3,762,480 | + 7.2 | 3,119,266 | 3,090,984 | +0.9 | 575,684 | 612,657 | — 5.9 | 5,602,443 | 4,312,322 | +30.0 |

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

output from fuel rose by 7.2 per cent and amounted to 4,033,951,000 kw.-hr., requiring the consumption of 3,119,266 tons of coal, 575,684 bbl. of fuel oil and 5,602,443,000 cu.ft. of natural gas; the first increased about 1 per cent, the last 30 per cent and the oil decreased nearly 6 per cent, compared with March, 1927.

Regionally, the most notable departures from the national average occurred in the East and West South Central States, where the year's increase in energy output was 13 and 17 per cent, respectively. The revenue figures likewise reveal the central South as the section having the most rapid gains; the per cent increase, by regions, compared with March, 1927, being as follows:

| | |
|---|---|
| New England .............. | 5.7 |
| Atlantic .................. | 8.0 |
| North Central .............. | 6.3 |
| South Central .............. | 14.4 |
| Western .................. | 9.3 |

Purchase of energy for resale again approached 1,300,000,000 kw.-hr., and was 16 per cent greater than a year ago. Returns on this item are particularly affected by consolidations; data for successive years are therefore only broadly comparable.

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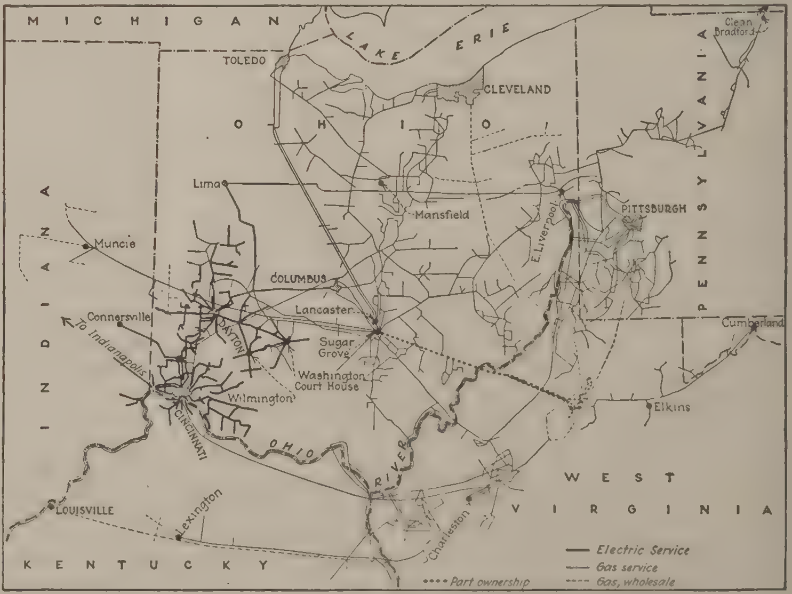
**STANDARD GAS & ELECTRIC SHAREHOLDERS APPROVE CHANGES IN SET-UP.**—At the annual meeting of the Standard Gas & Electric Company held at Wilmington, Del., May 16, the shareholders approved the proposed changes in the prior preference and preferred stocks outlined in the April 21 issue of the ELECTRICAL WORLD. The plan called for the changing of the 500,000 shares of 7 per cent prior preference stock of $100 par value to 750,000 shares of no-par prior preference stock and changing the authorized amount of 8 per cent cumulative preferred stock from 600,000 shares of $50 par value to 1,500,000 shares without par value.

# Columbia Gas & Electric Corporation Consolidates Its Properties

GROSS earnings of more than $96,000,00 class Columbia Gas & Electric Corporation among the nation's important utility groups. Serving a number of rapidly growing areas, chiefly in Ohio, Pennsylvania and West Virginia, this group has gradually built up a number of valuable operating units and has assets of $520,000,000.

Analysis of the corporation's financial position for the past year shows a growth of 5 per cent in gross earnings, while gross earnings from electrical operations alone increased by 12½ per cent. Total operating expenses, including taxes, increased 9.1 per cent, bringing the operating ratio up to 67 per cent, against 65 in 1926. Furthermore, other income dropped off sharply from $3,073,212 to $881,041, due to the cutting off of income from a block of bonds which the corporation sold for construction rather than issuing additional parent company securities.

The no par common stock of the parent company, of which there are



*Electric and gas systems of Columbia Gas & Electric Corporation*

3,372,226 shares outstanding, has had a rapid rise recently from a low this year of $89 to a recent high of $118. This stock pays $5 per share and earned $5.28 last year. Interest charges for the system as a whole were earned more than five times during 1927. The property investment of the system is about $4.72 per dollar of gross revenue, which is somewhat below the average for comparable systems.

During the year Columbia Gas & Electric has continued its policy of consolidating subsidiary operating properties, and, as a result, the financial structure is being greatly strengthened. There have been withdrawn from the hands of the public nine complete issues of bonds and stocks of subsidiary companies. In addition, four bond issues of subsidiaries and one bond issue of a leased company were called for redemption. The process retires some $40,567,672 of securities.

The officers of the Columbia Gas & Electric Corporation pursue an aggressive policy of acquiring neighboring properties whose location and operation make them logical constituents of the system. Several of these were acquired during the past year and have been or will be thoroughly co-ordinated with the system.

## Metropolitan Edison Changes Capital Structure

To provide for improvements and future expansion the Metropolitan Edison Company has increased its authorized capital stock from 900,000 shares, consisting of 400,000 shares of preferred stock and 500,000 shares of common stock, both without par value, to 1,500,000 shares, consisting of 1,000,000 shares of preferred stock and 500,000 shares of common stock, both without par value. The authorized indebtedness of the company has been increased from $50,000,000 to $100,000,000.

In authorizing these changes, stockholders at a special meeting voted favorably for the creation of a new class of preferred stock, to be known and designated as $5 cumulative preferred stock, and to revise the preferred stock of the company into 50,000 shares of $7 cumulative preferred stock, 400,000 shares of $6 cumulative preferred stock, 550,000 shares of $5 cumulative preferred stock.

## Average Output 3,020 Kw.-Hr. per Kilowatt in 1927

Analysis of the recent report of the U. S. Geological Survey on the output of public utility plants during 1927 reveals a wide range in output per average kilowatt of generator capacity.

A summary of the report was published in the Electrical World of April 28, 1928, on page 890. The present tabulation is based on the kilowatt-hour figures there given and on the mean of the installation at the beginning and at the end of the year. The influ-

KILOWATT-HOURS PER KILOWATT IN 1927

| Region | Kw.-Hr. per Kw. |
|---|---|
| United States | 3,020 |
| New England | 2,275 |
| Middle Atlantic | 3,115 |
| East North Central | 3,080 |
| West North Central | 2,495 |
| South Atlantic | 2,810 |
| East South Central | 2,670 |
| West South Central | 3,365 |
| Mountain | 3,810 |
| Pacific | 3,650 |

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Monday May 28 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 74 | 70 | 85 |
| Ala. Pwr., $7 cum. pf.—no par | m115½ | 114½ | 115½ |
| Allis Chalmers Mfg., 6% com. | 122½ | 115½ | 129¾ |
| Aluminum Co. of Amer., com. | 181 | 120 | 197½ |
| Aluminum Co. of Amer., 6% pf. | 109½ | 105½ | 110½ |
| **Amer & Foreign Pwr., 7% pf.—no par** | 109 | 105½ | 110 |
| Amer. & Foreign Pwr., com.—no par | 35½ | 22½ | 38¼ |
| Amer. Bosch Magneto, com.—no par | 40½ | 15½ | 40½ |
| Amer. Brown Boveri Elec.† | 20½ | 10½ | 26½ |
| Amer. Brown Boveri Elec., pf. $7 | 62½ | 40½ | 65½ |
| Amer. Gas & Elec., 6% pf.—no par | m107 | 105 | 108½ |
| Amer. Gas & Elec., com. †—no par | 170½ | 117½ | 184 |
| Amer. Lt. & Trac., 6% pf. | 115 | 114½ | 118 |
| Amer. Lt. & Trac., new com. | 240 | 170 | 249 |
| Amer. Pwr. & Lt., 6% pf. | 107½ | 106½ | 107½ |
| Amer. Pwr. & Lt., com. †—no par ev.div. | 86 | 62½ | 95 |
| Amer. Pub. Serv., 7% pf. | a102½ | 97½ | 102½ |
| Amer. Pub. Serv., com. † | m 65 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | a 97 | 87½ | 97 |
| Amer. Pub. Utilities, 7% pr. pf. | a102½ | 95½ | 102½ |
| Amer. Pub. Utilities, com. | m 50 | ... | ... |
| Amer. States Sec., A | a 11¾ | 4 | 13½ |
| Amer. States Sec., B | 15¾ | 7½ | 18½ |
| Amer. Superpwr., 6% 1st pf. | l 103½ | .... | .... |
| Amer. Super pwr., Class A†—no par | 45¾ | 36½ | 56 |
| Amer. Super pwr., Class B†—no par | 46½ | 37 | 56½ |
| Amer. Wtr. Wks. & Elec., 6% pf. | 103½ | 101½ | 106 |
| Amer. W.W. & E., com. new—no par ex.div. | 62 | 52½ | 70½ |
| Anaconda Copper cap. $3 | 78½ | 53½ | 74½ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr., & Lt. 7% pf | 108 | 107½ | 111 |
| Assoc. Gas & Elec., $3 50 50 | 54½ | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 97 | 96 | 98½ |
| Assoc. G: & E., Class A, 10—no par. | 48½ | 47 | 52½ |
| BABCOCK & WILCOX, 7% com. | 124 | 117½ | 128 |
| Binghamton L., H. & P., $6 pf. | 107 | 102 | 109½ |
| Birmingham Elec., pf.—$6—no par. | 107 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf. | m109 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com. 50 | m165 | 135 | 170 |
| Blaw-Knox, com.† | i 98 | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., com., new | f 60½ | .... | .... |
| Broad River Pwr., 7% pf | 106 | 105 | 108½ |
| Brooklyn Edison, 8% com. | 252½ | 206½ | 268½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf. 25 | 26½ | .... | .... |
| Buffalo, Niagara & East. Pwr. com. $1 20—no par | i 44 | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | 99 | 98 | 101 |
| Carolina Pwr. & Lt., pf.—$7—no par | l111½ | 109 | 111 |
| Central & S. W. Util., $7 pf.—no par | a103½ | 99½ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a109½ | 103½ | 112 |
| Central Ark. Ry. & Lt., 7% pf. | 106 | 105 | 107½ |
| Central Ill. Pub. Serv., $6 pf. | a 99½ | 97½ | 100½ |
| Central Ind. Pwr., 7% pf. | a100 | 95 | 101½ |
| Central Maine Power, 6% pf. | 97 | 96 | 98½ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 110½ | 104½ | 111½ |
| Central States Elec., 7% pf. | 117 | 104½ | 121½ |
| Cincinnati Gas & Elec., 5% com. | g100½ | 97½ | 100½ |
| Cities Service, $6 pf.—no par | l 102½ | 94½ | 103½ |
| Cities Service, pf. B—no par | l 9½ | 8½ | 9½ |
| Cities Service, pf. BB—no par | l 97 | 88½ | 97 |
| Cities Service, com.—20 | l 69½ | 54 | 70 |
| Cities Service, Bks. Shrs.—10 | l 34½ | 26½ | 34½ |
| Cities Service Pwr. & Lt., 7% pf. | m108 | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf. | 101½ | 95½ | 102 |
| Cleveland Elec. Illg., 6% pf. | 113 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 425 | 350 | 425 |
| Columbia Gas & Elec., 6% pf. | 109½ | 107½ | 110½ |
| Columbia G. & E. com. $5—no par | 113½ | 89½ | 118½ |
| Columbus Elec. & Pwr., $2 com.—no par | m 79 | 66 | 79½ |
| Columbus Elec. & Pwr., 7% | 109 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 109 | 107 | 111 |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 109 | 105 | 111 |
| Columbus Ry., P. & Lt. com. no par | 125 | 120 | 125 |
| Commonwealth Edison, 8% com. | a182½ | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 103½ | 102½ | 104½ |
| Commonw'th Pwr., $2, com.—no par | 84 | 62½ | 87½ |
| Conn. Lt. & Pwr., 8% pf | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117½ | 118 | 121 |
| Cons. Gas of N. Y., pf | 102½ | 101½ | 105 |
| Cons. Gas of N. Y., com. $5—no par. ex.div. | 158 | 119½ | 170½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e111 | 110 | 114½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e104½ | 100½ | 105½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par. | e 89½ | 67½ | 93 |
| Consolidated Pwr. & Lt., 7% pf. | m105 | .... | .... |
| Consumers Pwr., 6% pf. | 104½ | 106 | 107 |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108 | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par. | m250 | 240 | 265 |
| Crocker Wheeler, com.† | 62 | 23 | 70 |
| Crocker Wheeler, 7% pf. | 95 | ... | ... |
| DALLAS PWR. & LT., 7% pf. | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 109½ | 108½ | 110½ |
| Derby Gas & Elec., 7% pf. | 102 | 96 | 100½ |
| Detroit Edison, 8% com. | 199½ | 166½ | 199½ |
| Dubilier Condenser, com.—no par. | 4¼ | 2½ | 5½ |
| Duke Pwr., cap. | m140 | 130 | 145 |
| Duquesne Lt., 5% pf. | m104½ | 104½ | 116½ |
| EASTERN NEW YORK UTIL., $7 pf. | m110 | 111 | 112½ |
| Eastern States Pwr. B | 23 | 11½ | 26½ |
| Eastern States Pwr., pf | m100½ | 98 | 100½ |
| East Tex. Elec., 7% pf | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d295 | 252 | 305 |
| El Paso Elec. 7% pf | 110 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l109¼ | 108½ | 111½ |
| Elec. Bd. & Sh. Sec., com. $1—no par ex. rights | l105 | 76 | 127½ |
| Electric Household Util.† | a 26¼ | 13½ | 26¼ |
| Elec. Investors, 6% pf.—no par | 104½ | 101 | 104½ |
| Elec. Investors, com.†—no par | 70 | 40½ | 79¼ |
| Elec. Pwr. & Lt., ctfs. pf. | 109½ | 106½ | 110½ |
| Elec. Pwr. & Lt., ctfs., 40% pd. | m127 | 120½ | 129½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 42½ | 28½ | 45½ |
| Elec. Ry. Securities, com.—no par | 6½ | ... | ... |
| Elec. St. Battery com. $5 25 no par | 82½ | 69 | 84½ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 105 | 104 | 107 |
| Empire Pwr., ptc.† | 37½ | 27½ | 39½ |
| Engr. Pub. Serv. $5, pf.—no par | m 99½ | 99½ | 102 |
| Engr. Pub. Serv., com.—no par | 42½ | 33 | 46½ |
| Eureka Vacuum Cleaner, com. $4—no par | 73½ | 69 | 79 |
| FAIRBANKS MORSE, 7% pf. | m109 | 104 | 114½ |
| F.-M., com.—$3—no par | 44½ | 32½ | 54 |
| Federal Lt. & Trac., com $1.40 | 55 | 42 | 56½ |
| Federal Lt. & Trac., $6 pf.—no par ex.div. | 107 | 98 | 109 |
| Florida Pwr. & Lt., 7% pf. | 107½ | 104½ | 108½ |
| Ft. Worth Pwr. & Lt., 7% pf. | i114 | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf. | 80 | 75 | 85 |
| Galveston-Houston Elec., com. | 33 | 31½ | 42½ |
| General Cable, Cl. A | 74½ | 56 | 84½ |
| Gen. Elec. $3 com.—no par | 160½ | 124 | 174½ |
| Gen. Elec., special—6% | 11½ | 11½ | 11¾ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par | 46 | 35½ | 50¼ |
| Gen. G. & E. (Del.) pf. A $8—no par | 135 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par | m116½ | 108½ | 118 |
| Gen. G. & E. (Del.) pf. B $7 | 114 | 105½ | 114½ |
| Gen. Pub. Serv., $7 pf. | 98 | .... | .... |
| Gen. Pub. Serv., com., no par | 26½ | 16½ | 29 |
| General Public Utilities, $7 pf. | m102 | 98 | 101 |
| Ga. Lt., Pwr. & Rys., com. | m 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | h105 | .... | .... |
| IDAHO PWR., 7% pf. | 110 | 109 | 111½ |
| Ill. No. Utilities, 6% pf. | m 99 | 96 | 100 |
| Ill. Pwr. & Lt., 7% pf. | 105½ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 108 | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf. | 102 | 100 | 105 |
| Ingersoll Rand com. | m 95 | 90 | 98 |
| Int. Combus. Engr., com. $2—no par | 59½ | 45½ | 65½ |
| Int. Combustion Engr., 7% pf. | fm108 | 103 | 109 |
| Int. Util., Class A—$3.50—no par. | 49½ | 44½ | 52 |
| Int. Utilities, Class B—no par. | 19½ | 6½ | 19½ |
| Interstate Pwr., pf.—$7—no par. | 104½ | 99 | 103½ |
| Interstate Pub. Serv., 7% pf. | 106 | 103 | 106½ |
| Iowa Ry. & Lt., 7% pf | 101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT CO., 7% pf | 108 | 106 | 108 |
| Johns-Manville com. †—no par | 124 | 111½ | 134 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland.
*l*Bid price Tuesday, May 29. *m*Bid price Saturday, May 26. *n*Latest quotations available. †Dividend rate variable.

## Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Monday May 28 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY POWER & LIGHT pf. $7 | 112 | 109 | 114 |
| Kansas Gas & Elec. 7% pf. | l110 | 107 | 110 |
| Kelvinator Corp. | 20½ | 11¼ | 22¾ |
| Kentucky Hydro-Elec., 7% pf. | n104 | 102 | 104¾ |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 105 | 100 | 105 |
| LACLEDE GAS LT., 10% com. | m210 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | 38¾ | 19¾ | 40 |
| Long Island Ltg., 7% pf. | 110¾ | 109¾ | 112½ |
| Long Island Ltg., 6% pf. | m108 | 107 | 109 |
| Long Island Ltg., com.†—no par | m250 | 170 | 250 |
| Los Angeles Gas & Elec., 6% pf. | h111½ | 105¼ | 112¼ |
| Louisville Gas & Elec., cl. A. $1.75 | 37¾ | 28 | 41 |
| MAN. ELEC. SUPPLY, cap. $5—no par | 57¾ | 50 | 61 |
| Maytag Co., com. 50—no par | 37⅝ | 30 | 40¼ |
| Memphis P. & L., pf.—$7—no par | 110 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 107 | 103 | 109¾ |
| Metropolitan Ed., pf.—$7—no par | 109½ | 109 | 111½ |
| Metropolitan Ed., com. $8—no par | m170 | 125 | 185 |
| Middle West Utilities, 6% pf | a100 | 93½ | 100¼ |
| Middle West Util., 6% pr. lien | a107 | 99 | 108 |
| Middle West Util., com. $7—no par | a153¾ | 123¼ | 169 |
| Midland Utilities, pr. ln. 6% pf. | a 96½ | 94½ | 97 |
| Midland Utilities, 6% pf. A | a 90¾ | 89¼ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 100 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | l108½ | 107 | 109 |
| Miss. River Pwr., 6% pf. | 111 | 94 | 112½ |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | m107 | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | m105 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 44 | 29½ | 53 |
| Montana Pwr., 5% com. | m168 | 102¾ | 175 |
| Montreal Pwr., 7½% com. | f 107 | .... | .... |
| Mountain States Pwr., 7% pf. | m104 | 97 | 105 |
| Mountain States Pwr., com.† | 18 | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110½ | 98 | 110½ |
| National Carbon, 8% pf. | a138½ | 136½ | 139¾ |
| National Elec. Pwr., A† | a 37½ | 27½ | 42 |
| National Pwr. & Lt., pf.—7% | 108½ | 108¼ | 111 |
| National Pwr. & Lt., com.†—no par. ex div | 34⅜ | 21⅞ | 36⅞ |
| National Pub. Serv., 7% pf. | 103 | 99 | 103 |
| National Pub. Serv., 7% ptc., pf | 114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 28⅞ | 22 | 29¾ |
| National Pub. Serv., B com.—no par | 32⅞ | 24¼ | 34½ |
| Nebraska Pwr., 7% pf. | l109½ | 110 | 111½ |
| Nevada-Calif. Elec., com. | m42¾ | 33¼ | 42¾ |
| New Brunswick Pwr., 4% pf. | 64 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 110 | 98½ | 110½ |
| New Eng. Pub. Serv., pf. $7 | 106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 107½ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 102 | 91 | 100 |
| N. Y. Central Elec., 7% pf. | 105 | 101 | 105¼ |
| New York Power & Light 7% pf. | 114 | .... | .... |
| NiagaraFalls Pwr., 7% pf.—25 | 28½ | 27¾ | 29 |
| No. Amer., 6% pf.—50 | 55¼ | 53¼ | 55⅝ |
| No. Amer., com.—10 | 74⅛ | 58¾ | 78¾ |
| No. Amer. Edison, $6 pf.—no par... ex. div | 103¼ | 102½ | 105¾ |
| Northeastern Pwr., com. | 29⅞ | 19¾ | 31 |
| No. N. Y. Utilities, 7% pf. | 108 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 29¾ | 18 | 32 |
| Northern Ohio Pwr. & Lt., 6% pf. | 100 | 90 | 99 |
| No. Ont. Lt. & Pr. 6% pf. | m100 | 94 | 100 |
| No. States Pwr. (Del.), 7% pf. | 109 | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 143½ | 123 | 152 |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par. | m93½ | 89 | 100¾ |
| Ohio Brass, 6% pf. | m105 | 106 | 111 |
| Ohio Pwr., 6% pf. | 108 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | 104 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 111 | 107 | 112 |
| Ohio River Edison, 7% pf. | 109½ | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 114½ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 28½ | 26¾ | 30 |
| Pacific Gas & Elec., 8% new com. | 50½ | 43½ | 53¼ |
| Pacific Pwr. & Lt., 7% pf. | l110 | 106 | 110 |
| Packard Electric | n 67½ | 47 | 68 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 81 | 79¾ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 99¼ | 93½ | 100 |
| Penn-Ohio Edison, 7% pf. | 108 | 97½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 110 | 99 | 112 |
| Penn Pwr. & Lt.—$7—no par | l110 | 109¾ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 85¾ | 68 | 90 |
| Phila. Co., 5% pf.—50 | m 46½ | 45½ | 48¾ |
| Phila. Co., 6% pf.—50 | 55 | 52 | 57 |
| Phila. Co., com.—50 | m170 | 145 | 174¾ |
| Phila. Elec., 8% com.—25 | c 74⅛ | 55½ | 74¾ |
| Portland Elec. Pwr., 7% pf. | 105 | 100 | 104¾ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 43 | 42½ | 52 |
| Potomac Elec. Power, 6% pf. | m111 | 110 | 111½ |
| Pwr. Sec., pf.—no par | 66 | 60 | 74 |
| Pwr. Sec., com.—no par | 13½ | 11½ | 14⅝ |
| Public Serv. of Colorado, 7% pf. | 108 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | m113½ | 103¾ | 115 |
| Pub. Serv. of N. J., 7% pf. | 129 | 118 | 129¼ |
| Pub. Serv. of N. J., $2 com.—no par | 61 | 41½ | 66¾ |
| Pub. Serv. of No. Ill., 6% pf. | a112 | 110 | 115 |
| P. S. of No. Ill., com. $8—no par | a185 | 159½ | 190½ |
| Pub. Serv. of No. Ill., $8 com. | a185 | 159¾ | 190 |
| Pub. Serv. of Okla., 7% pr. ln. | 109 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 109½ | 108 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | m110 | 105 | 109 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 101¾ | 92 | 105¾ |
| Puget Sound Pwr. & Lt., com. | 71½ | 34¾ | 84¾ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 57⅝ | 54½ | 60 |
| Radio Corp. of Amer., com.—no par | 211¾ | 85¼ | 211¼ |
| Rochester Gas & Elec. 6% pf. D | m104 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107½ | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | m104 | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 117 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | m 75 | 70 | 75 |
| Servel, Inc. | 15¾ | 4½ | 17½ |
| Sierra Pacific Elec., 2% com. | 36¼ | 29 | 40½ |
| Sioux City Gas & Elec., 7% pf. | 107 | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l 109 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 89½ | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 57¾ | 40¾ | 61 |
| So. Calif. Edison, 8% pf. | 49 | 38½ | 41 |
| So. Calif. Edison, 7% pf. | 29⅝ | 28½ | 30 |
| So. Calif. Edison, 6% pf. | 27¼ | 25¾ | 27¾ |
| So. Calif. Edison, 8% com. | 50½ | 43½ | 53¼ |
| Southern Cities Utilities, 7% pf. | 85 | 75 | 92 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 70 | ... | .. |
| Southwestern Lt. & Pwr., $6 pf. | 94½ | 88 | 96½ |
| Southwestern Pwr. & Lt., 7% pf. | m112 | 103 | 115 |
| Standard Gas & Elec., 8% pf | m 71 | 65 | 71½ |
| Standard Gas & Elec., 7% pr. pf | 114 | 108 | 115 |
| Standard G. & E., com. $3.50 | 69¾ | 57¼ | 74¾ |
| Standard Power & Light, com. | 58¼ | 29¾ | 58¼ |
| Standard Pwr. & Lt., 7% pf. | m106 | 98 | 106 |
| Staten Island Edison, pf.—$6—no par | 102 | 99 | 103½ |
| Superheater, $6 com.—no par | 150 | 155 | 178 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 112½ |
| Syracuse Lighting, 8% pf. | m117 | 114 | 119 |
| TAMPA ELEC., com. $2 | m 68 | 62 | 71 |
| Tenn Elec. Pwr., 6% pf | 102¾ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf | 109½ | 107 | 110 |
| Tex. Pwr. & Lt., 7% pf | l113½ | 113¼ | 115 |
| Tide Water Pwr., 8% pf | 110 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 128¾ | 112¾ | 134 |
| Toledo Edison, 7% pf. | 109½ | 103 | 113 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | m145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 97 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c148½ | 114½ | 149¾ |
| United Lt. & Pwr., pf.—$4—no par. | m 56½ | 49 | 56½ |
| United Lt. & Pwr., pf.—$6 50—no par | 101¼ | 94½ | 103½ |
| United L. & P., com. A .48—no par. | 25¾ | 13¾ | 26½ |
| United L. & P., com. B .48—no par. | m 25 | 16 | 30 |
| Utah Pwr. & Lt., 7% pf. | l111 | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 105 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | m200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 103½ | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 42⅝ | 28½ | 44¾ |
| Utilities Pwr. & Lt., com. B $1—no par | 29½ | 18½ | 30½ |
| VERMONT HYDRO-ELEC., 7% pf | 99 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | m110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102½ | 97 | 103½ |
| WAGNER ELEC., 7% pf. | b106½ | 96¾ | 106½ |
| Wagner Elec., com.—no par | b 86½ | 37 | 120 |
| Washington Ry. & Elec., 7% com | m470 | .... | .... |
| Washington Ry. & Elec., 5% pf. | n100¾ | .... | .... |
| Washington Wtr. Pwr., 8% com. | 225 | 175 | 235 |
| West Penn Elec., 7% pf. | 113¼ | 109½ | 115 |
| West Penn Elec., Cl. A $7 | 110 | 106½ | 112 |
| West Penn Pwr., 7% pf. | 115½ | 114¾ | 117 |
| West Penn Pwr., 6% pf. | m110½ | 108¾ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf | 104 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | m104 | 100 | 106 |
| Western States Gas & Elec., com. | m 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 104¾ | 88¾ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | m 33 | 30¾ | 34 |
| Weston Elec. Instrument, com.—no par | 18¼ | 12½ | 18¾ |
| Wheeling Elec., 6% pf. | 106 | 95 | 109 |
| Worthington Pump, 7% pf. A | m 57½ | 46½ | 58½ |
| Worthington Pump, 6% B | 49 | 41 | 51 |
| Worthington Pump, com. | 34½ | 28 | 37½ |
| YALE & TOWNE com. $5—25 | 74¾ | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Tuesday, May 29. *m*Bid price Saturday, May 26. *n*Latest quotations available. †Dividend rate variable.

ence of regional conditions on the amount of installation required to produce a given annual output is evident.

## Electric Power in Canada

Almost 99 per cent of the electrical energy output of central stations in Canada in 1926 was hydro-electric, according to a preliminary report on the census of the central-station industry for 1926 recently issued by the Dominion Bureau of Statistics. The energy output was 19 per cent greater in 1926 than in 1925, the rapid growth being due in considerable degree to the pulp and paper and to the mining industry. The estimated horsepower purchased by the former from central stations shows an increase of more than 160 per cent between 1922 and 1926. Most of this is 24-hour power. The numerous small fuel plants were more important than their 1 per cent of the output would imply, by serving 57,000 customers.

The report gives data relating to the individual provinces as well as numerous statistical items for the industry in Canada as a whole, only a few of which can be here quoted.

GROWTH OF CENTRAL STATION INDUSTRY IN CANADA

|  | 1926 | 1925 |
|---|---|---|
| Power plants, number | 595 | 563 |
| Hydraulic, number | 294 | 284 |
| Fuel, number | 301 | 279 |
| Capital | $756,220,066 | $726,721,087 |
| Revenue | 88,933,733 | 79,341,584 |
| Salaries and wages | 19,943,000 | 18,755,907 |
| Employees, number | 13,406 | 13,263 |
| Pole-line, mileage | 29,695 | 27,653 |
| Transmission | 10,645 | 9,791 |
| Distribution | 19,050 | 17,862 |
| Customers, number | 1,337,562 | 1,279,731 |
| Energy generated, thousands kw.-hr. | 12,09,445 | 10,110,459 |
| Hydro, thousands kw.-hr. | 11,911,039 | 9,941,604 |
| Fuel, thousands kw.-hr. | 173,600 | 160,979 |
| Prime movers, horsepower | 3,769,323 | 3,569,527 |
| Waterwheels and turbines, horsepower. | 3,609,385 | 3,416,018 |
| Steam engines, horsepower | 36,386 | 24,230 |
| Steam turbines, horsepower | 103,847 | 101,457 |
| Internal combustion engines, horsepower | 19,705 | 17,822 |
| Generators, kva. | 2,995,387 | 2,844,709 |

## Economic Progress Reviewed by Industrial Board

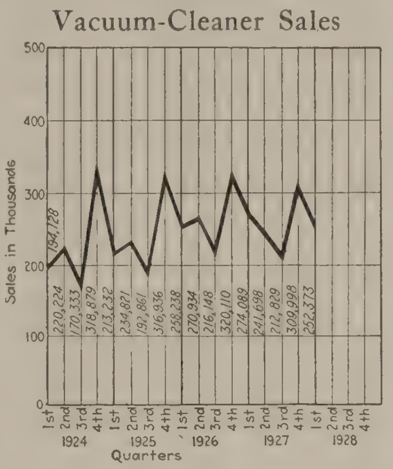
A review of today's most pressing business problems and of the contributions of science and engineering to economic progress was the outstanding feature of the twelfth annual meeting of the National Industrial Conference Board, held in New York, May 17. Particularly notable were addresses by Gilbert H. Montague, declaring that the Sherman law was being satisfactorily modified by interpretation, and by Charles H. Herty on the great contribution that chemistry has made to economic progress. Prof. Michael I. Pupin praised the college professor as the father of the electrical industry and the creator of that scientific idealism which he pictured as a proper policy for industry.

Mr. Montague, a New York attorney who is an authority on the Sherman law, declared that legislation was being constantly modified by the increasing liberality of court decisions on consolidations and combinations, by action of the Federal Trade Commission and by a liberal attitude on the part of the Department of Justice. He declared emphatically that it was not true that American business cannot thrive under the present anti-trust laws. He believes that the modifications are such and the tendency so liberal that we should not attempt to tamper with the Sherman law by amendment and thus set up additional bureaucratic machinery and create unsettlement until the meaning of the new amendments can be determined. He heartily recommended two books on combinations and consolidations publishd by the National Industrial Conference Board, and a third, now in press, to be put out by the same organization.

Magnus W. Alexander, president of the board, discussed thoroughly the various estimates of unemployment put out during the last six months, showing how the various figures were built up and proving the unreliability of the figures of 4,000,000 and more unemployed. He made a satisfactory defense, also, of the thesis that the mechanization of industry should not be curtailed because of any temporary effect it might have on the unemployment problem.

Virgil Jordan, chief economist of the board, made the point that those who expect our private foreign loans to be repaid when due are sure to be disillusioned. He believes that these loans will be funded and refunded indefinitely, just as are the bonds of large corporations in the United States. This he held to be the normal expectation. Nevertheless, our large loans abroad set up a new financial relationship between the rest of the world and the United States—a relationship into which we were thrust in the very brief four years of the war and for which, therefore, we have had no preparation in the way of adequate experience in international finance. The resulting problems are intricate and difficult. They must have the very deepest study by industrialists and business men. Otherwise we shall learn by bitter experience.

Loyall A. Osborne, president of the Westinghouse Electric International Company, was re-elected chairman of the board and Magnus W. Alexander president and chief executive of the organization. The other officers are as follows: Vice-chairmen, Charles Cheney, president Cheney Brothers, South Manchester, Conn.; Irenée du Pont, chairman finance committee E. I. du Pont de Nemours Company, Wilmington, Del.; Herbert F. Perkins, first vice-president International Harvester Company, Chicago; George S. Harris, president Exposition Cotton Mills, Atlanta, Ga.; treasurer, Fred I. Kent, director Bankers Trust Company, New York. The executive committee will be composed of the officers of the board and the following members: William D. Baldwin, chairman Otis Elevator Company; A. Farwell Bemis, chairman Bemis Brothers Bag Company, Boston; Cornelius F. Kelley, president Anaconda Copper Mining Company, New York, and William H. Nichols, Jr., president General Chemical Company, New York.



Vacuum-cleaner sales by quarters during 1924, 1925, 1926, 1927 and the first quarter of 1928. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

## Helium Now Available in Commercial Quantities

Helium, heretofore a rare element and not obtainable in the open market, is now available in commercial quantities. Although the most important use of helium is for inflating dirigible and passenger balloons, it has an increasing use in industry. It is being used for filling radio tubes and glow lamps and tubes for signs and as a cooling medium in

## *Imports of Electrical Apparatus Into the United States by Commodity and by Country of Origin for the First Quarter of 1928*

(Data furnished by the Bureau of Foreign and Domestic Commerce)

| Article | First Quarter |
|---|---|
| Carbon-filament incandescent electric lamps: | |
| Miniature | $64,450 |
| Other lamps | 79,492 |
| Metal-filament incandescent electric lamps: | |
| Miniature | 3,053 |
| Other lamps | 24,052 |
| Other electric lamps, including neon, etc. | 482 |
| Generators | 77 |
| Transformers | 757 |
| Converters, double-current and motor-generators, dynamotors and other converting apparatus | ...... |
| Switches, circuit breakers, fuses, choke coils, reactors, sockets, plugs, etc | 491 |
| Motors, stationary, railway, vehicle, automotive, and other | 112 |
| Electric fans and blowers | 262 |
| Table household, kitchen and hospital utensils and similar hollow or flat ware containing electrical heating element: | |
| Electric flatirons | 6 |
| Iron or steel-enameled or glazed with vitreous glasses | 653 |
| Copper, brass, steel or other base metal | 300 |
| Industrial electric furnaces and ovens | ...... |
| Therapeutic apparatus and X-ray machines | 6,331 |
| Radio and wireless apparatus and parts | 51,904 |
| Telegraph apparatus | 1,076 |
| Telephone apparatus | 1,337 |
| Storage batteries and parts | 2,934 |
| Batteries other than storage | 1,363 |
| Electrical machinery and parts | 207,543 |
| Electric apparatus and parts | 81,169 |
| Total | $527,844 |

| Country | First Quarter |
|---|---|
| Austria | $8,283 |
| Australia | 3,784 |
| Azores and Madeira Islands | ...... |
| Belgium | 21 |
| Brazil | 18 |
| British Honduras | 10 |
| British West Indies | ...... |
| Canada | 5,991 |
| Ceylon | ...... |
| China | 3,486 |
| Cuba | 247 |
| Czechoslovakia | 1,354 |
| Denmark | 53 |
| France | 11,863 |
| French Oceania | ...... |
| Germany | 163,975 |
| Hungary | ...... |
| Irish Free State | |
| Italy | 2,932 |
| Japan | 90,429 |
| Mexico | 100 |
| Netherlands | 2,744 |
| Norway | 525 |
| Philippine Islands | ...... |
| Portugal | 6 |
| Rumania | ...... |
| Spain | ...... |
| Sweden | 119,328 |
| Switzerland | 54,381 |
| United Kingdom | 58,314 |
| Total | $527,844 |

electric transformers and high-speed generators. It also is used as a non-oxidizing gas in annealing processes and metallurgical operations, and as a damper for scientific instruments because of its high viscosity.

Helium has been made available commercially by the discovery of new natural gas fields having a higher helium content and the development of an improved process of extraction by the Helium Company, whose plant is at Dexter, Kan., with headquarters at Louisville, Ky.

for a new addition to cost $300,000. The U. S. Coast and Geodetic Survey, Washington, D. C., will receive bids until June 22 for construction of a steel Diesel-electric propelled survey ship of about 770 tons displacement; separate bids will be received at the same time for furnishing main propelling machinery, pumps, windlass, capstan, boat hoist, etc.

# Market Conditions

BUYING is reported at a satisfactory level in the industry. Industrial business is good and inquiries presage future sales. Fractional-horsepower motor sales are said to be exceeding expectations largely owing to the increased demand for domestic appliances. Important projects include a can manufacturing plant at Chicago to cost more than $500,000; a new rayon mill near Richmond, Va., to cost $1,500,000, and a paperboard mill at Baltimore, Md., to cost $300,000.

In New England buying is at a good level and small motors are in demand. Maine and New Hampshire plants were active in ordering poles and line material. Industrial plant business looms up as the important factor in business in the Eastern district. Sales of industrial control apparatus are reported by one manufacturer as about 5 per cent better than they were last year. The demand for street-lighting equipment has improved in the New York metropolitan district, Buffalo, Philadelphia and Chicago. In the Southeast a good volume of business made up of many small orders is reported. A steel mill in Alabama ordered $65,000 worth of motor equipment and a bleachery in South Carolina purchased $15,000 worth of apparatus. Another bleachery plant to be built in South Carolina calls for an expenditure of $2,000,000, of which amount $300,000 will cover the electrical installation. A decidedly better tone is noted in the St. Louis district, and manufacturers report more business in sight. An order for two turbine units amounted to $80,000. Industrial business is better in the Middle West and conditions continue to improve. On the Pacific Coast many pole and crossarm inquires are reported including one for $50,000. Pump and motor business especially has been good owing to flood conditions in eastern Washington and Idaho.

## *Expansion of Sales Noted in Eastern District*

Sales continue on a satisfactory basis in the Eastern district, with industrial sales maintaining the lead over central-station and affiliated business. There is a pronounced demand for motors in larger sizes up to 250 hp. from iron and steel plants, textile mills and cement mills, with the New England district a prominent factor in commitments. Inquiries are holding up well for early future sales. Business in fractional-horsepower motors is said by one manufacturer to be exceeding all expectations for the year. There has been a marked increase in sales for talking machines, washing machines and other domestic appliances, and the first six months of 1928 will show an encouraging advance over the corresponding period a year ago. A water company at Pittsburgh, Pa., has placed an order for a turbo-generator unit to cost about $50,000, for a pumping station installation, and Evansville, Ind., has contracted for a 750-hp. geared turbine unit for extensions in its municipal waterworks.

Transformer business has been advancing for the past few weeks, with industrial commitments on a good level. Central-station business in that line shows a little decline, with utilities in the metropolitan district now coming into the market. A leading manufacturer reports an order from a hospital in northern New York for transformer with switchboard panel, etc., to cost close to $20,000. A maker of industrial control apparatus says that sales for the present year are running at 5 per cent or better than the average for the same period in 1927, with the gain particularly noticeable in the New York and Philadelphia districts. Construction operations in the Eastern district include the following:

Hansen's Laboratory, Inc., Little Falls, N. Y., manufacturer of food products, will build an addition to cost about $300,000. The American Enka Corporation, New York, plans a power plant at its proposed rayon mill near Richmond, Va., to cost $1,500,000. The Corn Products Refining Company, New York, plans a refining plant in Sao Paula, Brazil, to cost $1,000,000. Automotive Standards, Inc., New York, has purchased property with buildings at Newark, N. J., for plant to cost $400,000. The Public Service Electric & Gas Company, Newark, N. J., is securing a right-of-way for a proposed transmission line in Essex, Union and Middlesex Counties. The Direct Ink Ribbon Company, Camden, N. J., plans a plant to cost $85,000. Harrisburg, Pa., is asking bids until June 7 for fire alarm and police cable lines.

The Pennsylvania Railroad Company is carrying out a shop expansion program at Wilmington, Del., to cost $200,000, and will remove Pavonia shops at Camden, N. J., to that location. The Bureau of Supplies and Accounts, Washington, D. C., will receive bids until June 5 for generator units, impulse cable assemblies, etc., for Philadelphia navy yard (Schedule 9111). The Chesapeake Paper Board Company, Baltimore, Md., will ask bids about June 15

## *Prices of Copper, Lead and Zinc Advance*

Copper has sold in excellent volume and now appears to be firmly established at 14¾ cents, Connecticut Valley. More than usual activity in lead is reported and the New York price is now 6.30 cents compared with 6.10 cents a week ago. Buying of zinc has been almost non-existent, but some sellers are asking 6.15 cents and there is no inclination on the part of producers to make concessions. For the sixth consecutive week copper has sold in excellent quantity.

NEW YORK METAL MARKET PRICES

| | May 23, 1928 Cents per Pound | May 29, 1928 Cents per Pound |
|---|---|---|
| Copper electrolytic | 14.375 | 14.525 |
| Lead, Am. S. & R. price | 6.10 | 6.30 |
| Antimony | 11.125 | 11.0 |
| Nickel, ingot | 35 | 35 |
| Zinc spots | 6.475 | 6.475 |
| Tin, Straits | 51.625 | 50.625 |
| Aluminum, 99 per cent | 24.30 | 24.30 |

Base copper wire price May 29, 1928, 16⅝ cents.

## *Industrial Business Better in Middle West*

General business in the Middle West continues to improve. Industrial activity is not quite as spotty and with the stiffening up of the metal market, better business conditions are anticipated. The railroads report a varied movement of commodities and some hope is evidenced recently with regard to the coal situation. Employment conditions have improved somewhat. Interesting orders placed by utility companies included evaporator equipment, a feed water heater, a revolving car dumper, six induced draft fans, one railroad track scale and 500,000 lb. of bus bar copper. Construction projects are as follows:

The Mills Novelty Company, Chicago, plans a plant for coin machine manufacture, to cost $100,000. The Harrisburg Packing Company, Harrisburg, Ill., plans a packing plant to cost $100,000. The Construction Division, Veterans' Bureau, Washington, D. C., will receive bids June 12, for ash-handling equipment for hospital at Maywood, Ill. The Iowa Public Service Company, Ft. Dodge, Iowa, plans improvements in the power plant at Charles City, Iowa, to cost $100,000. Chillicothe, Iowa, plans a municipal power system. The Detroit Edison Company, Detroit, Mich., will build additions to power substations at Cortland, Grand River, Amsterdam, and Hart, to cost $200,000. The Detroit Macaroni Manufacturing Corporation, Detroit, Mich., will build a plant, to cost $175,000. The O. B. McClintock Company, Minneapolis, Minn., manufacturer of fire and burglar alarm systems, etc., plans a plant to cost $80,000.

The Zinsmaster Baking Company, Minneapolis, Minn., will build a baking plant to cost $170,000. The Great Northern Railway Company, St. Paul, Minn., plans a call for bids for the power plant and repair shops at Fargo, N. D., to cost $100,000. The Cleveland, Cincinnati, Chicago, & St. Louis Railroad Company plans repair shops at Bellefontaine, Ohio, to cost $155,000. The Contracting Officer, Material Division, Air Corps, Wright Field, Dayton, Ohio, will receive bids June 5, for 763 generator units (Circular 333). The Lakeside Cheese Company, Plymouth, Wis., will build a plant at Loyal, Wis., to cost $100,000. The Madison Silo Company, Madison, Wis., plans a plant to cost $75,000. The Hudson Manufacturing Company, Minneapolis, Minn., plans a plant for the manufacture of barn and dairy equipment at Waukesha, Wis., to cost $60,000. St. Paul, Minn., plans an ornamental lighting system on Concord Street. The town clerk, Afton, Iowa, will receive bids until June 15, for an electrical distribution system.

## *Active Business Reaches Good Volume in Southeast*

Satisfactory activity is reported in the electrical field in the Southeast with the volume sustained by increased small business. A power company in Georgia ordered bare and weather-proof copper wire amounting to $15,500, while a company in Tennessee placed orders for a 3,000-kva. transformer and distribution transformers amounting to $3,000. A small company in Georgia ordered small power transformers amounting to $2,500, while another company in the same state purchased small power and distribution transformer equipment totaling $3,600. A central-station company recently purchased control batteries costing $6,000. The demand for control batteries is active.

A steel mill in Alabama ordered motor equipment amounting to $65,000 and a bleachery plant in South Carilona purchased dyeing and bleaching equipment costing $15,000. A cotton mill in Georgia bought pole line materials amounting to $5,000 for use in its mill village distribution system, and an automobile assembling plant in the same state purchased an industrial truck costing approximately $5,000. Engineering contract was closed this week for a finishing plant and bleachery to be constructed in South Carolina, the plant to represent an expenditure of $2,000,000 with approximately $300,000 going into the electrical installation. Engineers are also at work on a 20,000-spindle cotton mill for Tennessee. Construction projects are as follows:

The Gulf Fertilizer Company, Tampa, Fla., plans a mill to cost $150,000. The Gentile Brothers Packing Company, Haines City, Fla., plans a cold storage plant with new fruit canning factory to cost $100,000. The Sixth Vein Coal Company, Madisonville, Ky., plans expansion in properties to cost $75,000. The B. V. May Hosiery Mills, Inc., Burlington, N. C., will build an addition to cost $400,000. The Atlantic Ice & Coal Company, Atlanta, Ga., plans an ice plant at Knoxville, Tenn., to cost $100,000. The Virginia Public Service Company, Charlottesville, Va., is negotiating for the purchase of the municipal plant at Staunton, Va. Huntsville, Ala., plans an ornamental lighting system.

## *Buying in New England at a Good Level*

Industrial sales volume showed improvement in the New England district, with small motor sales at a high level. An interesting order amounting to over $80,000 was reported. A number of industrial plants are equipping on a fairly extensive scale. A paper company recently placed an order for motors and control amounting to over $40,000, and a number of smaller orders are recorded. Small switch sales are good and negotiations have increased, particularly concerning heavy power apparatus.

Central-station supplies are moving well. Orders for poles and line material lead with buying active among Maine and New Hampshire plants. During the past week transmission line equipment sales increased. Projects for electric lighting are increasing, and street lighting is active. Boston plans to expend $125,000 for electric automatic progressive timing traffic signals. Interest in structural welding is increasing. Jobbing conditions are uneven. Electric ranges are in strong demand. Construction projects are as follows:

The New York, New Haven & Hartford Railroad Company has acquired a tract of land at John and Water Streets, New London, Conn., and plans a power plant. The Connecticut Power Company, New London, Conn., plans an equipment storage and distributing plant at Waterford, Conn., to cost $40,000.

## *Decidedly Better Tone Noted in St. Louis*

General conditions show an improvement in the St. Louis district. An order was placed for two turbo-generator units for the western part of the district at a cost of $80,000. The St. Louis water department bought a lot of electric driven service pumps amounting to $7,000. Another order from a paper company for motors and control apparatus amounted to $6,000. There is an increasing demand for line construction materials which are being shipped mostly to the southwestern part of the district. Manufacturers report more business in prospect and a decidedly better tone throughout the district, particularly in the south and west. Construction projects are as follows:

The Ward Furniture Manufacturing Company, Fort Smith, Ark., will build a factory to cost $85,000. The Barnes Dairy Products Company, Rogers, Ark., plans a milk plant to cost $65,000. The United States Engineer Office, New Orleans, La., is taking bids until June 6, for one electric-driven air compressor complete (Circular 265). The Shreveport Packing Company, Shreveport, La., plans a packing plant to cost $80,000. The Meeker Advertising Company, Joplin, Mo., plans a factory for the manufacture of display equipment, to cost $100,000. The St. Louis Electric Terminal Railway, St. Louis, Mo., plans a terminal and freight building to cost $1,000,000.

Stanberry, Mo., plans the installation of a municipal power plant. The General Baking Company, New York, N. Y., plans a baking plant at Oklahoma City, Okla., to cost $175,000. The Texas Company, Houston, Tex., plans expansion in the Port Arthur oil refinery to cost $3,000,000. The Arkansas-Missouri Power Company, Blytheville, Ark., has secured franchise at Blytheville, Ark., and plans extensions in transmission lines. The Arkansas Power & Light Company, Little Rock, Ark., will build a 33,000-volt transmission line between Gurdon and Camden, Ark. Durant, Okla., plans extensions in its ornamental lighting system.

## *Business in Good Volume on Pacific Coast*

Many pole and crossarm inquiries are reported on the Pacific Coast. They are mainly for carload shipments to various points. An inquiry of the Pacific Gas & Electric Company, approximates $50,000, and another covers 1,000 assorted treated poles, mainly 30 ft. and 35 ft., for the Hawaiian Islands. The Southern Pacific Company has just completed the installation of four selective teletype printers in the Los Angeles yard to record train departures and contemplate similar installations in San Francisco and Oakland. The electrical material is valued at about $7,500 per job. Motor orders for industrials are good typical orders though larger than average.

Flood conditions in eastern Washington and Idaho, occasioned by melting snow in the mountains preceded by heavy rains, brought considerable pump and motor business to dealers in Spokane, Seattle and Tacoma. Other sales reported include about 75 motors from 100 hp. down for sawmills and allied industrials; 6 2,500-kva. transformers for track substations for the Great Northern Railway in the Wenatchee Valley; 3 55,000-volt oil circuit breakers and a number of 15,000-volt breakers for a central-station company in the Puget Sound district. Construction projects are as follows:

Cold storage plants are planned for Wenatchee and Yakima. Paper bag factories are planned in Vancouver, Wash., and St. Helens, Ore. The Centralia Lumber Company plans a large manufacturing plant. The North Corona Land Company, 528 South Hill Street, Los Angeles, plans a steam power plant at Norco, Calif., to cost $130,000. Sacramento, Calif., plans installation of underground conduit system for all street lights. The Union Ice Company, San Francisco, plans an ice plant at San Jose, Calif., to cost $200,000. W. L. Soens, Durango, Colo., and associates have applied for permission to build a hydro-electric power plant at Bayfield, Ignacio, and vicinity, to cost $200,000. The Weyerhaeuser Lumber Company, Tacoma, Wash., plans a lumber mill near Klamath Falls, Ore., to cost $400,000.

Centralia, Wash., has applied for permission to build a hydro-electric plant on the Skookumchuck River, to cost $300,000. The Puget Sound Power & Light Company, Seattle, Wash., has a permit for a switching station. The Great Northern Railroad Company, Seattle, Wash., plans improvements in shops at Interbay yard, to cost $400,000. Sellers & Stone, Inc., Yakima, Wash., will build a cold storage plant for railroad car service to cost $150,000. The Pacific Gas & Electric Company, San Francisco, will make extensions in transmission lines between San Rafael and Petaluma, Calif. The Commonwealth Utilities Corporation, Colorado Springs, Colo., plans a transmission line to the municipal airport, Calhan and vicinity. Morton, Wash., will build a transmission line from La Grande, in co-operation with the Rainier National Park. Los Angeles and Santa Cruz, Calif., plan ornamental lighting systems.

# Activities of the Trade

## New Merger Groups Makers of Transmission Material

The National Electric Products Corporation has been organized and has acquired the business of the National Metal Molding Company of Pittsburgh and Economy, Pa., the American Copper Products Corporation of Bayway, N. J., and the British American Metals Company of Plainfield, N. J. The National Metal Molding Company manufactures rigid conduit, outlet boxes and fittings, metallic and non-metallic flexible conduit, armored and rubber-covered cables and wires and metal molding. The American Copper Products Corporation makes bare copper wire and rods, weatherproof wire and transmission cable. The British American Metals Company manufactures condenser tubes and brass and copper pipe. The new organization thus becomes a large copper-consuming unit. Through its subsidiaries the new company also holds the majority of the stock of the Habirshaw Cable & Wire Corporation with mills at Yonkers, N. Y., and Bridgeport, Conn.

The new organization states that the grouping makes up a combination of non-competitive manufacturers whose products or lines are more or less supplemental and which in their entirety may be described broadly as covering an entire industry. The National Electric Products Corporation has been formed under the laws of Delaware with an authorized capital stock of 300,000 shares of no par value common and $5,000,000 of 6 per cent cumulative dividend preferred stock. None of the preferred stock will be issued at this time and there will be no public offering of the stock. The officers of the new corporation are: W. C. Robinson, chairman of the board; Wylie Brown, president; F. S. Jerome, treasurer; I. A. Bennett and H. H. Robinson, vice-presidents, and A. L. Robinson, treasurer. The board of directors will consist of all of the officers and O. F. Felix and C. F. Holdship of Pittsburgh, H. C. Carpenter of Elizabeth, N. J., and C. J. Gleason of New York.

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The Ideal Commutator Dresser Company, Sycamore, Ill., announces that it has improved and added many special attachments to the Ideal combination blower and suction devices.

The National Electric Heating Company, Boston, manufacturer of "Nehco" industrial electric heating equipment, announces the opening of an office in the Graybar Building, 420 Lexington Avenue, New York City, in charge of Robert A. Carleton. E. S. Guild, formerly chief engineer of the Carleton-Mace Engineering Corporation, has joined the organization as electrical engineer and Fred V. Hadley has been appointed New England representative with offices at 127 Federal Street, Boston.

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## Altorfer Bros. Makes Large Shipments of Washers

For the second time in three weeks a train load of ABC washers, running as a special extra fast freight, was dispatched from the Altorfer Bros. Company factory in Peoria, Ill. The first train load was sent to the Southwest while the second went to the Eastern market. Early last year the Altorfer Bros. Company brought out, under the trade name "ABC Spinner," a washer with a porcelain tub. At the same time, to assure adequate production of a uniform, high standard porcelain, a complete porcelain department was installed at the factory, at a cost of approximately $250,000.

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The Allis-Chalmers Manufacturing Company, Milwaukee, announces that its Grand Rapids, (Mich.) branch office has been moved to 310 Building and Loan Building. This office is in charge of G. C. Culver.

The Excel Electric Company, Muncie, Ind., manufacturer of home electric appliances, announces that A. C. Crandall has been made sales manager. Mr. Crandall was formerly with the Central Indiana Power Company of Indianapolis.

The Wagner Electric Corporation, St. Louis, announces that E. D. Pike is now manager of its San Francisco branch sales office. Mr. Pike has been with the company for twenty-six years and until recently was in charge of the company's Pacific coast service operation.

The Dampney Company of America, Hyde Park, Boston, manufacturer of "Apexior" protective coatings for power plant equipment, announces the appointment of C. J. Hunter as its Philadelphia district sales manager. Mr. Hunter will have offices in the Philadelphia Bourse Building and will look after the company's interests in eastern Pennsylvania, southern New Jersey, Delaware, eastern Maryland, District of Columbia and northern Virginia.

## Fulton Iron Works Buys Foos Engine Company

Following the acquisition of a substantial stock interest in the Foos Engine Company of Springfield, Ohio, the Fulton Iron Works Company of St. Louis has purchased the Foos company, using common stock of the Fulton company. The announcement that a substantial stock interest was acquired by the Fulton company was made in the Oct. 29, 1927, issue of the Electrical World. The Foos Engine Company manufactures Diesel oil engines from 10 hp. to 300 hp. The Fulton company will operate the Springfield plant as a branch.

Harry J. Steinbreder, president of the Fulton concern, said that at the present time, exclusive of the Foos business the company has on hand sufficient orders to operate full capacity for the next four months. "Shipments for the company's fiscal year ending in June should exceed any one of the last five years and will in all likelihood be more than double the shipments of the last fiscal year," said Mr. Steinbreder.

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The Silvray Company, Inc., 55 West Sixteenth Street, New York City, manufacturer of Silvray indirect bulbs and "Spraylite," announces the removal to its new and larger plant, located at 53 West Fourteenth Street, New York City, where four times the present capacity will be available.

The Buffalo Foundry & Machine Company, Buffalo, N. Y., manufacturer of "Buflovak" vacuum dryers, evaporators and chemical apparatus, announces the appointment of O. S. Sleeper as engineer in charge of special development work. Mr. Sleeper has for the past seven years conducted the O. S. Sleeper Company, manufacturing similar equipment.

The Oliver Iron & Steel Corporation, Pittsburgh, announces the appointment of C. A. Heiser as district manager at Dallas, Tex., with headquarters at 409 Browder Street. Mr. Heiser, formerly assistant sales manager of the Southwest General Electric Supply Company at Dallas, will have charge of the line material, bolt, nut and rivet departments.

The McGraw Electric Company, Omaha, Neb., jobber, announces the purchase of the "Clark" electric water heater business from the Stoughton Manufacturing Corporation of Stoughton, Wis. The business will be conducted from the general office at Omaha and the manufacturing plant will be continued at Stoughton, Wis., by the designer of the Clark electric water heater. A. E. Julian, who will continue as sales manager of the water heater business, will move to Omaha, making his headquarters in the McGraw building. The executive management of the business will be under the direction of Arthur J. Cole, vice-president and general manager of the McGraw Electric Company.

# New Equipment Available

## Outdoor Potential Detector

A means of indicating potential on high-tension transmission lines at points where no potential transformers are used is a recent development by the Westinghouse Electric & Manufacturing Company. This is accomplished by means of a type O N static glow outdoor potential detector.

The detector consists of a vacuum type static glow lamp mounted in standard fuse clips and inclosed in a metal case having a glass window. It is suspended from the line conductor by a clamp in such a manner that the lamp is visible from the ground. One terminal of the glow lamp is connected to the line conductor through the clamp and the other is fastened to a brass rod antenna suspended from the case. The detector is applicable to line voltages from 4.5 kv. to 220 kv.

## High-Frequency Grinder

The addition of high frequency models to its line of grinders is announced by Forbes & Myers, Worcester, Mass. These new models are identical with the previous bench and floor type grinders made by the company with the exception that they are built to operate at higher speeds. The new grinders are now being built in sizes from ¼ hp. to 2 hp. for all commercial high frequencies and for maximum speeds of 12,000 r.p.m.

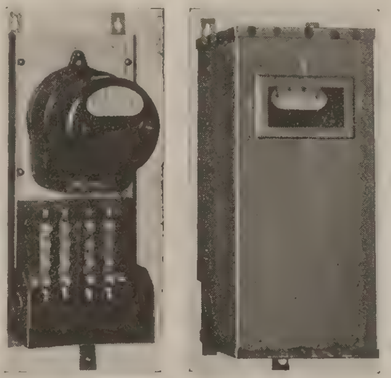
The motor is of the high frequency induction type with a long spindle, the motor armature and wheels being mounted directly on the spindle. It has four ball bearings, one close to each end of the spindle and one on each side of the motor. The space between the two bearings on each side of the motor is a large chamber for grease. The rotor is provided with aluminum bars and rings welded together. The company also manufactures a line of frequency changers for supplying these high frequency motors.

## Lever Operated Switch

A new switch, designed especially for splined shaft or shipper rod operation, is announced by the Cutler-Hammer Manufacturing Company, Milwaukee. This switch is for use as a pilot circuit control device on lathes, textile machinery and other equipment where starting and stopping of the machine is to be governed by a splined shaft, shipper rod or similar device. Low voltage protection is provided. Some of the features claimed by the manufacturer are: Non-stubbing contacts; shear pin to protect the mechanism; few parts and simple construction; operating lever which can be placed in any one of four operating positions 90 deg. apart, to suit any installation requirement; long, steel-to-bronze main bearing with oil hole; small size; fully inclosed in heavy steel case, and a cover which can be removed by loosening only two screws. The switch is designed especially for three-wire control, but also can be used for two-wire control on pilot circuits up to 550 volts.

## Outdoor Meter Box

A new type of meter box which makes it possible to mount residential meters out of doors for easy reading is announced by the Square D Company, Detroit, manufacturer of safety switches and other electrical control equipment. The case, finished in clear enamel, is of 16-gage steel, electrically welded, with a double strength window glass cemented in. The assembly includes a 60-amp. test block, a sealing stud at the bottom of the box, and a meter board of wood which permits the mounting of meters with differently spaced mounting holes. Two heavy steel strips are welded to the back of the box, offset to hold it away from the wall. The illustration shows the meter box with the cover removed and in place.



*Meter box which permits outdoor installation of watt-hour meter*

The distribution fuse box and service entrance switch are installed in the basement exactly as in the case of indoor metering. Service is brought from the pole directly to the meter box, which is mounted at the most convenient location on the outside wall of the house. The meter itself is protected, as the box is moisture-proof.

## Marine Type Instruments

A line of marine type ammeters and voltmeters, designed for use on shipboard or in mines or other locations where damp conditions may exist, has been developed by the Westinghouse Electric & Manufacturing Company. They operate on the D'Arsonval principle and are known as the type SX. Several features incorporated in these instruments are sapphire jewels, terminals in rear of instrument and accuracy within 1 per cent of full scale. The voltmeters have a range of 150 to 750 volts and the ammeters are available in a standard range of capacities from 50 amp. to 8,000 amp.

## Automatic Reclosing Feeders

A new line of automatic reclosing feeder equipment, arranged in the form of completely inclosed cubicles, has been placed on the market by the General Electric Company. These cubicles contain a circuit breaker and disconnecting switches, and are operated automatically by relays mounted on the front panel. The new cubicle construction has been designed to exclude dust and dirt from the operating parts, and to provide the feature of safety which is so important in the dead front type of switchboard apparatus now coming into use for inside installation.

Circuit breakers and disconnecting switches are mounted on a channel frame which also supports the walls of the cubicle. The front panel is arranged in the form of a door, and on it are mounted the necessary relays and meters for providing the automatic reclosing feature. On the back of this panel is located all of the control wiring, which is easily accessible. A rear door affords a means of conveniently inspecting breakers and all breaker parts. The cubicles are made in standard sizes and in ratings up to 7,500 volts. They may be arranged side by side to form a continuous switchboard of the completely inclosed type.

INSULATOR PINS.—A new series of pins known as the Locke "Redhead" and Locke "Leadhead" pins, has been placed on the market by the Locke Insulator Corporation, Baltimore. These pins consist of a cast-iron base with a steel through bolt and are intended for use with insulators having the standard 1⅜ in. N.E.L.A. pin hole. The "Redhead" pin is for use only with insulators having perfect metal threaded pin holes. The "Leadhead" pin may be used with these insulators or with any insulator having the 1⅜ in. standard N.E.L.A. pin hole.

PANELBOARD.—A new type of panelboard, known as the "Security," and which is of molded base unit construction, has been placed on the market by the Penn Electrical Company, Irwin, Pa. The fuse blocks are separate from the switch bases and the two types of fuse blocks are interchangeable. For instance, a panelboard arranged for cartridge fuses can be converted readily to a plug-fused panelboard. The line is made in the live face and safety construction types. The molded blocks will take either two double-fused circuits or four single-fused. The tumbler switches are of the heavy duty type and the switch plates are of molded bakelite.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued May 8, 1928)

1,669,039. Electric Soldering Iron; L. S. Brach, East Orange, N. J. App. filed Dec. 4, 1925.

1,669,082, 1,669,083. Synchronous Motor; V. A. Fynn, St. Louis, Mo. Apps. filed June 12, and Aug. 2, 1926. Adapted to carry variable load at synchronous speed.

1,669,097. Control of Electric Circuits; H. A. McCrea, Schenectady, N. Y. App. filed July 28, 1927. Providing for the disconnection of a faulty portion of a circuit.

1,669,099. Automatic Arc Welding Machine; P. O. Noble, Fort Wayne, Ind. App. filed March 26, 1927.

1,669,106. Electric Switch; J. F. Tritle, Schenectady, N. Y. App. filed Dec. 6, 1924. "Trip free" type.

1,669,107. Automatic Controller; L. A. Umansky, Schenectady, N. Y. App. filed May 9, 1927. For the driving means of a driven element, the number of rotations of which it is desired shall bear a predetermined ratio to the number of rotations of another driven device.

1,669,109. Induction Furnace; J. M. Weed, Schenectady, N. Y. App. filed April 19, 1923.

1,669,113. Stator Construction for Dynamo-Electric Machines; A. P. Wood, Schenectady, N. Y. App. filed Feb. 19, 1927. Employing frame plates to clamp bars which engage the sides of the stator teeth to stiffen them so as to render the use of clamping covers unnecessary.

1,669,114. Electric Heater; C. C. Abbott, Pittsfield, Mass. App. filed March 19, 1927. For ovens and the like.

1,669,120. Combined Switch and Plug Receptacle; F. C. De Reamer, Bridgeport, Conn. App. filed May 8, 1923.

1,669,122. Electric Socket; J. B. Downing, East Orange, N. J. App. filed Oct. 6, 1924.

1,669,125. Electric Switch; H. G. Hartmann, Schenectady, N. Y. App. filed Feb. 1, 1924. Latching device for disconnecting switch.

1,669,126. Spot Welding; W. Hopp, Heiligensee, Germany. App. filed Feb. 7, 1927.

1,669,129. Electrode; W. Irby, Lynn, Mass. App. filed Jan. 7, 1927. For use with the luminous type of arc.

1,669,132. Slip-Regulator Control; G. H. Jump, Buffalo, N. Y. App. filed June 21, 1926. For automatically regulating the slip of an alternating current motor so as to permit a flywheel or other inertia device connected with the motor to assist in carrying peak loads thrown on the motor.

1,669,134. Molded Commutator; H. T. Kelso, Fort Wayne, Ind. App. filed Dec. 3, 1927.

1,669,142. Static Frequency Changer; M. Osnos, Berlin, Germany. App. filed Oct. 20, 1925.

1,669,147. Vapor-Electric-Arc Apparatus; C. A. Sabbah, Schenectady, N. Y. App. filed July 21, 1926.

1,669,148. Electric Control System; C. Schiebeler, Berlin, Germany. App. filed April 28, 1926. For hoisting installation.

1,669,149. Protective Arrangement; O. C. Traver, Schenectady, N. Y. App. filed May 4, 1926.

1,669,150. Speed Regulation of Synchronous Motors; L. A. Umansky, Schenectady, N. Y. App. filed May 11, 1926.

1,669,154. Protective Relay; W. R. G. Baker, Schenectady, N. Y. App. filed Sept. 14, 1925.

1,669,157. Electric Fuse; G. R. Brown, Bridgeport, Conn. App. filed July 30, 1926. Inclosed fuse.

1,669,159. Phase Indicator; R. D. Duncan, Jr., East Orange, N. J. App. filed July 21, 1925.

1,669,162. Motor-Generator Control; P. W. Forsberg, Schenectady, N. Y. App. filed Nov. 3, 1925. Sets employed in electric locomotive or similar service.

1,669,163. Electricity Meter; J. Harris, La Fayètte, Ind. App. filed Dec. 27, 1928.

1,669,177. Electricity Meter; F. Scott, La Fayette, Ind. App. filed May 9, 1927.

1,669,190. Conduit Fitting; R. P. Dunmire, Erie, Pa. App. filed Oct. 30, 1925.

1,669,192. Hospital Appliance; J. C. Fischer, Wauwatosa, Wis. App. filed June 12, 1926. Distributing cart with food warming equipment.

1,669,193. Electric Extension Plug; J. A. Fourney, Oakland, Calif. App. filed Nov. 9, 1922.

1,669,202. Pressure-Controlled Switch; M. Lassen, Detroit, Mich. App. filed Oct. 17, 1924.

1,669,209. Lamp Socket; J. Ribaysen, Chicago, Ill. App. filed April 30, 1925.

1,669,240. Electric Switch; O. Hammerstrom and H. O. Engstrom, Bridgeport, Conn. App. filed July 15, 1924.

1,669,274. Electric Switch; C. E. Anderson, Stratford, Conn. App. filed Oct. 21, 1921. Toggle type.

1,669,283. Electric Switch; J. R. Carlson, Hartford, Conn. App. filed Nov. 10, 1922. Rotary snap switch.

1,669,298. Rotary Timing Switch; J. Y. Hartman, New Orleans, La. App. filed June 18, 1926.

1,669,318. Electrical Appliance; C. C. Baad, Bronx, N. Y. App. filed June 19, 1926. A table lamp having a base within which a pair of electrical appliances are normally housed, but which may be moved to an exposed position for use by dropping suitable doors provided in the base.

1,669,334. Coil Casing and Switch Therefor; W. Hemingway, Jr., Vicksburg, Miss. App. filed March 1, 1923.

1,669,337. Live-Line Clamp; G. A. Iler, Youngstown, Ohio. App. filed Sept. 30, 1925.

1,669,372. Multiple-Series Switch; V. R. Despard, Valparaiso, Ind. App. filed Oct. 16, 1925.

1,669,373. Operating Means for Rotary Switches; V. R. Despard and H. C. R. Popp, Valparaiso, Ind. App. filed Oct. 16, 1925.

1,669,374. Rotary Snap Switch; V. R. Despard, Valparaiso, Ind. App. filed April 9, 1926.

1,669,385. Method of Producing Electrical Heating Elements; E. L. Wiegand, Dormont Borough, and A. P. Wiegand, Crafton, Pa. App. filed June 4, 1927.

1,669,386. Safety Control Device; W. W. Williams, Bloomington, Ill. App. filed Dec. 12, 1925. For a liquid fuel heating system.

1,669,393. Battery Solution; A. Dembowick, Minneapolis, Minn. App. filed Aug. 4, 1926.

1,669,400. Impedance Meter; C. E. Vawter, Philadelphia, Pa. App. filed Aug. 5, 1921.

(Issued May 15, 1928)

Reissue 16,966. Synchronizing Device; O. C. Traver, Schenectady, N. Y. App. filed July 29, 1922. Automatic.

Reissue 16,967. Induction Furnace Having Unidirectional Circulation; J. R. Wyatt, Camden, N. J. App. filed Aug. 29, 1928.

1,669,409. Sheath for Cable Connections to Electric-Iron Plugs; G. Browning, Wilmette, Ill. App. filed May 6, 1926.

1,669,434. Switching Device; G. Werner, Frankfort-on-the-Main, Germany. App. filed May 17, 1924. For the electrical connection in any desired combination of a plurality of points of electrical operation.

1,669,447. Conduit Fitting; J. C. Boyton, Cleveland, and W. H. Doddridge, Lakewood, Ohio. App. filed Jan. 2, 1926.

1,669,453. Wiring System for Transformers for Multiphase Furnaces; H. Brock, Knapsack, near Cologne, Germany. App. filed March 15, 1927.

1,669,468. Medical Electrical Apparatus; C. Heintze, Chicago, Ill. App. filed Jan. 28, 1926. For electric ray treatment.

1,669,478. Lighting Fixture; J. G. Lengel, Los Angeles, Calif. App. filed Jan. 24, 1927.

1,669,484. Therapeutic Apparatus; C. W. Mowry, Portsmouth, R. I. App. filed March 17, 1926.

1,669,493. Circuit Breaker; J. Slepian, Swissvale, Pa. App. filed Oct. 15, 1923. Air type.

1,669,494. Lightning Arrester; J. Slepian, Swissvale, Pa. App. filed April 29, 1924. For direct-current circuits.

1,669,505. Regulation System; L. N. Crichton, Wilkinsburg, Pa. App. filed July 6, 1923. For the transmission of power at high voltages over long distances.

1,669,507. Prime Mover and Clutch; J. T. Dickson, Los Angeles, Calif. App. filed Feb. 11, 1927.

1,669,509. Electric Controller Device for Signals; S. J. Eyrse, Minneapolis, Minn. App. filed Dec. 17, 1924.

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Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

# New Trade Literature

INSULATING VARNISH.—The John C. Dolph Company, Newark, N. J., is distributing a solvent and calculating chart for Dolph's insulating varnishes.

CONTROL EQUIPMENT. — Bulletins GEA-19D, GEA-252A and GEA-360B issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its CR7006-D4 and D5 alternating-current inclosed magnetic switches; the type M, multiple unit control system for railway service, and the CR7761-F1 remote-indicating speed controller for slip-ring induction motors. The company also is distributing the following bulletins: GEA-468A, covering drum-type controllers for direct-current adjustable-speed motors; GEA-743A, describing drum controllers for two or three-phase slip-ring induction motors, and GEA-980, covering inclosed speed-regulating rheostats for starting and field control of direct-current motors.

ELECTRIC WATER HEATERS.—The Automatic Electric Heater Company, Philadelphia, has issued bulletin No. 51-28 covering the "Sepco" low wattage, storage type, electric water heaters. A diagram shows the construction of the heater, and operating data are included in the bulletin.

STREET-LIGHTING EQUIPMENT.—"Overhead Street Lighting Equipment" and "Ornamental Street Lighting" are the titles of catalog 218-A and 218-B issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These catalogs give complete information on all street-lighting equipment and accessories manufactured by the company, and also describe and illustrate the equipment with photographs, dimensioned line drawings, charts, and line drawings. New equipment and improvements on former designs are also included.

LIVE LINE MAINTENANCE TOOLS.—Catalog No. 4 issued by the Tip's Tool Company, Inc., 325 East Main Cross Street, Taylorville, Ill., covers a complete set of Tip's tools for live line maintenance. An illustration shows the practical application of the company's No. 11 live line maintenance guard and a drawing shows the method of working double circuit lines. Other illustrations show the method employed in using various tools.

ELECTRIC MOTORS.—Bulletin No. 102 issued by the American Electric Motor Company, Cedarburg, Wis., covers the American two and three-phase induction motors from ½ hp. to 200 hp. The bulletin contains an illustrated general description of the various types, gives the advantages of each and details the methods of manufacture.

SWITCHING EQUIPMENT. — Bulletins GEA-14B, GEA-53B and GEA-931 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its automatic switching equipment for sectionalizing and reclosing service; busbar clamps and clamp terminals for outdoor switching equipment, and automatic switching equipment for alternating-current railway-signal and train-control feeders. Bulletin GEA-974 issued by the company gives the dimensions of its type FKR-55 oil circuit breakers.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Cape Haitien, Haiti (No. 31,433), of motors and generators.

An agency is desired in Copenhagen, Denmark (No. 31,390), for electric refrigerators.

Purchase and agency are desired in Constantza, Rumania (No. 31,449), for dental X-ray apparatus.

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Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

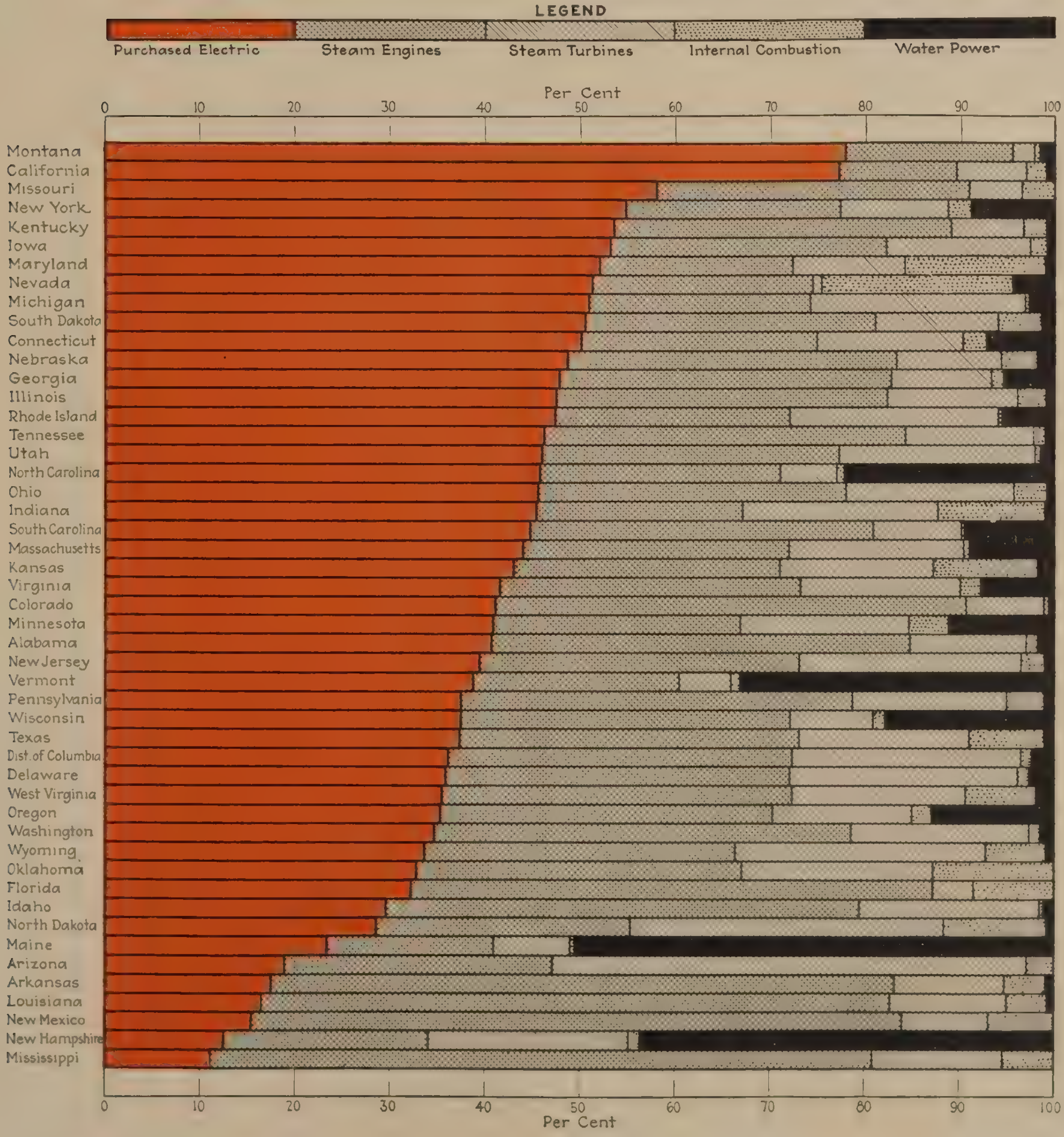
# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## Where Is the Industrial Power Market?

In Montana 78 per cent of the installed horsepower used in manufacturing is comprised in motors operated on purchased electric energy. In Mississippi it is only 11 per cent. The remainder uses steam, internal combustion engines and water power. Electrical operation on energy generated within the establishments is not included. The chart is based on the 1925 census of manufactures.

SOURCES OF POWER IN MANUFACTURING IN THE UNITED STATES



# Southern Operations Slightly Below Those of Last Year

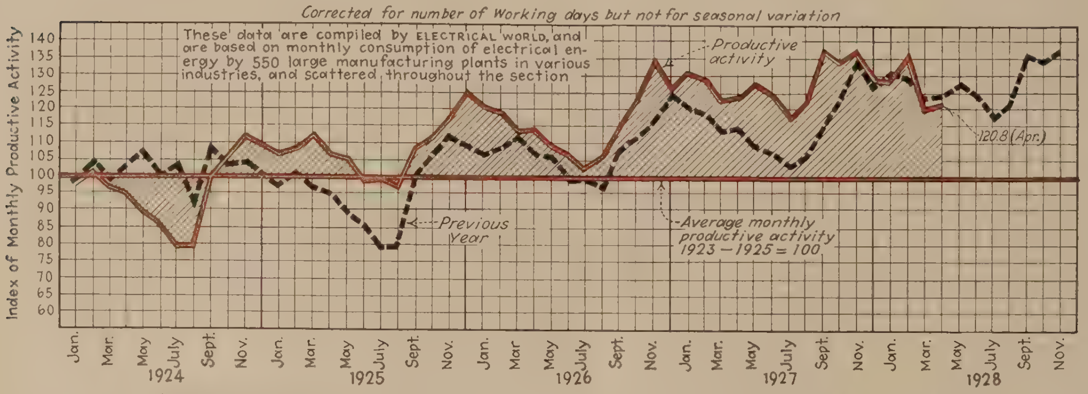
*Index of Productive Activity in the Southern States*

Average Monthly 1923–25 = 100
All Figures Adjusted for Number of Working Days

| | April, 1928 | March, 1928 | April, 1927 | Average First Four Months, 1928 | Average First Four Months, 1927 |
|---|---|---|---|---|---|
| All industry | 120.8 | 118.8 | 123.1 | 125.1 | 126.6 |
| Metal industries group | 121.7 | 116.1 | 130.8 | 121.8 | 146.0 |
| Rolling mills and steel plants | 124.7 | 136.7 | 130.8 | 136.2 | 146.0 |
| Metal-working plants | 113.4 | 100.6 | ..... | 107.3 | ..... |
| Food and kindred products | 114.4 | 106.8 | 115.2 | 118.8 | ..... |
| Stone, clay and glass | 205.7 | 178.0 | 141.0 | 185.8 | 142.3 |
| Textiles | 112.0 | 123.6 | 137.8 | 128.3 | 147.2 |
| Paper and pulp | 201.0 | 176.3 | 143.2 | 164.9 | 128.6 |
| Lumber and its products | 88.3 | 95.3 | 95.7 | 105.0 | 86.5 |
| Fertilizer industry | 68.7 | 91.1 | 125.0 | 101.2 | 186.0 |
| All industry (United States) | 119.3 | 118.2 | 116.9 | 120.9 | 116.5 |

April witnessed a more or less seasonal drop in industrial operations in the Southern States. The April rate of production was 2.7 per cent under March. Past history indicates that such a rate of decreased industrial operation would be expected at this season of the year. The average rate of general production during the first four months of the current year is about 1 per cent under the same period of 1927, a remarkable tribute to the industrial development of the South when it is remembered that the average rate of operation in the textile plants of the South so far this year was 14 per cent under the same period last year. General industry in the nation as a whole reported an April activity of 0.9 per cent above March and about 2.2 per cent above April last year. The textile and paper and pulp industrial groups were the only two reporting April operations under those of last year.

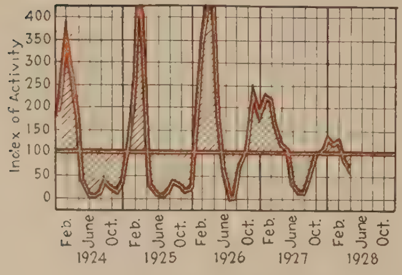
ELECTRICAL WORLD *Barometer of Industrial Activity in the Southern States*



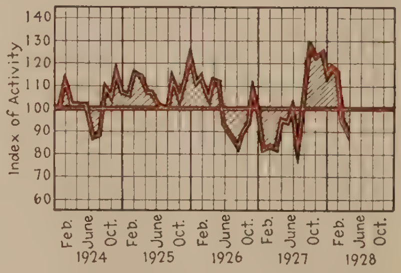
*States in* SOUTHERN GROUP

Delaware, Maryland, D. of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, Texas.

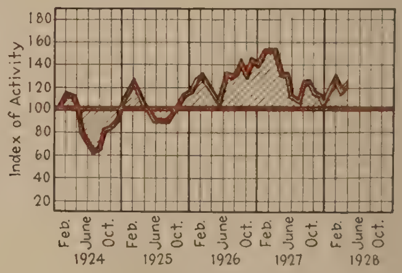
GENERAL INDUSTRIAL ACTIVITY IN THE SOUTHERN STATES



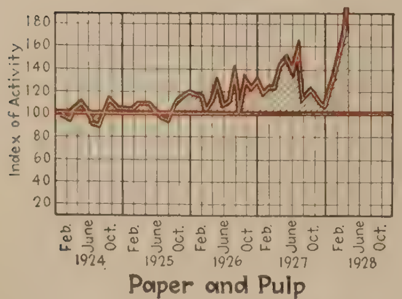
Fertilizer Industry



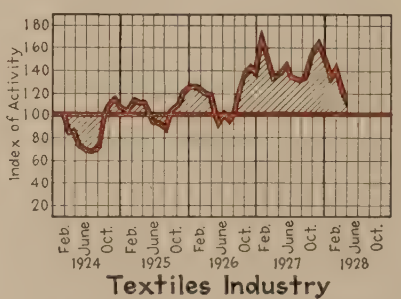
Lumber and its Products



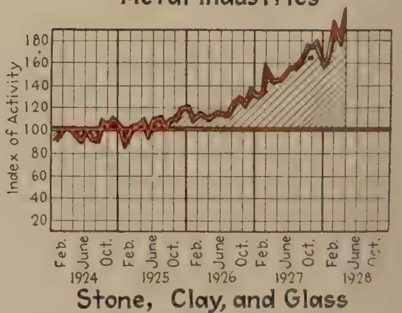
Metal Industries



Paper and Pulp



Textiles Industry



Stone, Clay, and Glass

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES
OF THE SOUTHERN STATES

Electrical World

*McGraw-Hill Publishing Company, Inc.*
James H. McGraw, *President*
Edgar Kobak, *Vice-President*

W. H. Onken, Jr.
*Editor*

Volume 91 *New York, Saturday, June 9, 1928* Number 23

# The N.E.L.A. Convention in Perspective

THERE was a great gathering of public utility executives at Atlantic City this week. Leading men came from all sections of the country seeking information and advice. They had heard rumblings of the investigation being conducted by the Federal Trade Commission and had read garbled reports of the doings of state committees on public utility information. What was to be the answer of the electric light and power companies of the country to these accusations and insinuations? Was the industry to be damned by distorted publicity and remain dumb?

From the beginning to the end of the convention the answer to these questions was forthcoming. The National Electric Light Association, through its president, its public policy committee and its chief executives, spoke. The industry found its tongue and gave voice to its policy on public information. It announced from the housetops that it will use all proper channels for the diffusion of information concerning the electric light and power business. It accepted full responsibility, openly avowed, for its every word and act. It asked only that it be not condemned merely for speaking at all, or told that it has no right to defend itself in the press or to protest against false statements in the schools. It is willing that its own declarations be disregarded along with intemperate criticism leveled at it, and that it be judged alone by its proved accomplishments and indisputable acts. On these, it declared, public praise or condemnation must be based.

THIS was the note struck at the convention that rang above all others. But there were many more. In this issue of the Electrical World is printed the articulate evidence that the light and power industry is going forward rapidly and is setting still higher standards for all its activities. It is improving its service through the development of the art, the perfection of its organization and the expansion of its facilities. The announcement that it has contributed $3,000,000 to the National Research Council program shows how it cooperates in well-considered plans for public benefit. Many able addresses traced the evolution of industry and showed how the investment and holding company is a logical agency for the conduct of utility business which has for its ultimate object better and cheaper service.

In all the meetings there was evidence of intense interest in every possible method to make the electrical industry more efficient. The commercial men have made positive strides in their work. They have a national sales program, a national sales policy which calls for co-operation, a national selling platform which has tangible planks on credit, advertising and sales prices, and in addition a balance-sheet policy which measures costs and returns. The engineers are trying to get more efficiency in capital expenditures and are using more foresight in system building. The accountants are becoming executive aids, and the public relations committees are trying to carry out tangible projects which will develop a nation-wide conception of the advantages of electric service and give the public a knowledge of utility affairs. No one can read the record presented in this issue without getting to know an industry which is wide-awake, busy, progressive and alert to every opportunity to adapt itself better to national service; but one must have mingled with the eight thousand electrical men at Atlantic City to get the inspiration, enthusiasm and spiritual values that vitalize the light and power industry of today.

VIEWING the convention in perspective, tracing its growth and conduct, and weighing comments of those who attended it, lead to constructive suggestions for future meetings. The exhibits are found to be a vital part of the convention activities and have become a major objective for many attending. But the convention programs might well develop along lines which would provide more opportunity for utility leaders to tell the rank and file how they are building the industry and in what respects the rank and file can carry out their plans. This would give unity in industry thought and action. There was some comment to the effect that too many papers dealt in self-praise of the industry on the one hand and in fault-finding with the public on the other. It was also remarked that many addresses contained facts and enunciated principles that would be new to a public audience but were well known to utility men. Thus it might be well to devote somewhat less time to so-called publicity-value program material and more time to basic plans for utility progress of a type to instruct and interest the thousands of utility men who attend the meetings. Every year sees a better convention than the preceding one, however, and the lessons learned at this year's convention will afford opportunity to make an even better meeting next year. In the final analysis, the fifty-first convention will mark a milestone in utility progress because it recorded new conceptions of how to win public confidence and demonstrated beyond cavil that the utilities have courageous and far-sighted leaders.

## *Puget Sound Company Wins Coveted Coffin Award*

AWARD of the Coffin medal and prize to the Puget Sound Power & Light Company of Seattle may have surprised many, because the municipal plant of Seattle is being constantly held up to public gaze as a wonderful example of the efficiency of local government in the electric light and power business. However, the record discloses that the Puget Sound company, while it may not have basked in the limelight of publicity, has been busily at work along original lines and particularly active in the farming communities surrounding the metropolis of the Pacific Northwest.

Electricity on the farm is being talked of in many sections; but in the State of Washington it has been made more than a topic of conversation—it is, in fact, a reality. To be sure, conditions on the Pacific Coast are such as to call for much irrigation and pumping of water; but the electric light and power companies of that section have been quick to translate that need into opportunity for rural electrical development and prosperity, and in that respect they are to be congratulated.

Another development of which the Puget Sound company has a right to be proud and which other companies might emulate with profit is the range load which it has succeeded in connecting to its lines. Every heating load from the flatiron up is a sizable load, and although it may entail a low energy rate, if properly developed the range business will be found profitable to the utility and a source of satisfaction to the user. Stone & Webster and the local management at Seattle are to be felicitated on capturing this year the coveted Coffin award. It will, we are confident, spur the company to still greater endeavor and mayhap to the vanquishment of municipal operation in Seattle.

* * * *

## *Sanity in Competition*

TRUSTS and monopolies have been outlawed for more than thirty years by government as repugnant to the fundamental philosophy of a democratic civilization. Government sought to build a large number of industrial units each standing alone and in competition with all other units. Yet economic conditions have developed so rapidly that a rigid adherence to such a philosophy of business cannot be other than a destructive policy, and after much floundering about there is evidence that modern business can be co-operative and yet remain competitive.

This is the day of mass production and distribution. There is competition between groups of industries and between industries. Hand-to-mouth buying is here, as well as modern facilities in banking, communication and transportation. Under the old-time conception of business competition, wherein each individual competitor stands alone, without group credit, market information or data on his group business, he finds himself driven to destructive competition in order to exist. He must seek relief through co-operation. Relief is had by the organization of business groups which pool individual interests and develop a workable machinery for co-operation in competition under the impulse of economic necessities and the guidance of governmental agencies. These groups may be called trade associations, business institutes or other names new to industry, but all operate on the same basic principles.

General Lincoln C. Andrews recently stated these principles as follows: "To promote in the industry a mutual confidence and high standard of business ethics; to eliminate trade abuses; to promote sound economic business customs and practices; to foster wholesome competition; to provide, for individual efficient business management operating independently, an opportunity to do business with an adequate return, and thus generally to promote the service of the industry to the public welfare." If business adheres to these principles in the formation of the mechanisms to give co-operation in competition, there is no doubt of the results. The sea is yet uncharted, but the beacon lights are installed.

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## *Accused, but Not Guilty!*

WISDOM, vision and the courage to face a difficult and critical situation characterized the utility men who journeyed to Atlantic City this week. Each had local conceptions and methods of thought as a result of some lack of public understanding of the utility business and of recent tendencies in the relations of government to all business. The national business trend toward consolidation, the attempts to get the government into business, the Federal Trade Commission's investigation of the utilities—these united to bring to a climax agitation over public relations both local and national. Utility men came from far and near to counsel together, to offer suggestions, to get suggestions and to prepare plans. They were accused, but not guilty; they had a policy, but not a method, and they wished to guide their local and national business into channels that would bear them toward greater and better electric service.

The light and power industry has an educational problem and must analyze more carefully the thoughts and emotions of the men and women of America. In his address President Sands said: "I have an abiding faith in the integrity and the ability of the American public to deal fairly with our industry once it is possessed of the requisite information for the exercise of intelligent action and the formulation of sound judgment. If we, because of adverse criticism, indifference or for any reason whatsoever, fail to see to it that the public has such information, then we must not blame the public if at times it fails to accord us that measure of justice to which we feel we are entitled." This is the counsel of wisdom and courage.

The industry has learned that public confidence cannot be obtained by passing its public relations responsibilities over entirely to undirected publicity departments. It has learned that good-will advertising can degenerate into braggart advertising very readily. It has learned that organized national good-will efforts must be planned carefully lest they grow into agencies which serve as the permanent repositories of job-holding men without vision. It has learned that the public responds slowly to protestations of virtue and rapidly to proofs of service. The industry has shown the customary human traits of selfishness, inconsistency, egotism and pride of accomplishment and has learned wisdom through these mistakes of omission and commission. Fortunate indeed is the electrical industry that its inexperience in dealing with human values has not led it into serious errors and mazes without exits. At this critical stage of its development it has knowledge gained through experience.

"Public relations" is only a catch phrase to express the desire to have the public believe in electric service and in those responsible for giving electric service with the same degree of faith that has led men of the industry to devote their talents and money to rendering this service. It takes faith, confidence, loyalty and enthusiasm to make both good business and good public relations. In business, as in everyday human relations, it is the unobtrusive, friendly and sincere carrying out of an unselfish service program that makes for happiness as well as prosperity.

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## *Commercial Program Crystallized*

FROM the commercial point of view the year just closed has brought significant progress that should encourage and stimulate the men of the sales branch of the power industry. There has been cumulative evidence that commercial purpose is crystallizing in executive thinking. The need for market development has long been discussed in theory. It is now taking more definite shape in a demand for action and the more serious consideration of the need for a balanced program that will evaluate the sales possibilities and the economies of the different classes of load. It might be said that the industry has been for some time groping and fumbling for commercial purpose. Now comes a demand for action.

Attention is focused particularly on the inadequacy of the electrical equipment of the home. Manufacturers, jobbers, contractors and dealers as well as power companies have been coming together in their thinking around this issue. Out of it has come a new spirit of mutuality, a more active desire for a practical co-operation which has expressed itself concretely first in the reorganization of the directorate of the Society for Electrical Development as a council of the industry and second in the calling of the Industry Sales Conference, now at work on the formulation of a broad sales program for the development of the popular market for electric service. President Sands and Commercial Section Chairman Davidson have given generous support and leadership to this movement, and its progress will stand as one of the achievements of this administration.

Impulse has been given to another policy of far-reaching commercial importance. This is an honest and sympathetic effort to effect closer co-ordination between the national associations of the industry. A very practical benefit has also come through the intertrade conference initiated by the merchandise committee with Mr. Greenwood as chairman. Out of this have come the definitions of a set of merchandising principles and standards that have done much to heal the widening breach between the power industry and the retail trades that sell electrical home-load appliances. This is constructive work that should carry forward steadily.

Broadly, action is indicated in four directions: A closer co-ordination of the organized industry for the purpose of going forward with the selling job, a practical attempt to define and reconcile the merchandising policies of the different sales agencies in industry, a more serious consideration of the need for better organization in the industry for sales work, and the growing realization that accurate cost accounting is essential to intelligent market operations. On top of this comes increasing opinion that the electrical industry must invest more money in market development and exert a stronger pressure of advertising in the "new competition." This point was stressed by Chairman Davidson and James H. McGraw before the convention.

It would appear that the period of commercial hesitation is finally at an end. The coming year should bring even more definite purpose and more decisive action in commercial affairs.

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## *Substations Passing Out*

LOAD growth in the electrical industry keeps engineers and system planners keyed to a high pitch. In larger cities a density is found ranging from 3,000 kilowatts to 300,000 kilowatts per square mile, and this density keeps on creeping upward. A ten-year perspective on load growth gives a new conception of a metropolitan system; it modifies present layouts and makes radical changes necessary.

The substation seems to be an expensive and hazardous incumbrance on the metropolitan system of the future which uses alternating current. It has served its time in the system layout and must pass, because it is no longer needed as a functional device. Instead of the substation there will be unit generators, an alternating-current grid distribution system, multiple-transformer vaults underground and synchronizing at the grid. It is a simple and reliable system, because all faults clear themselves if small cables are used to tap the network, no large concentration of energy is had in generating stations, system stability is a maximum and service is also a maximum owing to the simple layout and multiplicity of supply points. When several generating stations are used, there is no problem of tie cables or of load and wattless control. The system becomes the old Edison grid system, which has proved to be the most reliable system of supply and lacks only the storage battery to be comparable to the best direct-current supply system.

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## *New Jersey Public Service, Its Chief and Its Future*

THE dinner celebrating the twenty-fifth anniversary of the Public Service Corporation of New Jersey was as much a tribute to its organizer and president, Thomas N. McCarter, as it was to the company. Few executives have been in harness as long or have contended with as many discouragements and disappointments. And yet obstacles apparently served to sharpen his aggressiveness and quicken his zeal; for out of it all Mr. McCarter rises triumphant, with a splendid vision for the future of his corporation and of his state that is almost dazzling in its scope.

Mr. McCarter was Attorney-General of New Jersey when he was chosen to form and head the Public Service Corporation. Eminent as a lawyer, he was nevertheless handicapped at first in a field which at the time was primarily engineering in character. That he developed with the business and adapted his viewpoint to the expanding activities of his organization meant much for the public and the industries of New Jersey. Nor was his enterprise overlooked; for New Jersey responded and co-operated, with the result that the Public Service Corporation has in recent years grown by leaps and bounds. To Mr. McCarter's leadership most of the credit for this is due, and in his present state of optimism and justifiable pride of accomplishment there is no task in aid of the further development of New Jersey to which the Public Service Corporation and Thomas N. McCarter in particular will not set heart and hand.

Preston S. Arkwright

*President Georgia Power Company*

# *Newly Elected President of the National Electric Light Association*

# Public Understanding the Keynote

Atlantic City convention notable success. Speakers dwell on social and economic aspects of utility service. Splendid business conditions reported. Exhibits attract thousands

MORE than eight thousand utility people and their friends met at Atlantic City on June 4 to 8 at the fifty-first convention of the National Electric Light Association. The meeting was another notable success in all respects—programs, exhibition, weather and attendance. It was a worthy addition to the great conventions held by the light and power industry in recent years, and the reports and addresses made at the meetings contributed greatly to its success.

Several major topics stood out as of primary interest at the meetings. The social and economic aspects of the utility business received great attention from the point of view of getting public understanding. The outstanding addresses of President H. T. Sands and other industry leaders were paired with notable addresses by leading bankers and industrialists. It was evident in these addresses that public understanding was a major problem to all business groups and that undivided executive attention was necessary to successful public relations.

An epoch of selling has been reached by the light and power industry, and many notable addresses and committee reports attested the fact that the industry is going to do its selling job. The entire program covered regulation, railroad electrification, finance, commercial aspects of utility business, engineering, accounting, public policy, insurance, employee relations and a host of other topics which show the complexity, magnitude and national influence of the companies embraced in the association.

The first meeting of the convention gave evidence of the high quality of the programs that followed. After a hearty welcome to Atlantic City by a local official President Sands delivered his address. He said that the industry had made consistent progress during the past year on such projects as research, interconnection, home service, economy in operations and rural electrification and that nothing indicated that the peak of development had been reached in the art or in the service rendered. He praised the work of the four national sections as being basic to industry progress and told of the good work done by the committees of the association.

A notable feature of his address dealt with the Federal Trade Commission's investigation. In logical and sane terms he dealt with the several aspects of the investigation and recorded his confidence in the integrity of the utility industry and in the ethics of its leaders. He presented the facts in regard to school relations, public utility information bureaus, financial expenditures and other matters which—by inference only in many cases—have been called propaganda activities. He asserted the need for public information and the obligation of the industry to furnish it. President Sands urged a sane perspective and expressed an unbounded faith in the industry, in its leaders and in the continuance of the public confidence it holds.

At this meeting Treasurer P. S. Young gave a report of N.E.L.A. finances and Chairman Howard K. Mohr reported good news concerning growth in membership in the association. Managing Director Paul S. Clapp, in an able address, recounted the developments in the industry, told of the work of the headquarters staff and gave a complete picture of the large number of activities in which the association is concerned. He asserted that the industry assumes responsibility for extending and improving electric service in America and at this time is making great progress in its efforts to bring electricity to the farms. He maintained that the size and prosperity of the industry made it a focal point of public opinion and that its work was the best evidence of the success with which it had carried out its responsibility for service.

*J. S. Wise, Jr., G. M. Gadsby, L. O. Ripley and R. H. Timmons*

In a ringing address J. F. Owens, chairman of the Public Relations National Section, dealt with the spiritual and service aspects of utility affairs. He declared that the signing of a contract was only half the service job and pointed out that all utility employees had an obligation to carry through to completion the broadest possible conception of service. He accented the need for telling the public about the utility business.

In an able paper A. W. Thompson, president of the United Gas Improvement Company, Philadelphia, presented the case of the investment company. He traced the economic growth of business, whereby it increased in complexity and size so that owner management was necessarily replaced by professional management and the pooling of finance and service resources. In his opinion the outstanding feature of the electrical industry was good management, and this intangible element had equal rank with the tangible assets of the industry. He then gave the well-understood basic values accruing to the use of holding-company operations in the utility business.

Radio and its importance as a load and as an operating facility was the topic of an able paper by H. P. Davis, chairman of board, National Broadcasting Company. He said that the advent of the alternating-current radio set makes possible a new and attractive load for utility lines and that radio broadcasting opened new approaches for utility executives to get public understanding.

A feature of this meeting was an announcement by R. F. Pack that a co-operative research project had been approved whereby $300,000 per year for ten years would be spent under N.E.L.A. auspices.

### As Others See Us

Addresses by Samuel M. Vauclain, president Baldwin Locomotive Works; Oswald W. Knauth, vice-president R. H. Macy & Company, and Henry G. Wells, president National Association of Railroad and Utilities Commissioners, were features of the Wednesday morning general session. From within the industry there were addresses by J. E. Davidson, chairman of the Commercial National Section, and Dr. Willis R. Whitney, General Electric Company, the first being a vigorous call to sales action and the second a general picture of how closely progress is tied up with scientific research. The rate research report by Edwin Gruhl had even more interest than in previous years because of its analysis of recent criticisms. Reports of the codes and standards committee by I. W. Day and the exhibition committee by E. W. Goldschmidt completed the program.

Mr. Vauclain, relating some history on which future prosperity will have to be built, announced that as far back as 1890 he specified individual electric drive throughout the Baldwin works. Despite this pioneering move, industry as a whole was only 4 per cent electrified ten years later. "Why do industrial plants continue to put in their own boilers and generating equipment when the total costs of power so developed will be from three to six times that of purchased power?" he asked. Mr. Vauclain expressed the opinion that it is folly to worry about displacement of common labor with machinery because we shall not have any common laborers, in the old sense, soon. He urged industries to listen to the suggestions of their younger men, convinced that their power of understanding is greater than that of the passing generation on account of increased facilities for education. The prophecy was made that all trunk-line railroads and 50-mile laterals on the Atlantic Coast from Boston to Washington will be electrified in the next ten years.

Mr. Knauth outlined several principles of good merchandising. These are affording varied but rapid selection, permitting returns within a reasonable period to maintain good will, adjusting sales force to periodic fluctuations in volume, and balancing turnover and selection. Difficulties imposed by utility merchandising methods were related. He expressed the opinion that utilities should leave merchandising to existing distribution channels and concentrate on expanding public consciousness of opportunities for using electric service.

Mr. Wells defended utilities against certain accusations but at the same time warned of impending trouble if certain practices are not avoided. For example, he said that the majority of the industry should exercise moral suasion on the minority to prevent bad practices. Utilities must assume the duties imposed by their privileges. Electric utilities have the right to be heard in newspapers, public schools and in Washington, he declared, the same as any industry when it is oppressed or misunderstood, but there must be no evasion or distortion of truth. Holding companies are justified, he declared, until they become mere stock-jobbing concerns that ignore the rights of subsidiaries and conceal profits. Considerable attention was given to what constitutes a fair basis for figuring returns and avoidance of delays in adjustments.

Mr. Gruhl contended that many criticisms of rates are so general or are based on such non-comparable circumstances that they cannot be answered. Furthermore, a failure to refute last year's analysis of rates implied ignorance or misrepresentation on the part of critics. He reported that analyses of the two recent criticisms of rates including "What Price Rates?" have been completed. Since 1926 there has been a reduction of nearly 3 per cent in the average domestic rates.

### Railroad Electrification Featured

On Wednesday afternoon a splendid program was presented which featured railroad electrification as one of the outstanding possibilities for further business growth. Britton I. Budd presented a report of the railroad electrification committee which contained complete statistical summary and digest of opinion as regards electrification in all parts of the world. Recent developments in this country pointed to a rapid increase in railway electrifications supplied from utility lines. President Lawrence A. Downs of the Illinois Central gave an excellent paper on this topic. He told of the reasons for and results of the Chicago electrification and predicted a big future for electrical operation. He urged greater standardization as a means to increase the growth and reduce costs.

John E. Edgerton, president of the National Association of Manufacturers, gave a fine talk on the relation of government and business. Politics, feeding on public indifference, was alleged to be largely responsible for bad trends in the relation of government to business, and he argued that no help could be had until this indifference had been dissipated. He observed that government had got into industry and business largely by invitation and that government takes advantage of industry group selfishness and quarreling.

Women are inquiring into government and into social and economic affairs, Miss Belle Sherwin, president of the National League of Women Voters, declared in a good address which outlined the methods used by the league to develop women's thoughts and acts on aspects of business.

*J. F. Owens*

*A. W. Thompson*

Newly elected vice-presidents of the National Electric Light Association

A feature of the meeting was the notable progress recorded in rural electrification during the year and an address by Clifford V. Gregory of the *Prairie Farmer* which discussed rural electrification from the farmer's point of view. He said that farmers were machinery-minded and desired electric service, and he outlined a method which he thought the best for doing work for rural electrification.

### Public Policy Meeting

On Wednesday evening the feature meeting of the convention was held. A large audience listened to masterly addresses by R. H. Ballard and Melvin A. Traylor, president First National Bank of Chicago; witnessed the Coffin award presentation to the Puget Sound Power & Light Company and was entertained by Richard Crooks, tenor, and B. A. Rolfe's orchestra.

R. H. Ballard, chairman of the public policy committee, gave an able address on public policy and presented the official statement of the National Electric Light Association about alleged propaganda and undue influence on schools and concerning other matters of public interest.

Mr. Ballard said the greater use of appliances in homes and increased efficiency in operation had made it possible for the industry to reduce rates to customers and yet improve service. He dealt at length with the Federal Trade Commission's investigation and showed how the utility industry had followed economic trends of today to better and cheaper service and had used every logical method to tell the public about its business. The industry rightly has taken steps to defend itself against attacks of a group whose every act indicates a lack of practical knowledge in business affairs and whose guiding thought is political rather than economic. Certain proposed governmental projects involving the power business and built upon unsound economic ideas were also combated by the men who had made a specialty of public service. The record of the industry in service and achievements was held out as proof of ability. Mr. Ballard said that a duty rested upon the industry to make its affairs known to the people and to advise them about matters of industry concern.

*S. Z. Mitchell, B. I. Budd and F. L. Dame*

The social and economic aspects of the utility industry were dwelt upon by Mr. Traylor, who made a summary of economic evolution in business, stated the needs of modern business and dealt with the social relations and obligations involved in the conduct of big affairs.

### Education and Water Power

On Thursday morning several papers dealing with education were presented. Dean C. O. Ruggles of the College of Commerce, Ohio State University, gave an outline of a survey under way to evaluate industry needs in man power and the ability of the schools to impart the necessary instruction. Deane W. Malott, assistant dean Harvard Graduate School of Business Administration, said business had become a professional occupation and that the professional business schools were needed. He said these schools must work closely and intimately with industry to get the best results.

At this meeting Paul A. Schoellkopf presented an excellent report on water-power development which was replete with statistical data and contained an admirable summary of industry ideas on this subject. Franklin T. Griffith strikingly discussed private business and government business relations and stressed the imperative need of private initiative and research in the utility business if advances in service are to be recorded.

It was taken for granted that the lamp committee report presented by Chairman Frank W. Smith would be another notable addition to the fine reports this committee has prepared in the past. The data on lamp production, lamp voltages and lamp sales and a discussion of the business aspects of the subject gave an encouraging aspect to the lamp situation. At this meeting also W. H. Onken, Jr., gave the N.E.L.A. prize awards committee report. The prize winners are recorded elsewhere in the issue. Mr. Onken reported that an unusually good list of papers had been submitted.

### Teamwork and Co-operation

On Thursday afternoon reports and addresses of much merit were presented. Fred R. Jenkins told of the notable accomplishments of the educational work with employees. W. W. Freeman gave an address devoted to the value of teamwork in utility progress. He pointed out the interrelations in the utility business, the possibilities for more and better service, the dependence of the utility industry upon other industries for prosperity, and gave in all a striking picture of what teamwork would accomplish.

Breadth of vision and a tangible conception of the need for and value of well-developed commerical aviation facilities characterized an able address by William P. MacCracken, Jr., Assistant Secretary of Commerce, Washington, on commercial aëronautics. Progress in this direction has been rapid in this country, but business in general has not supported commercial aëronautics sufficiently or realized the service it can render, he said. A development program should receive the hearty support of all business.

Labor's part in electrical development was the topic of an address by Hugh Frayne of the American Federation of Labor. American labor has done wonders to enhance its status through its own efforts and through its foresight in adapting its program to the evolutionary advances in modern science and industry, Mr. Frayne asserted. As never before, labor is using its head as well as its hands, and it seeks to use power, mechanical production methods and other developments so that economic benefits both to the country and for labor will result.

In a fine address Merle Thorpe, editor of the *Nation's Business,* dwelt on human and governmental relations in business. Paternalism is the American brand of socialism and is the real foe of our democratic institutions today, he declared. Paternalism breeds bureaucracy, and bureaucracy is a greater menace today than communism or autocracy. Paternalism now looks for new worlds to invade and has assumed two phases—alleged governmental service and government operation of business. The spearhead is leveled at the public utilities. Paternalism would produce and distribute power and light. It would manufacture and sell fertilizer. It would market the farmer's grain and hogs. It would operate the merchant marine. The electrical industry is today carrying its brunt of the attack. If the bureaucrats are successful, they will then turn their attention to the canners and bankers and steelmakers. The present attack on the utilities is a signpost marked "detour." It would take us down an uncharted road with uncertain destination, harassed by bureaucracy, denying us a continued higher standard of living and our destiny of economic freedom.

A thoughtful address on the evolution of business was delivered by John T. Madden, dean of the School of Commerce, New York University. He traced the growth toward consolidation and pointed out the economic pressures that have resulted in the use of investment companies as a means to conduct big business under present conditions.

The final meeting on Friday morning was marked by two addresses of much interest. Interconnection freed from "bunk" was the topic of George N. Tidd, president American Gas & Electric Company. He deplored much of the publicity given the non-essentials of interconnection and pointed to the need for telling the public in tangible terms how interconnection benefits service.

The other address was by James H. McGraw, president McGraw-Hill Publishing Company, Inc. Mr. McGraw discussed industry selling and stated that the major principles which should be applied were the quality of the product, its presentation and its price. In the modern business world, he said, competition between industry groups made it necessary to study selling problems as never before, and he urged the electric industry to take its proper position in the marketplace.

Constructive talks by Arthur Williams, chairman of the insurance committee, and John F. Gilchrist, who gave a very helpful address on electrical advertising, were added features of the final session.

### FOUR SECTIONS ACTIVE

On Tuesday afternoon the four national sections held their meetings, and each attracted a large and interested audience. The committee reports were all records of industry stability and progress, and addresses of high merit added to the value of the meetings.

At the Public Relations Section meeting Chairman J. F. Owens urged the necessity for all utility people to help in getting the public to understand the utility business. That his admonition is being put into tangible form was attested by the splendid series of reports presented at the meeting. Feature addresses were those of Clayton Rand, president Dixie Press, Gulfport, Miss., entitled "Thunder and Lighting," and Mrs. Anne Steese Richardson, *Woman's Home Companion,* entitled "Women's Place is in the Home." Both speakers dwelt on human values and with wisdom and humor gave inspiring suggestions which could be applied to public relations work.

### ACCOUNTANTS AID MANAGEMENT

To any one whose last glimpse of an N.E.L.A. Accounting Section meeting was ten to fifteen years ago the attendance at this year's session was a great surprise. The "Rose Room" of the Traymore, in which seats for approximately 300 were provided, was completely filled. Long technical committee reports have been discontinued, as in the other sections, by presenting serial reports throughout the year, and there is a trend toward bringing in viewpoints of other than utility accountants. One paper was presented by Charles B. Scott, president Bureau of Safety, Chicago, on "Insurance Costs." He emphasized the possibilities of economy by comparing losses and premiums, making structural changes and analyzing personnel according to risks. His paper is abstracted elsewhere in this issue.

An inspirational address was delivered by Earle W. Hodges of Henry L. Doherty & Company on "Common Sense and Dollars." A discussion on "Accounting Treatment of Securities Discount and Expense" was given by Prof. David Himmelblau of Northwestern University, and in it some rather unorthodox suggestions were made.

E. W. Lloyd, vice-president Commonwealth Edison Company, emphasized an outstanding problem for which accountants must find the solution if utilities are to continue stimulation of energy usage through merchandising and new-business activities and not be penalized for expenses which are not truly merchandising or commercial. He referred particularly to the disposition of expenses for promoting pioneer uses of electricity, such as electric heat applications and devices which have not received general public acceptance. Allocations of expenses for transportation, rent, advertising, servicing, etc., connected with merchandising and new business are also not equitable, he declared. His contention was that some expenses are not truly merchandising expenses and should be chargeable to electricity sales. A more complete report of his address is presented elsewhere.

E. A. Davis, Accounting Section chairman, in opening the session, pointed out that growth of business and government requirements have imposed a burden on accounting departments that has not been relieved by increased personnel. He urged greater dispatch in organizing committee activities each year, avoidance of let-up in activities around March, and organization and training of accounting personnel for promotion through succession.

*W. H. Onken, Jr., R. H. Ballard, Marshall Sampsell and M. J. Insull*

H. C. Hasbrouck pointed out that the N.E.L.A. classification of accounts has been adopted by 29 state commissions and is favored by four more. For next year he recommended co-operation with the Commercial Section on merchandise and jobbing accounts and standardization of interconnection agreements. B. F. McGuire reported great development in machine accounting that has simplified operations and reduced unit costs. J. E. Loiseau announced that two reports on corporate finance—investment surplus and mortgage provisions—had been submitted and reported that work had been started on the latest tendencies.

M. R. Scharff declared that excellent results on studies of fixed-capital accounting had been obtained by assigning different phases to geographic divisions and recommended studies of additions to leased companies, periodic audits, improvement budgets and joint-pole construction. E. J. Brett recommended discontinuance of the general records committee. W. G. Young referred to three serial reports on purchasing and storeroom accounts. R. G. Smith announced that the summary of 1927 statistics from more than 300 utilities are now available.

The engineers of the industry at their meeting dealt with the economic aspects of the utility business. They presented a planned program for research, for system building, for standardization and for expenditures whereby their new slogan of "More capacity per dollar of investment" would have a tangible result.

The work of the year was outlined briefly by E. C. Stone, chairman of the National Section, and the attendants then listened to three able addresses. Alex D. Bailey stressed the importance of engineering research in utility progress. He noted the research work done in this country by several organizations and in conclusion stressed the point that the N.E.L.A. itself should embark upon a research program if it hoped to achieve the best results quickly.

W. E. Mitchell, vice-president Georgia Power Company, addressed the Engineering Section session on Tuesday afternoon. His subject was "Spending Our Company's Money," but Mr. Mitchell confessed to the "hobby of making human beings out of engineers," stating that any one could tell you how to spend money.

The opportunities for advancement and the type of progressive engineering thinking conducive to successful activities in this field were pointed out by Mr. Mitchell. The problems of a broad engineering viewpoint involving the increase of industrial productivity through scientific developments and a sense of engineering costs were considered as essentials. Mr. Mitchell urged not only the development of young engineers for utility work in the "school of hard knocks," but also the development of the abilities of men already in the organization.

The field of management was that suggested by Mr. Mitchell as offering the greatest promise. He urged young engineers to "broaden your field, lift your eyes, prepare for opportunities, eat up all the responsibilities in sight."

Chairman Stone also spoke on engineering planning and dealt at length with the complete meaning of economy in system planning. The engineer has a responsibility second to none in the industry, he said, and must measure up to the new economic conditions faced by it.

*A group of electrical men, including P. S. Arkwright, W. A. Taylor and H. P. Liversidge*

The Commercial Section closed its year's work with the announcement of many fine achievements. Outstanding was the final approval by the public policy committee of the interstate agreement on appliance merchandising. This has been a splendid achievement by the merchandising committee under the leadership of E. R. Greenwood, resulting in the adoption of certain merchandising principles by the power industry and the various associations of retail dealers who sell electrical household appliances. The merchandising committee also announced that 159 central station companies have entered the one-more-kilowatt-hour-per-day contest.

S. N. Holliday of the General Outdoor Advertising Company pictured the waiting opportunity for the upbuilding of the sign load and declared a potential business of $200,000,000 a year in prospect. M. C. Huse reported for the wiring committee, outlining the plans for co-ordination with the coming program of the Industry Sales Conference and commenting on the state of code development. H. W. Derry presented the report of the power committee in the form of a chart talk picturing the field for further development of motor load. W. H. Sammis exhibited two reels of a moving picture of electric heat in industry.

*J. F. Owens, W. E. Mitchell, A. M. Perry and President H. T. Sands*

Starting with the reception to President and Mrs. Sands on Monday night and reaching a climax at the ball on Wednesday night, the social and entertainment features of the convention maintained the high standards of previous years. The ladies came to the meeting in large numbers, and dances, teas, trips, golfing and other pursuits afforded pleasure in ample amount. Dancing on the pier was the evening attraction of greatest drawing power.

### Exhibits Better Than Ever

Serious interest in the exhibits well repaid the manufacturers in presenting a splendid display of new appliances and apparatus. That progress in the industry still goes on apace became self-evident after viewing the material on display. Despite the mechanical nature of the equipment, year after year the show is being made more beautiful and artistic in appearance.

Manufacturers who exhibited did not show a mass of equipment but confined their display to new developments. There were 209 companies participating. This means that 53 per cent of the manufacturer members took part, and, because of the lack of available display space, a few were unable to obtain booths. There was a 7 per cent increase in exhibits, since in 1927 194 manufacturers took part. From 41 participating companies in 1908 to 209 in 1928 is the colossal achievement in a display which now includes the most modern electrical appliances and power-house and distribution equipment.

# President Sands' Address

Work of the year discussed
Discussion of Federal Trade Commission investigation
Comments on committee activities

H. T. Sands

THE past year has witnessed a continuation of that consistent progress which has been the record of our industry from its inception. Intensive research conducted by our engineers is continually bringing to light new methods and economies in the production and use of electrical energy. Turbines with capacities and efficiencies hitherto unknown have been displaced by those of still greater capacity and efficiency.

High-voltage transmission and interconnection have gone on apace, bringing to the smaller communities electric service of the same character furnished to the large cities. There is a distinct trend toward decentralization of industry, due to the ability of smaller communities to offer to industry dependable electric service at reasonab'e cost. The home has been made a much more livable institution and the burden of the housewife greatly lightened through the introduction of the many domestic appliances which have demonstrated their worth. During the year 1927 one and one-quarter million homes were furnished with electric service for the first time.

Electric service on the farm has become a practical reality. Some four hundred thousand farms are now receiving electric light and power company service, and the farmer and his family are enjoying a standard of living and comfort hitherto unknown through the many profitable applications of electricity to farm homes and farm work. Mass production has reduced the cost of generation and the public has received benefits therefrom. Today electric service is being furnished over wider areas and at a lower cost per unit to the consumer than ever before.

Our service touches intimately the industrial and social life of the entire country and affects both the comfort and the economic welfare of every individual in the nation. This imposes on the industry an obligation of service of which it is keenly conscious and which it is anxious to discharge to the utmost of its ability. What the future may bring no one can foretell; but the record of the past justifies the belief that in the development of the art we have by no means reached the peak—that new inventions and discoveries will make possible a still more extended use of electric service and at a lowered cost to the consumer. As in the past, each step in future development will bring with it its own peculiar problems. The industry faces the future confident of its ability to solve these problems as they arise in the interests of all concerned and to continue to render to the public a good account of its stewardship.

As in past years, the major portion of the activities of the association during the present administrative year have been conducted through the several committees of the four national sections — Accounting, Commercial, Engineering and Public Relations. The interim reports published during the year and those to be presented to the convention by the chairmen of these four national sections present a fairly complete picture of the year's accomplishments. It is my purpose, therefore, to consider only some of the outstanding activities undertaken by these national sections, to touch briefly on some phases of the work of some of the other national committees and make some observations in respect of some present-day matters that I deem should receive the careful consideration of the members of the association.

## *Accounting National Section*

IN CARRYING on the work of its several committees, the Accounting National Section has placed added emphasis on the importance of geographic committee organization, co-ordinated with the committee organization of the national section. Much attention has been given to the public relations aspect of the work of the accountants in our industry and to the importance of the accountant viewing the conduct of his departmental activities in the light of its effect not only on the accuracy of the companies' records but also on the companies' relations with the public.

The section has also had clearly in mind the desirability of the trained accountant executive, believing that more and more the industry will require executives with a thorough groundwork of accounting experience.

This objective brings to the work of the several committees a wider perspective and to the accountants in our industry a broader outlook. The accounting department is the compass by which the managing executive establishes his position and determines the future course to be followed.

## Commercial National Section

AT THE request of the executive committee of the Commercial National Section, and with the approval of the national executive committee and the public policy committee, a commercial director has been engaged and is now attached to the headquarters staff. The association is particularly fortunate in having secured for this position C. E. Greenwood, for many years in charge of the commercial department of the Edison Electric Illuminating Company of Boston. Mr. Greenwood brings to this office a long experience in the commercial activities of the association and is particularly qualified to fill this most important position.

Another new activity undertaken under the auspices of this section resulted in the establishment of a service in home economics available to colleges and teachers. Miss Eloise Davison, professor of home economics in Iowa State College, has been engaged for this work. Her services are available to colleges and universities throughout the country. The requests already made upon the association for these services demonstrate the worth of this new activity.

In building for better and more aggressive merchandising practices, the section has stressed the importance of having high-grade executives at the head of the commercial departments of the operating companies—executives who will measure up to the sales executive in other lines of business.

Under the auspices of the merchandising committee several meetings have been held with representatives of other lines of business engaged in the sale of electrical appliances. Out of these conferences has come a realization of mutual interest and a better understanding of one another's problems. A set of merchandising principles has been drawn up and subscribed to by the various interests represented in these conferences.

## Engineering National Section

THE Engineering National Section adopted as one of its major aims in this year's work "more system capacity per dollar of investment." To this end the section has effectively co-operated with manufacturers of apparatus and equipment for more extensive standardization. Much work has been done and excellent results have been accomplished in co-ordinating the research work carried on by the several branches of the electrical industry.

The accident prevention committee, in collaboration with committees of the American Gas Association, American National Red Cross, American Telephone & Telegraph Company, Bethlehem Steel Corporation, United States Army and Navy, United States Bureau of Mines, United States Bureau of Standards and United States Public Health Service, has prepared and published a "Manual for First Aid and Resuscitation" for use by employees in case of electric shock, asphyxiation or drowning. This manual should be in the hands of every employee.

I wish to speak in particular of the excellent and constructive work which continues to be done by the inductive co-ordination committee. I question if the importance of this work is fully appreciated. In spite of the increased inductive influence from new high-voltage construction and larger loads on distribution feeders and the increased sensitivity of communication circuits, expansion in facilities has taken place with a minimum of conflict with those in charge of communication interests.

This development has taken place on the basis of engineering treatment, without the enormous burden of expense that might have been entailed in legal disputes. It represents a co-operative effort in American business of the highest order.

## Public Relations National Section

PURSUANT to resolution adopted by the executive committee of the Public Relations Section of the preceding year, the section has undertaken a survey of public utility education in the colleges and universities. The object of this survey is to determine:

1. The extent to which there is a study of public utilities in college and university courses.
2. The character and extent of the industry's demand for college-trained personnel.
3. The character of the opportunities open to college-trained personnel in the industry.
4. The willingness and ability of the industry to co-operate with colleges and universities.

For this most important work the association secured a man eminently qualified by training and experience to conduct the survey, Professor C. O. Ruggles, dean of the College of Commerce and Administration of Ohio State University, who was granted a year's leave of absence to undertake this survey. The details of the survey will be presented to you by Dean Ruggles at one of the sessions of this convention. Let me say, however, that in my judgment this is one of the most important activities ever undertaken by this association, and in its conduct we have had the most hearty, whole-souled co-operation from the colleges and universities of this country.

The need of continuous public information as to the fundamentals of our industry is becoming increasingly apparent. There is no better medium for presenting this information to the public than the local newspaper, interested as it is in the local community and all that pertains to its advancement. With this thought in mind there was prepared under the direction of this section an advertising copy service which has furnished to the member companies suggested copy for publicity matter to be published in the local newspapers. That this service has been worth while is evidenced by the extent of its use and commendations of the character of the copy.

## Committee on Civic Development

THE prosperity of any community and of the electric light and power company serving it go hand in hand. There is a mutual dependence which this industry clearly recognizes. Community growth and development is dependent upon the ability of its utilities to keep abreast of community expansion, and, conversely, the growth of any utility is measured by the development of the community it serves. Realizing this mutual interest, there was organized a new committee, the civic development committee. Its purpose is to interest our member companies in co-operating with every interest working for community development. Of necessity the work this year has been largely that of organization and survey.

In co-operation with the Metropolitan Life Insurance Company a conference on the migration of industry was held which was largely attended by business executives from every section of the country. We believe the work of this committee will be one of major importance to the country and to the industry.

## *Insurance Committee*

PRIOR to the present administrative year the insurance committee had concerned itself largely with the question of rates for various classes of insurance carried by our member companies. This committee by presenting to insurance companies an accurate summary of insurance experiences has obtained substantial reductions in rates for fire and casualty insurance. The committee is to be commended for its efforts and accomplishments. In these accomplishments your insurance committee and the representatives of the insurance companies have worked harmoniously.

There are, however, other points of mutual interest. Both interests are concerned with the formulation of all rules and requirements pertaining to the installation of electric wiring and equipment. The insurance companies of this country are large investors in the securities of this industry, and there often arise questions involving matters of policy. In view of these mutual interests the scope of the insurance committee has been broadened and its personnel has been enlarged to include not only insurance technicians but executives who can meet with the executives of the insurance companies to discuss matters of policy whenever occasion requires. Arthur Williams, past-president of the association, has undertaken the important work of chairman of this committee.

## *Geographic Divisions*

YOUR president has attended the conventions of every geographic division, with the exception of the Canadian Division. It is a great pleasure to be able to report to you that the work undertaken a few years ago of organizing the geographic divisions is bearing fruit and that these divisions are now functioning effectively and rendering a valuable service to their member companies.

The several committees of these geographic divisions are, in so far as local conditions warrant, co-ordinating their work with that of the similar committees of the national association. These committees have a comprehensive grasp of the character of the work to be done and of the methods to be adopted in its accomplishment.

## *Rural Service Committee*

THE rural service committee has directed its activities toward assembling, digesting and publishing the results of the experiments which have been carried on for several years through the farm experimental lines established in various sections of the country. Out of the work of this committee has come a growing appreciation on the part of the farmer of the desire of our industry to co-operate with him in solving this very real problem of farm electrification and a better understanding of what is involved in the extension of electricity to the farm.

The work of this committee has developed slowly but surely. We have endeavored to make certain in what way electric service can be used with profit to the farmer and to avoid saddling upon the farmer electric equipment poorly adapted to his needs. This means time, but it will, I believe, prove to be time well spent.

In co-operation with the local utility, arrangements have been completed for the establishment in the State of Maryland of a permanent national exhibit of farm electrification. This exhibit will display every known adaptation of electricity to farm work and, being situated near the nation's capital, which is visited yearly by thousands of people from all sections of the country, will, we hope, prove a national attraction.

## *Exhibition Committee*

THE work of the exhibition committee speaks for itself. A visit to the splendid exhibit on the pier adjoining this auditorium is a most liberal education to all concerned in the electrical industry. No one can afford to leave this convention without a thorough inspection of this exhibit. The association wishes to express its appreciation of the splendid co-operation of this committee in carrying out the many difficult details connected with this exhibit.

## *Society for Electrical Development*

DURING the year the Society for Electrical Development has been completely reorganized, and it now constitutes an effective medium for carrying out the work which its name implies, electrical development. As now organized, the four major branches of the industry—the manufacturer, jobber, contractor-dealer and the electric light and power companies—all have equal representation on its board of directors. Under the auspices of the society an industry sales conference has been organized and is now engaged in the preparation of a plan for intensive development of residential business.

Your association has whole-heartedly co-operated in this reorganization. W. W. Freeman, president of the society, is to tell the convention of the society's work and plans.

## *Federal Trade Investigation*

ONE of the outstanding events of this year has been, and still is, the investigation being conducted by the Federal Trade Commission. Before it commenced spokesmen for the industry said over and over again that there was nothing to fear from an honest inquiry and that there could be no objection to it. That still remains our attitude. We want it to be most searching and complete. We are anxious that the true facts be given to the public, that the people of the country may see and understand the make-up and habits of the organizations that furnish them the light for their homes and the power for their factories.

The National Electric Light Association, the Joint Committee of National Utility Associations and every organization representing the utilities, whether national or local, have thrown open to the commission everything in their possession. Minute books, account books, receipts and expenditures, vouchers, correspondence—in fact, every scrap of paper—have been made available for scrutiny. Every publication issued, every address delivered, every news release made, has been made available for examination by commission representatives. More than 2,500 separate exhibits have already been introduced and made part of the record, and accumulation still goes on.

It is easy to get a false impression of the investigation and of the manner in which it is being conducted. As we read daily in certain newspapers distorted versions with startling headlines and see prominently displayed photographs of letters and checks, we get an idea of sensationalism and perhaps visualize the hearings as exciting scenes. In fact, they are nothing of the kind. They are conducted quietly and peaceably. The atmosphere is that of a court room and the proceedings consist largely of the routine identification and orderly introduction of documents. That is the way in which the record is being made upon which the commission will finally base its findings and recommendations. The record gives the true story of what happens and it can be found nowhere else. That story is quite different from the narratives with which we are daily regaled in some of the daily newspapers.

### The School-Book Situation

Let us consider, for instance, the school-book situation. Under the direction of the state committees of public utility information, pamphlets dealing with electric light and power, gas, telephones and street railways have been published and furnished for use in the public schools. From some of the newspaper accounts, one would think that the utilities, in some mysterious manner, have forced innocent school officials to compel their students to learn falsehoods from textbooks composed of propaganda, or else that there has been a conspiracy between utility companies and school teachers to pervert the youthful mind.

It is an insult to American intelligence to believe that the utility companies would ever undertake such a plan, or that the thousands of earnest, hard-working school teachers throughout the land would allow it to be carried out if attempted. The men and women who teach the youth of our country must resent this imputation on their intelligence and their integrity. The American people will not believe that they are either fools or scoundrels. I do not speak on their behalf, but as to the utilities, I say that if they had ever undertaken any scheme to corrupt instruction, the individuals who were guilty of it could not be too strongly condemned and would already find themselves beyond the pale of good utility society. Of course, the answer is that no such thing has ever happened, or could conceivably happen. The very record before the Federal Trade Commission shows that it did not.

It is true that the utilities have furnished material for the use of teachers in the schools. They have done so openly, frankly asserting authorship and gladly assuming responsibility. No teacher has ever received copies for such use unless, after reading a sample, he or his school superiors have decided that it was useful to him and his students and asked that it be furnished. For several years the utilities have been giving this assistance to teachers. It is a public service known to everybody with school connections. It has been welcomed and appreciated, as thousands of letters of thanks testify. It remains for a certain type of press to discover and declare an evil in it.

What is the material that has caused all this disturbance? Is it a discussion of the theories of government, of private against government or municipal operation, or of any other controversial subject? Not at all. It tells about inventions, and turbines, and transformers, and transmission lines and ohms and amperes and kilowatts and the other things that go to make modern electric service possible. If I were stirred to any emotion at all by such matter, I might sympathize with the school child who has to put in his time studying it; but I would not worry about the effect on his political or economic opinions.

The pamphlets are almost pure statements of undisputed facts. It was intended that they should be so. As stated by one of our able executives, in testifying before the commission on this subject, the school pamphlets "are as strictly informative as it is possible to make them with the intelligence that God gives." That was the purpose. That was the way they were written and the way they still appear as introduced by the commission itself in the record.

Perhaps the best proof of the excellent character of these pamphlets, of their unbiased presentation of the subjects, is the fact that adverse critics have been able to discover practically nothing with which to find fault. Out of the scores of pamphlets introduced in evidence, only one paragraph from one copy from one state, not found in any of the others, has been held up to public gaze as an improper statement.

It is important, as these hearings proceed from day to day, that we keep a proper sense of perspective. Let us not magnify a detail until it absorbs the foreground. It is the completed portrait that will count.

### Human Frailty Exists

Human frailty exists in our industry as in all others. In an investigation like this, involving every act during the life of thousands of companies, hundreds of thousands of separate transactions, sales and purchases of properties, and manifold issues of stocks and bonds—business arrangements carried on by a multitude of individuals for the last quarter century—it would be miraculous if there should not be found some instances of bad judgment, of the influence of greed, even perhaps of actual wrongdoing. Such instances, if any be found, will, I am certain, represent a very minute percentage of the transactions under investigation.

None of us has yet attained perfection, and, besides, a transaction scrutinized with the hindsight of today may have quite a different aspect from that which appears when viewed in the light of the facts and circumstances surrounding its origin. Each association, each company, each individual must take responsibility for its or his own acts, receiving the credit or the blame that the record brings. Every tub must stand on its own bottom. Blame, if cause be found for any, should be placed where it belongs. The entire industry should not be condemned because of the misdeeds of a few, if any. The public utilities today are in the vanguard of American business. They are proud of accomplishments of the past; they do not fear the proceedings of the present; they are confidently carrying on their plans for the future.

Of late there has been some public criticism of the activities of the association. Such criticism discloses a gross lack of understanding of the character of the activities criticised. In the past few weeks certain portions of the public press have carried statements to the effect that the annual budget of the association, amounting to approximately $1,444,000, has been expended wholly for the purposes of propaganda and that this expenditure constitutes a burden on the consumer of electric service which he should not be asked to bear. There is nothing in the record or in the facts to bear out this statement. Such a statement completely ignores the many other activities of the association, all of which are maintained in the interest of good public service and, because of the co-operative character of your association, are carried on at a most reasonable cost to the industry.

The total annual cost of carrying on all of the activities of the association, including the refunds to the geographic divisions, amounts to approximately sixteen one-thousandths of a mill per kilowatt-hour sold to the public, or between four and five cents per customer per year. The amount which the association expends annually for the work of public information, which has been termed "propaganda," does not exceed $50,000—less than one-third the amount we are expending alone in the furthering of the extension of electric service to the farms of this country. The so-called "burden" laid upon the consumer annually can be reckoned only in fractions of a cent.

In particular, criticism has been directed to our work with educational institutions. In some instances it has been charged, referring to our co-operation with colleges and universities, that we are endeavoring to subsidize these institutions and use them as mouthpieces for the industry. Nothing could be further from the truth than this charge. We have been co-operating with educational institutions. We are now co-operating with them, and I hope shall continue to do so so long as these institutions desire our co-operation.

The purpose of this co-operation is to ascertain the material needed by these institutions to enable them to conduct their courses in public utilities on the bases of fact as applied to present-day practice and, once we have ascertained the material needed, to render such assistance as we may be able in placing such material in their hands, to be used, however, at their discretion. In no instance has the association endeavored in the slightest degree to coerce, to subsidize or to direct in any way the conduct of these institutions.

The time has long since passed when the purpose of a collegiate education was to fit men and women for the so-called professional careers alone. Today business is regarded as one of the greatest and most important of the professions, and out of the conduct of business as constituted today has come a new profession, the profession of management. It is of the utmost importance to every interest in this nation that our young men and women leaving our colleges to enter the field of public utility business shall be thoroughly grounded in the economics of that business.

No industry has a greater concern than ours in the integrity of our educational institutions. The charge is laid at our door that we are "propagandists," the purpose of this charge being evidently to discredit the work of public information. In so far as a propagandist is one who disseminates information based on fact, we plead guilty with pride. No matter how severe or how bitter the criticism, we must not relax our efforts to acquaint the public with every phase of our industry. We cannot do otherwise if we are to keep faith with the public and adequately discharge our service obligation.

I have an abiding faith in the integrity and the ability of the American public to deal fairly with our industry once it is possessed of the requisite information for the exercise of intelligent action and the formulation of sound judgment. If we, because of adverse criticism, indifference, or for any reason whatsoever, fail to see to it that the public has such information, then we must not blame the public if at times it fails to accord to us that measure of justice to which we feel we are entitled.

This industry is justly proud of its record. The high standard of living which has been attained in this country, higher than that enjoyed in any other country, would have been impossible without electric service. The men and women engaged in the industry are deeply conscious of their duty as public servants and are earnestly and conscientiously striving to discharge that duty. They are proud of its accomplishments, but their pride is measured not in dollars gained but in service rendered.

## *Suggested* MERCHANDISING STANDARDS*

*1. The general sale of electric devices at margins commensurate with the cost of selling is the only sound merchandise practice and is conducive to constructive building in the appliance merchandising field.*

*2. When combination sales are advisable, adequate margins should govern selling prices. Only the "true value" of articles should be stated in the advertising.*

*3. Deferred payments in connection with the sale of all merchandise are universal practice and are accepted by sound financial authority and favored by the public. A period not exceeding eighteen months is recommended as a maximum time allowance for load-building devices in the pioneering stage, and a period not exceeding fifteen months for financing motor-driven devices having general public acceptance. Relatively shorter terms, on a self-supporting basis, should be extended on items selling for less than $25. A carrying charge for financing service should be made in all cases and an initial payment be required large enough to constitute a sale.*

*4. The power company is in the merchandising business for the promotion of devices which constitute a medium of electric service. There are kindred lines of merchandise which are naturally used in conjunction with the appliance, but we suggest that it is not desirable for the merchandising department of the power company to engage generally in the direct sale of non-electric devices.*

*5. We recommend an adequate classification of merchandising accounts by the National Electric Light Association.*

*From report of general merchandise committee.

# Industry Public Policy*

### Rate reductions outstanding achievement. Economic trends and public reactions. Government and the utility business

By R. H. Ballard
*Chairman Public Policy Committee*

*R. H. Ballard*

ONE year ago in this city the National Electric Light Association held its fiftieth convention. As is customary when we pass one of the major milestones, our thoughts turned back to the early days of this industry which has contributed so much to our country's prosperity—to the earnest men who, in the face of every conceivable discouragement, persisted in their studies of the newly discovered force; to the progress of the new art, halting at first but gradually gaining momentum until every corner of the civilized world now pulsates with this invisible energy.

On such occasions we are prone to feel that our work has been good. It is not easily apparent where further progress can be made, yet in the year that has passed since the last meeting great things have been accomplished. In many respects it has been one of the most notable years in our history. In financial matters the stability of the industry has been evident in the widespread market for its securities to the point where they are held in ownership by millions of people. Technical progress of a remarkable character is shown in the constantly increasing efficiencies of our generating plants and transmission and distribution systems.

## Rate Reduction Outstanding

By intensive work in our commercial departments electrical appliances have been introduced into homes and factories in greater number than ever before. Not only does this mean greater comfort and convenience to the housewife and the artisan, but this larger market for our product, coupled with the increased efficiencies effected, has enabled us to make substantial reductions in our rates. In fact, rate reduction with continuous improvement of service is probably the outstanding achievement of the past year.

In the face of these constructive accomplishments, of which the buying public is the greatest beneficiary, the electrical industry has been subjected to a campaign of unfair publicity. Any investigation of the electrical industry which considers more than minor details will disclose that it has been developing along natural economic lines; that when unjustly attacked it has defended itself and has sought a fair hearing at the court of public opinion. The phraseology used by its critics is different, but when their remarks are carefully analyzed these are the things of which they complain: Ignoring the possibility that the same economic conditions which have brought about the chain store, the chain bank and the chain newspaper might also account for the chain utility, they have directed criticism against concentrated ownership and management, but only as applied to public utilities.

In the April issue of the *North American Review* there was a splendid article, entitled "Newspaper Mass Production," written by Roy W. Howard, the directing genius of a nation-wide chain of newspapers. In this article he argues that group production of newspapers is a sound practice in accord with present economic tendencies, by virtue of which the ultimate consumer is distinctly benefited. As the following quotations from Mr. Howard's article are read, it is suggested that the expression "public utility" or "electric power" be substituted for the words "newspaper" or "journalism" as they appear:

"The task of producing daily newspapers successfully is today a most complex operation, involving the superimposing of professional efforts upon a solid business foundation."

"Mere magnitude in an enterprise suffices to terrify a certain type of mind."

"'Chain journalism,' as its critics prefer to designate it, is nothing more than the editing and operation of a group of newspapers in different cities by a single corporation or a group of corporations, with a centralized control."

"Chain newspaper operation needs no apology. Newspapers in the long run, almost without exception, succeed or fail according to their ability to serve the public interests of their community. What is true of a single newspaper is equally true of a group. That chain operation makes for financial stability even critics of the system will admit."

"A frequent objection to chain ownership is that it results in standardization. After all, the answer to this indictment is to be found in whether the standardization produces a better product for a larger number of people."

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**Address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

"Production of a daily newspaper of today has become a complex job—the work of highly skilled experts. Chain operation enables the mobilization of this high-priced talent at a minimum cost to each unit of the chain."

"The public has no desire to see this country governed by its newspapers any more than it desires to see it governed by partisan political bosses."

Your public policy committee submits that Mr. Howard's article is a clean-cut statement explaining why no American enterprise, newspaper or public utility, if it is to meet its obligations of adequate service to the public, can afford to ignore the natural economic trend.

That the electrical industry has taken steps to defend itself against the unwarranted attacks of a group whose every act indicates a lack of practical knowledge in business affairs is but natural. Theorists of this type have advanced unsound ideas from the day of our independence. They would remove from the electrical industry all of those men who have established its present sound position and in their stead substitute men whose guiding thought is political rather than economic.

### GOVERNMENT IN BUSINESS

When the leaders of the electrical industry, serving 95 per cent of the country's electrical output under private enterprise, take legitimate steps to inform the public of the unsoundness of these proposals, the cry of "meddling" is raised. Government in business professing opposition to the general application of government operation of the entire electrical industry, there are some who advocate that certain large projects should be governmentally operated. Under the false argument of establishing tests of performance, they would substitute government competition for regulation; they would compromise with vital principles underlying the nation's progress and would substitute the views of a small group in public or private life for those of the vast majority of the people who believe in private initiative and enterprise. Those responsible in public life for the local regulation of utilities are satisfied that the states are competent to regulate their own utilities and that there is no general demand for the federal government to enter this field.

In the far West it is proposed to build a gigantic power dam for the avowed purposes of flood control, reclamation and domestic water supply, although, in fact, these latter services would be jeopardized and delayed by their inclusion in an uneconomic power development program. In the South it is proposed to enlarge a scheme of government ownership and operation, in the hope that the greater enterprise may prove successful, although the lesser project has so far been an economic failure. In these regions are men who have spent decades in the study of local power needs and have carried out engineering enterprises to meet these needs. By the very nature of things these are the men who are best informed to advise the public regarding further power development, but when these experienced men attempt to speak they are met by criticism, coming from advisers of the people of the same type that heckled the founders of the Republic.

With the obligation of public service goes the responsibility of using due diligence in the development and the protection of our business and to conduct its operations fairly and efficiently. This we have endeavored to do.

Every business has certain facts with reference to it known best to those actually engaged in it. Time and experience have established these facts almost like the laws of the Medes and Persians. Those not experienced in a business are as likely as not to obtain somewhat distorted ideas concerning it. Indeed, it is not unusual to find people presuming to know more about the electric light and power business, for example, than the men who have spent their lives in it. It would seem, therefore, that this industry is not only well within its rights in presenting facts concerning itself to editors, educators, and to the public, but that it is in duty bound to do so.

The schools of the country are shaping the thought of the oncoming generation with reference to all business, economic and social matters, and it is important that they should have the facts. The electric development of this past decade has brought great economic and social changes, and your industry has been active in making available to the properly constituted authorities of the schools the facts concerning its development. What better source have the schools for obtaining information on the electric light and power industry than from those engaged in its development? Do men consult a lawyer when they are sick or a physician when they are in need of legal advice?

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## *Principles for* MERCHANDISING*

*1. All discussions of the problems of the relations of light and power companies and dealers selling electrical appliances must be based upon proper and adequate service to the ultimate consumer.*

*2. There should be a segregation of the accounting of the merchandising departments of power companies from their public utility functions, and all items of expense incurred in the merchandising of appliances should be charged to the merchandising activities of the companies concerned.*

*3. It is recognized, however, that expenses incurred in the pioneering of appliances which have not yet met with sufficient public acceptance to be merchandise items in the stocks of local progressive dealers, and general advertising for the development of the market for appliance service, should properly be charged to the promotion accounts of the utilities and not charged to merchandising.*

*4. This conference recommends to power companies and independent dealers the necessity of constructive co-operation in their local fields for the better development of the electrical appliance business.*

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*From report of general merchandise committee.

# Statements to thi

## *from the N.E.L.A. Convention*

I HAVE an abiding faith in the integrity and the ability of the American public to deal fairly with our industry once it is possessed of the requisite information for the exercise of intelligent action and the formulation of sound judgment.

[*H. T. Sands*]

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THERE is a force within this country mightier than your multiplied motors, dams or power stations, and that is the united heartbeat of the American people, and much as the orator would sweep his audience or the evangel move the erring, get your spiritual batteries charged and play upon the ideals and emotions of our people.

[*Clayton Rand*]

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I FIRMLY believe that the electric industry will continue to be characterized by policies of fairness, open publicity and frankness, co-operation with public authorities, and above all by scrupulously living up to all the implications of its position as a public service industry, perfecting its machinery for self-regulation and control from within.

[*Melvin A. Traylor*]

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NO AMERICAN enterprise, newspaper, or public utility, if it is to meet its obligation of adequate service to the public, can afford to ignore the natural economic trend.

[*R. H. Ballard*]

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THE first plank in the platform of good public relations is good service.

[*E. C. Stone*]

IN 1927 a total of 246 utility companies in the United States sold directly to consumers 3,581,206 shares of stock having a par value of $263,527,269. The 1,681,768 customer-ownership stockholders have invested $1,600,000,000 in utility securities.

[*Philip G. Gossler*]

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WE ARE just entering an epoch of development of the industry which demands the sale of more energy, and the company whose executive backs up his sales manager, not only with money, but with intelligent teamwork, will reap the harvest of more energy sales in full measure.

[*E. W. Lloyd*]

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ALMOST daily we have brought to our attention examples of what wonders interconnection is doing in the way of improvement of service, and almost daily we are missing opportunities to tell our customers—to tell the people of the communities in which we operate—to tell the nation what we are accomplishing by interconnection, of what interconnection is doing, of the fundamental thing that we are striving for in interconnecting.

[*George N. Tidd*]

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WE BELIEVE that the cause of public service in its broadest aspect can be best served and the development of the industry promoted by giving full play to inventive ingenuity, to constructive financing and to sane and logical extension of the service we give. We believe these activities would be stifled under political ownership and management.

[*Franklin T. Griffith*]

# nk About

LET us take as our common objective the promotion of knowledge and integrity in the art of industry and in the upbuilding of manufacture and trade.

[*Deane W. Malott*]

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THERE is no way to cope successfully with organized error except with organized truth. Only a renascence of patriotic interest in government on the part of the better-informed and more responsible elements of society can accomplish needed reforms.

[*John E. Edgerton*]

⁂

IF YOU are desirous of hastening the utilization of electricity in the solution of railroad problems, there is scarcely any service you can render of greater importance than that which looks toward the development and standardization of the art of producing electrical energy and its application to steam-railroad operation.

[*L. A. Downs*]

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ELECTRIC utilities are essential to public wellbeing and are necessary to national welfare and national progress. The regulatory bodies and the public at large must not only seek protection against exploitation or oppression on the part of public service corporations, but must also seek for that attitude which will continue to foster private initiative and efficiency, to stimulate improved methods and increased effectiveness, to preserve superior facilities for the business man and the worker, to improve the standard of living for the American home. These ends will be attained not by litigation, not by regulation, but by intelligent and wholehearted co-operation of all concerned.

[*Henry G. Wells*]

I COME to the conclusion that your system of selling is incompatible with the best merchandising practice. It may be effective for the small store in the small town. But it conflicts fundamentally with the necessities of large-scale, economical and efficient merchandising practice, and a more effective way out must be found.

[*Oswald W. Knauth*]

⁂

THE farmer of today is machinery-minded and is thoroughly sold on the value of electricity. The farms of America offer to the public service companies a great undeveloped field for expansion, a field that is ready and impatiently waiting for that expansion.

[*Clifford V. Gregory*]

⁂

OF THE seventeen million wired homes in the United States, at least ten million are so incompletely wired as to preclude the possibility of extensive use of electricity in removing the drudgery from household tasks.

[*M. C. Huse*]

⁂

THE function of the investment or holding company is getting more and more to be that of adviser, and the authority to manage and operate is being more and more localized in the local officers of the company.

[*A. W. Thompson*]

⁂

SEVENTY-FIVE per cent of American industry is electrified. Power has wrought an increase in the value of products per wage earner from $1,000 in 1850 to $7,500 today.

[*H. W. Derry*]

⁂

THE purpose of a price policy in any industry is to develop the maximum of business at a minimum of cost, a result of mutual interest to producer, merchant and customer.

[*Edwin Gruhl*]

# Golden Rule Relations*

The job of informing the public is the job of each utility man. New conceptions of service introduced. Executive interest necessary

By J. F. Owens
*Chairman Public Relations National Section*

PROPERLY to inform the public we are privileged to serve is a function of our industry second only in importance to adequately, economically and efficiently serving that public. Both functions are vital to the well-being of our industry and our duty to the public.

Upon these fundamentals the committees of the Public Relations National Section based their program and their endeavors to vitalize the program during the year.

### Complete Job Needed

Two major activities were undertaken as broad phases of the program which resulted from the organization meeting.

1. Encouragement, through committees peculiarly adapted and organized, of action on the part of member companies that would make for greater efficiency on the part of company employees, with particular emphasis on the necessity of executives informing and training those employees whose duties bring them in immediate contact with the public.

2. A clear visualization of our service relations to the public. Through the committees that were formed for the purpose of bringing member companies to a realization of these relations, the second phase of the section's functions was planned. Even though mechanical equipment may be the latest and best and thoroughly suited to the task of giving a full measure of service; even though the personnel may be loyal and industrious, yet this is only half the story. There is another party to the question of service. That party is the public. It matters little that the mechanical and human equipment of the organization be all that any one could desire; that the service be above criticism, if the second party to the service contract is not fully informed, thoroughly cognizant of what it is getting in the way of service, and satisfied that the service is being furnished at the lowest possible rates. Therefore, the public must be informed.

*J. F. Owens*

Perhaps the major activities during the past year have been directed toward awakening member companies to a keener realization that their job is only half done when service is made available at the meter, accounted for and payment made, but that quite as much their duty as the rendition of service, is the complete dissemination of such information as may enable the recipient of service to use that service wisely and well, and over and above all such information, presentation of such facts about the service as will prevent him from becoming an easy prey of demagogues with only self-interest to serve. The customer must know that his service can approximate perfection only when he, the second party to the service, responds with that full measure of co-operation, born of a knowledge that he not only is being adequately served, but that he is being honestly served.

On this premise the executive committee of the section early in the year requested headquarters staff, under the direction of George F. Oxley, director of public information, to prepare for submission to the committee a series of advertisements that might either be used by member companies or serve as suggestions in the preparation of copy for their own advertisements. Advertisements were prepared, approved by the executive committee, and a weekly newspaper advertising copy service inaugurated. These advertisements are being widely used throughout the United States.

The effect of this movement has been twofold: First, the advertisements themselves carried a terse, definite message to the reading public—a message drawn from men and women of our country whose opportunities to study and evaluate the electric light and power industry of this country have been notable. It brought to the people of the country observations of men and women, who, through their achievements, have reached places which warrant their statements being accepted at par. Second, as valuable as the effect of the advertisements themselves, is the attendant effect on member companies, hitherto not consistent advertisers: a realization effected that they have only been partially discharging their obligations to the public when they content themselves with merely rendering service, without providing with it a full and complete fund of information to insure proper use of that service by customers. Thus, the advertisements performed a dual mission.

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*Address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

### More "White Space"

The committee believes that the press is the best medium for disseminating information. It believes that it is the duty of every utility company to utilize the press, through paid advertising columns, to give to the public a straightforward, well thought out and carefully prepared account of its stewardship. But it is recognized that we cannot overlook other media of information—the spoken word, the daily contact of employees with their neighbors and friends. All possible factors should be utilized in giving true information about our business.

> *The job is only half done when service is made available at the meter, accounted for and payment made.*
>
> *Every utility company should utilize the press, through paid advertising columns, to give to the public a straightforward, well thought out and carefully prepared account of its stewardship.*
>
> *The commercial man, as he goes forth to interest a prospective customer, visualizes himself as a bearer of good tidings.*

There can be no doubt but that in the past there has been a contest, if you please, between the demand, on one hand, by customers for service, and, on the other, the necessity for securing capital and equipment to provide that service. The time and attention of those responsible for the company's performance have necessarily been devoted to what might be termed the material side of rendering service. While executives and their co-workers have been busy selling to financiers the opportunities that lay ahead of them; while new demands for service have created conditions that required new equipment, naturally the genius of the industry has been turned toward its material development. Men have been busy thinking out ways to do new and better things than they ever did before. Superintendents devoted their time and effort to reducing manufacturing costs, cutting down transmission losses and effecting operating economies. Inventors were developing new equipment and new appliances for greater utilization of service.

In short, the best brains of the industry have, of necessity, been chiefly concerned with the material phases of the business. Service demands increased day by day and the industry grew by leaps and bounds. Exigencies of the hour demanded greater efficiency in generation and larger units of production and operation. These conditions called for consolidation. Small, inefficient companies must unite in order that the economies that come only through employment of large manufacturing units could be secured.

Executives were busy doing the job. Their energies were directed toward this internal development. While this was going on, there were others who, prompted by purely honest motives, were beginning to fear the size to which the industry was growing. And there were others with less worthy motives, who saw an opportunity to capitalize this fear and who, by the utterance of untruths, half-truths, or distorted statements, wilfully and sometimes maliciously encouraged the somewhat latent fears of many right-thinking men.

It was then that leaders of the industry awakened to the realization that they had left at least half of their job to those who, either through lack of understanding or unholy motives, were making a miserable botch of it.

Far-seeing men determined that organized effort must be made in an attempt to bring every member company to a realization of the truth; that in addition to the rendition of service at the lowest possible rate commensurate with good service, their trusteeship to the public demanded that the service carry with it the information which they alone were in a position to provide and that a vital element in stability of service and service companies was public co-operation.

In former years the engineer was content if his turbine measured up to standard and met all of the known tests for satisfactory performance; if his transmission lines met the requirements of recognized engineering standards and practices; if his substations were adequately and properly built and if his meters were accurate. The accountant was content if his records presented a true picture of the company's operations; if he could supply the executives information necessary for a study of the company's operations and a forecast of future requirements, and if bills for service were accurate and complete. The commercial man felt that his job was adequately performed when he secured a contract for service.

Today, the engineer sees not only his turbine as machines; his transmission lines as so many poles, wires, insulators and anchors; his meters as accurate measuring devices. His vision extends through and beyond these material elements to the ultimate customer. He pictures himself as the instrument, through whose genius a service is brought to a waiting public, a service that shall shorten hours of labor and provide moments of leisure that may be employed in a development of the finer things of life, the training of mind, and permit a reaching out for cultural advantages that make for complete manhood and womanhood. The accountant knows that his records are more than mere figures upon reams of paper. He realizes that service bills transmitted to customers offer an opportunity to carry a distinct message, a readable message to be easily understood and analyzed by one who does not understand the technicalities of modern bookkeeping. The commercial man, as he goes forth to interest a prospective customer, visualizes himself as a bearer of good tidings. He senses that securing the contract is only half the job; that it is his duty to give the customer a friendly understanding of the company he represents; that the customer be made to know that the company's mission is not fulfilled when a plant is physically connected to his lines. He realizes that his job as a company representative is only begun when he secures the customer's business, and that his major obligation is to keep in constant touch with the customer, to be his friend, his confidant, his adviser

*Philip G. Gossler*
Chairman Committee on Customer Ownership

*Homer E. Neisz*
Chairman Committee on Industrial Relations

*Miss Sophia Malicki*
Chairman Committee on Women's Work

*W. S. Vivian*
Chairman Committee on Public Speaking

and to be on such a footing of mutual understanding that the customer will call on him instinctively for counsel and advice in the utilization of his service.

But men come and go, engineers change and give their places to others. Customers change too. If it is true that our job is only half done when, as utility men, we inspire the members of our organizations to realize the largeness and the opportunities of our business and that they are really emissaries of a new order; if it is true that half our job is to fully inform our customers concerning our companies, our policies and our aims, then this task of creating and maintaining proper relationships with our public is never ending. More and more will it require the best thought and brains of the industry to bring about and safeguard a mutual understanding. More and more are we not only justified, but definitely obligated, to employ every legitimate means to properly inform and impress the public. More and more will it be necessary to employ the best methods for the dissemination of ideas, to provide the facilities of a clearing house for information and practice and to encourage the laggards, if there be such. The claim upon our industry of this obligation is quite as definite, if not as insistent, as the obligation of service.

The Public Relations National Section functions, in its present set-up, through eight separate committees. Each of these is submitting a report of its activities during the past year and each has pursued a course of action, predicated upon the major functions of the section, as outlined in this report. Some of them, particularly the women's committee, include both major functions. The work done by these committees merits a comprehensive and detailed report. But the men who have been responsible for this work are best fitted to tell the real story of their operations and their reports are being presented at this convention.

## Investment Diversification Good

By Dean John T. Madden
*New York University*

THE tendency that will show itself more and more clearly is that of lessened investment in individual companies and a broader diversification in the investments in order to distribute the risk. The investor in securities of an electric light and power investment or holding company has at once diversification and distribution of risk, and if the investor happens to be a manufacturing corporation, it, too, has additional diversification and distribution of risk.

If the trend toward one of the several forms of amalgamation is to continue—and it probably will—the investment company may be one of the devices by which the number of loss-producing companies will be reduced. I can unhesitatingly say that history will reveal public utility financing to have been more free from taint than that of any other industry taken as a whole.

*T. J. McManis*
Chairman Committee on Manufacturers' Advertising

*T. A. Kenney*
Chairman Committee on Information Bureau Organizations

*W. A. Jones*
Chairman Committee on Relations with Financial Institutions

*Carl D. Jackson*
Chairman Committee on Co-operation with Educational Institutions

# Utilities and the Public*

### Electrical industry faces a critical situation. Its future depends on its own actions. Regulation and rate of return

By Henry G. Wells
*President National Association of Railroad and Utilities Commissioners*

*Henry G. Wells*

TODAY the electrical industry is prosperous. Its growth has been rapid. The possibilities for the future are tremendous. But already there are signs of unrest, and the responsibility is upon you to determine by your acts whether the industry shall continue on its course normally and properly—whether the great mass of the public shall continue to have confidence in those in charge, or whether those who are at the moment attempting to discover evils to present to the public are to receive encouragement from some in your midst who may adopt unwise policies and unfair methods. The public will not be governed by what you say but by what you do. They look not for promises but for results. If an investigation develops any substantial number of facts that the public does not like, it will not only be those involved who will suffer but the whole industry.

If a small minority of your membership fails to live up to the principles of this organization, the organization suffers. Strenuous moral suasion may be necessary on the part of the majority to protect itself from the results of unwise action of that minority. The great mass of the public today do not sense any great evils; they are not convinced that there is anything substantially wrong. But it may not take much to change the picture. And so it behooves those directing and guiding this great industry to walk circumspectly. They must be fair. They must be not too selfish.

Because an industry is big and because it has had a tremendous development it furnishes an opportunity for attack. But the American people today as a whole do not get enthusiastic over attacking anything merely because it is big. Henry Ford has built up one of the largest industries in recent years, yet has been comparatively free from hostile criticism by the public—at least while he confined his activities to his business. And so, while the size of your business furnishes an ample target for the few, your conduct can be such that the acquisition of recruits to shoot at it will be difficult.

## Factors of Responsibility

There are two factors in the case of the electric industry which make it even more imperative to realize the great responsibility involved: First, the electric company is usually a public service corporation; second, as such it is granted privileges by the state and municipality and even in most cases allowed a monopoly in its business.

Many arguments are presented from time to time to justify certain acts of the utilities because in many respects the utilities have factors of ordinary business, but often it is evident that the utility officials overemphasize those factors and do not sufficiently recognize the distinction that exists and which should control in their public and business relations. The utility industry is protected in many ways because it is a public service corporation. It enjoys many advantages that private industry does not enjoy, but it must expect to assume the duties that go with such privileges. There are some rights, however, that are common to all industry and all individuals.

The electric utility, like any other industry, has a right to be heard. It has the same right to present its views on matters affecting it as any other business. The electric utility, like any other industry, has a right to have its spokesmen at gatherings of the public. It has the same right to publish its articles in newspapers and magazines as has any other interest. The electric utility has the same right as anyone else to see to it that the education of the young shall contemplate both sides of any question.

The electric utility, like any other individual or organization, has a right to be represented at Washington and the various state capitals by its own officials or by paid attorneys—call them lobbyists or what not—so long as they conduct themselves properly. It has the same right to protect itself from unjust attack as is granted to others. It has the same right to correct false and misleading statements as anyone else.

It is an interesting situation when some of the stanchest advocates of free speech are attempting, by means of investigation, to give out the idea that a great and useful

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**Abstract of address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

industry has no right to protect itself by means of free speech. It is an interesting situation when advocates of municipal or governmental ownership can set forth their arguments orally, by written articles in newspapers and magazines, and can even be found in the schools and colleges teaching the youth of the land the advantages of such a doctrine, yet they would deny you the same privilege. In one case it is educational, in the other it is propaganda.

Any fair-minded citizen will grant your organization the same right to present arguments for private ownership. Any red-blooded American will grant you the right of self-preservation by means of speeches, magazine or newspaper articles and proper instruction to the youth of the land. But there are certain obligations attendant upon these rights. The public have a right to expect fairness, no misrepresentations, no distortion of facts, no concealment, no evasions. It must be the spreading of truth and not misleading propaganda. They have a right to expect ethical conduct on the part of paid attorneys or agents.

### Holding Company Function

One or two weaknesses at this critical time may well be pointed out with a view to preventing the increase of recruits seeking pot shots at the large-sized target of the electric utility. One of them is the holding company. The value of holding companies, properly administered, is well recognized, in the co-ordination of common interests, the unification of a common purpose, the strengthening of the weak by the strong, the stability given to new financing and expansion and the possibility of better and more adequate service. But that strength is a source of weakness when directed to selfish purposes. When any company becomes primarily a stock-jobbing concern, when its aims are directed solely to the benefit of the speculators in such securities and not to the benefit of the subsidiary companies and the public they serve, then the public has a right to complain. When any such holding company issues securities far in excess of the worth of the underlying companies, it is a source of danger to the public. When any such company attempts to conceal excessive profits on the part of some or any of the subsidiary companies, such a policy is naturally the object of criticism and attack on the part of the general public.

Another potential breeder of target-shooting recruits has developed recently in my own state. And it isn't localized either. The same attitude is apparent in spots throughout the country, and the majority of regulatory boards are watching the situation with increasing interest. It is the attempt to set up reproduction cost as the sole factor in a rate-base valuation, coupled with the payment by large interests of exorbitant prices for the stock of well-managed and prosperous companies, relying on that type of valuation to secure a return on those high prices. It is only necessary to quote from one of your trade magazines to indicate where this may lead. Referring to a recent case, this magazine says:

"In one sense, it is to be regretted that the situation in this particular case did not require the court to find definite values for the physical property for actual (not theoretical) depreciation and for going value, and that it did not state what actually constituted a fair rate of return."

That should not be the attitude of the utilities, to advocate making the United States Supreme Court a fact-finding body. How far we have traveled since the early decisions under the Fourteenth Amendment. How much farther do you expect to travel? To my mind, the situation warrants a word of warning.

### Reproduction Cost

Reproduction cost assumes the reproduction of a plant which would never be reproduced exactly as is. It apparently assumes valuing a plant on a basis which would not always be considered in determining its value for some purpose other than for rate making. It often involves long and expensive investigations, complying with elusive requirements, and recognizing cumbersome theoretical opinions of experts, resulting finally in a composite guess. And when this composite guess is finally determined, the factors on which it is based may have changed so that it can no longer represent the true value and the whole process may have to be repeated. In fact, it would be quite possible to have a company before the regulatory commission and the courts almost continuously. "It does not enable justice to be done speedily and efficiently either to the public or to the investor. In periods of enhancement of prices the public may be compelled to pay excessive rates. In periods of depressed prices the investor is compelled to receive less than a fair return upon the capital invested." At times when companies might need speedy relief in the shape of increased income such relief might be unduly delayed. One wonders what the attitude of some companies will be if there comes in the course of the next ten years a marked decline in prices below present levels, particularly those companies a substantial portion of whose plants was built shortly after the war during the era of very high prices.

Of course, you will ask, what then will be the attitude of regulatory boards? Will they insist then upon reproduction cost as a base, as the public did in the first instance? And, no doubt you will quote Smythe vs. Ames, wherein the public's representatives were arguing for just such a basis as the companies are today claiming. Frankly, that ought not to be the position of the public or the regulatory boards. We hear a great deal about the prudent-investment theory of Massachusetts, but some of us are not committed to that as a proper theory to be binding upon us. Neither do we believe that with changed conditions the public would force us to adopt the reproduction-cost theory as the proper one unless we are forced to adopt it at the present time. We have had regulation for many years in Massachusetts and have not insisted on any hard-and-fast rule. We have sought and are now seeking simplification, and we believe that ought to be the aim throughout the country. Somehow it has seemed as though the coining of the word "valuation" was a mistake. "A fair return upon the fair value of the property" was a glib phrase which served its purpose at a time when conditions as to regulation and capitalization were more or less chaotic. But is it necessary today? Rather, is it not an unfortunate phrase when applied to present-day conditions? After all, is not the whole proposition an economic problem, pure and simple.

### Rate of Return

If rates are allowed or fixed sufficient to pay all proper operating expenses and maintenance charges—to pay taxes and interest on indebtedness, to set aside an adequate depreciation reserve and have a reasonable surplus left over after the payment of such dividends as will keep the market price of stock issued under the authority of the commission for proper capitalizable purposes at such a figure that new issues may readily be marketed having in mind the purchasing power of the dollar and its fluctuations—can any one say there has been confiscation in fact, whatever theoretical experts may argue? And those facts are not hard to determine. Operating expenses and maintenance charges are available from year to year from the annual returns, and the necessary evidence to show any present changes in them would not take long. The same is true as to interest and taxes. There would seldom be more than a slight difference of opinion as to depreciation, and any regulatory board must recognize the importance of allowing an ample amount for that purpose. Market value of the stock-purchasing power of the dollar, amount of dividends and of surplus are all matters of judgment, fairly easy of determination in the light of existing conditions at the time.

If economic conditions change, only a few weeks at the most would be required to change the rates. Some may say, "But that means prudent investment as a base." Not necessarily. Granted that indirectly most cases would work out that way—and probably therein rests the widespread opinion as to the so-called Massachusetts rule—yet one can readily imagine conditions arising where rates would be allowed more than necessary to pay a fair return upon the prudent investment but which, nevertheless, were deemed necessary from an economic standpoint.

Sounds simple, doesn't it? Regulation in Massachusetts *was* simple up to a year or so ago, and none of the companies complained that we were taking their property away from them. But now, instead of the few weeks formerly required for a rate case, what do we have? We have had some cases in which five or six months is required to present evidence to us, and probably two or three or more years will elapse before the court tells us whether our decision was right or wrong. And at the end of that period of time undoubtedly conditions will be such as to warrant starting the farce all over again. It will be unfortunate for the public and for the companies if that tendency becomes general. When extremely prosperous companies adopt this attitude, the public can only see a pretext to deprive them of what they are morally entitled to, a fair share in the prosperity, whatever may the legal principles involved.

Some of you are doubtless beginning to think I am unduly petulant over this matter. Rather am I apprehensive. It is brought to the attention of this great organization as a "stop, look and listen" signal. You ought to know wherein danger to your future can be minimized. You are facing a critical period in the history of the industry. There are those seeking to hamper you, and undue selfishness merely helps them in their aim. If what I have said seems unduly critical, it is said with the best of intent, to preserve this great industry for the benefit of the public and itself.

Electric utilities are essential to public wellbeing and are necessary to national welfare and national progress. The regulatory bodies and the public at large must not only seek protection against exploitation or oppression on the part of public service corporations, but must also seek for that attitude which will continue to foster private initiative and efficiency, to stimulate improved methods and increased effectiveness, to preserve superior facilities now provided for the American business man and the American worker, to improve the standard of living for the American home. These ends will be attained, not by litigation, not by regulation, but by intelligent and wholehearted co-operation of all concerned.

# *Reducing* Insurance Costs*

By Charles B. Scott

*President Bureau of Safety, Chicago*

*Charles B. Scott*

THE growth of the electrical industry and the present large units of organization have brought exceptional opportunities and responsibilities to every one in the organization to co-operate with the management in eliminating needless waste and effecting possible economies. The accountant has exceptional advantage in being able to assist in such an important undertaking because of constant evidence before him of these items of expenditure and their effect upon earnings. His opportunities also come from his relationship with the treasury department in maintaining the proper financial structure.

The insured usually interprets his insurance as a betting arrangement by which he may escape the payment of his losses because of his more advantageous end of the wager and the attractive odds offered. It should be needless for me to assure this audience that such an idea of insurance protection is entirely wrong. The fundamental laws of compensation apply to insurance, and eventually the insured must pay the penalty of his negligence and misfortune. The insurance company really finances these penalties over a period of time and thus makes the burden less noticeable. When the final accounting is made the insured and his associates receiving protection must not only pay the losses involved, but

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**Abstract of address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

in addition to these the cost of administering the insurance business plus a reasonable return to the insurance company's stockholders.

For some reason, difficult to explain, the average business organization and individual carrying insurance handle insurance matters rather indifferently. Purchases of materials and supplies are made in a businesslike way The purchaser knows what he is buying and the fairness of the price paid. Insurance is too often purchased without any definite knowledge of what is being bought and with only a vague assurance as to the meaning of the policy granting the protection or the reasonableness of the cost.

This situation is in part due to the idea that coverage and rate making are highly technical and that rates once officially promulgated cannot be lowered except by some costly process of construction or alteration of property, or in the case of casualty insurance by some cycle of good luck in accident experience which may automatically reduce the cost of casualty protection.

For the public utility company insurance is a means of relief from the immediate payment of unexpected losses, a safeguard for uninterrupted service and a protection against catastrophe. Attention is particularly directed to that feature of protection applicable to continuity of service so essential in the public utility business. Service may be quickly and seriously impaired or discontinued by damage to the plant or equipment, and the consequent loss of business may impose a serious burden upon the company. To protect the investors and customers it becomes necessary to guard against such losses as may result from interrupted or discontinued services. Therefore proper coverage and protection measures should be employed, even though they be only for the prevention of consequential losses.

The electrical industry is now paying just rates of premium for fire insurance protection. This assurance was brought about several years ago and has been steadily maintained by the efficient and businesslike attention given to insurance costs by the insurance committees of the National Electric Light Association. The present committee and its predecessors have diligently kept a record of rates charged and losses sustained and have received the most hearty co-operation of the insurance interests in keeping the proper balance between these factors of rate determination. The appreciation of the members of the association is due its insurance committees and the co-operating agencies and representatives of standard fire insurance companies for this service, which has not only resulted in broader coverage, just rates and improved methods of fire prevention, but also in a better understanding of the mutual interests of the electrical and insurance industries.

### Possibilities of Cost Reduction

There is no intention, however, to cover the subject of insurance in the broad and general way indicated by what has been said, but to deal with the possibilities of economy in insurance costs and with a somewhat literal interpretation of this term as it is applied to the costs reflected in premiums paid for protection. Such costs when compared to payroll and other large operating items may not by such comparison alone appear to be of great importance, but if those costs are susceptible of material reductions, then their import becomes established. The task of reducing some of these larger expenditures to any appreciable extent may, and no doubt is, much more difficult than a reduction of insurance costs, and to properly evaluate the latter the possible savings rather than the comparative volume of expense should be kept in mind.

Structural changes in the physical property provide the more frequent opportunities for reduction of premium rates for both fire and casualty insurance. Recommendations for such changes in structure and the installation of safeguards usually emanate from the insurance broker or safety engineer and are often given little attention because of a preconceived idea that such recommendations are seldom practical or of material consequence. It is true that some of the recommended expenditures for changes may not be reflected in lower rates, but even these may be of great importance for the protection of the property or employees or in the interest of uninterrupted service.

### Reclassification of Payrolls

A proper classification of payrolls has a distinct bearing on just and proper rates charged for casualty insurance. This may be illustrated by the proper allocation of the payroll of office workers in the engineering department to the office classification payroll and the lower rate thereon, instead of to the classification of payroll and rate applying to other employees of this department who are exposed to construction hazards and properly subject to the higher rate. Frequent revisions and proper arrangement of payrolls in accordance with the several risks and differing rates should be made and may often result in substantial savings in liability insurance costs.

The third factor in all rate changes is that of loss experience. Herein lies the most prolific source of economy and the factor requiring special consideration. Loss experience is controllable. Time will not permit an amplification of this thought, about which so much has been said. It is sufficient to emphasize that the prevention of accidents and fires can be accomplished only by intelligent and constant attention such as is given to the other operations of the public utility. This attention must be assured by systematic plans of organization and by the interest and co-operation of every employee. Well-planned and efficient accident and fire prevention work will establish better employee and public relations, prevent service interruptions and eliminate those incidental costs of accidents and fires not covered by insurance.

The desirability of the insured to assume a part of the risk has always been recognized and made possible by the co-insurance provisions of insurance coverage. The proportion of the risk to be thus assumed by the insured depends upon the character of the risk and the ability of the insured to bear his proportion of the loss immediately. It is the usual practice for the insurer to assume four-fifths of the risk and for the insured to become a self-insurer for the remainder. The question as to what proportion of risks, or as to total risks, which may properly be considered for self-insurance is particularly apropos for public utility companies. This is especially true of those engaged in the manufacture and distribution of electrical energy who maintain metropolitan plants of large values or those whose properties are established over wide areas with widely distributed units of value. Such companies have exceptional opportunities and advantages for economies in insurance costs through self-insurance plans.

By such plans properly and soundly established economies are possible through the elimination of large administration expenses, including acquisition costs imposed upon standard insurance companies. There are other advantages in dealing directly and justly with injured employees and the public, reflected in a closer and better relationship with these possible claimants.

Any self-insurance plan to be successful must be most carefully decided upon and must be based upon those sound principles of finance, law of averages and prevention of loss which form the foundation for the successful standard insurance carrier. Having established such a plan, charges for protection based upon standard rates should be collected and wisely administered. A most carefully developed plan of adequate excess and protection against catastrophe must be provided as a part of any such successful arrangement for intercompany self-insurance. More important than anything else, an agency must be provided to minimize fire and accident losses. Success is impossible unless well-organized, intensive and continuous efforts are maintained for the prevention of losses incident to the risks carried.

Insurance, insurance costs, protection, improvement of property and personnel, uninterrupted service, conservation of waste and economy in operating costs—these are of unquestioned importance and merit the attention of all of us who share the responsibility for a careful administration of our trust.

# Electrification Surveyed*

## Conditions in Europe and America studied. Recent electrification projects. No need for standardization

By Britton I. Budd
*Chairman Committee on Electrification of Steam Railroads*

*Britton I. Budd*

THE past year has seen an extension of electrification in the United States, most of the larger European countries, South America, Australia, India and Japan. Initial installations are being made in some of the smaller countries like Costa Rica, Czechoslovakia and Siam. Several of the European countries are at work on programs for electrification which will take years to complete but on which substantial progress is recorded every year.

In Great Britain electrification is still confined for the most part to suburban passenger traffic. No through service has been electrified as yet, but extensions of the suburban systems are constantly being made. In Holland considerable additional track has been electrified for passenger service only. Sweden recently completed electrification of one long line for general traffic purposes. France, Germany, Switzerland and Italy continue to extend electrification to new sections. At the end of 1927 Germany had 750 miles of road electrified and was proceeding with 185 miles more. Switzerland had 1,250 miles of standard-gage routes electrified and 150 more miles scheduled for 1928. Italy has about 750 miles of electrified routes in 1927, with 200 miles scheduled for completion in 1928 and expectation of about 1,400 miles by the end of 1930.

Lines operating into Warsaw, Poland, and Prague, Czechoslovakia, are being electrified and may be in operation by the time this report is printed. Three new standard-gage lines are projected between France and Spain across the Pyrenees. Some of the work is now under way, and it is reported that two of the lines at least will be electrified. Several of the smaller European countries are reported to be making studies of electrification.

The Indian government is working on ambitious plans for electrification of a large extent of the principal lines in that country. Two railroads are already operating by electric power in the vicinity of Bombay, the first having gone into service in 1925 and the second in 1928. Both these roads plan to keep on extending their electrified sections for several years.

In Central and South America there have been several extensions of electrification. The Mexican Railway Company has extended its electrification, the Paulista Railway of Brazil has extended also, and the Western Minas Railway has ordered its first electrical equipment. The Transandine Railways in Chile and Argentina, which are operated as a unit, are electrifying and the Chilean section has been completed. In Canada the Canadian National Railways have announced that they will build a new terminal at Montreal and use electric traction in the city.

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*Abstract of report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

In 1927 the Chicago, Milwaukee & St. Paul Railway completed the extension of its electrification from Black River to Seattle. This extension was about 10 miles of double track and brought the total length of track electrified up to 881 miles.

The Illinois Central Railroad completed in 1927 the first full calendar year of electrical operation on its Chicago surburban service. Electrical operation began in August, 1926. The last steam schedule was for 396 trains per day. The number has been gradually increased up to 566 trains on week days in April, 1928. Express service has been added on some lines and more frequent service to most stations. The running time of the different services has been shortened by 11 to 28 per cent. The response of patronage showed about 19 per cent more rides in 1927 than in 1926.

The Virginian Railway also completed its first calendar year of electrification in 1927. The first short section of electrification was placed in operation in September, 1925, but the entire electric zone was not in service until September, 1926. Officials of the road express satisfaction with the new motive power, which has greatly facilitated their movement of heavy-tonnage trains over mountain grades.

The Pennsylvania Railroad is engaged in a large electrification project at Philadelphia. A new passenger station for through traffic is being built on the west side of the Schuylkill River. An underground station for suburban traffic is being built in the heart of the city near the old Broad Street station. All operation into the underground station will be electric, and the electric trains will connect the two new stations with each other through a four-track subway. Two suburban services to Chestnut Hill and Paoli have been electrified for several years. Two additional surburban routes are now in the process of electrification and are expected to be completed in 1928. One line extends to Chester and Wilmington, 28 miles south of Philadelphia. Electric operation on this line is scheduled to begin about the middle of the year. The other line extends westward from Philadelphia to West Chester via Media, a distance of 27 miles. This electrification is expected to be ready by early autumn.

### Cascade Tunnel Nearing Completion

The Great Northern Railway on May 1, 1928, holed through its new Cascade Tunnel. This tunnel is nearly 8 miles long, the longest in the Americas. It is within the Great Northern's electric zone and will be equipped for 11,000-volt overhead trolley like the old tunnel which it replaces. The old tunnel was originally electrified by itself in 1909 with three-phase alternating current. This was changed in 1927 to the present single-phase system in anticipation of establishing an electrified division extending about 75 miles. It is expected that the new tunnel and approaches will be ready for service in the fall of 1928.

The Philadelphia & Reading Company has been engaged for some time in drafting plans for the electrification of its Philadelphia suburban service. The Boston, Revere Beach & Lynn Railroad has announced that it will electrify. This is a high-speed, narrow-gage road carrying suburban traffic between East Boston and its terminals at Winthrop and Lynn, Mass. The Detroit, Toledo & Ironton Railroad has been operating by electricity over 18 miles of its route between Fordson and Flat Rock, Mich. Electrification is now being extended a distance of 27 miles from Flat Rock to Petersburg Junction.

During April, 1928, the Delaware, Lackawanna & Western Railroad announced plans for electrification of its New York suburban service. The electrification will follow the main line from Hoboken to Dover (via Newark and Summit) with two branches to Montclair and Gladstone. The total mileage is said to be 78 miles of route and 173 miles of track. Detailed specifications have not been announced, but it is estimated that construction will be completed in about two years. This project has an interesting and rather unusual feature in the support being given by the communities affected. Representatives of civic organizations in all these communities, with a population of about 1,250,000, presented a petition to the railroad asking for electrification and pledging co-operation in securing an advance of commutation fares to support the improvement of transportation facilities.

The Cleveland Union Terminals Company, which is constructing a new union station in Cleveland, has called for bids on electrical equipment. It is expected that it will soon announce the details of the proposed electrification.

### Systems of Electrification

Some countries have taken definite steps to standardize on a system for all future work and in certain cases have gone so far as to rebuild previous electrifications to conform with the new standard. In general it may be said that the central European and Scandinavian countries favor low-frequency alternating current at a high voltage. The standard system in these countries uses single-phase energy at 16⅔ cycles with 15,000 volts at the trolley wire. A secondary standard is used in Germany for suburban service with direct current at 800 volts.

England and the western countries of Europe are using direct current at voltages from 600 to 1,500, with third-rail for suburban lines and overhead trolley for the longer lines. The English colonies are following the lead of the home country, as also are those railroads in South America which look to England for their technical advice.

Italy has had a long experience with the use of three-phase energy at 3,300 volts and is proceeding with the general electrification of long-distance lines on this basis. It is interesting to note that experimental installations are being made with high-voltage direct current and still higher voltage for three-phase.

In a report to the Sectional World Power Conference in 1926 H. Parodi of the Paris-Orleans Railway gave his view of the adoption of standard systems in Europe. He stated that the two general choices of system have grown up around different and distinct conceptions of the relationship which will be maintained in the future between the railroad and power industries. France, England, Belgium, Holland, Japan, South America, Africa, India and Australia have followed the policy of utilizing the power stations producing three-phase current for industry and of distributing the power for railroads and industries through a single system of high-tension lines. Germany, Switzerland, Austria, Norway and Sweden have followed the policy of creating two separate systems of generation and transmission for industrial power and for transportation, the railroad power system being single-phase with a frequency of 16⅔ cycles while the general power system is three-phase and

50 cycles. He notes that the countries in which the railroads are privately owned have paid most attention to the general interests of the country, while the countries where the railroads are government-owned have neglected the advantages which might accrue from a single unified or interconnected power supply system.

### Conditions in United States Different

In the United States, of course, conditions are quite different from most of the European countries. Electrification has been adopted here for specific purposes in widely separated parts of the country. Each railroad has attempted to employ the system best adapted to its own particular problem. The results have been generally satisfactory with whatever system has been adopted, as is testified by the operators in each case.

There has not yet developed a general need for standardization on account of the overlapping of the various installations or of the necessity for interchanging equipment. This has resulted in the United States retaining an important position as a proving ground for all the best and latest improvements in electrification. Both direct current and alternating current are being extensively used, and the voltages vary from ordinary street-car practice up to 22,000 volts.

Among the equipment which can be used on any existing 11,000-volt system are the New Haven locomotives with series motors, the New Haven locomotives with motor-generator sets, the Norfolk & Western locomotives with induction motors, the Virginian locomotives with induction motors, the Great Northern locomotives with motor-generator sets and the Detroit, Toledo & Ironton locomotives with motor-generator sets. Thus there are in this country five widely separated roads performing entirely different services with locomotives of special type developed for their individual needs, but which could, if required, be operated over the same electrified system. Taking power in similar form, they have the separate advantages of single-phase, three-phase and direct-current motors for their respective duties.

There are also two railroads which have locomotives adapted to run on either 11,000 volts single-phase or 600 volts direct current. The motor-generator locomotives with 600-volt traction motors can also be adapted to run on a 600-volt direct-current supply. There is no present indication that the several well-established systems of electrification are going to decline in favor. It is not unlikely, however, that there will be further developments in the interest of interchangeability between roads as there have been in different motive-power equipment for varied duty on different divisions of the same road.

### Operation in the United States

A study of electrification during the year shows the same prevailing reasons for electrification which were emphasized last year, namely, to increase capacity, to improve service and to promote general economy. Long tunnels, mountain grades and the congestion of city terminals are underlying causes in the United States.

Up to date there have been installations of electrical operation on nineteen railroads in this country. The total mileage operated by electricity is about 1,800 miles of line and about 4,000 miles of track. Of all the roads concerned, this is about 2.5 per cent of the miles of line and 3.0 per cent of the miles of track. For the whole United States it is about 0.7 per cent of the miles of line. For comparison with the United States, there are in the world about 100 railroads with electrified sections in operation or under construction, distributed through 35 countries in all continents.

Of the nineteen roads, twelve are engaged in suburban and terminal operation around large cities. Seven operate over heavy grades and through long tunnels. Most of the terminal roads also have one or two tunnels ranging from a few hundred up to several thousand feet in length, the tunnels of the Pennsylvania Railroad under the Hudson River at New York being considerably longer than any of the others. The curvature on the terminal roads is only moderate.

The mountain roads have 89 tunnels, aggregating 327,000 ft. This is equivalent to an average of 3,700 ft. per tunnel, or 47,000 ft. of tunnel per road. The grades likewise are long and steep with ruling gradient as high as 2.2 per cent. The average ruling grade is 1.5 per cent for an average distance of more than 46,000 ft. In general, the curvature on ruling grade begins near the upper limit of the terminal roads and runs up as high as 12 deg.

### Equipment and Power

Of the nineteen roads, three operate passenger service only with electric power, four operate freight service only and twelve operate both passenger and freight service. The statistics for locomotives and motor cars are for the largest equipment on each road. Passenger locomotives are more nearly uniform in size than the freight locomotives and the horsepower varies from 1,000 to 4,000. The heaviest passenger engines are on the Great Northern Railway with a weight of 715,000 lb. Freight engines vary widely on account of some roads having only switching and way-freight service. The freight locomotives for trunk-line service range from 262,000 lb. up to 1,282,000 lb. and from 1,300 hp. to 7,000 hp. The heaviest locomotives are those of the Virginian, which are larger than any others in existence, either steam or electric.

Motor cars vary considerably in weight and seating capacity. The weight varies from 62,000 lb. to 176,000 lb. When used with trailers they are motored at 400 hp. to 1,000 hp, and without trailers at 240 hp. to 470 hp. About two-thirds of the roads use trailers with their motor cars.

### Power

The electric power used by seventeen of the nineteen roads in 1927 amounted to 1,585,000,000 kw.-hr. The generated power is slightly more in quantity than the purchased power, but there are more roads purchasing power than generating it. Twelve of the United States roads purchase all their power, while five generate all their power. The remaining two purchase about one-third of their power and generate the rest.

The energy used for passenger-train service varies about the same as in the city and interurban railway service, between 1½ kw.-hr. and 7 kw.-hr. per car-mile. The power used in freight service was reported by six of the railroads. These results vary from 25 kw.-hr. to 100 kw.-hr. per 1,000 gross ton-mile, indicative of considerable difference in the service performed by the roads and the character of the country through which they operate. Five of the roads have locomotives equipped for regenerative braking, but only two report the proportion of regenerated power as respectively 9 and 16 per cent of the total.

# Extend Rural Service to 21,217 Farms

By Charles F. Stuart

*Chairman Rural Electric Service Committee*

IT IS probable that no year in history has witnessed such significant developments in the application of electricity to agriculture as the year just closed. Farmers, farm organizations, agricultural colleges, the electrical industry, manufacturers of electrical equipment, manufacturers of farm machinery, governmental departments, all have been stepping harmoniously forward, overcoming obstacles, developing new facts, interchanging and spreading information, enlisting new recruits, building farm lines and putting electric power to work at more and more tasks on an ever-increasing number of farms.

During the year more and more electric light and power companies have organized themselves to undertake intelligently the extension of their service into agricultural territory. The year marked an increase of 60 per cent in the number of companies having either rural electric service departments or men especially trained in this particular field, and there is prospect of an even more material development in this line in the year to come.

No attempt was made to count the number of additional farms connected in 1927, as this work has now been included in the periodical electrical census taken by the Bureau of the Census, Department of Commerce. It is significant, however, that in four states, where electric utility organizations made such a count it is found that electric light and power company service was extended to 21,217 additional farms.

### Farm Load Good Business

Information received pertaining to organization, development and operation of rural electric service departments by several companies indicates that farm business properly undertaken can be made mutually satisfactory to farmer and power company. These departments prove by their own experience that in this supposedly most discouraging of fields an acceptable load in many instances can be and has been developed to the mutual satisfaction of both parties to the transaction. This has been accomplished by intelligent load building, by which is meant the application of electricity to agricultural tasks in such a way as to promote energy consumption and at the same time cut labor costs and increase farm production.

One of the biggest problems still remaining is that of acquainting the farmers themselves with the possibilities of electricity on the farm. Times have been far from prosperous for many of them. They have been too busy scratching a living out of the soil to keep pace with the rapid progress being made in the application of electricity to agriculture. To millions of them the vision of electricity on the farm is confined largely to a more acceptable type of illumination. They do not know that nearly 200 different services on the farm can be performed by intelligent employment of electricity. It is only within the last few years that definite information has been available, and as a consequence it often is found that in a given rural community only one-third of the farmers are alive to the progress which has been made and the relief from drudgery made possible by modern day application of electricity. It is also true that some utility organizations have not kept pace.

This problem of acquainting farmers with the modern-day idea of electricity on the farm is not discouraging at all. It merely means that such communities are not yet ready for electric service, but that as neighboring communities, more familiar with the situation, put electricity to liberal use on the farm, these more backward communities soon will profit by the example set.

### Rural Electric Service Departments

Only a few years ago the establishment by an electric light and power company of a rural electric service department was regarded as a very formidable and hazardous proposition—something of an adventure, to be undertaken, if at all, only after grave consideration and mature deliberation. That day, however, is past. Pioneers in the application of electricity to agriculture have blazed a conspicuous trail, marked by definite and specific information, and it is the prediction of this committee that within a comparatively few years every electric company occupying considerable rural territory will have a rural electric service department.

Creation of such a department is no longer an adventure, no longer difficult or hazardous. In fact, it is now regarded as the one logical and sensible way to meet the demand of agriculture for electricity on the farm.

The plan of procedure, once regarded as calling for much preliminary consideration, now is simple. The executive head of the company selects an individual, perhaps one already on the payroll, to take charge of this work. This selection, of course, requires some judgment, as the person picked should not only know the electric business, but also something of farming, and he should be what is termed sympathetic with agriculture. If he is not thoroughly up to date on the progress which has been made these last few years in putting electricity to work on the farm, he can speedily remedy that, for a wealth of specific information regarding electric farming in all sections of the country now is available to him.

Next there should be devised a rate. This should be no more difficult than devising a rate for any other class of business. The tendency among companies which have progressed in this field is for the company to finance all or a considerable part of the cost of building the line. In so far as the rate itself is concerned, the thought of principal importance is that it should be a form of rate which will encourage liberal consumption.

The next move is for a survey of the agricultural areas included in the company territory, taking into consideration the different types of farming, density of population, existence of present lines available for farm service, natural geographic boundaries, etc.

There is nothing very difficult, hazardous or intricate about any phase of this procedure. It is merely approaching farm service in a common-sense way, the same as electric companies have approached other classes of business. It is the only means by which requests for farm service can be met intelligently, and it is the only means by which the rural load can be built intelligently.

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**Abstract of report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

## *N.E.L.A. Answers*

# Propaganda Charges

*The fifty-first convention of the National Electric Light Association issued the following official statement:*

THE NATIONAL ELECTRIC LIGHT ASSOCIATION has long believed that the success of the electrical industry in the performance of its public functions has been and must be based upon public confidence in its integrity, in its motives and in the character of its achievements. The association has believed, further, that that confidence could be based only upon knowledge and maintained only by a willingness on the part of the industry that the public should have the fullest details of the manner in which it operates.

The American people of today are electrically minded. In the space of less than half a century this nation has reached a state of advancement where the electrical industry furnishes and the nation usefully employs nearly as much electrical energy as the rest of the world combined.

As electric science has advanced the problems and business of the industry have grown greatly. This progress has been so rapid, one development crowding so fast upon another, that it would be difficult without adequate information for general public understanding to keep abreast of the advance.

Recognizing that lack of knowledge is as unfair to the public as it is harmful to the industry, the electric utilities consider it their responsibility to place all the facts before the public.

It is for these reasons that the Nationa Electric Light Association, among its other important functions in the development of the electrical industry, some years ago assumed the responsibility and adopted the policy of preparing and diffusing as widely as possible full, accurate and timely information on all phases of the business.

In this effort the association has encouraged the use of all proper channels for the diffusion of information concerning the industry and has made the facts available to newspapers, magazines, educational institutions and to teachers in public schools.

The truth of the statement, not the place where it is put, is the test. Full responsibility, openly avowed, for every word and act is desirable. All members of the association should scrutinize everything they say and do in the light of these principles, and to the extent which public investigation or public criticism of what we have done may aid in disclosing improprieties, should welcome it. We do not wish to be judged either by intemperate criticism or by our own declarations. We are ready to be judged by our accomplishments and our acts.

The National Electric Light Association in the interest of the public and its own will continue to make available to the public the facts on the progress and development of the industry, and to review from time to time the information distributed, in order that every assertion of fact, policy or principle shall conform to the highest standards of accuracy.

# Service the Answer*

## Economic and social aspects of the electrical industry reviewed. Federal control unnecessary. Holding company benefits

By Melvin A. Traylor
*President First National Bank, Chicago*

THE fact which most deeply impresses the layman is that the entire emphasis in the electric industry has been upon the objective of greater service to the public. In no activity more than the electric utility has the significance and spirit of the descriptive phrase "public service industry" been more fully exemplified. Better service has been the constant aim—service which is more reliable, more satisfactory and more adequate, and which is adapted to ever and more new uses. And better service has been translated by the leaders of your business into terms of constantly greater service to an ever larger proportion of our population, always with a constantly decreasing customer charge.

*M. A. Traylor*

It is impossible, it seems to me, to exaggerate the significance of the rôle played in our modern twentieth century civilization by electricity and, therefore, by those engaged in its production and distribution. It is probably safe to assert that during the past quarter century no force has been more influential in furthering social progress and human well-being. It has lessened the irksomeness of the laborer's toil; it has reduced the drudgery and routine work in the home; it has lifted many of the burdens of the housewife and lightened those that remain; it has lengthened and made immeasurably more satisfactory our hours available both for work and recreation; it has improved transportation and promoted a better diffusion of our urban populations. Rural electrification programs, such as have been sponsored by many electric companies, have done much for rural life. The electric switch has replaced the coal oil lamp, an instrument of historic service, as well as of smoke and of danger. The farmer now shaves as his wife churns by the same current, while the children project the latest movie in the front parlor—another institution of blessed memory.

And most significant of all, electricity has been harnessed to the machines of our industrial age and has added tremendously to the productive power and efficiency both of capital and labor. Indeed, we are led to conclude that the electrical industry has been one of the most potent forces in elevating the standards of life, or convenience and of comfort for the rank and file of our entire population.

Your industry has demonstrated to other industries the fundamental truth that enlarged and improved service is entirely compatible with sound business considerations. The great social service rendered by you has proved entirely consistent with your own business motives. Your product and sole stock in trade is service, and experience has demonstrated that the less costly and the more dependable your service the more diffused and intensive has become public demand for it. With that increased and better distributed demand have come better load factors, greater production, diminished costs of production per unit, reduced rates, larger sales of service and larger financial returns. Many other businesses in the United States could well profit through the lesson taught by the electric industry in pointing the way to increased prosperity through improved service.

Passing now to more specific problems and tendencies in the electric utility field, there are several which seem to me of peculiar significance.

### A New Concept of Regulation Prevails

Originally, the controlling motive leading to regulation of utilities by public authorities was to protect the consumer and to secure for him low rates. Indeed, this was undoubtedly the "prime mover" (to borrow a technical term from the electric industry) in originally instituting public utility regulation. Perhaps we should not criticise public officials for this, for there was on both sides in the earlier days a lack of perception of the real identity of interests between the community and the utilities which serve it.

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*Address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

But now it is becoming increasingly apparent to regulatory authorities, to city councils, state commissions and the courts, and even to the people in general, that rates must not only be not too high but also not too low. The public has come to recognize that otherwise not only will new capital be secured with difficulty and at greater cost, but that even existing service and facilities cannot be maintained. Regulation of rates is conceded by all to be necessary, but it is now becoming more widely recognized that they must be fair to all parties concerned—fair to users, fair to the owning companies and fair to the army of investors they represent. It is becoming more and more clearly recognized that if rates are too high an undue burden is placed on the users, and also that if rates are too low all parties suffer. For the inevitable result of regulation which is drastic or confiscatory is to divert investment capital to other channels, thereby making it difficult or impossible for the utility to provide the additional plant, equipment and facilities which are necessary to keep pace with the ever-increasing public demands for service.

This changed conception of the proper objectives of regulation has been due, in considerable measure, to the emphasis that has been placed by leaders in the industry and in the National Electric Light Association, through its public policy committee, upon better public relations, upon education of the public and upon the development of an attitude of mutual understanding.

*Rates must not only be not too high but also not too low.*

*Regulation by state commissions has fully justified itself.*

*Interconnection has decidedly lessened the significance of political boundaries.*

*Much good for the electric industry has been accomplished by the holding company.*

*Statistics show that propaganda for municipal ownership has not had any considerable effect in recent years.*

By way of parenthesis, I would like to remark that in my judgment we should recognize that the movement for regulation by state commissions has fully justified itself. Despite the lack of experience of some commissions in the early days and despite the fact that in a comparatively few instances the decisions of these bodies have not been entirely acceptable to those in the business, they have done much to further this newer concept of regulation. And I know of no form of governmental machinery or administrative device which is likely in the long run to prove more effective from the public standpoint, or more intelligent and fair, from the standpoint of the industry. It would, therefore, seem to be of the utmost importance that management should co-operate wholeheartedly and effectively with these bodies. That this association and its members have done so is happily apparent from the cordial relations which obtain between its members and the regulatory bodies.

The development of interconnection and long-distance transmission has been one of the most amazing technological achievements of the century. Its story is a commonplace to you all. A fact which occurs to me in this connection and which I hope is realized by most of our people is that interconnection and long-distance transmission have decidedly lessened the significance of political boundaries—of municipal and state boundary lines. There are many who feel that some character of governmental machinery must be adapted to meet the new situation.

Already the demand is being advanced, from certain quarters, that federal control is now necessary. It seems not improbable that the industry will have to recognize the inevitability of one of these three alternatives: (1) Regional control of some sort through regional boards; (2) regional co-operation in regulation upon the part of existing state bodies, or (3) some sort of federal regulation such as that exercised through the Interstate Commerce Commission.

The latter alternative would seem most unfortunate and undesirable. The Interstate Commerce Commission is already overburdened and the establishment of still another national bureau or commission would be necessitated. This would involve an extension of the tendency toward overcentralization of control in Washington, which has already been carried too far. This tendency toward centralization at the expense of the powers of the states is contrary to the fundamental principles of our dual system of government. But entirely aside from considerations of political policy or principles, federal control would seem unnecessary, as the problem involved is not truly national in scope. Rather, it is a regional problem. For example, the power situation in the Chicago area is not of concern solely to Chicago or to Illinois. On the other hand, neither is it a problem of national scope. It is a problem concerning Indiana, Illinois and Wisconsin for the most part, i.e., a regional problem.

It seems to me that either of the first two methods of control might prove sound—either some sort of regional board, formed by the joint action of the states, or perhaps preferably a program of co-operation between existing state commissions. Either plan might be effectuated through the use of the so-called "compact clause" of the constitution, which permits states, under federal authorization, to co-operate in the solution of regional problems of this sort. The compact clause has been utilized, for example, by New York and New Jersey in the joint control of New York harbor.

The same factor, i.e., the lessening importance of municipal boundaries, due to interconnection and long-distance transmission, will, I believe, defeat the home rule agitation, at least as it applies to the electric light and power industry.

Much good for the electric industry has been accomplished in recent years by the so-called holding company, but just here let me say that it seems to me peculiarly unfortunate that the term "holding company" should have been coined because, as a matter of fact, the holding company as we know it in the utility field differs little save in name from the more modern investment company or investment trust, the holding company being substantially a public utility investment corporation, with assets consisting of the stocks of utility operating companies.

By means of these companies it has been made possible to secure better and less costly financing, higher caliber managerial supervision, economies in purchasing, better engineering methods, and general reduction in overhead cost. To enumerate all the advantages of a holding company, or more properly the public utility investment company, would require more time than is available to me on this occasion, but no discussion of this subject would be fair which did not acknowledge the very obvious fact that except for these large holding or investment corporations, no such developments as have been recently witnessed would have been possible.

Through their ownership of widely scattered yet contiguous properties, they have been able to bring order out of confusion, harmony out of discord, and success out of failure, and the best of these achievements lies in the fact that they have benefited most those who are in the greatest need of such service—not the companies themselves, nor those who own their securities, but those who live in small towns, rural communities and, chief of all, those living on the farm.

Nevertheless, on every hand we hear proposals for the regulation of holding company activities. It is charged by the critics that holding companies are often subterfuges for avoiding regulation; that they are to a great extent merely "milking companies" to collect undue fees by means of special contracts with operating companies; that they indulge in undesirable financial manipulation and excessive pyramiding to the detriment of public utility credit. Thus far nothing concrete has come of these criticisms; no fraud on the investing public has been proved. None of a serious character probably exists. If here and there mistakes have been made, the advocates of sane policies and sound practices within the industry, and they are in the vast majority, are best prepared to handle the situation and should be allowed to do so.

It would seem that the regulation of operating companies by the various states through their commissions should suffice. Such regulation should meet the requirements of the situation, for the public is interested primarily only in local rates and in local service. Holding companies, as such, are of no more concern to the utility public or to the consumer than is any private investment organization.

I am convinced that holding companies need fear no serious attempt at regulation of their activities, so long as those activities bring benefit, or at least bring no detriment to the conditions of local service and local rates. So long as holding companies place no undue burdens on local companies, there is no adequate cause for regulation. However, if it should happen that any considerable number of holding companies should unreasonably divert earnings of local companies, exact excessive charges for various services, or inflict losses on investors and thereby impair public utility credit through an unsound and excessive amount of pyramiding, then extensive regulation on the holding company could be only temporarily postponed.

An analogous situation is to be found in the development of security issue regulation. At first, there was little attempt at regulation of security issues. Rates and service were the points of chief concern. But the belief, in some cases justified, that financial practices of certain companies not always engaged in the production of light and power as regards securities were adversely affecting rates and service, led to the extensive regulation of security issues which now prevails. Holding company regulation, if it should come, may conceivably be traced to similar circumstances. Agitation frequently concerns imaginary ills. But it is to be remembered that actual regulation is seldom instituted, or maintained, without some justification from the public point of view.

However, I am firmly convinced that such legislation will result only if those directing the development of the holding company movement put in effect unsound policies which in the long run will injure local operating companies, and thereby afford cause for public discontent. The sins of a few companies may be visited upon the entire group, once public indignation is aroused. I confidently believe that this result will be prevented by wise leadership within the industry itself. The best preventive for excessive government control is wholesome control from within. Certainly government regulation in this field is undesirable if it can be avoided. For in the field of management and investment—which constitute the chief functions of the holding, or public utility investment company—the highest degree of flexibility and elasticity is necessary. Regulatory "red tape" would inevitably prove a hindrance.

*A problem of major importance is properly to work out a balance between regulation and management.*

*I firmly believe that the electric industry will continue to be characterized by policies of fairness, open publicity and frankness, co-operation with public authorities and, above all, by scrupulously living up to all the implications of its position as a public service industry.*

### Faith in the Future

In general industry prosperity, the electric industry has participated, for its well-being is inextricably intertwined with that of the communities which it serves. Indeed, due to its rapid advances in technique and operating efficiency, it has been enabled, more than most industries, to maintain earnings while at the same time decreasing the price charged for its product.

I firmly believe that the electric industry will continue to be characterized by policies of fairness, open publicity and frankness, co-operation with public authorities, and above all by scrupulously living up to all the implications of its position as a public service industry, perfecting its machinery for self-regulation and control from within. If this proves to be the case, there is every reason to expect that it may confidently look forward to an era of still further development, expansion, and satisfactory earnings. Likewise, with such an attitude of straight forward policy prevailing throughout the industry, there is every reason to expect that regulation will prove to be neither confiscatory nor excessive, not encroaching unduly upon management, nor upon the incentives of private ownership and enterprise. Thus, it is to be hoped that the electric industry, while insuring fair prices to consumers and fair returns to investors, may become an even greater instrument for promoting social progress, economic betterment, and human welfare.

# The Power Industry in the Marketplace*

### By JAMES H. MCGRAW

*President McGraw-Hill Publishing Company, Inc.*

MUCH has been said and written about the need for more energetic methods of market development in the power industry. This is generally admitted. There is no point in my expanding this statement. But it happens also that it does not rest within the control of the power industry to delay action in this matter. For conditions are changing in the marketplace and the power company, that up to now has borne a charmed life because of the natural popularity of its production, is beginning to face and feel the opposition of an aggressive and resourceful competition.

I refer to the growing organized intercompetition between industries that is coming to be called the "new competition." And I submit to you that in future the sale of electrical energy and electrical equipment in the American market is going to depend less upon whether or not people should use the service. It will depend more upon whether or not they elect to spend those dollars for electricity or for something else which at the moment may have greater appeal.

For this new competition is itself engendering a new general philosophy of selection. It is teaching the public to discriminate—not necessarily as to what may be best, but what is most desirable. And just as we have come to learn that we cannot buy all the magazines on the news-stand, so America is beginning to realize that it must plan its purchasing more carefully because selection is becoming more difficult and because of the more deliberate process of modern easy payment buying.

The prevailing question today has become whether to apply available money to something electrical or to an automobile, a radio, a phonograph, a camera, furniture, clothing, shrubbery, or a more extended vacation. This mental attitude, as you know, as not been the outcome of accident. It is the result of ingenious and highly organized sales activity.

### INDIFFERENCE TO ELECTRICITY

At the present time in the neighborhood of 108 industries are engaged in concerted programs of co-operative promotion for the purpose of strengthening their positions in the marketplace, by securing the attention and developing the interests of the public. Almost every item of the family budget is now subject to the influence of these campaigns and they are effecting some remarkable changes in the relative sales of different groups of manufacturers. The walnut furniture manufacturers, the copper and brass producers, the paint manufacturers, the laundries, the florists, the icemen and all the rest of them are appealing and arguing for a larger share of that universal lodestone, the consumer's dollar.

James H. McGraw

And while this is all happening, gentlemen, while the American public is lending its ear to these ably presented messages of personal interest and is reacting to the influence of these suggestions, what does it hear and what does it care about electric service? To put it bluntly, if I may, while so many of these other branches of industry have been so actively and cleverly holding the attention of the people, the electrical industry has stood, not mute in the marketplace, but it has not made itself interesting. And when it has talked it has talked too often about itself.

Men and women are busy with their own affairs and they have not been bothering their heads about electricity all these years. The romance of our great industrial development, its spectacular financial expansion, the perfection of its tremendous networks and the magic of its ceaseless service, thrill and inspire us. But to the man on the street it is not nearly as wonderful and astonishing as radio or the motor car. To electrical men the present refinement of electric service, reaching well nigh every hamlet throughout this broad land and making available so many new contributions for labor saving, convenience and economy, is a dominating thought in life. But other men and women are far more consciously affected by the moving picture and by modern plumbing. This fact, I think, the power industry has failed to appreciate and analyze and to reckon with.

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**Address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

It is precisely to this point that I desire to direct your attention—to the point that it is a new kind of a market that we are facing today in the power industry. It is a highly competitive market and a market competitive not so much between manufacturers as between appeals. Success in such a market is very dependent upon three simple elemental factors: First, the quality of the product offered; second, its presentation and, third, both in place and importance, I think, its price. I would like to comment upon the position of electricity in the new marketplace from these three aspects.

As to quality, our case is clear and strong. There is no acceptable substitute for electric service in most of its common applications. Humanity admits its marvelous power and admires even when it does not adopt. The dependability and perfection of the physical service provided by the modern central station is completely satisfying. Quality, then, we may say, is unquestioned.

In the presentation of its product, however, I think that the electrical industry stands at a disadvantage today. And I have not forgotten that the power companies spent $10,000,000 for advertising in 1926, according to the last available report of your committee on advertising. But let us examine into this expenditure.

That year the power industry enjoyed a total revenue of $1,652,000,000. It therefore appropriated about six-tenths of 1 per cent of its gross income for the purpose of telling its story to the public. However, $3,700,000 of that expenditure was for good-will advertising, $1,000,000 was for supporting the sale of securities, $4,300,000 went to advertise appliances and the remaining $1,000,000 was devoted to promoting electric service of all kinds. Does it occur to you that only the last two items are of any particular influence in the marketplace?

What you say to the public about appliances and about lighting or power or some other form of service applies directly to the industry's sales problem and registers in the new competition. But the advertising of securities, while entirely constructive and desirable, is a matter of financing and a matter of general good will. It does not directly sell either service or equipment. And good-will advertising, while desirable in reasonable proportion, does not close sales, although it creates favorable sentiment. Therefore, 47 per cent of the power industry's advertising was directed to general purposes and only 53 per cent of the advertising expenditure was directly contributed to increasing the public interest in the actual things we have to sell and are urging them to buy. Our advertising appropriation to support our salesmen in the marketplace, therefore, figured about three-tenths of 1 per cent.

### WHAT OTHERS SPEND

But other industries that sell the popular market have learned that an adequate presentation costs more than this. Three cigarette manufacturers, for example, together spent $54,000,000 in advertising last year. And to compare percentages, one leading manufacturer of motor cars spent 3 per cent, a leading soap firm 2 per cent, a large paint manufacturer 3½ per cent. And so it goes. The contrast is striking.

Of course, the popular advertising of electrical manufacturers is a further contribution to the telling of the story of electricity, but this does not bulk large enough to upset the argument. A glance at the comparatively small weight of popular advertising that is advocating anything electrical amidst the pressure of promotion devoted to other appeals gives impressive proof that we are not making our voice heard in the marketplace. Moreover, the power industry cannot and should not depend on the manufacturer to popularize electric service. His first responsibility is to sell equipment. The central station must do its share of the market building and that share should be a generous one.

I would say, then, that the power industry is spending entirely too little money for advertising to make a strong presentation of its product. Instead of the $5,000,000 or so which your committee says was spent in the newspapers for this purpose last year, I believe the appropriation should be not less than 1 per cent of the industry's gross income. If it were 2 or 3 per cent for the whole industry, it would still be less than the three cigarette manufacturers spent last year.

I would say also that the power industry is spending entirely too large a proportion of its advertising appropriation for indirect appeal. I believe that in the past the executives of the electric power companies have made the very common error of inclining toward the kind of advertising that interests them and their friends instead of the kind that concerns the general public. Utility good will advertising appeals to the electrical man. It can be made extremely valuable in interpreting the policies of the company and its service to the community. But by and large, the average citizen is far more interested in an advertisement that tells him about something that he wants or could use.

### STRENGTH OF DIRECT APPEAL

As a general rule advertising that increases a man's interest and confidence in the use of electricity will build more good will than an advertisement designed to increase his interest and confidence in the utility company. He buys light or power or industrial heat. His wife can use a clothes washer or a refrigerator. They do not contemplate buying a power company. And they naturally assume and expect that electric service will be good and that the company will grow and deal fairly with the public. The very large proportion of good-will advertising—for much of the security advertising has a good-will purpose—I believe, is a direct reflection of the fact that the power industry has permitted itself to get into a defensive attitude in the relationship which it sustains with the public.

We forget sometimes that the strength of the automobile industry lies in the popularity of the motor car, not in the virtuous reputation of the automobile manufacturers. Automobile advertising talks not about companies but about cars. Electrical advertising, in my opinion, has its greatest sales and good-will value when it talks specifically about electric service in terms of definite uses and not about the central station. If you like your car you have no complaint against its manufacturer. If electric service has become a matter of your daily life and tied up with the habits of your home and the practice of your store or factory, you are well sold on the value of the power company to you.

### THE RIGHT TO SELL

There is a case in point, I believe, in the current criticism of the public utility associations for their expenditures in the presentation of their arguments against the proposed entry of the federal government into the power business. It lies not in the size of these appropriations. For in relation to the capital invested or the total revenues represented, they were not large. They seem small when we consider the menace of such political privateering upon the public service and the danger to the savings of the millions of investors involved, should such false economic doctrine prevail. But public attention is arrested by the fact that this money was spent for defense and the man in the street asks, Why?

Ten times that amount could have been spent in constructive advertising without comment. For America is accustomed to huge expenditures for market building. Men marvel at the amounts appropriated to advertise motor cars and talking machines, chewing gum and silk stockings. But they never question the business judgment of these manufacturers. The policy has proved itself sound before our eyes.

I believe that once this idea is made clear in this industry there will be no objection or opposition on the part of the regulatory commissions to large, properly balanced advertising expenditures by public utilities. I suggest that it would be well to analyze the comparative expenditures of this and other industries for market development, and to establish with the utility commissions the economic soundness of spending money courageously to increase the volume of sales per customer in order to make reduced rates possible. No one questions the right of a Wrigley or a Ford to advertise to this purpose. Why is it less sensible to promote aggressively this other merchandise? Every business has an inherent right to sell.

### Luxury Now the Vogue

Again in the matter of the price of electricity, I have the feeling that as an industry we lack confidence and courage in our own values. Power companies have too often adopted a defensive policy on rates. But there is nothing wrong with the cost of electricity. The price is not too high. It stands alone in its record decline among all the costs of living. Electric service is worth more than it costs today, reckoned against comparable services or commodities. And I believe that the present tendency among the power companies is to reduce rates too rapidly, forgetting that the whole psychology of America today inclines toward luxuries and is indifferent to the economy appeal.

I wonder if we are not making a mistake in talking too much to the public about the utility of electric service. As a matter of salesmanship, is not its luxury its most attractive feature to the rich and to the humble home alike? Review the outstanding examples of spectacular success in the popular market and it is striking that most of these products that have become the vogue in America and established themselves in modern life lie in the luxury class. Automobiles, travel, moving pictures, phonographs, radio, cameras, tiled baths, silk stockings, perfumes, cosmetics, safety razors, candy and cigarettes have all come into universal popularity through the luxury appeal. This experience cannot be ignored by electrical men. "Give us the luxuries of life and we will dispense with the necessaries," said a humorous philosopher, with a keen insight into human nature.

### Price Courage

It is the practice in the American marketplace to advertise in order to increase sales and effect a larger production that will reduce the cost and make possible a lower price, which in turn will stimulate more sales. The power industry, in my opinion, has pursued a policy of reducing rates without sufficient provision for the development of the market. A rate reduction may save a million dollars in a year to the people of a city, but after the announcement is forgotten the small decrease in the monthly bill goes practically unnoticed. If that million dollars were to be expended in that single year in local newspaper display advertising, supported by such direct mail, billboard and other attention-compelling methods of display as might be effective, can any one possibly doubt that electric service would win far more popularity and probably enough additional load to provide for the same decrease in rates without reducing revenues?

After all, rates are not such an intricate scientific affair. We need not fear them. The rate is just the price of a commodity that must be sold in competition in the marketplace. It must cover production, cost and overhead and yet facilitate the selling. For this reason the so-called inducement or promotional type of rate gains steadily in acceptance in the industry. It encourages larger sales to the individual customer. And that has been a profitable feature in prices always. For the price of a piece of merchandise cannot be fashioned for the convenience and gratification of the seller alone. The prime requisite is that it should encourage the customer to buy.

The industry needs rates that will help extend the more complete use of electric service by every consumer, but the power company must have price courage and not give away in premature rate reductions the millions that should be spent in the development of the market. For it is more in the public interest that the comforts and economies of electricity be brought into universal use and made less expensive by the consequent increased production than that it be cheapened by price cutting before adequate money has been spent to build the market. So it is with us.

### Man Power for Sales

It is into this kind of an arena of large-scale merchandising that the power industry is now entering. And given the quality and given the presentation and given the price, there is one other essential without which success cannot be expected. And that is man-power. Fortunately the power industry is already well supplied in sales personnel. It has in recent years recruited an able staff of commercial-minded men who are eager to go forward. When the executive interest and backing and the financial appropriations needed for the larger operations are provided there need be no question of the capacity of the industry to play its part in the marketplace.

For the development of the popular market, the selling of a complete use of electric service in the homes of all the people one other resource is vital. There is need for the upbuilding of a strong and prosperous independent retail trade in every community. The power industry cannot sell merchandise in adequate volume unaided. It needs a broad skirmish line of active dealers at every neighborhood center of household supply, each contributing his share to the growing load. It needs an army of contractors at work installing adequate wiring that the use of everything electrical may be made natural and easy. The encouragement and guidance of this independent trade to a progressive co-ordination will need leadership, sound policies and unselfish patience. And this will be forthcoming.

I have an abiding confidence and an increasing enthusiasm for the power industry. It has grown great in a service that has won the plaudits of the world. It has triumphed in invention, in engineering, in finance and in administration. It brings to the new problems of this oncoming commercial era resources that will carry over all obstructions. It will not fail to win new honors in the marketplace.

# Water-Power Development*

By PAUL A. SCHOELLKOPF
*Chairman Water-Power Development Committee*

*Paul A. Schoellkopf*

THERE has been no outstanding development in either the theory or utilization of water power during the year, although some progress has been made in both lines.

The efficiency of hydraulic turbines has been improved to the point where it seems there is little room for betterment. As in the design of electric generators, the efficiency is now so high that a nearer approach to 100 per cent can scarcely be expected. Improvement in details has resulted in reaction turbines being placed in service during the year showing an efficiency of 94 per cent over a considerable range. Perhaps the most promising field for water-wheel improvement at present lies along the lines of greater efficiencies in low-head wheels with higher speeds and corresponding lower costs.

There is much interest among hydraulic engineers at the present time over tests on the experimental Stevenson Creek Dam in California and also on the use of small-scale models in hydraulic studies.

### FEDERAL POWER COMMISSION'S REPORT

During the year the Federal Power Commission issued nine preliminary permits involving 419,407 hp. primary capacity and an estimated installed capacity of 772,800 hp. Eighteen major licenses were issued involving 85,571 hp. of primary capacity and 574,880 hp. of ultimate installed capacity. Twenty-two minor licenses or licenses for minor parts of complete projects were issued involving 43,553 hp. primary capacity and 80,928 hp. of ultimate installed capacity.

Eleven projects were completed or put in operation during the year with an aggregate installed capacity of 217,694 hp. The principal among these were:

| | Horsepower |
|---|---|
| San Joaquin Lt. & Pr. Corp. (Calif.) | 42,200 |
| Louisville Hydro-Electric Co. (Ky.) | 108,000 |
| North Western Pr. & Lt. Co. (Washington) | 16,500 |
| Inland Pr. & Lt. Co. (Idaho) | 10,880 |
| Chelan Electric Co. (Washington) | 33,000 |

Thirty-one new projects having an installed capacity, when completed, of 362,000 hp. have been started during the fiscal year ended June 30, 1927, bringing the total of projects completed or under construction at the close of the year to 128 with a proposed ultimate installation of 4,610,000 hp.

### SOME POWER DEVELOPMENTS IN 1927

An unusual hydro development is the Rocky River plant of the Connecticut Light & Power Company in Connecticut, where electrically driven pumps are being installed to use off-peak power to pump water into a high level storage reservoir. This practice is common in Europe but this is its first large scale use in the United States.

At the Buck's Creek plant of the Feather River Power Company a foreign made banded penstock has been installed operating at a static head of 2,561 ft. Seventy thousand horsepower will be developed in two impulse turbines. This is the highest head plant in the United States.

The largest power development now under construction is the Conowingo Dam and power house on the Susquehanna River, being built by the Susquehanna Power Company, a subsidiary of the Philadelphia Electric Company. A total of 378,000 hp. in seven 54,000-hp. units is to be installed under the present contract and provision is being made for four more units of the same capacity. The first units were started early in 1928.

### DEVELOPED WATER POWER IN THE UNITED STATES

The United States Geological Survey reports that on Jan. 1, 1928, the developed water power in the United States in plants of 100 hp. or more was 12,296,000 hp., showing an increase of 575,000 hp., or 4.9 per cent, during 1927. The figures for recent years are as given in the following table:

| Date | Horsepower | Increase Per Cent |
|---|---|---|
| 1921 November | 7,926,958 | |
| 1924 March | 9,086,958 | 14.6 (2.3 yr.) |
| 1925 March | 10,037,655 | 10.5 |
| 1926 Jan. 1 | 11,176,596 | 11.3 (0.8 yr.) |
| 1927 Jan. 1 | 11,720,938 | 4.9 |
| 1928 Jan. 1 | 12,296,000 | 4.9 |

The distribution of this capacity among the states is as follows:

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*Abstract of report presented before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

| | State | Horsepower | Per Cent of U. S. Total |
|---|---|---|---|
| 1. | California | 1,992,000 | 16.2 |
| 2. | New York | 1,786,000 | 14.5 |
| 3. | Washington | 702,000 | 5.7 |
| 4. | Alabama | 652,000 | 5.3 |
| 5. | North Carolina | 640,000 | 5.2 |
| 6. | South Carolina | 579,000 | 4.7 |
| 7. | Maine | 541,000 | 4.4 |
| 8. | Wisconsin | 480,000 | 3.9 |
| 9. | Georgia | 469,000 | 3.8 |
| 10. | Michigan | 381,000 | 3.1 |
| | All others | 4,074,000 | 33.2 |
| | Total | 12,296,000 | 100.0 |

From 1922 to 1925 inclusive the average annual increase in installed capacity in hydro-electric plants was 9 per cent. In 1926 and 1927 it was 4.9 per cent. While the period is too short to make these figures conclusive in themselves, they correspond so well with the known conditions that it seems safe to say that we are facing a slowing up in hydro-electric development. Two factors are principally responsible:

1. The remarkable reductions in steam power costs in the past five years have made many water-power projects economically unattractive today that looked attractive five years ago.

2. Political controversies and restrictive state laws have for the present prevented developing most of the larger and more feasible water power projects.

The United States Geological Survey estimates the total developed and undeveloped water powers of the United States available 50 per cent of the time at 59,000,000 hp., corresponding to about 80,000,000 hp. installed capacity. The 12,296,000 hp. installed corresponds, therefore, to 9,600,000 hp. available 50 per cent of the time and leaves 49,400,000 hp. still undeveloped.

Of this amount the following are held up by political controversies, international negotiations or restrictive state laws:

| | | Horsepower |
|---|---|---|
| 1. | Various rivers in Maine | 630,000 |
| 2. | St. Lawrence River | 812,000 |
| 3. | Niagara River | 2,437,000 |
| 4. | Potomac River | 360,000 |
| 5. | Cumberland River | 126,000 |
| 6. | Tennessee River | 2,000,000 |
| 7. | Colorado River | 5,767,000 |
| | Total | 12,132,000 |

It should be noted that the figures in the above list are taken from the United States Geological Survey inventory and represent all the power that it is physically possible to develop. For various reasons it is quite unlikely that all this power can be developed on the Niagara and Colorado Rivers.

### MANY DEVELOPMENTS NOT NOW POSSIBLE

The following large water powers have been studied in recent years and while some of them can be developed at low cost they have been found, with certain possible partial exceptions, to be unfeasible under present economic conditions:

| | | Horsepower |
|---|---|---|
| 1. | Monongahela River | 218,000 |
| 2. | Red River | 115,000 |
| 3. | Missouri River | 2,800,000 |
| 4. | Flathead River | 877,000 |
| 5. | Columbia River | 7,977,000 |
| 6. | Snake River | 5,612,000 |
| 7. | Deschutes River | 734,000 |
| | Total | 18,333,000 |

Of the remaining 18,935,000 hp. probably less than 30 per cent, or 6,000,000 hp., can profitably be developed under present conditions.

To sum up, an analysis of the United States Geological Survey inventory of the 59,000,000 hp. available in the United States shows that 9,600,000 hp., or 16 per cent, is developed, 6,000,000 hp., or 10 per cent, will probably be developed in the near future, 12,000,000 hp., or 20 per cent, which probably is economically feasible is being held up by political controversies or restrictive state laws, and the balance, 31,400,000 hp., or 54 per cent, probably cannot be profitably developed under present economic conditions.

The results of this analysis check fairly well with figures given by Major Glen E. Edgerton, chief engineer of the Federal Water Power Commission, in an address before the Mid-West Power Conference Feb. 15, 1928.

A summary of Major Edgerton's figures is:

| | | Horsepower |
|---|---|---|
| 1. | Total water power in U. S. (50 per cent of time) | 55,000,000 |
| 2. | Corresponding installed capacity | 75,000,000 |
| 3. | Probably 75 per cent of this is under federal jurisdiction. | |
| 4. | Installed capacity Jan. 1, 1928, about | 12,000,000 |
| 5. | Licensed by Federal Water Power Commission, but not constructed | 4,000,000 |
| 6. | Under preliminary permit from F.W.P.C. | 5,500,000 |
| 7. | Applications not acted upon | 15,000,000 |

Item 5 includes several projects with construction periods of fifteen years or more.

The casualties in preliminary permits up to date have been so heavy that it would be conservative to assume that not more than 75 per cent of item 6, or 4,125,000 hp., will be found feasible.

Item 7 includes projects on the St. Lawrence, Tennessee, Colorado, etc., held up by political controversy and amounting to about 12,000,000 hp.; the balance of the 15,000,000 probably is not feasible.

If it be assumed that the undeveloped water powers not under federal jurisdiction have the same relative probability of development as those under federal jurisdiction and that the ratio of power available 50 per cent of the time to installed capacity is 55 to 75, the following may be deduced from Major Edgerton's figures:

| | | Horsepower | Per Cent |
|---|---|---|---|
| 1. | Total water power in U. S. available 50 per cent of time | 55,000,000 | 100 |
| 2. | Total developed water power, January, 1928 | 8,800,000 | 16 |
| 3. | Development probable in next ten to fifteen years | 5,900,000 | 10.7 |
| 4. | Development probably feasible if political controversies be adjusted | 11,000,000 | 20 |
| 5. | Probably not now economically feasible | 29,300,000 | 53.3 |

Until developed, water power produces nothing; when developed it continues to produce indefinitely, not being depleted by use, as are most other resources. The importance of developing the water powers that are feasible of development needs no argument. In fact, for the past twenty years the importance and value of water power resources have been so extravagantly urged upon the public by conservation enthusiasts, government operation advocates and others that no sane and reasonable policy of dealing with the development of water power has been able to exist for long. In June, 1920, after twelve years' discussion in Congress, the federal water power act was passed. In spite of its proved adequacy to protect the public interest under all conditions, whatever else may be said of it, it has been subject to annually increasing attacks until it has become, temporarily at least, inoperative with respect to many of the larger and more feasible power prospects.

The following is a statement of electric energy developed in the United States by hydraulic plants 1921 to 1927 inclusive:

| Year | Kw.-Hr. | Per Cent Increase |
|---|---|---|
| 1920 | 16,150,000,000 | .. |
| 1921 | 14,970,000,000 | —7.3 |
| 1922 | 17,207,000,000 | 15.0 |
| 1923 | 19,343,000,000 | 12.4 |
| 1924 | 19,969,000,000 | 3.2 |
| 1925 | 22,356,000,000 | 12.0 |
| 1926 | 26,189,000,000 | 17.1 |
| 1927 | 29,875,000,000 | 14.0 |

It will be noted that the increase in kilowatt-hour output does not correspond directly with the increase in installed capacities heretofore given. This is due principally to the variation in rainfall from year to year.

The average kilowatt capacity during 1927 of the hydro plants reporting to the Geological Survey was approximately 6,970,000. The average kilowatt capacity during the same period for the fuel burning plants reporting was about 19,580,000. The following table shows the average capacity factor at which the hydro and steam stations operated in 1927:

|  | Capacity Kw. | Output, 1927 Kw.-Hr. | Equiv. Continuous Kw. | Capacity Factor |
|---|---|---|---|---|
| Hydro stations | 6,970,000 | 29,875,000,000 | 3,410,388 | 48.9 |
| Steam stations | 19,580,000 | 50,330,000,000 | 5,745,434 | 29.3 |

There has been no water-power legislation enacted by Congress so far this session. Several bills for the disposition of the government property at Muscle Shoals have been introduced. In the meantime, the government plant at Muscle Shoals is being operated by the War Department, and the power is being sold under a revocable contract to the Alabama Power Company.

The Swing-Johnson bill providing for the construction of the Boulder Canyon dam has again been reported out favorably to both houses of Congress. The principal opposition to this measure has been due to the inability of the seven states in the Colorado Basin to agree upon an interstate compact for the division of the water. Efforts to procure an agreement between the states have been persistent during the past year, but so far without success. Without such agreement the legislation probably cannot pass both houses at this session. In the meantime an understanding of this project seems to be spreading. If the project were really understood by the country at large it would have no chance of being adopted, for it is primarily a project to subsidize political ownership and operation on a scheme that is unsound from both an engineering and an economic point of view.

Bills are again before Congress for both the Umatilla and Columbia Basin projects on the Columbia River, but even their supporters seem to have no expectation of procuring action at this session.

Perhaps the most important federal activity pending relative to water resources is the surveys provided for in the last rivers and harbors act in accordance with the report of April 12, 1926, of the Chief of Engineers and the Federal Power Commission. These surveys were given considerable prominence in connection with the Mississippi flood problem. Many localities are pressing for early completion of them with the expectation that they will, through the plea for local flood control, prove the means of obtaining federal contribution toward local irrigation or power projects that have not been able to get launched on their own merits.

A recent exchange of notes between the United States and Canada indicates that negotiations for carrying out the combined navigation and power project on the St. Lawrence River may be resumed in the near future.

# Why the Investment Company*

"CONSTANT demand by the public for improved service and higher quality of production has necessitated concentration of capital in increasing amounts. As the American people are rightly opposed to government or municipal ownership of utilities, this means that these great enterprises, requiring investment of enormous sums, must be made inviting to investors; otherwise they will seek other fields and the utilities will go begging for capital and public support."

This was the keynote of the address of Arthur W. Thompson, president United Gas Improvement Company. He went on to review the evolution of industry, particularly of the utilities, from ownership by a few partners in local companies to control by investment companies and operation under a management system that has proved far more efficient and economical. Public utilities, he said, are being regrouped according to economic interests along defined geographical lines. Hand in hand, there has been proceeding a widening diffusion of stock ownership, the tendency being to divorce ownership from management. There are now 5,500,000 security holders of utilities, as compared with 500,000 about 25 years ago.

"The managers of these large companies," Mr. Thompson said, "are agents for all the stockholders or owners and hold their positions at the will of the stockholders. Their positions can be secure only through honest management, high business ethics and high moral standards, which brings into public service high-class, well-trained professional men.

"The investment company, by reason of its supervision of a large number of properties, is enabled to maintain a staff of technical experts, each skilled in his particular line, whose services always are available to the operating company. Through the investment company the needs of the local operating company, which are increasing rapidly, are financed on favorable terms." The investment company, the speaker asserted, assures the best of engineering. Its accountants subject the operating results of the local company to close monthly analysis, making for strictest economy in operation.

"The function of the investment company is getting more and more to be that of adviser, and the authority to manage and operate is being more and more localized in the hands of the local officers of the company," he said. "The problems from now on will be national rather than local in scope, and public utility executives must begin to think in terms of national problems, realizing that anything one group does affects not only that particular group but the entire industry. The standard of performance must be not whether a given policy is legal but whether it is in the public interest."

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**Abstract of address by A. W. Thompson, president United Gas Improvement Company, before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

# Industry and Business Schools*

Professional business school result of changed business conditions. Industry co-operation essential to success. Progress of industry constructive

By Deane W. Malott
*Harvard School of Business Administration*

*Deane W. Malott*

THE reasons for the rapid growth of schools of business are not obscure. With the dissolution of the army in 1919, men who had been trained in the pursuit of war, recognizing the advantages of specific intensive training, sought entrance to the business school as a preparation for their life work, with the result that twice and three times the expected numbers sought admittance to the schools of business in that year. Then, too, with the growing complexity of the business unit has come the need for trained men to fit into organizations where one man's capital, labor and knowledge are not sufficient, as they once were, to direct the business efforts. The organization has not always functioned well, and even today we have great problems yet unsolved which are calling for all the intellectual power, all the idealism and all the sportsmanship which we are capable of producing.

Hence, business schools have taken a place in the educational scheme of things and give promise of having started on a career of importance to business. Now, what may you men of industry expect from this educational mushroom? We hear rumors, and occasionally see something in print, concerning the new profession of business, and we have come to realize that the world needs sadly this new profession. But the visibility is low, so to speak, and we see obscurely into the meaning of the term. Obviously, there have been many professional men of business, but it is safe to say that business, the profession, is only now emerging. Its problems and tasks, however, have not waited at all. They loom large on the business horizon.

The difference between the old-time business and the emerging profession of business today is the result of the effort to establish guiding principles, underlying fundamentals, recognized by the leaders of industry and trade, as being the guides to navigation in a previously uncharted sea. It is the result of the emergence of ethical standards governing accepted practices and methods of procedure. It is the result of a rising consciousness of the social responsibilities of the business man, along with his business activities. These together are weaving the enduring web of a business tradition, to the pattern of which each leader of industry may contribute the example of his efforts. In the upbuilding of these professional aspects business education must assume a leading part if it is to fulfill its prophecy of service. But the graduate of the business school is no more a full-fledged swivel-chair business executive than is the interne from the medical school a skilled surgeon or the graduate of the law school a seasoned court lawyer. Experience and judgment, a knowledge of the particular technique and the confidence of his fellow-man are important ingredients to be added when he has left the academic halls, and they may require years to attain.

What, then, is the object of the training offered by the schools of business? We are all attempting in the first place to teach men to think. At Harvard we have substituted for the method of teaching by precept the analysis and diagnosis of actual problems collected from business. Our research men are constantly at work seeking from business men data concerning the actual problems which face them. In the discussion of these problems the student arrives at a reasoned judgment, and underlying economic and business principles are brought out where possible. In the course in public utility management, for instance, the problem of regulation is approached from the actual court and commission decisions, and the question of rate determination has as its basis actual problems surrounded by the necessary facts and theories for its determination. The student thus acquires a method of approach of far more importance than the facts themselves, for business is dynamic and facts as they exist today will not hold true in the day in which these young men assume their responsibilities in industrial affairs.

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*Address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

But the relation between the schools of business and industry goes far deeper than the training of young men for business life. From you men and from those in other fields must come the teaching material, and the soundness and wisdom of our instruction is in large measure dependent upon your co-operation in allowing us to keep in constant touch with the measured tread of progress in industry and trade. No school of business, if it is really to serve industry, can be a thing apart from business activity. Our research men are constantly in the field, and in the process of obtaining teaching material we are building up for you an ever growing background of economic data which may guide you on your way. And the men of business have been everywhere co-operative and generous of their time and strength, not only in giving us often the intimate details of their problems, but in bringing personally into the classroom their counsel and experience.

*Business as a profession is just emerging.*

*The large corporation in its process of development generally tends to elevate itself to higher ethical standards, and there inevitably creeps in more of a feeling of trusteeship, not alone for the security holder, but for the employee and the community as well.*

*The social responsibility of the business man is inescapable.*

They have given financial aid to the development of business research and teaching. Trade associations and individual business concerns and business men have practically supported the research work of the Harvard Business School, which is providing teaching material for more than a hundred other business schools throughout the country. The students can through their tuition pay the instructional costs, but obviously the costly research necessary to provide teaching material in the various fields of business cannot be covered by tuition charges and can come only from the far-visioned leaders in industry who realize the importance for the future of the intellectually trained man.

Within the last five years public utility instruction has been added to the curriculum of the Harvard Business School. In this audience are many men from concerns which for the last three years have been giving their financial support to the development of public utility management, teaching and research in the Harvard Business School, and you may be interested therefore in a report of progress. This money has been spent to help pay for instruction in a course in public utility management advice concerning which has never been sought from nor given by those contributing to this support; to collect several hundred actual problems, from commission and court decisions and from concerns in the public utility industries—all factual incidents reported for class use and published as a collection of cases—and to produce a detailed and inclusive factual study on "the interstate transmission of electric power," published without comment as a compilation of facts and of specific use to us as teaching material. Wherever material resulting from our studies is of direct and immediate interest to the business world it is made available, and factual studies are published from time to time.

This is not only typical of our relations with other industries, where in several different fields groups of business men are helping us in the furtherance of knowledge and research, but I believe is typical of the sort of effort going on in other professional schools of business. And the support of this industry and of other industries to the professional schools of business has made possible the development of intellectual training for business, the establishment of business principles, and a basis for creating a professional motive in the young men entering business which otherwise would never have been possible.

### ETHICAL STANDARDS IMPROVE

Naturally funds come from the larger units and groups in industry—from those groups where power is often associated with some sinister purpose. The "soulless corporation" is constantly held up as the great example of unethical operations, although seldom is it deserving of this characterization. The large corporation in its process of development generally tends to elevate itself to higher ethical standards, and there inevitably creeps in more of a feeling of trusteeship, not alone for the security holder but for the employee and the community as well. This ethical evolution goes on because through the years a large organization must be reasonably trustworthy in its complex internal operations in order to continue to conduct the business service which is the purpose of its organization. It must, therefore, choose trustworthy men for its organization, and a group of men who so conduct themselves that their associates can trust them will over a period of years be the type of men who are trustworthy in dealing with their public. We are all more sure of an honorable trade with the great national corporation than with the man in the fruit stand at the corner. Moreover, the big corporation generally emphasizes stability and permanence, rather than immediate profits, with the result that its policies are determined for the long run and that more consideration is given to factors of ethical importance than might otherwise be the case.

### BUSINESS RESEARCH IMPERATIVE

Moreover, it has long been recognized that sound business practice must rest on firmly established research into the facts and economic principles of business. A concern which operates its own research department is looked upon as outstandingly progressive in bringing to its highest fulfillment the service it offers to the public. It certainly is no less far-visioned to make possible through financial support industrial studies by the schools of business, where adequate research organizations are set up, away from the firing line of conflicting motives and prejudices, and where men are dedicated to the search for truth.

It is also an accepted principle in the development of business to build up public recognition through advertising and to attract the most capable men into the industry. Certainly it is in keeping with this policy to provide ample opportunity for the training of young men in the problems of the industry, in the schools of business.

Young men are challenged by the problems which business offers.

Let there be more and still more co-operation, therefore, between industry and the schools of business, for the opportunities are legion and time is running against us. Two hundred years of adventuring in the realm of science has opened constantly new and larger opportunities for progress and for the culture and comfort of modern civilization.

Owen D. Young, in an address at the dedication of the buildings of the Harvard Business School a year ago, said: "I can see a picture of the adventurers in pure science moving out into unknown fields as the great geographical explorers set sail for unknown lands. Following them are the applied scientists learning how to use the new forces just as the early settlers followed the old adventurers. Finally, business organizes itself to harness these forces and put them to work. Never were opportunities so great as now. Never did unexplored areas seem so vast. Never was there a more responsible trusteeship needed for the discovery of new opportunities or for the administration of existing powers. We need today more than ever before men to administer this trust who are not only highly skilled in the technique of business, men who have not only a broad outlook in history, politics, and economics, but men who have also that moral and religious training which tends to develop character."

### SOCIAL RESPONSIBILITY INESCAPABLE

This is a challenge to the combined efforts of schools of business and industry. If it is to be met, we must develop men fundamentally capable of meeting the social responsibilities which business men more and more will have to assume. Religion is fraught with dogmas, political leadership is losing ground, science has created a materialistic world, and on all sides complicated questions of social relationships press for solution, and the leaders to attack these problems are strangely missing. Yet the social responsibility of the business man is inescapable. It involves the job of raising industry itself, from within, up to a higher ethical plane, a plane which is not socialism, nor communism, nor government operation, nor the exercise of the police power, but rather a great development from within the business itself of a sound and effective control of industry, its relations with labor, with its customers and with the public.

The co-operation of business schools and industry is no easy task. It calls for breadth of view, for perspective and for patience. Problems of right and wrong arise with such constant frequency that the need for careful thinking and high standards is especially great. You men in business are constantly dealing with moral issues. The moral strain to which the young man is subjected in entering the ministry, medicine or teaching is far less than in law or business. Material success is a temptation for which we may too readily subordinate the ethical and cultural aspects of life, and this temptation is far greater in business than it is in the other professions.

On the other hand, if one realizes that all types of service which are open to the young man entering the other professions are also open to the young man entering industry, there is a tremendous challenge to maintain youthful idealism and sportsmanship; these will contribute immensely toward the solution of the problems likely to confront civilization during the next few generations.

# Utility Women Help*

## Should be trained in electrical housekeeping and understand the problems in the homes

By MISS SOPHIA MALICKI
*Chairman Women's Committee*

TO UTILITY women there appear to be two challenging conditions demanding a personnel thoroughly informed to meet them. These are (1) the lack of public understanding of utility structure and its operation, (2) the lack of knowledge as to what the services of utilities can do for the home. These conditions directed the choice of subjects of the committee program. Throughout the country utility women are studying economics of utilities and application of electricity to the household. Along with this they are preparing for and carrying out plans for diffusing the information to women outside of the industry.

A utility company should be the community household management center. It should answer the plea of housewives for a place to which they can turn for advice and assistance on problems of efficient management of the home. This should also be a laboratory for studying performance of equipment sold by the company and finding new uses for it. All women of a serving company should be as thoroughly trained in electrical housekeeping as possible, and through their knowledge should broaden and follow up the work of the home service members.

All committee units follow the plan of inviting representatives of women's organizations, schools and home makers to the educational meetings and receptions. This acquaintance is valuable to utility women because it brings to them recommendations for serving the customers better. It gives to the visiting women an understanding of the purposes of the organization and of the companies' sincere desire to satisfy their public. It is important that our women understand how to help the home makers of their communities; it is just as important that the home makers know our women can help them. Wives and relatives of utility employees have a large interest in the industry and are enthusiastic participants and contributors to successful committee work.

### PROBLEMS OF THE FARMER'S WIFE

The farm woman's problems are a large concern to utility women. Understanding full well the difficulties interfering with complete farm electrification, they want to bring these explanations to farm women and also to give to them an appreciation of what electricity will do on the farm. In one state the women's committee has arranged an organization including utility women, representatives of the Federation of Home Bureaus, home demonstration agents and members of home economics colleges to study means for the best co-operation between the farm women and those of the electrical industry.

Safety, a subject of universal importance, is followed in all educational and public work. Committees are giving resuscitation and first aid instructions to clubs, schools and young people's organizations. This study of safety practices qualifies committee members to participate in community safety programs. Units of safety councils find utility women valuable coworkers because of their understanding of the importance of safety education.

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*Abstract of report presented at N.E.L.A. convention, Atlantic City, June 4-8, 1928.

### A Form of Social Service

Women's committee units in all localities are taking their proper part in civic and philanthropic activities. The opportunities for participation are many—health campaigns, baby weeks, invalid soldier, orphan and other programs. Public speaking is followed by committee members—not with the thought of intriguing audiences through their eloquence, but to present simply and directly the facts women are requesting. This is recognition of an obligation. Many of you last year heard Mrs. Baldwin, chairman of the living costs committee of the National League of Women Voters, say: "We have many questions which we want to ask you. We want to know the cost of production and distribution; we want to know about the regulation of utilities; we want to know the facts—to understand your problems."

And we should certainly fail in a duty if we did not make ourselves heard in places where improved home making is studied. The fact that women need to place a higher value on their energy and time brings a direct responsibility to the utilities for a liberal portion of education in standards of health and decency. Our services supersede the largest portion of drudgery in housekeeping, and ours the blame if so many women are still doing physically work for which machinery is developed. This is a social problem and ours is a fault chiefly of omission. We have not universally enough competent women to give the assistance to home makers they need.

Women appreciate and respect the responsibility placed on them of spending 80 per cent of the money going into retail trade. They are happy to learn that utilities are making every effort to put brains behind the counter and impart to them more information about what they are buying and using. This educational work is gaining for utility women their recognition by home makers as intelligent representatives of an industry deeply important to home making.

## SOME N.E.L.A. SERIAL REPORTS, 1927-1928

### Commercial

*Industrial Heating*

Carburizing in the Electric Furnace, No. 278-5.

Industrial Electric Heating Installations, No. 278-28.

Sales Plan for Developing Industrial Electric Heating Load for Electric Service Companies, No. 278-13.

*Lighting Service*

Lighting Service Manual Part II, No. 278-1.

*Power Committee*

Economic Utilization of Waste Wood, No. 278-18.

Serial Report Power Committee, No. 278-61.

*General Merchandising*

Trade Practice in Central-Station Merchandising, No. 278-9.

*Industrial Lighting*

Results of the Industrial Lighting Sales Campaigns, No. 278-19.

*Wiring*

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### Engineering

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Service Tests of Treated and Untreated Poles, No. 278-3.

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Totalizing Output of Two or More A. C. Circuits on One Watt-Hour Meter by Paralleling Secondaries of Current Transformers, No. 278-43.

*Hydraulic Power*

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*Electrical Apparatus*

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### Accounting

*Purchasing and Storeroom*

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Public Speaking Committee, No. 278-59.

Lamp Committee, No. 278-63.

Water-Power Development Committee, No. 278-66.

# Radio and the Power Industry*

Millions in revenue from alternating-current sets. Use in public relations. Engineering applications. Future uses outlined

By H. P. Davis
*Chairman Board of Directors, National Broadcasting Company*

*H. P. Davis*

THE radio industry has grown so fast that few, aside from those directly connected with it, have any idea of the rapidity with which it has developed. In order that we may obtain the correct perspective and thus see the possibilities, I am going to quote a few basic figures which have been gathered from sources which, I believe, are authentic. These data in one way or another have been frequently quoted—my justification in repeating them is the fact that their increasing significance renders them well worthy of repetition and consideration.

The radio industry, directly and indirectly, gives employment to more than 320,000 people, with approximately 30,000 manufacturers, agents and distributors engaged in the manufacture and sale of its products.

The sales of radio merchandise in the year 1920, prior to the start of KDKA, were less than two million dollars. Sales have grown from year to year, until in 1927 they were approximately five hundred million dollars. In seven years, therefore, a business in the neighborhood of two billion dollars has been created.

The total number of homes in the United States is approximately 28,000,000; there are about 10,000,000 homes with receiving sets, leaving about 18,000,000 homes without receiving sets. At present 694 broadcasting stations in the United States are entertaining the public; and it is estimated that there are about 40,000,000 broadcast listeners in the United States.

Here, within the range of a single voice, we have a potential audience of 40,000,000 people, and the number is constantly increasing. Such has been the increase in the radio industry in the United States. It has been the most remarkable achievement in the industrial history of the world, and should furnish a sufficient answer, if such is necessary, as to the permanence of radio.

Radio has become an indispensable element of modern life. No new service ever received such immediate response and favorable reaction from the public or was so instantly popularized.

During the past year there has been a wholly revolutionary change in the power supply for radio receiving sets. With the advent of successful alternating-current operated thermionic tubes, the battery filament supply is being rapidly superseded by these alternating-current devices, and the entire energy required for operation of a radio receiver may be obtained from the lighting circuit.

More than one hundred million radio tubes have been sold, and a conservative estimate would indicate that there are fifty million radio tubes now in daily operation, with the possibility that this number will be greatly increased within a short period.

Although at the present time only a part, possibly a third, of these radio tubes derive power directly from the lighting circuit, yet the number will rapidly increase. The receiving sets, of which these tubes are a part, draw current both day and night every day in the year, and it may be conservatively stated that the average requirement of current by each receiver is not less than eight kilowatt-hours per month. In a number of surveys that have been made by power companies and others, to determine the effect of this load, it has been found that the average radio set owner has increased his light bill from 25 per cent to 40 per cent, due wholly to the additional hours he uses the lighting service. This is no mean item of increased revenue available to lighting companies, due to the increase in power consumption by radio listeners.

It is my belief that this is only a beginning of a very considerable and valuable load, the amount of which is readily appreciated from the figures I have given. Furthermore, the number of receiving sets now in use and the possibilities of a great expansion in the number, all of which will eventually be electrified where such a service is available, must result in many millions of dollars

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**Abstract of address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

a year additional revenue to the lighting companies.

The policy of the power companies with respect to the service they will render these radio customers is one that must receive serious and sympathetic consideration.

There remains then the question of how the power company may best utilize and develop radio broadcasting to further its public relations.

It is the key to millions of homes. It takes part in the family life and enjoys the intimacy of the family circle. These features make its employment one of great delicacy and fraught with danger if not handled with the best judgment and tact; for radio comes into the home as a guest and will be welcome or unwelcome exactly under the same rules of behavior as any other guest.

The use and development of radio broadcasting by the public utilities is a contribution they owe to the industry. already several of them have made evident their appreciation of this fact, and three different ways of using this facility are being developed:

First—Broadcasting station ownership and operation.

Second—The use of chain broadcasting station facilities.

Third—Local broadcasting.

From my experience in developing, maintaining and operating broadcasting facilities, I do not recommend the first. The growth of the sponsored program has largely extinguished any value of individual ownership in favor of the sponsored program.

In the case of the large, nationally developed public utilities, network facilities like those provided by the National Broadcasting Company are to be recommended.

For the local utilities, the medium is obviously the local broadcaster.

The offerings in all cases should be of the highest class in the entertainment features, coupled with carefully prepared information.

So much for the present. What does the future hold?

No one, ten years ago, would have envisaged the actualities of today; yet we, who are directly within the industry, I repeat, may presume to predict even better things. While our radio brings us only sound today, in our laboratories sight transmission is an accomplished fact. We call it Television, and it only remains now to reduce it to a practical form to make it available to the public. This will be another appliance one hundred per cent electric.

### TALKING "MOVIES" NEAR

Talking "movies" in the home is also just around the corner. At the start, this device will be actuated through the use of individual film records; later, as a service of the broadcasting station.

Apparatus is now developed in practical form whereby a message or a picture can be transmitted in facsimile form—in other words, as a typewritten page or picture. This is an entirely new and revolutionary system of telegraphic communication.

This agency opens up other avenues whose development can be most far-reaching. I conceive it possible, when combined with the principles of the Televox, to arrange a device for use as a broadcast receiver which can be started or stopped at will. This device will automatically take the message from the broadcasting station in facsimile form—in other words, as a printed communication. At one's leisure, he can go to his receiver and get the market reports, weather reports, important news items—in fact, through selective controls, any service would be available for which he may indicate a desire. Items of interest will be made available in the home or office immediately they occur, and thus furnish the means by which this information may be quickly and easily obtained.

Progress in this direction is inevitable; its future is assured.

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# The Rate Situation Discussed*

### By EDWIN GRUHL

*Chairman Rate Research Committee*

*Edwin Gruhl*

NOTWITHSTANDING the outstanding success of the electric light and power industry in efficiently serving its public, and especially its achievements in anticipating requirements of its patrons, there has occurred during the past year much discussion in criticism of the industry and its rate policies. Coupled as these criticisms usually are with the belittling of regulation and the advocacy of municipal and government ownership, it is not surprising that the data upon which they are based do not withstand the scrutiny of critical analysis.

The rate research committee has issued reports for many years and therein has pointed out from time to time the policy of the industry toward rates—only, however, in so far as provided by the scope of the committee's activities. At no time has the committee ever expressed any opinion as to the reasonableness or unreasonableness of any rates *per se,* nor is it within its province to do so. It is not within its scope of activity to discuss the merits of private versus government ownership or the questions of policy involved therein. The work of the committee has dealt mainly with rate forms, types, methods of analysis, etc., and in its reports it has endeavored to point out advantages of the most suitable forms of rates which are beneficial both to the customer and the company and to comment on important events in rate matters occurring during the year, such as court and commission decisions, rate papers, results of special research, etc.

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*Report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

The purpose of a price policy in any industry is to develop the maximum of business at a minimum of cost, a result of mutual interest to producer, merchant and customer. As has been pointed out in previous reports, that policy may be expected to vary according to the locality, its domestic and industrial requirements, its cost of providing service, its possibilities of increased development of the use of such service and other factors. But the ideal policy for time and place exists irrespective of the form of regulation or the character of ownership. The extraordinary development of the industry and its ability to reduce prices with such growth in business demonstrate that as a whole its rate policy has been sound.

Much of current criticism has been quite general and is thus difficult to answer specifically. The principal allegation seems to be that the rates in a specified community are too high compared with the rates in other specified localities. This charge, in fact, appears to underlie most of the criticism directed against the industry as a whole. In many cases the rates cited specifically are in error. In others, comparisons of rates are made as between different localities and as between different classes of customers, with no consideration given to the differing conditions and factors which in nearly all cases totally invalidate such comparisons. The usual method of making such a charge takes the form of selecting the lowest rate of a municipal plant as the criterion by which to compare all private-company rates, without any mention of the subsidy which often makes such low rates possible or of the rates of the other municipal plants which are materially higher.

> *The purpose of a price policy in any industry is to develop the maximum of business at a minimum of cost.*
>
> *It is believed that the industry has met the burden put upon it as a new and growing industry and has not only lowered its charges generally but that the service received by the consumer today is worth many times the value of that which he received but a few years ago.*

Attempts have also been made to create the general impression that more or less discrimination exists against the residence class in favor of the large power user. It has been claimed that generally the rate schedules are the haphazard results of charging "what the traffic will bear" and that there has been little or no attempt made to adjust rates on a scientific basis.

All of these charges have been widely broadcast throughout the country and have received limited comment in the press in certain sections. Occasion was taken in our last year's report to disclose the error of such comparisons and alleged facts appearing in a similar connection during the then current year. The analysis presented by your committee has not been refuted. Its report has been given wide circulation and is certainly familiar to all careful students of the principles of rate analysis. The continued repetition of erroneous statements under these conditions can be accounted for only as the result of misrepresentation or ignorance.

The report of your committee this year (which will be published later as a serial report) undertakes to disclose, for the benefit of member companies and all students of the rate situation of the industry, additional data and information in refutation of these general charges. While the material does not pretend to completeness, it is sufficiently indicative to demonstrate that many of the charges repeated against the industry constitute unwarranted and misleading propaganda.

Under the heading "Rate Comparisons" there will be found of particular interest comparisons of bills of municipal plants for domestic service with charges of communities served by corporations. These demonstrate that, if such cost comparisons are proper, the customers of a number of widely quoted municipal plants are not as fortunately situated as those served by public utility corporations under private ownership, and that for the group as a whole charges in reality for this class of service, concerning which there has been the most discussion, are lower than those by the municipal undertakings.

Two publications, "What Price Electricity in Our Homes," by Morris Llewllyn Cooke, and "Power Control," by Raushenbush and Laidler, have recently appeared. These have been analyzed by the committee and are commented upon in the forthcoming report. Study has also been made of the rate situation in Ontario, looking to the comparative trend of domestic, commercial and power rates, with the analysis disclosing that the classification is not, as frequently alleged, based upon cost of service to the class, but upon other considerations, the most important of which is that of political expediency, the domestic customers being favored at the expense of the commercial business. This is confirmed by the recent report of the commissioners of Toronto, which admits that domestic service in Toronto has been rendered at less than cost and announces increases in domestic rates effective in July.

The report also discloses in reveiw the significant decisions within the last year of courts and commissions, all of which appear to confirm previously established principles. Carl D. Jackson, legal advisor of the association, and John D. Van Wagoner, assistant, have continued their careful work as editors of *Rate Research.*

Especially informative will be found the bibliography on classification of service and analysis of costs. It will be seen that the industry has been well aware of these important factors since the earliest days of the central stations. It is believed that the industry has met the burden put upon it as a new and growing industry and has not only lowered its charges generally, but that the service received by the consumer today is worth many times the value of that which he received but a few years ago. The industry has endeavored to render approximate justice in its charges to its different classes of consumers, and, on the whole, it can confidently be asserted that this has been done.

# *Coffin Award for 1928*

GOES TO

# Puget Sound Power & Light Company

RURAL development, domestic load building through intensive sales effort and railway electrification are among the outstanding accomplishments that won for the Puget Sound Power & Light Company the 1928 Coffin award. In 1927 the company connected 3,700 farm customers, raising the total to 25,000 (63 per cent of the 40,000 farms). During the year 8,042 electric ranges were sold, establishing a record for the third consecutive year. The total number of range customers at the end of the year was 22,369, or a range to every 4½ residential customers. The average annual consumption per residential customer during 1927 was increased 113 kw.-hr., bringing the total to 763 kw.-hr. At the same time the number of domestic customers was increased 11 per cent. Two transcontinental railroad lines utilize Puget Sound power for operating their electrified sections.

*Baker River power plant*

Popularly Owned
Company in Washington
Our Stock Is A Good Investment
Electricity will do for Agriculture what it has done for Industry

*Domestic and rural uses of electricity stimulated by appliance displays*

## *Some Puget Sound*

# Accomplishments

*Electric pumping that produced 100 bushels of wheat per acre*

### RURAL

Added 3,700 rural customers in 1927; serves 25,000 out of 40,000 farms.

Pioneered in electrifying brooders; reduced cost of orchard spraying; improved irrigation.

Virtually all of the $30,000,000 poultry industry in western Washington is electrified and 90 per cent receive service from the Puget Sound Company.

Developed many new farm uses for electricity.

### DOMESTIC

Established inducement rates.

Increased average domestic consumption 113 kw.-hr. in 1927.

Average is now 763 kw.-hr. despite 11 per cent increase in customers; average revenue $31.39.

Sold 8,042 electric ranges in 1927.

Total on lines is 22,369, or one for every 4½ domestic customers.

### RAILROADS

Aided electrification of Great Northern and Chicago-Milwaukee Railroads.

### GENERAL

Removed serious barrier to hydro development by hoisting fish over 293-ft. dam.

Increased gross revenue 14 per cent in 1927.

Increased domestic revenue 21.3 per cent in 1927.

Raised total domestic consumption 30.2 per cent in 1927.

*Electric train on the C., M. & St. P. R.R.*

# Allocation of Sales Costs*

### Merchandise Accounting Inadequate in Utility Business—Classes of Charges and Importance to Sales Efforts

By E. W. Lloyd
*Vice-President Commonwealth Edison Company*

*E. W. Lloyd*

VERY few central-station companies were in the merchandising business ten years ago, but recently the number has increased very rapidly, principally owing to the fact that the central-station companies are realizing the necessity of selling more kilowatt-hours to each customer and that the sale of electrical merchandise gives the greatest promise of bringing about this result.

The proper allocation of accounts covering the cost of the important subdivisions of these operations has not had very much consideration. The classification of accounts as it now exists is not sufficiently broad to cover what is required by the merchandising manager or the executive to provide a complete picture of the situation and enable him to know his exact costs. In many instances merchandising accounts have been combined with other accounts, and we frequently find the functions of a merchandising department carried on in part by other departments in the business without control or supervision by the merchandising or commercial manager. I ask you what private business could stand such a condition for even one year.

The central-station companies in most instances to date have seemed to overlook the necessity of selecting men who by inclination and training belong to the merchandising class, but have put in charge of their merchandising operations men of no general practical knowledge of the intracacies of the art of selling, with the almost foregone conclusion that they cannot succeed. Now I do not mean that this is the only reason that the central-station companies have been unable to merchandise at a profit. There are numerous other reasons, some of which I will mention—the lack of customers' acceptance of many electrical devices as a whole; many electrical devices are still in the early development stage of their existence; many of the functions performed by electrical devices can be accomplished by other utensils backed up by years of customer experience. There are still a few articles of merchandise, such as the flatiron, that have common use in the home, but a large majority of devices have not had common acceptance, so we are faced with the resistance of prejudice and unfamiliarity on the part of the ordinary "prospect." Another factor is the long life of ordinary electrical appliances. The customer buys an iron, toaster or percolator and frequently does not need another one for several years. In other words, the narrowness of the electrical line and the infrequent purchases of most devices usually sold in the merchandise shops of utility companies, dealers and other electrical stores are a distinct handicap in the attempt to make money by selling such merchandise without side lines. Without these, those who complain of us could not exist.

The reason the department, chain and hardware stores can and do undersell the central-station companies with the same line of merchandise is because they have a broad line of appeal in other forms of merchandise which bring the same customers into their stores frequently. As a consequence their overhead per unit of sales is very much lower. A notable example is the corner cigar store, which, in order to pay enormous rents, has added such articles as razor blades, lighters, clocks and many other things.

In many cases our stores have been loaded up with costs which do not properly belong against the store division of the central-station activity. Part of the rent costs charged to merchandising activities should be allocated against the electricity sales of the company, because the company in most instances is required to furnish reception and display rooms in which the public can transact the normal business of electricity supply, and at least part of the cost of these rooms should be properly charged against electricity sales rather than against merchandise sales.

#### Handicaps to Profit

Another handicap has been the charges for advertising. The insistent demands of public utility companies from every source for participation in every class of advertising known to trade are well known. The sale of goods by a merchandising company, with the necessity for showing a profit or going into bankruptcy, permits the use of only such advertising media as would bring profits to his business.

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*Address, "Some Problems for the Accountants in Merchandise and News-Business Expense," before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

Another example of improper charges against merchandise activities has been in connection with that class of merchandise known in one case as experimental and in another as promotional—for instance, any devices using electricity which are strictly in the experimental stage and which, if the central-station company did not promote and push them, would never be developed. We have had many experiences in the past with such appliances. How many ruefully remember the difficulty of selling the early electric iron, the table lamp and the electric fan! The second instance is the promotional form of merchandising, where the device has been developed but has never had very common acceptance—for instance, heating and melting furnaces, commercial cooking and other industrial devices. The cost of persuading customers to use such devices is a way beyond the possible merchandising profit. The cost of selling such devices has no place in merchandising costs as applied to merchandise of common acceptance, such as is usually sold in larger quantities in electrical stores. Another cost which is frequently charged to merchandising effort is putting on a campaign for the sale of a particular kind or class of merchandise which in the last analysis would not be attempted if the company carried on any merchandise sales activities in the usual acceptance of the word—for instance, such campaigns as the placing of kitchen-window ventilating fans, kitchen lighting units, the replacement of old lighting fixtures in the home with new ones, the installation of wiring for more outlets in homes already wired, the development of new electrical devices to place the manufacturer in a position where he can make enough of them twelve months of the year to warrant him making a price the public will pay. We have not at all reached the stage where the manufacture of such devices is possible on a basis of production which will permit the making of a price that will encourage use. At the present time we are trying to encourage the manufacture of electric dish-washing machines, egg beaters, therapeutic devices, hair dryers, massage machines, insulated ovens, etc. It is hardly necessary to enumerate any more of such a line. It would not be difficult to enumerate dozens of them.

*In many cases our stores have been loaded up with costs which do not properly belong against the store division of the central-station industry.*

*I do not believe there is any excuse at this time for central-station companies selling common and accepted lines of electrical merchandise at a loss.*

*There are thousands of applications of heavy-duty appliances which will never be put in service if the central-station company does not do the pioneering job.*

*Any executive whose company is selling only 350 kw.-hr. a year per residential customer should be thoroughly ashamed of his position in the industry.*

What I am leading up to is this, the accountants in our business in developing adequate accounting systems should take into consideration the factors above enumerated; that the charges against simple merchandise that has had some customers' acceptance should be segregated from others entirely promotional or experimental in character; that they should give consideration to the proper allocation of certain costs for rent and other overhead costs which have a distinct relation to the sale of merchandise of common acceptance. Storeroom and transportation costs, rent, advertising, etc., should be scrutinized carefully to determine in what classification such charges belong.

The standard line of household utensils, all of which are on display and sale by the average electrical store and in the electrical section of department, chain and hardware stores—and which, by the way, were only a few years back in the experimental or development stage and scorned by those who are now complaining in some locations of some of our practices have in the last year or two been given considerable attention by half a dozen national organizations representing the department stores, hardware stores, drug stores, furniture stores, etc. Some complaints were being registered against central-station companies for selling goods at a loss. There are many angles to this problem, many of which these associations do not understand. They only know the merchandise referred to in a previous paragraph that has had sufficient customer acceptance to permit them to sell it on a par with other goods they sell at a price which will net them a profit provided the local central-station company does not adopt the practice of price cutting. We should in no event continue a practice of price cutting, but I do not believe the practice is so common as some people think. I believe, on the whole, the central-station industry is maintaining prices of merchandise on a fair basis. Our critics are not themselves free from criticism on this score. We can, particularly in the large cities, refer to the daily advertisements showing cut prices on many lines of electrical merchandise, in many instances much lower than the central-station company can sell them.

I do not believe there is any excuse at this time for central-station companies selling common lines of electrical merchandise at a loss except in specific cases where the device in question has not had sufficient acceptance to make it a common article of trade and where if the central-station company does not make some effort to place it in that position it will never get there. There are plenty of such articles being developed every year.

I think we should discourage the giving of premiums of various kinds, but I see no reason why we should not follow the accepted practice in the merchandising trade for the disposal of merchandise that does not move quickly. All merchandising concerns recognize this principle. They also look for leaders to attract people to their stores. When merchandise does not move quickly they see to it that it will, by cutting the price. It is standard accepted practice to carry on seasonal sales on a very wide line of goods at prices they advertise as being below the standard prices. Who is not familiar with the January linen, the August fur and the March furniture sales? Now, this suggestion that we cut prices does not mean that we should cut the price of merchandise of standard acceptance, but that we have the right to follow accepted practice in merchandise trade, such merchandise to be legitimately disposed of.

We note that department stores advertise a standard line of goods at cut prices where they are able to buy a job lot of a firm going out of business, to buy from a jobber or manufacturer caught with too much stock or to purchase a bankrupt stock. Why should we not do the same if the goods are right?

There is still another class of merchandise which must be given consideration, and that is the heavy electric appliance used in industry, which is not being promoted or sold by the manufacturers, manufacturers' agents or jobbers in sufficient quantities to make the common use of such devices possible. Some one has predicted that there will be just as much electricity used in the next generation for heat applications in industry as has been used in motors in the past generation. This may or may not be true, but the fact remains that there are thousands of applications of heavy-duty appliances which will never be put in service if the central-station company does not do the job or until such time as there are enough of these devices manufactured or demanded so that others may do the work of selling at a profit.

Another factor is the cost of servicing devices. All electrical devices require more or less service from time to time, and it is natural that the public call on the central-station company for such service, all of which is part of the cost of popularizing the device. Nevertheless, not all of this servicing cost should be charged to merchandising accounts as the central-station company enjoys revenue from the sale of electricity from the device for long periods of time and if the device is not in use the company in question is losing revenue because of this fact.

These are devices in the promotional stage which cannot in the first few years of their development carry a merchandise profit. As a recent example, let us recall the domestic refrigerating machine and in the recent past the washing machine, on which we and the manuafacturers have had to incur large losses in order to put such devices on a strictly merchandise basis. Some of them have not arrived yet. If the central-station companies had not placed themselves behind these and similar devices with money and service at their command, the department and hardware stores would not be able to sell them today. Who ever heard of a case where those now complaining furnished money to perfect any electrical device?

I am sure that if we went out of merchandising neither they nor the public would receive the benefit accruing when science, invention and the manufacturers are encouraged by the central stations, which help in placing in the hands of the public the labor-saving devices that are helping in such a large measure to place the American home on a higher plane and standard of living than ever before attained.

We are just entering an epoch of development of the industry which demands the sale of more kilowatt-hours, and the company whose executive familiarizes himself with the full merchandising problem and backs up his sales manager not only with money but with intelligent teamwork will reap the harvest of more energy sales in full measure.

In most of the cases coming to my attention the sales manager is not getting the assistance needed to do a big job, and it is a big job. Any executive whose company is selling only 350 kw.-hr. a year per residential customer should be thoroughly ashamed of his position in the industry, and he can only change it by intelligent rate structure plus fair merchandising intelligence and a forcefully backed-up sales effort. The accountant must not shirk his duty in this situation.

## *The Ten Cardinal Rules of Customer Ownership*

Prepared by the Customer Ownership Committee
of the National Electric Light Association

1. The sale of the securities must be direct from company to customer or through an agency expressly created for the purpose and controlled by the company.

2. The safety of the securities offered must be amply protected by property and earnings.

3. A minimum rate of dividends must be provided for in so far as honest judgment based on experience can foresee.

4. A reliable resale market must be maintained in some manner so that shareholders who wish to dispose of their holdings can do so promptly at nominal expense.

5. A partial-payment purchase plan must be operative in order to give every customer who can save a small amount monthly full opportunity to become a shareholder, and to encourage thrift.

6. The proprietary interest and responsibility of shareholders must be emphasized and the shareholders supplied regularly with information regarding their company and its affairs.

7. Loss of capital by shareholders in hazardous and fraudulent offerings from various sources must be guarded against by the rendering of authentic information and advice to shareholders.

8. The number of shareholders must be increased steadily, and efforts should be made to avoid large individual accumulations of stock.

9. Employees must be carefully instructed in order that all representations made to customers or others shall be in line with the facts.

10. Managements must realize that customer ownership multiplies their obligations to the public and intensifies the trust reposed in them. It does not replace the constant striving for higher efficiency, good service, reasonable rates, courtesy and progressive public relations policies.

# Importance of Accounting*

### Complexities of the accountant's work have grown greatly, but the standard of personnel has not kept pace with the increased requirements. Machines in accounting

### By E. A. Davis

*Chairman Accounting National Section*

WE ARE passing through an interesting period in the development of this country—probably, from the phases of both government and business, one of the most interesting in the country's history. This is not the time or place to theorize on the tendencies in either phase nor on their possible consequences. One of the byproducts of the governmental phase has been an increased, though temporary, burden thrown upon the accountants of most of the companies. This condition made itself manifest during the past year and in all likelihood will continue well into the next administrative year. Probably no other section of the association is faced with this same condition. It must not be allowed to act as a retardant influence upon the forward movement of this section, and it appears unusually desirable that the work for the year be got under way with dispatch. Those of you present who are responsible for the work of the geographical divisions should bear this in mind and apply yourselves diligently to the task before you. It will be several weeks before the new organization for the national section can be perfected and functioning. In many of the geographic divisions a great deal can be accomplished before that time, and to you present who will be carrying on the work in such divisions I bespeak for the new administration earnest co-operation in this direction.

*E. A. Davis*

As a means of assisting the new administration in getting the committee work under way with the minimum of delay I obtained from each of the national committee chairmen a review of the year's work of his committee, together with his recommendations as to next year's procedure. Interesting among the comments received was a statement calling attention to the tendency of the committees to ease off on their work in the early months of the calendar year. This is no doubt due to the habits of old continuing, habits created under the old plan of publishing all committee reports for distribution at the annual convention with a dead line for the receipt of copy set at approximately March 1. That condition no longer exists. Reports may be printed at any time under the present plan, and there is no reason for a committee's activities not continuing up to the time the annual convention assembles.

We dwell quite extensively in our meetings and in our reports upon accounting problems and procedure and very little, if at all, upon the personnel problem as it is found in the average accounting department. Those of us whose experience covers no more than fifteen years have seen the complexities of the work being done in this department increase tremendously. Pension plans, savings plans, federal taxes, incentive wage scales, transmission lines are but a few of the contributory causes and do not take into account problems occasioned by rapid growth. In addition, we have seen the requirements of the other departments and of the executives become much more exacting in the character and quality of the information provided by the accounting department. Justifiably so. Despite all this, I seriously question if the average personnel standard has been raised to any marked degree. The reason for this is probably not difficult to discover. It is unfortunately true that too frequently economy waves pound hardest on the accountants and their departments. But the accountant who practices economy to the extent of depriving himself of the right kind of assistants and timber for promoting through succession is likely to prove extravagant.

Furthermore, the complexities and the decidedly specialized nature of the accounting work in this industry make it more essential than in any other industry that there shall be competent assistants developing in the accounting departments. As a rule the responsibility for their selec-

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*Abstract of report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

*H. C. Hasbrouck*
Chairman Committee
on Classification of Accounts

*J. E. Loiseau*
Chairman Committee
on Corporate Finance

*B. F. McGuire*
Chairman Committee
on Customers' Records

*M. R. Scharff*
Chairman Committee
on Fixed Capital

*F. J. Brett*
Chairman Committee
on General Records

*R. G. Smith*
Chairman Committee
on Statistics

*W. G. Young*
Chairman Committee
on Purchasing and Storeroom

tion rests upon the accountants and it is not a responsibility that should be taken lightly.

It is entirely within the realm of possibilities that business conditions of tomorrow will require more than heretofore company executives whose basic training has been along economic lines. Careful selection of assistants today might provide the needed executives of tomorrow. A carefully selected personnel is but the beginning, however. Their subsequent training and development is of equal importance and is a serious responsibility of the accountants. As an aid in this development I do not believe it is necessary for me to point out to this gathering the practical advantages afforded by permitting active participation of the assistants in the work of this section.

### Machines in Accounting

That we are living in a machine age is just as true of offices as it is of factories or of homes. The opportunity for doing more work and better work by the use of mechanical devices exists in the offices as it does elsewhere. The reports of the Accounting Section have not up to the present time dealt extensively with the application of such devices. The types available are many and various. None of them is made to meet the requirements of public utility offices exclusively. Some of them are better adapted for one class of work while others will excel in another class. The amount of information available as to the types of devices best adapted to the various accounting operations in a public utility office is meager and, as a rule, the product and concept of the manufacturer. Certain difficulties have heretofore existed which have tended to discourage any attempts by committees of this section to issue reports dealing primarly with these mechanical office devices. It is believed that the way has been paved this year for the removal of these difficulties so that the Accounting Section can by means of committee reports or some other manner make available to the member companies authentic information on such office equipment—information derived from its practical operation in public utility offices.

## Progress on Standardized Accounting*

By H. C. Hasbrouck

THERE are 39 regulatory commissions having jurisdiction over the accounting practices of electric light and power companies, including 38 state bodies and the commission of the District of Columbia. Twenty-eight of the 39 have adopted the standard classification recommended by the National Association of Railroad and Utilities Commissioners and formally adopted by the National Electric Light Association. The accountants of four other state commissions are now giving serious consideration to the adoption of the standard classification.

The standard form of annual report has been less generally adopted, principally, it would appear, because the state commissions require more statistical data than the standard form of report contains.

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**Abstract of report of committee on classification of accounts, presented at N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

Decisions on questions of interpretation which have been passed upon by the committee in prior years are on file at National Electric Light Association headquarters, but still await editing for publication. This task, we hope, will be completed by the work of next year's committee.

The committee has gone definitely on record as believing that no changes in the standard classification should be recommended this year, but this does not prevent it from giving consideration to certain modifications which have been suggested and which undoubtedly merit discussion. Some of these it has before it at the present time, but it is not prepared to make definite recommendations thereon.

Among other matters for which this must be offered as in the nature of a progress report are the co-operation with the Commercial Section in an effort to obtain a uniform system of merchandise and jobbing accounting, which at present awaits the initiative of the Commercial Section, and the study of the accounting problems involved in interconnection agreements. This last subject was referred to the committee by resolution of the executive committee of the Accounting Section last February. It has been laid before all members of the committee, but evidently requires careful consideration, in view of its importance and comparative novelty. It can probably be best handled in a serial report by next year's committee.

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# Railway Electrification*

### Illinois Central electrification described. Why power was purchased. Future of electrification outlined. Interrelation of the railroad and utility industries

By L. A. Downs

*President Illinois Central Railroad*

IN CARRYING out the electrification project in a manner to provide for the inevitable future growth of Illinois Central freight, passenger and suburban business at Chicago and assure the maximum efficiency in terminal operations, the Illinois Central is practically reconstructing its entire Chicago terminal. The electrification itself is being undertaken by stages. First is the electrification of the suburban service; that stage was completed in August, 1926, six months ahead of the time agreed upon. Next will come the electrification of freight operations, and later the electrification of through passenger operation.

When the electrification is completed it will cover 420 miles of freight, passenger and suburban tracks. In addition to the electrification itself, the whole Chicago terminal improvement project includes: Elimination of both highway and railway grade crossings on the main line for a distance of 38 miles south of the Chicago River; relocation of nearly all tracks in the Chicago terminal area; the movement of approximately ten million cubic yards of earth; construction of an immense gravity freight classification yard on the outskirts of the city; construction of extensive shop facilities; relocation and construction of freight and passenger car yards; construction of bridges, tunnels and subways; erection and reconstruction of suburban stations and platforms; erection of a through passenger terminal at the south end of Grant Park; construction of 250 miles of new trackage; construction of several miles of retaining walls and the reconstruction of the signal and interlocking system.

*L. A. Downs*

Some of these improvements were not essential to the electrification and could have been deferred until later, but it would have been more difficult and costlier to carry them out after electrification. The elevation and depression of tracks for the elimination of grade crossings, for example, was far more economical under steam operation than it would have been after the overhead supports were erected and transmission wires were in place on fixed bridges. A permanent track plan was worked out which will reduce to the minimum the possibility of having to shift tracks after electrification.

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*Address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

The electric suburban service covers a zone embracing 37.8 route miles and 127 miles of trackage. In the electrification of this service it was necessary to erect more than 900 catenary structures and to string approximately 293 miles of transmission wires and and 470 miles of messenger and contact wires. The 1,500-volt direct-current system with overhead contacts is used.

The electric service was begun with new equipment throughout. The cars, specially designed for this service, are of all-metal vestibule construction, each having a seating capacity of eighty-four. Spaciousness, cleanliness, good ventilation, uniform heating and ample lighting are among their notable features. The trains are operated in multiple units of two cars—a motor car and a trailer semi-permanently connected—and four-car and six-car trains are most numerous, although station facilities have been designed to accommodate eight and ten-car trains where required. At present 260 cars, having an aggregate seating capacity of approximately 22,000 persons at one time, are in use, and these cars are carrying approximately 120,000 passengers every weekday.

Aside from equipment, the most important factor entering into the electrification of the suburban service of the Illinois Central System was the choice of power supply. The practicability of constructing an independent power system, including generating plants, transmission lines and substations, for the sole use of the railroad was carefully considered, but the decision was against doing so and in favor of purchasing all electrical energy, under contract, from the Commonwealth Edison Company. Under this arrangement the Commonwealth Edison Company erected its own substations at designated points on the right-of-way, and it now supplies direct current to the traction system and alternating current, of suitable characteristics, for signal, light and other auxiliary uses.

### Reasons for Plan

I believe you will be interested in an outline of the reasons which led us to adopt this plan. The erection of an independent power system would have involved a heavy investment on the part of the Illinois Central, and the high cost of generation in such a plant, by reason of the necessity for a relatively high percentage of reserve generating capacity and on account of the comparatively small peak-load demand, would have made the operation inherently less economical than the purchase of energy from a large and highly organized power system. Furthermore, the ownership and operation of such a plant would have carried the railroad out of its sphere into the highly specialized field of power production, a field in which it might have been difficult for the railroad to keep itself up to date. Moreover, uninterrupted service must be maintained. Any breakdown of electric supply in such a busy terminal would be highly disastrous. The purchase of energy from a large power system having an ample generating reserve and duplicate transmission lines assures the Illinois Central of a dependable, uninterrupted supply of energy.

In its physical characteristics the electric suburban service represents a vast improvement over the steam service which it replaced. The widespread public approval that has been given this service is evidenced by the fact that the present volume of suburban patronage is already more than one-third greater than immediately prior to electrification in 1926. The increase in patronage has been so much greater than was anticipated that we have already found it necessary to place orders for twenty additional cars for early delivery. Because the running time of trains has been reduced between 11 and 28 per cent, electrification has increased the desirability of outlying communities by bringing them all within closer reach of the central business district.

I have already referred to the fact that under steam operation the Illinois Central suburban service was an unprofitable enterprise. It not only was failing to pay a return upon the investment in suburban facilities and equipment but the revenues were not sufficient to meet out-of-pocket expenses. By reason of the greater economy of operation and the increased patronage which followed electrification, in addition to an increase in rates which shortly preceded it, these out-of-pocket losses have been entirely wiped out, and the service is now producing considerably more than enough revenue to pay operating expenses and taxes. Although the present net income is still substantially short of a fair return on merely the outright cost of the suburban electrification itself, including the $10,000,000 worth of equipment purchased, there is ground for hope that with the continued growth of patronage the time will eventually come when the suburban service will be fully self-supporting, including a moderate return upon the whole investment.

One of the potential byproducts of railway electrification in the larger cities is the development of air rights. The development of such rights at New York demonstrates the possibilities in this direction at Chicago. The Illinois Central owns 65 acres of valuable property adjacent to the Loop business district in Chicago which will be available for air rights development as a result of the electrification of the terminal. It will be many years before these air rights can be fully developed, but they will be of large importance in estimating the eventual results of electrification.

Because of the prominence of our electrification program—the publicity it has received and the discussion it has caused—I am often asked for an opinion concerning the future of railway electrification. I am not given to prophecies, but I think there is no doubt that utilization of electric energy will continue to increase as special problems in railway capacity and operation are encountered.

### Influences Upon Electrification

As I see it, there are two elements which will have important influences upon the future development of railway electrification. The first of these is the development in the art of applying electricity to the problems of railway operation. Thus far it can hardly be said that railway electrification has passed out of the experimental stage. It has not been standardized to the extent of steam railway design. Each project that is undertaken is a new experiment in that it deals with a special problem, all phases of which have not been developed heretofore. I regard our own electrification as such a project. I have faith that the results we shall finally accomplish will fully compensate us for the expense we incurred, but when costly undertakings are being considered without the necessity which forced the Illinois Central into its electrification program it takes more than faith to justify the large expenditure involved. Engineers must know in advance that the results will be sufficient to pay a full return upon the investment, and they must be able to marshal the facts to support that knowledge.

If you are desirous of hastening the utilization of electricity in the solution of railway problems, there is scarcely any service you can render of greater importance than that which looks toward the development and standardization of the art of producing electrical energy and its application to steam railway operation. I do not mean that all types of electrification should be alike, for there are many problems, but I do mean that the art shall be reduced to such generally applicable terms that a railway engineer can know that under certain definite conditions certain definite results will be produced.

The other important element influencing the future development of railway electrification is the financial element. After it is proved that money can be saved by spending money for electrification, there is still the problem of where to get the money to spend. Every railroad in the country has plans for large engineering projects of demonstrable money-saving value that must be deferred from year to year because the money is not readily available with which to carry them through.

Here, too, but in another way, you can make a real contribution not only to the progress of railway electrification but also to the continued improvement of railway service and the increased economy of railway operation.

A simple illustration will show the results of the constant pressure for reduced rates. On the Illinois Central System our average revenue for hauling a ton of freight one mile was reduced from 9.66 mills in 1921 to 8.86 mills in 1927. Now, this reduction of eight-tenths of 1 mill per ton mile may seem to be a small item, but when it is applied to the 16⅓ billion ton-miles of revenue freight handled by the Illinois Central System last year, it amounts to more than $13,000,000, and $13,000,000 is 6 per cent on approximately $216,000,000. I am not going to say that this missing $216,000,000 worth of potential investment would have been made in electrification if we had had it at our command, but you can see for yourselves how much better disposed toward electrification a railroad with $216,000,000 extra of investment power would be than a railroad that lacked such an amount.

The constant downward adjustment of rates threatens to undermine railway credit. Credit is dependent upon adequate rates. If the railroads are to improve their properties and increase the capacity of their plants in keeping with the ever-increasing demands which are being made upon them, they must be allowed to earn returns that will attract the needed capital.

The electrical industries and the railroads have much in common. Both are engaged in providing for the masses of our population services of the most essential nature which have contributed greatly to the effectiveness of human endeavor. Both face large and important problems arising out of their common necessity for increased production, greater economy and equitable regulation. Finally, the buyer-and-seller relationship between them has grown to large proportions as the railroads have come to make greater use of electricity for light and power and the expanding electrical industries have made greater use of the transportation service which is the product of railway operation.

Both industries have felt the blighting effect of misguided public opinion in the past. Both have been the targets for hostile legislation and restrictive legislation. Both have consciously and earnestly sought to improve their relations with the public. There is no question in my mind that a great deal has been accomplished in this direction in the last decade. This accomplishment is reflected in the friendly attitude that now prevails generally in the public mind toward these industries and in the increased tendency on the part of law-making and regulating bodies to give them both a square deal.

I have been impressed by the excellent work which the National Electrical Light Association and the various electrical companies have been doing in recent years toward bringing about a better public understanding of their problems. There is no question that the whole electrical industry has been vastly benefited by this work. I believe it has had a beneficial effect upon corporations generally. On the other hand, the efforts of the railroads along similar lines have probably benefited your industry in like manner. Such efforts are cumulative in their effect. Their full benefits will not be felt for years to come. It takes time to efface the long-standing prejudices of the past and to bring the public mind, long given to mistrust of corporations, into a sympathetic understanding of their problems.

Confidence and co-operation cannot be built on any other basis than that of mutual understanding, and such understanding can be obtained only with the constant interchange of trustworthy information and intelligent discussion. The public is fair when it knows the facts and understands them. To me it is unthinkable that the frank, open, straightforward course which has increasingly marked the conduct of business affairs in recent years shall be abandoned.

# Lighting Service Committee Work*

By J. Daniels, *Chairman*

It is now recognized that the central-station lighting service department has its own peculiarities which are not shared by other branches of the industry. It has, therefore, been found desirable to hold closed meetings from which all manufacturers' representatives are excluded. The merits of various equipment or methods of lighting practice may then be freely discussed without offense to outside interests. Such meetings are naturally designed to further the central station's interests, but have incidentally benefited the entire industry by calling the attention of manufacturers or outside interests to any practice considered commendable or otherwise.

It must always be borne in mind that the central-station engineer is concerned first and last with the effect upon the ultimate consumer. Each customer looks to him for an expert and unbiased engineering service, free from the influence of sales or commercial propaganda.

The committee has other work well under way which will have an important effect upon lighting practice. The sub-committee on specifications for testing commercial glassware has prepared a standard method of selecting, testing and rating lighting equipment. All equipment recommended by a central-station lighting specialist in the future must come up to definite standards. Such a practice is obviously as advantageous to the reliable manufacturer as to the ultimate consumer. The elimination of sub-standard materials from the market is an excellent thing for the electrical industry—it should be aggressively promoted in every line.

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**Abstract of report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

*A. M. Lloyd*
Chairman Committee
on Commercial Cooking

*H. W. Derry*
Chairman Committee
on Competitive Power

*C. L. Harold*
Chairman Committee
on Customer Relations

*A. B. Collins*
Chairman Committee
on Domestic Electric Range

*W. H. Sammis*
Chairman Committee
on Industrial Heating

*J. Daniels*
Chairman Committee
on Lighting Service

*T. F. Kennedy*
Chairman Committee
on Promotional Rates

*G. B. Richardson*
Chairman Committee
on Refrigeration

*C. L. Dunn*
Chairman Committee
on Home Lighting

*C. E. Greenwood*
Chairman Committee
on General Merchandising

*C. J. Eaton*
Chairman Committee
on Electrical Advertising

*R. J. Malcomson*
Chairman Committee on
Street and Highway Lighting

*L. M. Branch*
Chairman Committee
on Transportation

*W. C. McWhinney*
Chairman Committee
on Water Heating

*M. C. Huse*
Chairman Committee
on Wiring

# Call to Arms in Sales Work*

### Chairman J. E. Davidson outlines work of Commercial National Section and appeals for action on market development. Need for more sales and less market study

J. E. Davidson

THE time calls for action along the entire sales front of the whole electrical industry. This is the most important message that any man could bring from the Commercial Section. It is not only a question of the opportunity, which is vast, but of necessity as real as it is pressing. It is not a question of preparedness. It is not one of plan. It is not one of internal betterment, important as that problem is. It is whether or not we are to meet the supremacy challenge of the other great industries.

I know of no industry which has engaged in more numerous or more intensive association activities than has our own. Through the National Electric Light Association, National Electrical Manufacturers' Association and the Society for Electrical Development we have moved energetically to put our house in order, commercially speaking. While it would be premature to say that such task has been accomplished, I do not hesitate to suggest that enough has been done to justify shifting the emphasis of our strategy to the consumer selling front.

Let us for the moment turn our attention from ourselves and look to our markets. Let us measure the pace at which we are moving by the pace of other industries. Let us question the adequacy of what we are doing—the utter inexcusableness of not doing more. There can be no question of the fact that the strides of others prove our pace is too slow. In many respects our market is growing faster than we are. I do not mean to criticise the sales efforts of individual companies nor of individual groups. Splendid individual sales and advertising campaigns are being carried on. Columns are being thrown forward, well ahead of the line of battle. But collectively we are not engaged in that unified and coherent action which alone holds out the promise and the hope of those victorious results to which we are fairly entitled.

In the meantime other producers are eagerly availing themselves of opportunities which are equally ours. I will not burden you with a repetition of the data which have been accumulated through our surveys. Many of you are familiar with the basic facts, which can be boiled down to the statement that not by any means are our endeavors getting the share of the consumer's dollar which is our just due.

The keenest competition of all is not among individual manufacturers, but among industrial units. It is academic to tell you that in our fight for sales we are competing with the automobile industry and the whole roster of great industries among which the consumer distributes his purchases. Why is it that we are not making greater headway? There are numerous answers. But I venture one which few will challenge.

It is a fact that as an industry we have not organized for a powerful and sustained advertising and sales promotion drive to impregnate the entire consuming public with what we call "electrical consciousness." We need this drive, gentlemen. We need it to enhance the pulling power of our product advertising, to sell the idea of these products in advance or in conjunction with our efforts to sell the products themselves. Without it we are depriving our individual and group activities of the free and effective play we all desire.

After two years of close observation and participation in the work allotted to the Commercial Section, I do feel that definite progress has been made toward our objective. A year ago we were far from satisfied. Even now we are far from content. But I have high hopes that another six months will see the fulfillment of our wishes definitely under way. The time is ripe. The need for action is pressing. There has been much discussion. Essential information has been gathered and analyzed. The ground is well prepared. This is the moment to strike—and vigorously.

Primarily, I suppose, we are all thinking selfishly, which perhaps is well enough if we combine constructive action with thought. But there is a great deal more than that beyond our commercial goal. We have come to realize that public utilities are merely the trustees of electric service. It is our duty to give the public every opportunity to secure the comforts and the benefits of more varied electric service.

We have been so occupied with our individual problems that we have been content to accept business as it came to us. It is true that we have aggressively pushed our respective lines—thinking solely in terms of electric refrigeration, electric irons, toasters and other like appliances. But we have not faced the whole broad canvass of the possibilities of electrical development. Why exult to the country and to ourselves over the wonderful advancement which electric service has brought about? Instead we should point out to every American home owner the fact that we and they are merely on the threshold of almost undreamed-of advances.

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*Abstract of report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

In fact, I should like to propose that our rallying cry should be "More kilowatt-hours per capita!" To accomplish this, however, kilowatt-hours must be definitely sold. Hence our aim in merchandising must be to create a real longing for more electrical appliances and to place the appliances in the hands of our potential customers and by intelligent educational methods make sure that they are used.

The "resident kilowatt-hour contest" which has been launched by the general merchandising committee has furnished every member company an excellent barrage for intensifying interest in selling more electrical energy. The purpose of this contest is to promote the sale of one more kilowatt-hour per home per day. Figure experts can see the importance of this movement, for, if the millennium could be reached and every home in the country were induced to use one more kilowatt-hour per day, our electrical energy consumption would increase about six billion kilowatt-hours, bringing in an increased revenue of about $300,000,000. While such a millennium may not immediately come about, without question this contest, if it shall have enthusiastic local support, will do a great deal toward increasing our sales of electrical energy.

### Need Co-operative Help

While our part in this program is clear, we cannot rely solely upon our own efforts. We must influence and win the enthusiastic aid of those who can and who logically should back us up. Among them are the retailers who handle, or are in a position to advocate, the purchase and use of good electrical appliances. Architects and builders can render invaluable service. Nor have we pushed electrical advertising—signs, window displays, floodlighting and allied opportunities for the greatest possible consumption of electrical energy. Until now we have left these important matters to the individual initiative of electrical manufacturers and electric light and power companies.

But the cities and smaller towns are by no means our only field for broadening our market. The farm and rural districts present a marvelous opportunity for concentrated effort. Agriculture can be taught to profit by electric motorization just as manufacture has learned its value. While economic conditions in some sections present obstacles, this should not prevent our pioneering in these communities in our work of education. Profits are, of course, desirable but should not be our sole aim. The winning of new friends and a nation-wide, non-sectional good will is of equal and vital importance. Worthy electrical appliances in the nation's homes will cause more word-of-mouth comment and result in more friendly feeling than all the pamphlets ever printed and all the speeches ever made. But first these appliances must be introduced into homes.

To accomplish these things there must be a concerted drive to sell not only appliances but electrical ideas. This is sound business and even sounder public policy. Plans aimed at such end have justified themselves. Power companies have done remarkably well in their urging of the wiring of old and new homes. The need for appliances thus created has been as effectively filled as created. But the surface has barely been scratched. No industry is further from the saturation point than our own.

It is an established fact that 37 per cent of the homes in America are not as yet even wired for electricity. Until they are their doors are closed to us. Even such homes as are wired are still pitifully lacking in the domestic electrical appliances that they might readily and advantageously possess. What are we going to do about it? We have had numbers of local campaigns and occasional national propaganda. During the past year successful schools have been conducted by the electric advertising, industrial heating and commercial cooking committees; splendid work has been done by the refrigeration, domestic electric range, wiring, general merchandising, lighting, transportation, customer relations, street and highway lighting and our other committees.

Practically every patron of these splendid concerns is a logical customer for us. Yet what is the fact? We get a much lower proportion of the public's expenditures than almost any other business. Far less essential businesses are more progressive than the electrical industry. Shall we tamely submit to this? The moment for decision is here. But it must not be a haphazard movement to which we commit ourselves. Whatever large-scale campaign we determine to enter upon must be backed up by special sales promotion material, thoughtfully prepared for the requirements of our individual groups. There must be a close-knit sales-promotion organization in every state and district—a close liaison between our field men and our headquarters activities to energize, facilitate and dovetail every move we make.

## Electric Range Committee*

By A. B. Collins, *Chairman*

USUALLY when a new and revolutionary product is announced it meets with overnight acceptance, and this has been true nationally in the case of radio and electric refrigeration.

However, this was not true of the electric range. While its fundamental value was early recognized, its practical application throughout the country was not immediate and the electric range has been required to go through a long period of pioneer development.

Previous range committees have devoted their efforts primarily to research and their findings, which have been published from time to time in the past few years, have enabled this year's committee to put, as it were, the stamp of approval of the industry upon electric cookery.

Therefore, the domestic electric range committee is privileged to present to the industry "The Plan to Sell Electric Cookery."

This comprehensive plan has been developed by the committee in collaboration with the National Electrical Manufacturers' Association and the Society for Electrical Development.

This plan book has been made possible by the many years' work of previous committees and it may be said to represent and express the ideas of those who have participated in the pioneering and development activities.

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*Report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

# Interconnection

## *and Its Benefits**

Some fallacies discussed. Types of interconnection. Publicity values measured. Cases of interconnection benefits cited

By George N. Tidd
*President American Gas & Electric Company*

*George N. Tidd*

WHAT is interconnection? The New Century Dictionary says: "Interconnection is the state or condition of being interconnected." Well, that is like defining salt by saying it is NaCl. But it doesn't explain it. Let us try another angle. Perhaps by examining the objects sought and the results actually attained by interconnection we can arrive at the one fundamental and, having attained it, keep it before us as a guide so as to gage the desirability or undesirability of a particular interconnection by its adherence or deviation from the fundamental object or purpose. But first it may be desirable to explode some notions and ideas and explain what interconnection is not.

### Fallacies Regarding Interconnection

What is interconnection? What are the objects and purposes sought by interconnection? Does interconnection mean long-distance transmission of power? Does it mean superpower? Is it the same as its Marxian twin, giant power? Will it of itself bring about that sought-after millennium—the electrification of every farm?

The answer to the last four of these questions is emphatically no. Interconnection has nothing to do with long-distance transmission. The development of the art of long-distance transmission may make possible interconnections that were not feasible before, but long-distance transmission is certainly not the *sine qua non* of interconnection. Nor does interconnection aided by long-distance transmission mean the abandonment of steam generating plants—which will, of course, always be the main source of power—at the local centers, concentrating them all at the mine mouths and transmitting electrical energy from there hundreds of miles to the load. Leaving aside the obstacles to such a procedure due to the lack of necessary cooling water at most coal mines and to the comparative unreliability of transmission, we are still confronted with an almost insurmountable barrier. This is the fact that for any long distance, say one considerably in excess of 100 miles, the cheapest way of transmitting coal-generated kilowatt-hours is in freight cars and in the original state.

Interconnection—or, rather, one form of it—has made superpower possible, but, again, fundamentally, they are independent. Some of the finest examples of perfect interconnections have been recorded between systems that each had only a few thousands in kilowatt capacity—in fact, before superpower was "invented."

Will interconnection solve the problem of electrifying the farm? It will help, certainly. It will make, has already made, possible the extension of rural lines in many sections that would not otherwise be within reach of a power supply, but fundamentally the rural electrification problem is a distribution problem. Traced down, it becomes a problem of finding sufficient users for electrical energy on the farm to make the consumption in the individual installation sufficiently high to bring down the fixed charges of the distribution system to the point where the farmer can afford and is willing to use it. This is a problem not only for utilities but also for the farmers, for the various agricultural colleges and agricultural experimental stations. But interconnection alone cannot solve it.

We again come to the question, what is interconnection? Before we proceed with this let me make a distinction between two types of interconnections. I believe that in a discussion of the situation there is a real gain in dividing interconnection into two classes.

### Centralized Production Interconnection

The first type of interconnection had for its object the tying together of many small and scattered plants and the connection of such a network to a single efficient generating station or to a group of them. It is in the development of this type that the holding companies did such pioneering and lasting service. The object here was the substitution of a single and efficient generating source for the many scattered and isolated plants, or briefly the centralization of generation. The benefits to the holding companies of such a move have been pointed out many times before. But it has not been pointed out often enough that only by such centralized generation has it been possible to give the small city, town and village electrical service of the same high standards and at rates equal to those obtaining in the very largest communities. As the size of electric turbines and of stations grew the distance to which it was necessary to reach in order to get together enough load to load a centralized plant increased. The size of turbines and plants had of necessity to be increased because in such increase lay the only hope of cutting costs that were mounting in other sections. This led to interconnection of groups of communities that had in turn been previously interconnected. Carried far enough, this has sometimes been called superpower.

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*Address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

It is to be noted, though, that when groups began to be interconnected some of the advantages that were obtained previously in the tying together of small communities were no longer obtainable. For example, one of the things that disappeared, and very quickly, was the saving due to diversity. Thus, to take a typical case on our own system, on a system peak of 490,000 kw. our diversity between the four major groups was only 15,000 kw., or 3 per cent. This you realize is not very much of a diversity. In general, the same condition will obtain in other systems unless other factors besides geographical extent are brought in, such as the tying together of different types of load—namely, the industrial load and the lighting load—or factors such as a difference in time between systems, or others of the same type. But, broadly, this phenomenon reduces itself finally to one of centralized production similar to the integration that has been going on in other industries. That is the idea some of us had in mind twenty or so years ago. We thought of centralized production as the only means of keeping our heads above water. But, of course, that was before interconnection was discovered.

### Interconnection for Mutual Aid

The second type of interconnection, which was developed much later, was generally between systems that were normally completely independent and had an entirely different group of objects in view. Many of these objects have been gone into extensively before. To touch on them lightly here. They are the possibility of staggering construction between independent companies with the elimination of the economic waste that goes with building too far in advance of the load (and yet if construction is to be done economically, it generally has to be done in units larger than the immediate load in most cases justified); the possibility of fuel saving by utilizing during certain periods the more efficient of the plants; the possibility of reducing the reserve or standby capacity, and particularly the possibility of utilization of hydro, and, finally, the possibility of mutual aid in times of emergency.

All of the above, with the exception of the last two, have been gone into many times before the association and elsewhere. In the case of the utilization of the hydro facilities, however, interconnection can particularly claim this as one of its definite accomplishments, since it is only through extensive interconnected systems that this has been made possible. To cite a specific example: In one case where we have a hydro capacity of approximately 20,000 kw. distributed among four stations, it has been found necessary on Saturday afternoons and Sundays to transmit a portion of this capacity into a network extending over a distance of more than 320 miles from the source in order to utilize fully even such a small capacity; but the result of such an interconnection was fully shown in the kilowatt-hour output of this little hydro system. For a number of years before it was interconnected it averaged only around 76,000,000 kw.-hr. per year, but when the interconnection was completed the annual production went up to about 105,000,000 kw.-hr., a net increase of 38 per cent. The result of this increase is, of course, a saving of natural resources. The other object and accomplishment of interconnection—mutual aid—has, it appears to me, been almost altogether neglected, and not only has it failed to receive the proper amount of publicity, but very often the publicity that was given to it gave the wrong viewpoint and the wrong conclusion to the average man who read in the newspapers what was being done by interconnection and what its direction and aim were.

### Mutual Aid Paramount

It seems to me that, after considering all the benefits that are possible to the systems making an interconnection—and we are talking now of independent systems each one of which is in the position of being able substantially to carry its own load—and to the public, the combined weight of all of them will generally be less than the weight of the possibility of rendering mutual aid. Time and again I have had analyses of possible interconnections brought to me, made on a strict engineering basis, where apparently sufficient benefits, particularly benefits from a dollar and cents viewpoint, were not evident to justify the expenditures involved to make the interconnection, and I have had to take the burden of deciding whether or not the interconnection was to be carried through. In almost every case of that type the decision has been to make the interconnection on broad general principles, and again in almost every case subsequent operation has more than justified the decision.

It is possible for a utility so to design and build its system that it will be able to take care of every contingency—possible, but hardly justifiable. For if the system is to be built to withstand emergencies that cannot be foreseen, we enter into a period of guessing how far to go in providing for contingencies. We may take, for example, in the case of a power house or a substation, the highest level of flood water recorded and design our station to be safe against that, but to be really safe we ought to take into account the possibility that the previous high-water mark may be exceeded. Such occurrences are by no means rare. In doing that, if we want to be safe, we enter, as stated above, into a period of guessing, and such guessing continued throughout the entire system will open the floodgates of expenditures that would just as surely engulf us as would the physical water from the floodgates of heaven. We have a choice, therefore, between two methods of drowning.

### Not Prudent to Stand Alone

Is there no way out of the situation? There is none, if each system is going to stand alone and on its own. But it is not good for a utility—it is not wise, it is not prudent—to stand alone or to be alone. The alternative is to interconnect. Too often have we seen cases of trouble develop on systems—I have seen them happen numbers of times on our own system and have heard of many other cases on other systems—that would invariably have resulted in a partial cessation of service, and often in complete cessation, were it not for the fact that help was available through an interconnection which made it possible to carry on and keep service uninterrupted and unchanged just as if nothing had happened. And this brings me to a point that I have always felt has been almost totally overlooked in informing the people whom we serve of our activities. I will go further and state that on many occasions the information that we have given out has been of such a kind as to leave the layman with an impression wholly at variance with the facts and one that cannot help but be ultimately of considerably harmful effect to the utilities.

### Harmful Publicity

Why have utilities been so eager to rush into print with news of the various long-distance and spectacular interconnections that have been made? For example, the interconnection that was made between Chicago and Boston. Were these connections in any sense new accomplishments to be particular proud of? Certainly they involved no new engineering accomplishments in bringing to a conclusion a long-planned project. Here certainly they meant nothing significant from an economic standpoint. As a matter of fact, they were hardly more than stunts or tricks carried out by a few overzealous and young load dispatchers who could not resist the temptation of setting up this technical toy that was placed within their too ready reach. Granting, however, that no harm was done by carrying through the interconnection, there was still considerable harm done in broadcasting through the nation, as in that particular case, that power from Chicago, for example, supplied lamps in Boston. The harm consisted in conveying and giving to the public in general the idea that steam-generated power could economically be transmitted from Chicago to Boston, or that anybody who had any sense of responsibility would permit the carrying through of a project economically and technically so unsound. If publicity is sought in cases like that, let us adhere to the prosaic facts. Let us not stress the romantic side, even though that side has better publicity value.

Hook-ups of the kind alluded to, when carried out, have a certain amount of actual value, but the value is always no greater than the weakest link in the hook-up, and that, when examined carefully, will be found to be a link having a capacity of from 5,000 kw. to 15,000 kw. on the interconnections made to date. By a process of substitution or passing along it would be possible, therefore, to make available the capacity of that smallest link from one end of the system to the other; but that is an entirely different affair from transmitting energy from one extreme end of that system to the other end.

### Failure to Give Desirable Publicity

Instead of stressing the "stunt" aspect of interconnection, why do we not proclaim and broadcast the real deeds of interconnection every time one is accomplished? Why would it not be desirable to tell the public of the troubles that we encounter and the troubles we get into owing to the fact that apparatus, no matter how perfect, and plants, no matter how well designed, break down, and of the relief brought so instantaneously through the medium of interconnection that the public served is unaware that trouble has even occurred? Interconnection has accomplished wonders in this regard, and all with modest expenditures, which it was possible to absorb without any reflection in an appreciation of rates; but with a tremendous reflection in the way of improvement in service to a point where today absolute continuity is the only criterion by which service is measured. In the case of our own interconnections we have kept a record of the number of cases where interconnection has saved service in the last two years and these have run into more than thirty. Let me cite a number of them taken at random from our files:

*Case No. 22.*—In November, 1927, unit No. 1 at the Philo plant of the Ohio Power Company, which has a rating of 40,000 kw., developed internal trouble and was taken out of service for inspection and repairs. Two weeks later, and before unit No. 1 was replaced on the line, unit No. 2 of the same capacity developed internal trouble also and was removed from service, thus completely shutting down the Philo plant and reducing the capacity of the Ohio Power Company system by 80,000 kw. It was not possible to get unit No. 1 back in service until the following week. The accident to unit No. 2 was on a Saturday, and, owing to the fact that the load was light then, the system did not feel it; but when Monday came around the interconnections were immediately pressed into service and the following arrangements were made:

The connection with the West Penn Power Company was called upon for an additional 15,000 kw. The connection with the Ohio Public Service Company was called upon for the maximum possible load. The Cleveland Electric Illuminating Company was called upon, and it responded with a promise of all that could possibly be carried on its 66-kv. cables between Lake Shore and Oak Street substations, allowing approximately 50,000 kw. to feed into Akron and from there in turn into Canton, which is a point on the Ohio Power Company's system, this amount being fully 30,000 kw. above the normal supplied by Cleveland. The interconnection with the Southern Ohio Power Company was called upon, and that company responded with a promise of 5,000 kw., although later on it was found that this was not really necessary. The system south of the Ohio River, which had been receiving some help from the Ohio Power Company, was asked to call, in turn, on its interconnections, so that the Ohio Power Company was relieved of all necessity of helping it. Some of the minor interconnections were called upon for their quota. The result of all this was that the interconnected system load of the Ohio Power Company and the companies connected with it was carried without the slightest disturbance or hitch on Nov. 29 and until noon of Nov. 30, when one of the Philo units was placed back on the line. The load continued to be carried without the slightest interruption with a lesser call upon the interconnections until Dec. 4, when the second unit at Philo came on the line. In all of this, it may be noted in passing, no interconnections were called upon to transmit quantities of energy any long distance, but each interconnection was called upon to feed into that portion of the system where it was tied in its quota or its available amount of power, in some cases the relief being actually obtained by a substitution process.

Here was a contingency that could not possibly be foreseen or, if it had been foreseen, be designed for, and yet, through the help of interconnection, service to an industrial territory extending many thousands of square miles and to hundreds of thousands of consumers went on without the least disturbance.

*Case No. 10.*—The West Penn Power Company, which is interconnected with the Ohio Power Company at their joint plant at Windsor, W. Va., and at other points, had a case of trouble on July 13, 1927, at its Springdale plant. Unit No. 2 developed blading trouble and had to be pulled off the line. The operator pulled unit No. 1 off the line at the same time as this turbine was hunting and he believed it was also in trouble. This reduced the capacity of Springdale by 40,000 kw. At once the West Penn system itself picked up 5,000 kw. and the interconnected system picked up 35,000 kw. of this load. In the meanwhile the West Penn system brought additional capacity into service at its various plants, but it took approximately one hour to get this capacity on the line. During this entire period the interconnected system took care of 35,000 kw. and service to all the consumers of the West Penn Power Company continued without the slightest disturbance. What a beautiful story there is to tell here of the value and accomplishments of interconnection!

*Case No. 31.*—On March 29 and 30 of this year the northwestern section of Ohio experienced the most severe sleet storm that had been encountered in more than twenty years. The territory served by the Ohio Power Company in that section of Ohio is mostly agricultural, with a very small amount of industrial load. The loads are scattered and many miles of transmission line are necessary to serve it. The entire territory is served by two lines radiating from Lima, but during the sleet storm both went down, 88 poles being lost in a distance of about 16 miles. This division, however, is interconnected with the Defiance plant of the Toledo Edison Company. When Defiance was notified of the trouble it immediately picked up a portion of the system load—that is, that portion that was not in trouble—and as the lines were repaired the service was extended from Defiance. The Defiance plant continued to carry the load on all the northwestern division of the Ohio Power Company until Thursday, April 5, at which time the lines radiating from Lima were again placed in service. Here is another case of interconnection saving many days of interruption in an emergency which could not possibly have been foreseen or economically have been provided against except through interconnection.

I could cite many more cases, but you all are probably familiar with as many as I. The point is, however, that almost daily we have brought to our attention examples of what wonders interconnection is doing in the way of improvement in and maintenance of service without staggering expenditures, and almost daily we are missing opportunities to tell our customers, to tell the people of the villages, towns and municipalities in which we operate, to tell the nation, of what we are accomplishing by interconnection, of what interconnection is doing, of the fundamental thing that we are striving for in interconnecting. How much longer can we go on missing these opportunities?

## Customer Relations Committee*

By C. L. Harold, *Chairman*

In two aspects the committee determined at the start of the year upon a policy of expansion. First, in accordance with recommendations of the previous committee and national headquarters, beginning in November, 1927, the Service Suggestions have been published each month in the National Bulletin in lieu of the previous plan of printing a separate monthly folder under the title of "Service Suggestions" and mailing to a selected list of commercial and other executives.

Second, the committee thought that it should enlarge its usefulness by not only preparing and publishing monthly a Service Suggestion and gathering data in connection therewith, but it should also assemble information on other subjects which, although pertinent to customer-relations work, were not appropriate for general publication. The work has progressed considerably in this direction and we seize this opportunity of emphasizing to member companies the availability of this particular phase of committee service to individual member companies that might be interested. Member companies are invited to indicate freely their need for research or investigatory work which the committee is organized to perform and whose results we believe are not of sufficient general interest to warrant broadcasting to the entire fraternity.

In changing the method of disseminating Service Suggestions, the underlying thought in the plan of National Bulletin publication was that not only would the circulation or publicity be increased, but that any selected list for mailing a separate pamphlet monthly would almost certainly omit many individual employees of member companies whom it would be impossible to identify as interested in customer-relations problems.

The following Service Suggestions were issued during the present administration:

November, 1927—"The Executive, the Employee and the Customer Meet on the Job."
December, 1927—"Branch Office Layouts Designed for Better Customer Relations."
January, 1928—"Questions and Answers on Telephone Standard Practice."
February, 1928—"Educating Customers to Replace Blown Branch Fuses."
March, 1928—"Desk Contacts versus Counter Contacts."
April, 1928—"Résumé of Service Suggestions Issued by Customer Relations Committee."
May, 1928—"Use of Mechanical Devices in Complaint Handling and Appliance Demonstrations."
June, 1928—"The Customer and the Bill."

Inquiries for additional information from various members and member companies were received regarding every one of these suggestions. The résumé of all of the Service Suggestions issued by the committee since 1921 which appeared in the April N.E.L.A. Bulletin brought in requests from 45 members and member companies for approximately 2,500 copies of various Service Suggestions which have been reproduced and are now in the mails.

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*Abstract of report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

## PRIZE AWARDS

### *Charles A. Coffin Medal:*

Puget Sound Power & Light Company (see pages 1196 and 1197).

### *Doherty Medal:*

J. M. Whittier, Edison Electric Illuminating Company of Boston, "Industrial Development by the Central Station."

### *H. M. Byllesby Prizes:*

First—Herman L. Gruehn, United Gas Improvement Company, "Pensions."

Second—L. W. Clark, Utica Gas & Electric Company, "Economic Forces and the Public Utility Accountant."

Third—Claron D. Barber, Commonwealth Edison Company, "The Accountant and the Industry's Advancement."

### *Martin J. Insull Prize:*

Gail Belden, Middle West Utilities Company, "The Economics of Public Relations."

### *James H. McGraw Prizes:*

First—B. M. Riker, Charles H. Tenney & Company, "Industrial Electric Heat."

Second—Edward P. Price, San Antonio Public Service Company, "Lignite as a Commercial Fuel."

Third—W. T. Blackwell, Public Service Electric & Gas Company, Newark, N. J., "Street Lighting."

### *Arthur Williams Prize:*

H. W. Derry, Union Gas & Electric Company (Cincinnati), "Getting Your Share of the Power Business."

### *Harriet Billings Prize:*

Cladd H. Chase, Brooklyn Edison Company, "Effective Good Will Work Performed by the Distribution Department."

### *Frank W. Smith Educational Prize:*

Edwin D. Smith, Northern New York Utilities, Inc.

# Farmers Machinery-Minded*

Factory methods welcomed. Electricity the needed agency. Economics of farm service. Methods advocated by farmers

By Clifford V. Gregory
*Editor "Prairie Farmer"*

*Clifford V. Gregory*

ENGINEERS tell us that productive efficiency in this machine age depends largely on the use of power. From that standpoint the farmer ranks high. The average farm worker uses 4.5 hp., while the average industrial worker uses only 3.6 hp. In industry the average horsepower per man increased from 1.9 in 1899 to 3.6 in 1925, while in agriculture the average increased from 2.2 in 1899 to 4.5 in 1925.

The farmer of today is machinery-minded. That is nowhere better illustrated than in the grain belt of central Illinois, where for generations farmers have produced their crops with power machinery, until they no longer like to work with their hands. They hate to turn a crank, and who can blame them? They do not like to milk cows. They have been slow to turn from grain production to dairying and other intensive types of farming, notwithstanding all the educational efforts of the agricultural colleges.

Electricity is going to succeed where the professors have failed. It will succeed because it is making livestock farming a machine operation. When you can prepare the feed, do the milling and take care of the milk by machinery you have removed the obstacle that has kept the grain farmer from making the readjustment that he knows he could make at a substantial profit.

Dairy and livestock farming are profitable because they make a factory of the farm. It no longer sells raw materials. The dairy cow and the hog and the hen put the grain through at least one process of manufacture. On the farm which is equipped with electric power and electric refrigeration still other steps in the manufacture of finished food products are possible, and the profits of the farm are increased accordingly.

Farmers are thoroughly "sold" on the value of electricity. How are they going to get it? Certainly not through "juice peddlers"—promoters who build a line for a group of farmers at excessive cost, buy energy from a central station at wholesale prices and retail it to the farmer customers. Often they never get to that stage. They collect the farmers' money, build the line, and then go off and leave it to shift for itself. These promoters are parasites on the industry and have done more than everything else together to give it a black eye in the country.

### Opinions on Methods

Many companies have been following the practice of building country lines at the expense of their farm customers, in some cases returning the cost to them as a deduction from their monthly bills over a series of years. This plan does not encourage a large consumption of electricity, as the farmer is compelled to invest so much money in the line that he has little left for the purchase of equipment.

A plan which is being rapidly adopted, and which seems to be the most practical, is for the companies to build the farm lines at their own expense. in return charging a high monthly minimum. Four of the leading companies in Illinois, for instance, are now financing farm lines to the extent of $450 per farm and making a minimum monthly charge of $10 for energy furnishing 135 kw.-hr. for this price, with a charge of 3 cents per kilowatt-hour for any excess. If the farmer customer will buy equipment with the $450 which he might otherwise spend for line, he will make electricity a profitable investment both for himself and for the power company.

I. W. Dickerson, farm mechanics editor of the *Standard Farm Papers,* has given me the following figures to show the effect of equipment on consumption of energy: Lights only, 34 kw.-hr. per month; $100 worth of equipment, 68 kw.-hr.; $250 worth of equipment, 84 kw.-hr.; $300 worth of equipment, 117 kw.-hr.; $400 worth of equipment, 127 kw.-hr.

As a help to the more rapid extension of power lines into the country on a mutually profitable and satisfactory basis, I wish to conclude with the following suggestions:

1. The valuable experimental work conducted at the instigation of the National Electric Light Association should be continued, in order that we may learn still more about profitable applications of electricity to farm operations. Studies should be made of the place electricity holds in profitable systems of farm management.

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*Abstract of address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

2. Rural lines should be built by the power companies. The farmers' money should be spent for equipment rather than for lines.

3. Erection of rural lines by irresponsible promoters should be discouraged.

4. Rates should be based on the principle of a relatively high minimum with a low charge for excess energy, in order to encourage increased consumption.

5. The question of prompt servicing of rural lines should be given more attention. As the farmer places more and more dependence on electric energy, he must be assured a supply that is practically free from interruptions.

6. Efforts should be made to supply electric equipment that is especially designed for farm requirements, and costs should be reduced if possible.

# Thunder and Lighting*

### By Clayton Rand

*President the Dixie Press*

IT IS a far and endless journey to the first picture that I would flash upon the screen of your fancy, for we find ourselves by the side of the man who first invented fire, in the flame of which he warmed his body and the rays of which spread light in his dank and dark, crude cave. I see him cooking for the first time the meat that heretofore he had eaten raw and setting up with his signal fires the first lines of communication. This ingenious primitive, playing with fire, was writing the first few wavering lines of the history of light and power.

The great achievements of light and power are better measured in what has been accomplished for modern man, as it has multiplied his power, increased his usefulness and reduced the burdens of living. I do not have to go back very far to picture my mother over a washtub, the insufferable heat of a wood cooking stove, on a warm summer's day, with an old-fashioned flatiron, and refrigeration limited to an occasional cake of ice wrapped in a piece of newspaper and stored in a box. I can picture the endless labor of that home, broom-swept, the hand-manipulated churn and the vigilance of an old-fashioned coffeepot.

Yesterday America was but a fumbling child among the nations of the earth, largely agricultural, as a whole a carrier of wood and water for the financial barons of England and Europe. Today under the magic touch of light and power, with half the world's motors in operation, each one of us has more mechanical slaves at his command than had our forefathers on the plantation in the palmiest days of the ante-bellum South.

### Mechanical Slaves Now Used

But I look upon electric power as a force as spiritual in its operation as it is material in its results. Long before the discovery of electricity did men not refer to the unfathomable soul within them as a spark divine? Who knows but that the search of science may yet reveal that this spark within is one electric, impregnated with the fire of an infinite God, energized with the processes of creation? And it would seem to me that the purpose that should inspire the work of you men and women who represent this great power for good in the increased happiness and prosperity of the world should be the consciousness of the fact that there is something well-nigh sacred in the way you use it—a strange force and power which, though utilized and somewhat understood, is yet as unfathomable as the fires which are kindled in the soul.

Clayton Rand

I appreciate the fact that power today is standing trial. I, too, have heard the voice of the critic in high circles, who stirs the emotions of his constituency by the charge that the so-called "power trust" is without soul or mercy. I also see in this great business of light and power men and women who are dreamers and builders, who through the years are constructing out of their faith and fancy the most formidable force that has been released in the experiences of men.

If you can conscientiously say that your purpose is one for the promotion of greater happiness and prosperity among the people, the voice of the "knocker," though never silenced, will become, in the light of truth, but "sounding brass and tinkling cymbals." I know intimately some of the great exponents of light and power in America, and I believe that I can testify that these men are moved by the bigger vision and the larger responsibility they owe their fellow men. I believe that they are dreaming and building to the end that this nation shall become one, not only completely electrified, but also fired by the faith of a conviction that will know no defeat until all of their high ideals are gloriously achieved.

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*Abstract of address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

# Good Merchandising Practice*

Fundamentals of merchandising outlined. Utility merchandising methods discussed and many methods and practices condemned

By Oswald W. Knauth
*Vice-President R. H. Macy & Company, New York*

TO A merchant the distribution of electrical goods is a part of distribution in general. The merchant, therefore, attempts to apply the same policies to electrical goods that he finds successful in other goods, and I think, if you will follow me, that I can best begin by stating a few fundamentals of merchandising and then see how those merchandising necessities link up with the particular peculiarities of the electrical business.

Oswald W. Knauth

I am always irritated when I hear a man say that the problem of merchandising is to have the right goods at the right time at the right prices. This statement makes it all seem so simple, and yet it is pompously enunciated as a profound truth over and over again. When we try to make a proper selection of electrical articles to offer our customers, we are confronted by a double problem.

First—We wish to offer them a proper choice of toasters, urns, flatirons, percolators, and so on, at varying prices and of varying designs. But then we find that different customers also prefer different types of make, some of which are in complete lines and others cover only a few articles. If, therefore, we attempt to carry a complete line of each different make, we find that we have a tremendous confusion of choice and great difficulty in keeping in stock on all of the items which we are carrying. Now, our object as merchants is so far as possible to help the customer in his choice, and to do this properly we must make that choice as easy as circumstances permit. Good merchandising would, therefore, demand one of two practices—either that we carry in any one store one complete line or that we carry such items out of each line as we believe to be the best, the whole, of course, constituting a complete selection.

Second—Good merchandising demands the satisfaction of the customer in buying what he or she wants. An article must not only be sold at a profit, but also must carry with it a certain amount of good will, which encourages the customer to come back and keeps the store going next week and next year. Salesmanship should be directed to this end, and our whole policy of allowing exchanges and so forth is to insure the fact that our salespeople do not oversell a customer. In order to accomplish this, salespeople must be controlled by the store and must be definitely supervised from the customer point of view.

Third—The costs of distribution vary greatly. It is too often taken for granted that these costs are of a definite fixed percentage. In fact, I wonder if the costs of distribution do not vary as much as the costs of manufacturing. For instance, advertising cost varies from 1 to 6 per cent. Rent varies with the volume of business done in a given space, from 2 to 10 per cent. Selling cost varies with the possibility of sales in different locations and with the excellence of service. Let me illustrate for a moment the causes for the variations in the cost of salesmanship. Every store does about double its average monthly business in December. Every store does a fraction of its average monthly business in July and August. Every store is much busier on Saturday than on any other day of the week. Every store is comparatively empty from 9 to 11 and from 4 to 5:30 and very busy between 11 and 4. Now, if we were to have enough trained salespeople to take care of trade in December on a Saturday between 11 and 4, we must be tremendously oversupplied in July on a Monday between 9 and 11. Therefore, we must make some arrangements which will offset this wide hourly, weekly and monthly variation. We do it by means of daily part timers, who come in at 11 and leave at 4; we have Saturday specials, who come in only on Saturdays, and along during the fall we build up a surplus force to take care of the Christmas rush. But at that we only do a partial job—

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*Address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.

partial because the irregularities are so spasmodic and because we cannot pick up as expert sales clerks for such irregular intervals as we demand for our minimum business. You can see from this that every store must choose between great expense for selling and some degree of poor salesmanship, and the way in which each store chooses brings about a particular character for that store and a comparatively high or low cost of selling. This cost of selling may vary from 3 to 10 per cent.

Fourth—The completeness of choice varies in different stores. Some stores have a policy of low stocks and rapid turnover. Others have a policy of carrying exceptional articles for exceptional customer requirements. It is easy enough to achieve high turnover by keeping only such articles as are in normal demand. This means a low cost of storage and of inventory and ease of handling. It would seem to be the thing to do were it not for the sacrifice of good will when some customer demands some peculiar color or material or shape and has to go elsewhere to find it. That customer's normal trade is also likely to go elsewhere under these circumstances. Yet no store can afford to fill itself up with abnormal articles, for these rapidly turn into junk. Where to draw the line? This is the practical problem with which we merchants are faced, and it is as we answer this that we build up stores having different characters and having different rates of expense. These expenses are shown particularly in markdowns, which may vary from perhaps 2 to 10 per cent, but they are also shown in more or less expense of store operations.

### Methods of Utility Merchandising

Now let us look at the methods of retail distribution which you have built up in the electrical industry and see how they fit in with the demands of good merchandising. You have built up your systems on (1) more or less complete lines of articles; (2) an indicated retail price for each of these articles; (3) special demonstrations for the particular pushing of each line; (4) extensive advertising to build up a demand for your particular articles and for your name in general.

This system brings it about that you simply have to bring your articles into a store, be given floor space, and sales result. Prices are made, the demonstrator demonstrates, the public demands, and the supply is at hand. It is all very complete and very well worked out, and it is the easiest way for the storekeeper. And it works. Evidences of this are available at every hand. I need not go into this any further in such a gathering, for I know you are all familiar with it. I can therefore turn immediately to the problem of adapting this system to the necessities of good merchandising. I just want to interject one remark at this point: that is, that the necessity of sound merchandising is far greater today than, say, twenty-five years ago. There are more good merchants in the field, and competition is infinitely more keen. We cannot afford loose methods or loose thinking if we are to stay in business. Proofs of this are available at every hand.

Now, when your system is introduced into a store it brings about several grave difficulties from a merchandising point of view:

First, it brings about a duplication of similar articles if several lines are carried which really do not add to the customer's range of choice. This means more display space, difficulty of keeping in stock on the increased range of items, confusion in the stockroom, a multiplicity of many small orders. All this means that a store is apt to be sold out on its best-selling articles and add to expense generally.

Second comes the difficulty of bringing a customer to a rapid and certain choice. Why this toaster against that at the same price? The more she sees, the more uncertain she becomes. You attempt to meet this with your expert demonstrators, who can talk with conviction on the small conveniences and the hidden excellences of different devices; but when several demonstrators demonstrate conflicting excellences the confusion of the customer ends in rapid flight.

Third, your extensive advertising certainly familiarizes the public with your name and makes for ease of selling, unless the customer happens to bump into a rival display and demonstrator first. Then anything may happen. The demonstrator may play fair and sell rival goods, or may enter into a rapid supersales argument, or may disparage the other line and thus cast a doubt over electrical goods in general from which we all suffer. All this is impossible to control.

Fourth, is your practice of naming the retail price in advance. This is the easy way. But it is impossible from the point of view of really good merchandising—partly, as shown above, because the costs of merchandising are not fixed, but widely different; more especially, however, because the naming of the best retail price is a difficult matter and cannot be done at long range.

### Utilities Not Good Merchandisers

I come then to the conclusion that your system of selling is incompatible with the best merchandising practice. It may be effective for the small store in a small town. But it conflicts fundamentally with the necessities of large scale, economical and efficient merchandising practice. And a more effective way out must be found.

Before closing I want to add a few remarks in regard to the burning problem of public utility retailing of electrical goods. I do not take this problem of competition as seriously as some of my colleagues, for it has been my observation that the public utility methods of merchandising are so clumsy that they cannot be a menace to us, in spite of their many advantages, as long as we are as expert as we must be. Moreover, this public utility competition is not a national problem, because practices vary widely in different localities. Even were it dangerous, I cannot see on what grounds we as retailers can prevent public utilities from going into retailing or attempt to dictate to them what their policies should be. As a matter of fact, their policies can often be compared to existing retail policies, even if these are unsound and unsuccessful policies.

But I do raise one question with all earnestness to those who guide public utility policies. As I take it, you are interested in the sale of electrical goods, not for their own sake, but for the sake of increasing the consumption of energy. If this is the case, would you not be wiser and more successful if you studied the question of increasing these sales through the existing retail organizations, whose outlets are widespread and well-established, rather than add a single or several retail outlets, whose sales are an insignificant part of the total? Your present methods irritate and annoy the retailers who must make their living out of distribution alone. Why create this ill will? Would it not be more effective to study how to help them increase their distribution, so that increased energy will be consumed? And are there not greater possibilities of such increase than by setting up a rival distributing system of your own?

# What's New About Lamps[*]

## By Frank W. Smith

*Chairman Lamp Committee*

During 1927 a total of 305,000,000 large tungsten-filament lamps were sold in the United States. This is an increase of 3.7 per cent over the previous year's sales as compared with an 11.8 per cent increase of 1926 over 1925.

In addition, 12,600,000 large carbon lamps were sold in 1927, of which about 22 per cent were of domestic manufacture and the remaining 78 per cent were imported. The total large carbon lamp sales in 1927 were 31.8 per cent less than in 1926, which was virtually due entirely to the decrease in imported lamps. The sales of domestic-made large carbon lamps have remained about constant during the past three years, something less than three millions each year.

Most of the imported carbon lamps are sold to the public through the 5-cent to one-dollar chain stores, so it would appear that the considerable reduction in the sale of these lamps is largely due to the publicity given during the past year on the "costly bargain" of the carbon lamp to the home user.

The figures stated above do not include miniature lamps, such as those used for flashlight, Christmas-tree and automobile service. These data are as follows:

| | 1926 | 1927 |
|---|---|---|
| Miniature Tungsten Filament | | |
| Flashlight | 32,700,000 | 37,380,000 |
| Automobile | 116,300,000 | 116,500,000 |
| Christmas tree | 34,350,000 | 44,350,000 |
| Miscellaneous | 4,990,000 | 6,900,000 |
| Total miniature tungsten filament | 188,340,000 | 205,130,000 |
| Miniature Carbon Filament | | |
| Christmas tree | 12,680,000 | 13,415,000 |
| Miscellaneous | 1,030,000 | 1,050,000 |
| Total miniature carbon filament | 13,710,000 | 14,465,000 |

Christmas-tree lamps are generally supplied with current from central-station service, and as the current consumption of eight of these miniature lamps is the equivalent of one 40-watt lamp, the 1927 miniature Christmas-tree lamp sales are the equivalent in watts consumption of about 7,250,000 40-watt lamps, an increase of 20 per cent over 1926.

TABLE I—AVERAGE LUMENS, WATTS AND EFFICIENCY OF LAMPS SOLD EXCLUDING MINIATURE LAMPS

| | 1925 | 1926 | 1927 |
|---|---|---|---|
| Average lumens | 712.0 | 747.0* | 732.0 |
| Average watts | 57.6 | 59.6* | 59.0 |
| Average lumens per watt | 12.4 | 12.5* | 12.4 |

* Corrected 1926 values.

*Frank W. Smith*

Table I presents the average lumens, watts and efficiency (lumens per watt) of large lamps sold during the past three years, and Table II presents the relative demand for lamps during the past three years, divided into voltage groups. Table III shows the relative demand for the more important sizes of lamps during the past three years.

The average light output of street series lamps sold in 1927 was 2,293 lumens, slightly less than that of the year previous. The relative demand for the different sizes and ampere ratings of street series lamps during the past three years is shown in Tables IV and V.

During the past year the matter of voltage standardization has again been brought prominently to the fore through a revision of the book "Central Station Voltages," the last preceding copy of which was issued in 1923. The 1923 book was a cumulation of all the information obtained for several successive revisions and showed the proper lamp voltage for a total of 14,639 communities. With a campaign consisting of only one original letter and one follow up letter, the committee received information for publication in the 1928 book, covering 18,868 communities. Of the towns listed in the 1923 book, 3,917 are not covered in the recent issue, because the company supplying did not respond to the committee's inquiry. The 1928 issue includes, however, 7,746 towns which are listed for the first time.

The greatly increased coverage of the new voltage book is due in part to the greater interest of the industry in the matter of proper voltage conditions and in part to the ramifications of the large systems, some of which reported lists of communities served ranging up as high as 500 towns. Another reason for the greater coverage is

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[*] *Abstract of report presented at the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

### TABLE II—DEMAND BY VOLTAGE GROUPS, PER CENT

| | 1925 | 1926 | 1927 |
|---|---|---|---|
| 115-volt group | 88.8 | 89.6* | 89.9 |
| 230-volt group | 3.5 | 3.3* | 3.2 |
| Street series group | 1.5 | 1.7* | 1.6 |
| Street railway group | 1.6 | 1.5 | 1.4 |
| 30-volt and 60-volt group | 3.4 | 3.1* | 3.1 |
| Miscellaneous | 1.2 | 0.8* | 0.8 |
| Total | 100.0 | 100.0 | 100.0 |

* Corrected 1926 values.

### TABLE III—DEMAND FOR LAMPS BY SIZES, PER CENT

| | 1925 | 1926 | 1927 |
|---|---|---|---|
| 10 watts | 4.5 | 3.8 | 4.1 |
| 15 watts | 4.0 | 5.0 | 5.0 |
| 25 watts | 22.2 | 20.4 | 21.6 |
| 40 watts | 14.9 | 15.2 | 14.4 |
| 50 watts | 18.4 | 17.3 | 16.5 |
| 60 watts | 8.9 | 11.6 | 12.7 |
| 75 watts | 7.4 | 4.9 | 3.4 |
| 100 watts | 7.7 | 9.5 | 10.3 |
| 150 watts | 1.8 | 2.1 | 2.4 |
| 200 watts | 2.8 | 3.0 | 3.0 |
| 300-1000 watts | 1.1 | 1.1 | 1.0 |
| Street railway | 1.6 | 1.5 | 1.4 |
| Street series | 1.5 | 1.3 | 1.5 |
| Miscellaneous | 3.2 | 3.3 | 2.7 |
| Total | 100.0 | 100.0 | 100.0 |

### TABLE IV—DEMAND FOR STREET SERIES LAMPS BY SIZES, PER CENT

| | 1925 | 1926 | 1927 |
|---|---|---|---|
| Less than 600 lumens | 9.9 | 2.6 | 1.6 |
| 600 lumens | 23.5 | 18.3 | 18.2 |
| 800 lumens | 7.7 | 6.7 | 7.1 |
| 1000 lumens | 25.4 | 30.0 | 30.0 |
| 2500 lumens | 12.2 | 17.7 | 17.7 |
| 4000 lumens | 8.9 | 12.7 | 12.3 |
| 6000 lumens | 9.3 | 9.8 | 10.2 |
| 10000 lumens | 3.1 | 2.2 | 2.0 |
| Miscellaneous | ... | ... | 0.9 |
| Total | 100.0 | 100.0 | 100.0 |

### TABLE V—DEMAND FOR STREET SERIES LAMPS BY AMPERE RATING, PER CENT

| | 1925 | 1926 | 1927 |
|---|---|---|---|
| 4.0 amp | 5.1 | 3.0 | 3.5 |
| 5.5 amp | 9.2 | 3.9 | 5.7 |
| 6.6 amp | 60.1 | 64.4 | 64.7 |
| 7.5 amp | 10.8 | 10.1 | 8.8 |
| Compensator | 12.6 | 18.4 | 16.6 |
| Miscellaneous | 2.2 | 0.2 | 0.7 |
| Total | 100.0 | 100.0 | 100.0 |

the trend in recent years of municipal plants to sell out to private companies or buy their energy wholesale from private companies. In past years it has been very difficult to secure voltage information from municipal plants.

Table VI gives a detailed statistical summary of the new voltage book as well as a comparison with similar data for 1923. The outstanding changes with respect to voltage in the five year interval are:

1. A shift of approximately 20 per cent of the total volume of service from 110 volts to 115 volts.

2. An increase of approximately 3 per cent in the percentage of total service at 120 volts.

3. The unification at one voltage for the entire city of over 50 per cent of the total volume of service in cities formerly supplied at more than one of the three standard voltages.

4. The practical disappearance of all lighting voltages other than 110, 115 or 120 volts.

In order to get a complete picture of the relative status of the three principal voltages, the populations of the communities having more than one voltage have been allocated to the individual voltages.

The object of compiling the voltage book is to eliminate as far as possible those instances where too high a voltage of lamps is supplied. The disadvantages, which are well known to the companies but not generally known by the consumers, resulting from operation of lamps of too high a voltage, are:

1. The customer receives less light and at a greater cost per unit of light.

2. The central station loses kilowatt-hour sales due to the decrease in wattage consumption of the lamps.

3. The manufacturer and dealer lose lamp renewal sales.

It is therefore to the best interest of all parties concerned that only lamps of proper voltage be used. A realization on the part of the dealer of the harm resulting from using lamps of improper voltage will almost invariably result in a change to the proper voltage.

The voltage book has been distributed broadcast throughout the electrical industry to all wholesale distributors of lamps so that they may have comprehensive information at hand as to voltage of lamps which should be shipped into the various communities they supply. Coincident with this, the lamp manufacturers are conducting a campaign with the wholesale distributors to the end that their full co-operation shall be rendered in supply of proper voltage lamps.

### TABLE VI—ALLOCATION OF POPULATIONS TO INDIVIDUAL VOLTAGES

| Voltage | Approximate Relative Total Volume of Electric Service, Per Cent | | Change |
|---|---|---|---|
| | 1923 | 1928 | |
| 110 | 36.3 | 15.9 | —20.4 |
| 115 | 40.9 | 61.6 | +20.7 |
| 120 | 19.4 | 22.4 | + 3.0 |
| Odd voltages between 100 and 130 | 2.7 | 0.1 | — 2.6 |
| High voltages, 200 and above | 0.7 | ..... | — 0.7 |
| Total | 100.0 | 100.0 | |

In order to realize the full benefit of this whole endeavor, it is necessary that the local retail dealers in lamps be in harmony with the central station in the matter. The most effective point of contact with the retail dealer on this subject is through the central station. All possible angles of approach to the problem of eliminating wrong voltage of lamps will have been covered if each central station gets out a circular letter to the local dealers advising them of the proper lamp voltage and of the losses in case a higher lamp voltage is supplied.

# Engineers for Economy*

Strive to get more out of investment dollars. Outline methods for planning system development. News of engineering activities

By E. C. Stone

*Chairman Engineering National Section*

*E. C. Stone*

WHILE there have been no radical advances in engineering practices during the past year, analyses of the work of the various committees show definite progress in the development of ways and means of obtaining "more system capacity per dollar of investment."

In power generation, intensive study has been given to the subject of availability for service of installed generating capacity. Actual performance data covering a large number of both steam turbines and water wheels over a period of years have been analyzed and published in serial reports of the prime movers and hydraulic power committees. Obviously, accurate knowledge as to the expectancy of outage to generating machinery will permit of more accurate determination of the installed capacity necessary to carry given loads. Because of the important part of the total system investment that is included in generating capacity this is an important item in over-all system costs.

The thermal efficiency of power generation from steam has been further improved. It is found, however, that the maximum efficiency is obtained only by a substantial increase in the cost of the plant. Hence the cost of fuel and the operating load factors expected over a period of years will have a vital influence on design. Where the load factor and fuel costs are low it does not pay to design for the best possible thermal efficiency. The expression "dollar efficiency" referring to the plant performance which will give the lowest over-all cost of energy per kilowatt-hour, including both operating and fixed charges, is coming to be a generally used term.

Economy data covering one year's operation of ten representative plants for pressures from 310 to 1,200 lb. show lower heat consumption for the higher pressure stations, but there is a greater tendency on high pressure to scale formation and more attention must be given to feed water treatment. The increased use of evaporators with and without chemical treatment is reported. Air preheaters for temperatures varying from 400 to 500 deg. F. have been installed with good results. An increase in the use of single-pass condensers is reported, notably, in connection with the larger turbine units. A comparison of the amount of condensing surface per kilowatt of turbine capacity shows 0.91 sq.ft. for single-pass condensers as against 1.22 for those having more than one pass.

The use of pulverized fuel, both in utility stations and industrial plants, is increasing rapidly, and high efficiencies and ratings are being reached. A number of units are operating between 200,000 and 300,000 lb. of steam per hour. Automatic combustion control is giving valuable results. Stoker capacities are being increased to meet the demand for heat radiation per square foot of available space. Water-cooled walls are reducing stoker and furnace maintenance cost and slag trouble. Of particular interest is the report on power station betterment which deals with the problem of bettering operating conditions in existing plants, with a view to obtaining maximum results from installed equipment before any additional expenditures are made for improvements.

Progress is reported in the commercialization of certain processes for the distillation of coal, and a number of plants are being located both in this country and abroad. The most notable in this country is a plant near New Brunswick, N. J., operating on the K. G. S. system for the production of lump fuel and gas for domestic use, and tars and oils. The Standard Oil Company of New Jersey has obtained the American rights for the Bergin's process covering the production of synthetic petrol.

## WATER POWER STUDIED

The hydraulic power committee has been giving special attention to the problem of forecasting water supply and important results have been obtained. While definite conclusions are not yet available, some of the methods used are showing surprising accuracy and it is hoped that they will soon be developed to such a degree of reliability as will make practical definite forecasting of water supply at least for short future periods. Water-wheel testing has also received intensive study. The value of maintaining accurate measurements of water

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**Abstract of address before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

consumption is emphasized and new methods have been developed whereby such measurements can be obtained at practically any installation.

Recognizing the necessity for advanced planning of system development, the electrical apparatus committee has set up a sub-committee to deal with the fundamental planning of systems. Last year a tabulation of preferred system voltage ratings was published and a survey is now under way to determine to what extent the proposed voltages are in use or acceptable. This subject is now in the hands of a joint committee with the National Electrical Manufacturers' Association, whose business it is to submit definite recommendation for standardization of system voltages. This step will logically follow that made several years ago when standard utilization voltages were established.

The interconection of major power systems has continued to progress during the year. The definite advantages of interconnection are coming to be more clearly recognized to be increased reliability of service and more efficient use of generating capacity installed. Interconnection is not resulting in transmission of power over long distances, but is rather making it possible for adjacent systems to utilize each other's facilities to mutual advantage. While the economies of interconnection represent a large amount of dollars all told, it is probable that they do not bring to the companies to which they are available a saving in overall cost of power of more than 3 per cent to 5 per cent.

There are now twenty alternating-current low-voltage networks in operation. This type of system provides higher grade service for densely loaded urban areas at a substantially lower cost than is possible by other methods, and is accordingly coming to be recognized as the standard method of alternating current distribution for dense loads. A comprehensive study of motor operation on networks in service indicates clearly that there is no necessity for the development of a new line of 200-volt motors for network use. The starting of large motors on networks is being taken care of by step starters which provide for building up the starting current by definite ampere steps at definite time intervals.

The problem of short circuit interruption is still in the foreground, and while improvements in design have brought about better performance of circuit breakers, this situation is still far from satisfactory. An intensive investigation of the oil circuit breaker problem has been undertaken by a special committee of the Association of Edison Illuminating Companies. The Engineering National Section is participating in this investigation through official representation on the Edison's Association committee.

A special committee on system testing of oil circuit breaker interrupting capacities has developed a standard testing procedure and three major companies have already completed series of tests under this procedure. Comparisons of test results on different systems are thus possible.

The problem of short-circuit control also is being approached from the angle of definitely limiting the maximum values of current through system design. One of the most interesting principles employed is the paralleling of various generators through remote substations instead of over the bus in the station in which they are located, thus interposing line impedance between units.

Two field investigations are under way relating to the behavior of insulating oil in service in transformers and oil circuit breakers, one dealing with handling and treating methods and the other with oil deterioration. It is expected that much needed experience data will be obtained which should result in substantial improvements in methods of handling oil.

During the past year manufacturers of motors and all appliances, except washing machines, have agreed with the N.E.L.A. and A.E.I.C. to the adoption after Jan. 1, 1929, of a new line of fractional horsepower motors with substantially improved characteristics as to efficiency, power factor and starting current. The use of the new motors should help materially to solve the problem of voltage fluctuations, particularly in houses not adequately wired.

### Temperature Rating Used

Further progress has been made in establishing the principle of total temperature rating of electrical machinery.

The first step was taken when provision was made for increasing the rating of general purpose motors for a temperature rise of 50 deg. C. by multiplying the 40 deg. rating by a service factor. Now, through the efforts of our representatives on the standards committee of the A.I.E.E., it is expected that a basis will soon be adopted for the operation of transformers at loads above the standard rating when the ambient temperature is below the 40 deg. C. standard. Appreciable economic gain to the industry will inevitably result.

The overhead systems committee has centered its activities around an intensive study to determine the best possible design for overhead line structures. A survey of the entire country is being made to determine from actual experience the wind and ice loads to which overhead lines are subjected. The committees of the Geographical Divisions are actively co-operating in this work. Supplementing the results of actual experience, an exhaustive experimental investigation is being carried on at the University of Michigan. A special wood pole line has been erected which is being subjected to a wide range of wind and ice loading. Accurate measurements of the stresses developed are taken and recorded. It is proposed to continue this investigation next year.

A thoroughgoing study of rural line design and construction has been practically completed by the overhead systems committee, which will soon publish a serial report on recommended practices. This will reflect the combined experience and judgment of the best engineers in the country and should become the future standard for this class of construction.

The underground systems committee reports the increasing use on voltages as low as 11,000 of three-phase installations of three single-conductor cables in single large ducts. A comparative analysis of the cost of three 1,000,000-circ.mil single-conductor cables in one duct with three three-conductor 350,000-circ.mil cables in separate ducts, both designed to carry the same load, indicates a saving on the former over the latter of 59 per cent in duct system and 25 per cent in cable. Furthermore, the enormously higher dielectric strength of single-conductor cable as compared with three-conductor cable has been definitely established. Installation of metal-shielded conductor cables are increasing. At the end of 1927 there were 104 miles of this cable in operation without cable or joint trouble, as compared with 22 miles in 1926. Duct sections 1,000 ft. in length are being successfully used, thus effecting a reduction in manhole and joint costs.

*K. R. MacKinnon*
Chairman Committee on Accident Prevention

*A. H. Kehoe*
Chairman Committee on Electrical Apparatus

*H. P. Liversidge*
Chairman Committee on Engineering Administration

*Bryon E. White*
Chairman Committee on Hydraulic Power

The research into the properties of paper-insulated cable has been continued and further progress made. The purpose of this research is to develop the facts necessary to make possible the writing of specifications which will cover the requirements and tests necessary to assure the purchaser of obtaining satisfactory and uniform cable of this type.

Analysis of operating results on underground cables actually in use show that defective workmanship accounts for the greatest number of joint failures from any one cause. There are five times as many failures in splicing cables due to poor workmanship and poor insulation as there are in the cable itself due to internal and electrical causes. It thus appears that our cable operating organizations are not keeping pace with the improvements of the manufacturers.

*J. C. Martin*
Chairman Committee on Inductive Co-ordination

The most important activities of the meter committee during the past year have dealt with the training of metermen throughout the country. This committee has fostered short educational courses on meters and metering practices at universities and schools all over the United States. The attendance at these courses has been very gratifying, and the result is bound to be an improvement in the average technique of our metermen. There has also been conducted a number of general group meetings of metermen of the various Geographic Divisions. The attendance at these meetings has been in the hundreds, and much good work has been done. The meter committee is now engaged in the preparation of a correspondence course which will be designed to provide material for the training of new employees as meter testers or to perform other duties in meter departments, and for others desiring a better knowledge of meters and metering.

During the past few years the inductive co-ordination committee has performed an outstanding service in crystallizing the basic problems of inductive co-ordination with the communication circuits and in training the engineers of member companies on this important subject. The committee has also served as an advisory staff to assist in directing the field surveys in the development and research program carried on by headquarters engineering staff.

Practical solutions are now being obtained so that situations involving inductive co-ordination can be worked out on the basis of the physical facts involved rather than on theory.

It is worthy of mention that recent meetings of the development and research committee have been outstanding in that discussions of work done and under way predominated, whereas in previous meetings the discussion had centered about work that should be done. The entire picture was one of a grasp and understanding of the work as well as of actual accomplishment that has not heretofore been so evident. Engineers of headquarters staff trained in these problems are available at the call of member companies to make field studies of conditions existing in specific troublesome cases.

*E. E. Hill*
Chairman Committee on Meters

*Harold Cole*
Chairman Committee on Overhead Systems

*E. B. Ricketts*
Chairman Committee on Prime Movers

*J. W. Sylvester*
Chairman Committee on Underground Systems

The problem of voltage regulation at the customer's service is demanding more consideration as the practice of combined light and power circuits develops and the variety in types and characteristics of utilization apparatus increases. Voltage regulation is a very important factor in over-all distribution system costs. It has been generally held that incandescent lamps require very close voltage regulation and in many systems no expense has been spared to maintain a very narrow voltage range on the circuits carrying lighting service. Actual experience indicates, however, that such close regulation is scarcely justified and a trend toward broader regulation is noted in order to bring about a reduction of distribution cost.

The voltage regulation problem involves two factors: First, the maximum and minimum range of voltage, with the gradual variation between these limits as determined by magnitude of load, length of line, size of wire and voltage impressed; second, quick fluctuations in voltage which are caused by the operation of individual pieces of apparatus, as for example the starting of motors. The solution of the problem by improving system regulation is the most costly in many cases.

A specific case at hand where there is a tendency to demand unreasonably close regulation is found in the alternating-current radio sets now coming into general use. On account of the sensitiveness of the alternating-current tubes to voltage variation, considerable expense and complication is required in the design of sets of this type to meet the wide range of service voltages throughout the country. Nevertheless, it is unquestionably a fact that the cost of providing for this range of voltage in the radio equipment is insignificant compared to what it would cost the power industry to provide all over the country service voltages within a sufficiently narrow range so that regulating equipment would not be required on the radio set.

### Future Conditions

Looking forward to future conditions, the trend of which is clearly shown, emphasis is placed on the necessity for "more system capacity per dollar of investment" because of the increasingly important part that fixed charges are playing in the total cost of electric power service. Heretofore a major factor in the economies that have taken place in the power industry has been improvement in the efficiency of fuel consumption. Now, however, the cost of generation has become such a small part of the total cost of service that it is necessary to look elsewhere for further major economies, and the system investment offers the greatest field of opportunity in which to find them. In the past attention has been centered in reducing fuel and other operating costs. In the future it will be devoted particularly to economical system design and control of construction costs.

It is inevitable that the power industry will spend more money in the next ten years than in any past like period. It will be called upon to meet more exacting service requirements than ever before, and will be under greater economic pressure so that more careful attention will have to be given to every dollar spent. These are the engineer's problems and are more difficult than those which have confronted him in the past. There is therefore an important executive problem to be worked out in recruiting and training the necessary engineering talent and in providing an organization to enable it to adequately function. To meet these more exacting requirements the engineer must develop himself into a "scientific business man." His job starts with getting solutions to the physical problems but by no means ends there. He must be a good business man, a salesman, a diplomat and "must play with the team" if he is to deal successfully with those men with whom he must deal if his plans are to materialize. Just to the extent to which he anticipates executive judgment, which must be based on organization, commercial and public relations viewpoints as well as on engineering, to exactly that extent does he become a more valuable man to his company and himself, and put himself in line for bigger things.

# Codes and Standards*

By Irvin W. Day

*Chairman Codes and Standards Committee*

OUR obligation to the public in the supply of a necessary service requires that we weigh with impartiality and a fearless devotion to our public trust the fixing of rules and the adoption of standards for the conduct of our business. We want wise and reasonable rules—rules that are based on good, sound business economics—rules that have always the best interests of the public at heart. Therefore, having in mind the final costs, in the rendition of our service to the public and for which we in the end are responsible, it is necessary that we follow most intimately the formulation of codes and the adoption of standards for the conduct of our business.

The work of our committee during the past year has been largely concerned with co-ordinating the activities of the N.E.L.A. with the work and activities of other associations or groups. Harmonious relationships have been established and effective work started toward the elimination of confusion in standardization matters. Much wasted time and effort are still caused by the multiplicity of standardizing agencies. Attention was called to this situation in our report last year. There appears to be a wholesome desire on the part of every one to simplify standardization procedure, but prestige, brought about through years of contact or control, is perhaps the greatest barrier to real progress. While the light and power companies are not standardizing agencies and have no direct responsibility as such, their interests and those of the public they serve are indirectly affected by everything that is done along these lines. They are perhaps more directly affected by formulation of codes and should take a serious interest in their development.

We desire to bring to the attention of member companies the importance of recent code developments. We earnestly recommended that the executives of the member companies impress upon their engineering and operating organizations the necessity of becoming familiar with both the safety and fire codes as well as the various other codes which affect construction and operating methods of the power companies. Lack of interest or lack of familiarity with these matters may involve the expenditure of large sums of money by the power companies, and it is most important that each company designate some one in its organization to follow particularly matters relating to codes. It would be well that N.E.L.A. headquarters be advised as to the person so designated to the end that closer co-operation may be established between association headquarters and the member companies on matters affecting new codes as well as the revision of existing codes.

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*Report presented at N.E.L.A. convention, Atlantic City, June 4-8, 1928.

# National Engineering Work*

Why a headquarters engineering staff is needed. Work of staff outlined. Relations with other organizations. Progress notable

### By H. S. Bennion

*Director of Engineering N.E.L.A.*

*H. S. Bennion*

THE National Electric Light Association had been organized thirty-five years before an engineer was placed on its staff. This happened about eight years ago. Today it has seventeen engineers, and these are spread out rather thin over the field they are supposed to cover.

The question arises as to why, after getting along thirty-five years without an engineering staff, the association should need such a big one now. There are two primary reasons for this. The first is that physical developments in the United States in recent years have expanded so greatly that the various elements bump into each other much more persistently than they used to. This is the case on the surface of the ground, underground, in the air and in the ether. We have not the elbow room we used to enjoy. Fields of interrelation and interdependence have multiplied. In the past five years the expansion of our electric plant and equipment has equaled the total growth of the preceding forty years.

The second reason for the engineering staff is to be found in the recent and rapid growth of other organizations, particularly national organizations of an industrial, technical and governmental character. The federal government alone has added some eighty-five bureaus, commissions and boards in the past twenty-five years. According to the Domestic Commerce Series of the Department of Commerce and reports of the National Research Council there are about 1,500 trade associations in America. There are 120 important technical and scientific associations and some 600 small and highly specialized organizations of this character. I have taken no account of civic, political, patriotic and religious societies, though any of these may undertake work having an important bearing on the development of the electric light and power industry. There are also many corporations of national scope, such as the American Telephone & Telegraph Company, the Western Union Telegraph Company, etc.

The building up of our staff has lagged a goodly distance behind the parallel development of these other organizations and behind the growth of the business we serve. To our credit, or perhaps to our discredit, we have not taken the initiative in furthering national work of this character. We have rather consistently waited to be pushed by the force of circumstances into more work. The appointment of an engineer to serve on the headquarters staff came years after the large and efficient Bell Telephone systems had become seriously concerned with inductive interference. Even today our force of twelve engineers devoting itself to the joint research and development program of the N.E.L.A. and Bell Telephone systems is small compared to the force of the American Telephone & Telegraph Company devoted to the study of this joint problem. Inductive co-ordination work undertaken jointly with the Western Union Telegraph Company adds to the task of this comparatively small force of ours.

The growth of the movement for standardization and codification and the turning by regulatory bodies toward the development of specificational rulings governing the public utilities has been the second important factor in contributing to the size of the engineering staff.

A third factor has been the administrative burden coming to the officers of the Engineering National Section and its committees as a natural result of the size of the association and of its consequence in the world of affairs. As I stated before, our physical structures have doubled in extent in the past five years, and this may be taken as a measure of the corresponding increase in our importance to the general welfare.

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**Address, "The Purposes and Accomplishments of the Engineering Staff," before the N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

The fourth factor in contributing to the job of the engineering staff has been the demand for more research and survey work by the association. To date this demand has generally come to a head when relations with other organizations disclosed the need for certain specific information.

The foregoing are the major reasons for the engineering staff. Developments such as radio, aviation, etc., have just added so much to the job.

### JOINT WORK BASIC

The inference could well be drawn from the foregoing that we have strengthened our organization for purely selfish purposes; that each time we saw our interests seriously threatened we have built up the home guard to drive out the invader from our preserves. While it is true that there is this element in the development of our engineering staff, it is the minor element. As a matter of fact, we have organized to take on additional work as it has become patent that such organization on our part was badly needed in the general scheme of things. The product which we generate and distribute has become the lifeblood of the country. It is an indispensable or extremely important factor in most of the activities of the various important elements of the entire nation. Our physical structures occupy large areas and have characteristics of great moment to others. The telephone companies do not now and never have feared our organizing to tackle the inductive co-ordination problem. They have welcomed it. They hoped for such action on our part long before we acted. They have appreciated very clearly for a long time that in a field so technical and intangible real progress could only be made through co-operative effort and that the better organized we were in this respect the more able would we be to co-operate.

And who loses by such co-operative effort? No one does. The benefit is general. The two utilities directly concerned gain by this process because they are left just as free to reach their customers and to sell their respective services as the natural laws of induction will permit. They avoid the unnecessary losses which are bound to occur where artificial barriers or arbitrary conventions are imposed by an outside referee. The state regulatory bodies are relieved of the thankless task of laying down arbitrary rules governing a highly complex relation. The courts are freed from endless technical testimony and, most of all, the public is served without long delays and at a minimum over-all expense.

The importance of standardization and simplification to the general welfare of the country is so well appreciated that elaboration on the point is not warranted. It sometimes is not appreciated, however, that real progress in standardization is not made by fiat, law or arbitrary ruling, but only by co-operative and diligent effort on the part of all important parties concerned. Particularly is this true in the highly technical fields. The concerted effort of the electric light and power industry in developing electrical standards represents an enormous contribution toward the public good. This work could scarcely be accomplished without our organized assistance. Our expert technicians who devote in the aggregate countless man-hours to this particular work render a great public service, and this service is just as important to the public welfare whether they are furthering a sound proposal or opposing an unsound or premature standard.

In the fields of safety affairs the same general statements are equally true. Real progress in minimizing fire and casualty hazards resulting from the use of electricity can only be had with the help of an organized electric light and power industry. The co-operation of the engineers who design and install power generating and distributing plants, who establish the operating methods of the large systems, and who train and direct the operating personnel is essential to any safety program, not only in the development of codes, regulations and ordinances but in the further extension and perfection of the arrangements for preventing fires and accidents. The establishment of rules and requirements without their initiatory and helpful participation is bound to result in ineffective, possibly dangerous and unnecessarily burdensome requirements. The public will not be well served. It probably will not be adequately protected in important parts, and it will be unnecessarily burdened by other specifications.

This general elaboration can be shortened by stating that in the modern scheme of things the organized effort of each important industry is essential to the efficient promotion of the public welfare.

### JOINT WORK SLOW BUT IMPORTANT

In the carrying out of an extensive joint development and research program it is only natural that there should be a long interval between first obtaining the information in the field and the final issuance of a mutually acceptable report to the industry. The latest research data are, however, being applied rather generally throughout the country for the solution of inductive co-ordination problems through the participation of our staff engineers and those of the American Telephone & Telegraph Company in the handling of current cases. This knowledge is also made available and put to use through the large number of power engineers serving on the joint development and research sub-committees and on the inductive co-ordination committee. In other words, we are now cashing in on our research work and have been for some time. To a considerable extent, we have a working knowledge of this particular relationship.

In co-operating with the sub-committee on loading and strength of aërial lines the staff has contacted with the Weather Bureau stations and with a number of member companies throughout the country in furtherance of the program for obtaining records of glaze storms. A staff engineer covered parts of New England and the Middle Atlantic states in collecting records of the older pole lines. Contact was also maintained with the experimental work which is being conducted at the University of Michigan as a part of this general research project, to facilitate the procurement of instruments which can be used in the work.

At the request of one of our larger member companies, we have collaborated in the specification to accompany a joint use contract. This agreement, as I understand, is now being put to use between the companies of the Bell System and the subsidiaries of this power company. The specifications are available for the information of other companies. It is hoped that after a trial of two or more years this agreement and the specification may serve as a basis for action in this field by the joint general committee.

It seems to me most desirable from the standpoint of efficient public service in the whole utility field that so far as possible the utilities should work out among themselves the specifications governing their respective joint relations and that regulatory requirements and codes covering these matters should be confined to statements of principles and to the laying down of general rules. This makes for flexibility without sacrificing safety and permits keeping construction practices closer abreast of the advancing knowledge of the art. To bring this about the utilities must demonstrate that they are able to govern their inter-relations to the benefit of all concerned, particularly to the benefit of the public. When we have made this demonstration, we can then ask for the elimination of specificational matter from national codes and from state rules. Should this be effected, the necessity for frequent revisions of codes and state rules would be largely eliminated.

During the year we have participated in hearings before state commissions engaged in the formulation of regulations governing overhead construction in Maine, Iowa and Idaho. My assistant, Mr. Campbell, through familiarity with the provisions of rules in a great many states and through his intimate knowledge of the Safety Code and of the viewpoint of the other utility services in the fields of joint relations, can be of great assistance in the formulation of state rules and, in my opinion, can render an important public service in making his broad knowledge of this particular subject available throughout the country. This endeavor aids in the development of sound rules since profit is had from the experience of others.

We have assisted the oil burner sub-committee of the general merchandising committee in making a survey of the extent of use and the characteristics of the oil burner. We hope to assist in more such surveys. Our industry must take a leaf from the Gas Association and conduct research projects in the field of utilization to determine with more precision the fields of use for our product and the limits within which it can successfully compete with other products. These are matters of concern to the engineer as well as to the sales force. Our industry must keep abreast of the times in getting business.

We have assisted the special committee on the marking and lighting of airways with a view of keeping the industry informed of the developments in that field and in an effort to aid the Department of Commerce in its desire to obtain central station power for airway beacons and for landing fields. A survey was made of the experiences of a number of member companies in furnishing such service and in dealing with the problems presented by the developement of airports at the larger towns and cities.

### Codes and Standards

In the field of codes and standards we have been particularly active. My assistant, Mr. Maxwell, has made it a point to cover all meetings of the American Engineering Standards Committee, of its electrical advisory committee, of the electrical committee of the National Fire Protection Association and to attend meetings of the larger inspectors associations. In addition, we have participated in numerous miscellaneous meetings and conferences where code matters were involved.

With the present state of organization in the field of standardization, as pointed out at the beginning of this talk, it becomes mandatory that our association have a message center, so to speak, to which all the latest information of what is going on in the field of codes and standards is reported. This center must also be a historian's office from which the continuous record of any standardizing movement can be had. This need my office has been directed to fill. Since it is being depended upon for this purpose, it becomes more and more essential that individuals and committees engaged on standardization projects keep headquarters posted on developments relating to their assignments.

I need not enumerate here the machinery set-up and the procedure adopted by our association for handling its share of the standardization load. Suffice it to say that there are 150 current standardization projects in which we are participating. I should like, however, to call your attention to one point that those of you who have not seen hard service in the standardization mill may overlook. Our association machinery is big and slow moving. As an industry we are notorious for having divided views on questions—technical and policy. Among the numerous standardizing bodies it frequently happens that certain of the projects are moving comparatively fast. Our association must act quickly or forever hold its peace. We on the staff in our rôle of maintaining routine contact are like sentries on outpost duty and frequently must decide whether there is time to call up the main body to attack the question at issue or whether we ourselves must engage it with the limited force at hand. In other words, it often happens that we must take the initiative, procure an answer quickly and give it authoritatively, sometimes making commitments of importance on our own responsibility. These are emergency actions and I call attention to them because our motives might be misunderstood and because their occurrence emphasizes the desirability of keeping headquarters posted in matters bearing on codes and standards so as to reduce the chance of our giving the wrong answer in such a situation.

In addition to the foregoing general tasks, which we have with us more or less all the time and which form the main grist of the work of the Engineering Staff, there are multifarious duties that come to hand from many quarters. These are too numerous and too fleeting in character to warrant enumeration. Since engineering forms the foundation of our business, it goes without saying that there are points arising from time to time upon which engineering comment is useful to management. Our rule of conduct on the Engineering Staff is to make ourselves generally useful by contributing wherever possible to the common good.

## Essentials of Industrial Relations*

By Homer E. Niesz

CONTACTS with the individual customer occurring at best but a few times a year, and including all the elements of personality, may easily create bitter hostility, irritation, passing satisfaction or even occasionally lasting enthusiasm, depending upon the character, intelligence, appearance, manner and genuine desire to serve which the employer manifests. These statements, emphatically true of face-to-face contacts, are, in a modified but an equally important degree, also applicable to contacts by correspondence and by telephone. Improved performance, it would seem, can only result from specific training, critical supervision and regular measurement of personal service given. These three lines of advance require full recognition of the supervisor's responsibility for training in his group.

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**From report of customer relations committee presented at the N.E.L.A. convention, Atlantic City, June 4-8 1928.*

# Government in Industry*

Lax public interest in government produces critical business reactions. Obligations of industry and of government

By John E. Edgerton
*President National Association of Manufacturers*

*John E. Edgerton*

WHAT has been taking place in your particular industry and in the general field of public utility is only an acute local manifestation of a general tendency of government. It is a cutaneous outbreak of an organic disease on our political body. This malady was prophetically diagnosed twenty-five hundred years ago by a wise Chinese philosopher who said: "As restrictions and prohibitions are multiplied in the empire the people grow poor and poorer. When the people are subjcted to overmuch government the land is thrown into confusion. When the people are skilled in many cunning arts strange are the objects of luxury that appear. The greater the number of laws and enactments the more thieves and robbers there will be. Therefore, the Sage says, 'So long as I do nothing the people will work out their own reformation. So long as I love calm the people will right themselves. If only I keep from meddling, the people will grow rich. If only I am free from desire, the people will come naturally back to simplicity. If the government is sluggish and tolerant, the people will be honest and free from guile. If the government is prying and meddling, there will be constant infraction of the law. Is the government corrupt? Then uprightness becomes rare and goodness becomes strange. Verily, mankind has been under delusion for many a day. Govern a great nation as you would cook a small fish—that is, don't overdo it.' "

Even his most unforgiving enemy or unsparing critic cannot say truthfully of the President of the United States, Calvin Coolidge, that he has been noticeably lacking in that rarest of qualities in public life today—courage. Whatever other judgment history may pronounce upon him, if it be true to its purpose of unimpassioned record of fact it will say that no servant of the people of the United States was ever more consistently courageous in resisting the encroachments of federal government upon the prerogatives of its citizens. When he was Governor of Massachusetts he was moved by his observations of tendencies in that state to say that "the alternative of private ownership and control is public ownership and control. Broadly extended this is communism."

As a matter of fact, gentlemen, there are extremely few people in America today who are willing to admit their belief in the principle of government ownership and operation of the instrumentalities of production and distribution. On the contrary, most of those who are lending themselves to the enterprises of socialism either through non-resistance or active connivance are loudest in the repudiations of socialistic purpose. They are wearing the cloaks of Republicanism, Democracy, Progressivism and other political regalia. Practically every legislative body in the land from the board of aldermen or commissioners of the smallest town to the Congress of the United States has in it members under one name or another who are constantly looking for opportunities to project government into that territory of competitive private enterprise for which it was never intended by our fathers.

Then there are others in the same bodies who have not enough information, understanding or intellectual energy to offer effective resistance and who thus become the unconscious tools of selfish leaders. Outside of but tangent to this circle of political privilege and opportunism is another which includes, besides the usual motley elements of communistic hybrids, an army of retired or retiring millionaires and the widows of others who obtained their wealth in many instances through dubious processes and are now helping to sustain the forces that would wreck free government. Verily, of all the trusts that menace the future of our country today the political trust looms as the most sinister; and in this intemperate day of inquiry into the affairs of others it is high time that the people should get together and appoint a committee to investigate it.

### Public Interest in Government

Only a renaissance of patriotic interest in government, on the part particularly of the better informed and more responsible elements of American society, can accomplish the needed reforms. It can not be done merely by organized denunciation and protest, for this is the

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**Abstract of address before N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

known common resort of those seeking refuge from the condemnations of a consciously guilty record. And upon none does the obligation of leadership in the restoration of constitutional government fall more heavily than upon industry and its controlling forces; for not only is it always the first and greatest victim of bad government, but those who guide its destiny have an equipment in experience and understanding which peculiarly qualifies them for the tasks of good citizenship. To lead successfully in any constructive work, however, it is necessary to wear the impenetrable armor of a clean record. A soldier conscious of secret disloyalty to the aims of his belligerency lacks inevitably the courage without which effective fighting is impossible.

We all know that there are in the industry and business some who are unscrupulous in their methods and practices, preying upon public confidence and plundering helpless people. That is as undoubtedly true of my branch of industry and the others as it is of yours. There is no advantage in refusing to recognize a fact so obvious. On the contrary, the sooner the honest majorities of the organized trades not only recognize but meet it with vigorous and unmistakable disapproval, the easier it is going to be to get government back into its proper place. All too long have industry and business shielded their crooked actors by furnishing them harbors of safety in their organizations and by failing to establish and maintain codes of ethics through the impartial operations of which the black sheep may be distinguished from the white. This situation supplies to ambitious government and designing politicians all needed excuse for their pestiferous inquisitions. It is the unconscionable few who thus bring embarrassment, inconvenience and sometimes destruction to the innocent many. At this point lies the richest opportunity which the trade organizations have for service both to themselves and their country. Let them devise methods of handling their own prodigals and thus remove even a seeming necessity for government intervention.

Then, too, if you will examine the record carefully, you will discover that in many if not most instances government has got into industry and business largely upon its own invitation. It is not an uncommon occurrence to see in Washington and at other seats of government groups of industrialists and business men actually petitioning government to extend its powers and functions, to establish this board or that, or to interfere here or there with the business of somebody else. The average trade or business organization is usually concerned about what the government does or does not do so long as it does not pester that particular group. On the other hand, it is wont to rejoice in the discomfiture of a competing group even if such occasion of joy weakens the general position by impairing a principle upon the maintenance of which the security of all depends. Government is quick to sense and take advantage of such opportunities of disunion, and by playing group against group it nullifies resistance to its advances in the ostensible interest of the common good.

Finally, there is no way to cope successfully with organized error except with organized truth. It is true that wars of defense and for righteous principle are sometimes even more expensive than wars of offense and aggression. That is especially true with wars waged upon an industry by government. Not only do the innocent parts of that industry suffer, but those of all others eventually share the harmful consequences. In the present circumstances, therefore, when the instinct of legislative investigation is so manifestly aroused and government is so obviously bent upon competitive engagements with its citizens, it is the clear duty of all industry and business to share the burdens of common defense against unjust and unnecessary attack. In the meantime, and as security for the future, every trade and business organization should clean itself where necessary and should so live that when its summons comes to join the innumerable caravan which moves to that mysterious committee room in the boisterous halls of Congress it go not like a quarry slave at night scourged to his dungeon, but, sustained and soothed by a clear conscience, let it approach the seat of investigation like one who wraps the drapery of his couch about him and lies down to pleasant dreams.

# Private Ownership Gives Service*

By Franklin T. Griffith

*President Portland Electric Power Company*

THERE is no general accusation that our statements supporting the cause of private ownership and operation are untrue, but we are specifically charged with spending large sums of money for the purpose of creating favorable public sentiment on behalf of private operation. In the minds of proponents of government ownership this practice of ours is deemed highly reprehensible, and our right to use any portion of our revenues in placing our cause before the bar of public opinion is questioned.

We believe that the cause of public service in its broadest aspect can be best served and the development of the industry promoted by giving full play to inventive ingenuity, to constructive financing and to sane and logical extension of the use of the service we give. We believe these activities would be stifled under political ownership and management, and we also believe they can be brought to the highest pinnacle of success only by that plan calculated to bring to the highest degree of perfection the capacity and ability of the individual. We advocate no new principle in this regard, but we stand four-square on the fundamental principles of our government. An attack upon the principles for which we stand is an attack upon our government itself.

This government was never formed or intended to function as a business organization except in so far as business necessarily is involved in government. We are against socialism and we are unalterably opposed to communism. We are, in our corporate and individual capacities, citizens of the United States. The right of free speech belongs as much to us as to any other group of citizens. We do not object to the dissemination of views differing from ours, but we most strenuously do object when such different views are bolstered and supported by plain misstatements of fact, and I insist that when we challenge misstatements of fact made by those who would plunge the nation, the states and the municipalities into the dark pool of political operation, we are doing that which is not only our right but our duty as citizens as well as representatives of the industry of which we are a part.

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**Abstract of address, "The Clearing House of the Industry," before N.E.L.A. convention, Atlantic City, June 4-8, 1928.*

# News of the Industry

## Forty-five-Million-Dollar Hydro Plant Planned

*New Move Made in Development Projected on Upper Connecticut River at Fifteen-Mile Falls by New England Power Association*

PERMISSION to build a hydro-electric development on the Upper Connecticut River to yield 220,000 kw. from the stretch known as Fifteen-Mile Falls in the district between St. Johnsbury, Vt., and Littleton, N. H., was sought in a petition filed on June 1 by the Grafton Power Company with the Public Service Commission of New Hampshire. The New England Power Association is the parent company in the project, which was noted a year ago by the ELECTRICAL WORLD as in contemplation and which is one of the largest ever undertaken in the East. At this writing it has not been decided whether the construction work will be begun this summer or not, as certain negotiations in progress remain to be satisfactorily concluded, should a favorable decision be rendered by the commission after hearing the petition.

The Fifteen-Mile Falls development will represent an investment of approximately $45,000,000. About 330 ft. of fall in the river is embraced in the scheme, which has been receiving extended engineering study for some years past. To a representative of the ELECTRICAL WORLD President F. D. Comerford of the New England Power Association stated that if the project is carried through as planned, it will be handled as a single comprehensive development rather than as a small-unit piecemeal program. A hearing has been set for June 27 at Concord, N. H.

## Supply Jobbers Change Their Name

*Will Henceforth Be Known as the National Electrical Wholesalers' Association—E. Donald Tolles Is Made Managing Director*

AT ITS twentieth annual convention, held at Hot Springs, Va., this week the Electrical Supply Jobbers' Association unanimously voted to change the name of the association to the National Electrical Wholesalers' Association. At the same time E. Donald Tolles, who has served the association for many years as its executive secretary, was appointed managing director.

George E. Cullinan of the Graybar Electric Company, the chairman, in his opening address on Wednesday morning said that the jobber was not sick, but that he had his problems, which were caused mainly by rapidly changing conditions in the business. He also said that the greatest current misconception of the jobber was that he buys and sells instead of acting as a distributor and warehouseman, which was his actual function. Another misconception was that the jobber does not do a promotional job. This was refuted by Mr. Cullinan, who also pointed out that selling methods depend on the type of products.

H. T. Bussman, vice-president of the Bussman Manufacturing Company, St. Louis, spoke on Wednesday evening on what is to be gained by the four branches of the industry through co-operative effort as provided under the Industry Sales Conference. Mr. Bussman expressed the belief that the conference would do something which no one association in the industry or no one member could accomplish alone. Summed up in one sentence, he said that the four branches of the industry could co-operate to lay the groundwork for a bigger and better business.

An equalization of dues reported and adopted by the association will reduce the cost of membership to more than 90 per cent of its members. The association also voted to support the Industry Sales Conference in making its proposed survey preliminary to the formulation of a plan of procedure.

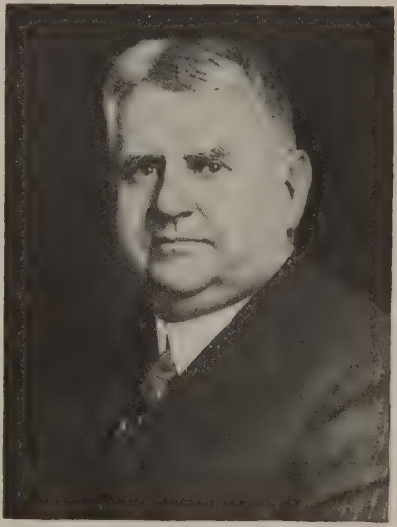
On Thursday evening O. H. Caldwell of the Federal Radio Commission spoke on the radio situation. A demonstration of talking movies, using the Western Electric sound projector system, closed the session.

The following have been elected members of the executive committee of the association:

H. O. Smith of Akron, J. A. Duncan of Chicago, G. H. Wahn of Boston, E. J. Coyle of Philadelphia, L. T. Milnor of Cincinnati, chairman of the Central Division; W. E. Robertson of Buffalo, chairman of the Atlantic Division, and A. J. Cole of the McGraw Electric Company, Omaha, executive committeeman at large.

## Public Service of New Jersey Celebrates

### Twenty-fifth Anniversary of Company's Formation Marked by Banquet at Newark—Leading Men in Various Pursuits Praise Its Achievements Under T. N. McCarter



*Thomas N. McCarter*

BEFORE a representative gathering of men prominent in the public, professional, business and industrial life of New Jersey and outside that state, the Public Service Corporation of New Jersey celebrated its twenty-fifth anniversary at the Robert Treat Hotel in Newark on June 1. Co-operation between the Public Service Corporation and the public was the keynote of the many congratulatory speeches made at the banquet. More than six hundred men heard from the lips of Governor A. H. Moore glowing testimony to the value of the Public Service Corporation in the development of the State of New Jersey. He referred to it as an institution, rather than a corporation, which has become part and parcel of the state.

Thomas N. McCarter, organizer of the corporation and its president since formation, was the toastmaster. He painted a wonderful picture of the future greatness of New Jersey and of the opportunities lying before the Public Service Corporation. The utterance that received the greatest acclaim, however, was Mr. McCarter's announcement "that in recognition of the long and loyal service of those who have served the corporation and its subsidiaries twenty-five years (some 750 in number), and who as a result wear the Public Service gold button, the board of directors has directed, as of this day, a payment to each of these employees of 10 per cent of their year 1927 compensation."

Mr. McCarter did not dwell at great length on the accomplishments of the corporation during the quarter century of its existence, choosing to let the record speak for itself. "While it is pleasant to look back over our accomplishments," he said, "yet our eyes are fixed upon the future, not the past. New Jersey is not in the twilight of its life. It is rather at its sunrise. New Jersey has just commenced to grow." He visioned the day when there will be a vast community between the Hudson and the Delaware Rivers, when every steam railroad will be electrified, when gas will be the fuel used, when every portion of the state will be interconnected electrically, and when the Public Service Corporation's system will be tied in with the large power systems of New York and Pennsylvania.

How much of that development he himself would see Mr. McCarter did not know, but he said: "While I am charged with my present responsibility, the flag with which we started, bearing the same old legend, 'To develop the State of New Jersey and to make it a better place in which to live,' will remain nailed to the Public Service mast to be seen of all men."

In congratulating the organization, its stockholders and the public in general on the achievements of the first twenty-five years of Public Service, Owen D. Young, chairman of the board of the General Electric Company, declared: "Full meed of credit should be given the men of imagination of Public Service who at its inception were looking forward with courage, self-sacrifice, determination and supreme confidence. Imagination means the leadership of the world."

Similar sentiments were expressed by A. W. Thompson, president of the United Gas Improvement Company of Philadelphia, and by Edmund W. Wakelee, vice-president of the Public Service Corporation in charge of law.

Besides the toastmaster and other speakers at the head table were Senator E. I. Edwards, Joseph F. Autenreith, president of the State Board of Public Utility Commissioners; John B. Miller, chairman of the board of the Southern California Edison Company; Samuel T. Bodine of the U. G. I. Company of Philadelphia, and Edward T. Stotesbury of Drexel & Company, Philadelphia. Among the guests were a number of prominent public utility men from nearby states.

While the dinner was the overshadowing event of the anniversary celebration, a number of other features formed part of the occasion. Every office of the Public Service Corporation throughout the state was appropriately decorated with flags, and a short time before an oil portrait of Mr. McCarter was unveiled in the directors' room in the Newark terminal.

Among the records of the Public Service Corporation the following are of interest. Since its inception the company has expended more than $300,000,000 in improving and extending its electric, gas and transportation facilities. It has paid in taxes more than $105,000,000. It has increased the number of its stockholders from a few hundred to more than 74,000 in 1927. It has increased the number of electric customers more than 42 times. It has increased its annual electric sales by more than 57 times. It has built an industrial power load from virtually nothing to one representing more than 60 per cent of the entire industrial load of the territory served. It has made far-reaching reductions in rates and at the same time has increased its annual revenues by nearly seven times.

Since 1903 $163,000,000 has gone into additions to and extensions of electric facilities. The generating capacity of the system has been increased more than sixteen times; fourteen old stations have been scrapped and five new stations have been built. Approximately twenty thousand persons are at the present time employed by the company.

# Gadsden Answers Attacks on Utilities

## Chairman of Joint Committee's Executive Body Deprecates "Premature Conclusions" and Defends Companies' School and Other Literature

THROUGH the office of the Joint Committee of National Utility Associations, Washington, the following statement with regard to alleged use of the schools for private utility company propaganda and the companies' literature in general has been issued for publication by P. H. Gadsden, chairman of the executive committee:

"I have attended several hearings of the Federal Trade Commission in its present inquiry into public utilities, and I have noted that some newspapers have drawn what seem to me to be premature conclusions from the evidence so far introduced in the record. For instance, it has been said that propagandists employed by the public utilities have penetrated the educational systems of the country, distributing material unfairly praising the services of public utilities and improperly criticising and condemning public ownership, that textbooks have been written or rewritten by authors subsidized by the public utilities, and that professors have been paid to write the utilities' propaganda into books on economics and civics.

"These characterizations of the activities of the representatives of the utilities are unwarranted by the evidence so far introduced and are basicly untrue. Representatives of gas, electric, street-railway and telephone companies have from time to time made examination of textbooks used in some of the public schools. Incorrect statements relating to the utilities, obsolete material and omissions of essentials have occasionally been found. In some instances also distinct propaganda favorable to government ownership, accompanied by unfair attacks upon the privately owned utilities, was discovered. Such conditions, when noted in connection with the surveys made, have frequently been called to the attention of school authorities and publishers. In some cases the biased material has been eliminated by the responsible parties.

"The charge that textbooks have been formerly introduced in the schools by public utilities' representatives directly or indirectly has no foundation in the evidence taken or in the facts. Utility representatives have no facilities for such an enterprise and would not use them if they had. In many states the public utility companies have been requested by university, college and school authorities to assist in associating the theories taught in educational institutions with the actualities of the business world. The companies have thrown open their plants to visits and inspection by teachers and students. They have given vacation employment to hundreds of young men who plan to enter the business on completion of their education. They have provided talks to students explaining the salient features of their operations. This is an industrial age, and such instruction is essential to prepare students for the conditions which will confront them when they go to work.

"Public utility companies have prepared and furnished to teachers—not to students, as a matter of fact—pamphlets explaining the business of operating gas plants and electric light plants, carrying on telephone communication and operating electric railways. These are instructive and informatory booklets containing historical and technical data and statements of fact as to which there can be little, if any, dispute. These pamphlets should frankly disclose—and so far as I am informed invariably have done so—their origin upon their covers. If a teacher desired to use them in his classes, he obtained them by asking for them. If he did not ask for them, he did not receive them.

"I have not, of course, been able personally to examine each of these pamphlets, but as to those I have seen the standard of accuracy and truthfulness has been highly maintained. Every one will agree that in publications to be used in any manner in the schools controversial matters should be eliminated so far as possible and prejudice and bias strictly avoided. In this respect the pamphlets I have examined will fairly stand the test.

"The investigating agents of the Federal Trade Commission are now engaged in putting the evidence in the record. They are not commenting on it as it goes in or passing premature judgment upon the activities disclosed. Subsequently the commission will sum up the evidence, draw its conclusions, formulate its recommendations and make them public in its report to the Senate. Also, the record itself will be available for general examination, as it is now, from time to time as accumulated. It is hoped that premature conclusions, based on partial and sometimes not unprejudiced presentations in some of the newspapers, will be avoided so far as possible by the general public.

"As for literature combating government ownership and operation propaganda, this has, of course, been distributed somewhat widely by representatives of the utilities. I do not feel any inclination to apologize for this material. The propaganda on the other side has been enormous and most energetically distributed and circulated. Moreover, private initiative has been the rule in the United States and its results have seemed to justify it as the American system. If the utilities have been able to assist in maintaining the American standard, they are unlikely permanently to be criticised for doing so. The increasing appreciation by consumers and the public of the usefulness of the service rendered by the utilities is the best evidence that private initiative is quite capable of performing the task.

"In Pennsylvania the Public Service Information Committee, in response to requests from county school superintendents, distributed 120,000 copies of booklets. By reason of erroneous inferences drawn by individuals who neglected to obtain complete information, the committee desired to secure a fair and impartial review of these particular activities. Therefore a letter was addressed to Dr. John A. H. Keith, State Superintendent of Public Instruction, requesting that he appoint a committee to review these booklets so that the facts might be established. That procedure, I am informed, is being followed in other states, so that the educational authorities themselves will pronounce judgment upon the material contained in booklets. Dr. Keith has appointed a committee to review the material in Pennsylvania, and I am confident similar action will be taken elsewhere."

## Davidson Defends Nebraska Utility Pamphlet

J. E. Davidson, former president of the National Electric Light Association and vice-president of the Nebraska Power Company, has issued a statement to the public in which he says that furore about the testimony before the Federal Trade Commission with relation to a 30-page pamphlet sent to some of the schoolteachers of Nebraska is an effort to make a mountain out of a molehill.

"As a member of the executive committee of our national association I know of the work being done," Mr. Davidson asserts in this statement. "I examined carefully the manuscript of the pamphlet circulated in Nebraska, and no one connected with the industry in the state has any apologies to make for its contents. I challenge any one to point out one sentence of propaganda of any sort within its covers. Surely there can be no poisonous propaganda in telling this interesting story, a plain story written for the sole purpose of acquainting the youth of today with the great servant electricity."

## Rocky Mountain Officials on the Stand

*Director of the Public Utility Information Bureau and N.E.L.A. Division Secretary Explain Activities Before Federal Trade Commission Investigation*

AT THE session of the investigation into public utility companies by the Federal Trade Commission on Thursday, May 31, Theodore J. Grayson, director of evening schools, University of Pennsylvania, took the stand at his own request in order, as he explained, to correct errors in testimony of a previous witness relating to the manner of the establishment in the university of a public utilities course for public utility employees. Mr. Grayson testified that the course, which was begun in the institution about five years ago, was the outcome of a request on the part of the Pennsylvania Public Service Information Committee to the university authorities, that everything was done in a frank manner and that there was no dictation or even suggestion by the utilities as to the manner of teaching the course or the matter to be taught therein. Mr. Grayson had been paid by the Joint Committee of National Utility Associations $250 each for three speeches he had made in which he opposed government ownership and had derived other income for services rendered to utility organizations.

Another witness was the director of the Rocky Mountain Committee on Public Utility Information, George V. Lewis of Denver. This committee now has an annual appropriation of about $18,000, according to Mr. Lewis. The committee is opposed to the Swing-Johnson bill for the development of Boulder Dam, Mr. Lewis said, but it has done nothing against the project beyond "relaying" literature calling attention to what public utility men regard as a menace.

Several years ago, Mr. Lewis testified, a survey of textbooks was undertaken for the committee by Hubert P. Wolfe, a research fellow of the University of Colorado, part of whose salary the committee paid. A report on high-school activities, made after the third year of effort, said that the committee was "rapidly withdrawing from mental circulation the countless counterfeit ideas relative to the public utility business which have been foisted upon the people for so many years by the unfriendly, the misinformed and the prejudiced." Mr. Lewis next identified checks aggregating more than $1,600 which he said had been paid to Prof. W. C. Duvall, of the engineering school of the University of Colorado, for conducting a survey of municipally owned plants for the Rocky Mountain committee.

Mr. Lewis' testimony, continued on Friday and Saturday, further developed that the Rocky Mountain committee was interested in the appointment of a fact-finding committee on the Colorado River project under the auspices of the University of Colorado. Mr. Wolfe had helped in preparing arguments to be made before the board of regents in favor of setting up such a committee.

The witness testified that his committee undertook to combat through local utility managers a municipal ownership movement which it called the "income-warrant menace." This he defined as a financial device intended to induce municipalities to take over public utility plants. He testified that a pamphlet on the subject was distributed through the state, and he identified a report in which he was credited with retarding this movement.

Orville A. Weller, secretary of the Rocky Mountain Geographic Division of the N.E.L.A., testified that the national body contributes about $4,000 annually to the support of the division and that the utilities in Colorado, Wyoming and New Mexico spend from $1,200 to $1,700 on the association. He explained a power survey undertaken by the association recently as being intended to obtain data on the probable growth of its member companies. Denying that its purpose was to show the advantages of private over municipal ownership, he said that it grew out of repeated statements by tourists that Colorado's tremendous power is going to waste. He said that they received this impression from visiting the state during the high-water season.

The Federal Trade Commission will resume its inquiry on June 11, after the N.E.L.A. convention is over. Officials of the Texas and Louisiana-Mississippi information bureaus will be the first to testify, according to the arranged program.

## Shoals Bill Not Approved

*President Coolidge Fails to Sign Measure Within the Constitutional Time Limit, and It Therefore Cannot Become Law Before Next Session*

FAILURE of President Coolidge to affix his signature to the Muscle Shoals bill left in his hands by Congress before the expiration of the constitutional ten-day time limit, which was at midnight on Thursday, June 7, has killed the measure for the time being at least, though it can, of course, be repassed and again put before the President when Congress reassembles in December. The "pocket veto" fulfills the prediction that because of the President's consistent opposition to putting industrial functions into the hands of the government, he would not make the bill a law.

Meanwhile, Representative Cannon of Mississippi, former parliamentarian of the House, has stated that nothing but the United States Supreme Court can untangle the difference of view as to the effect of failure of presidential approval between sessions. Mr. Cannon also says that it has been the unanimous opinion in both the House and the Senate, when similar questions have come up, that a pocket veto has no effect in preventing a bill from becoming a law.

# First Building at Leaside Under Construction

*Ontario Hydro-Electric Power Commission's New Transformer Station Will Handle 220-Kv. Energy Supplied on Contract by Gatineau Power Company*

THE first 220-kv. step-down transformer station in Canada is now being built by the Ontario Hydro-Electric Power Commission on a site in the town of Leaside, Ontario, just northeast of Toronto. This station, when completed, will be one of the largest single transformer stations on the continent. Some time ago a contract was made with the Gatineau Power Company for the supply of 260,000 hp. of 25-cycle power, to be delivered to the commission. In order to bring this power from the place of delivery to a point where it could be fed into the Niagara system, two single-circuit 230-mile, 220-kv. transmission lines will be required—the first in Canada at this voltage. One of these lines is now under construction, and, according to a progress report, about 60 per cent of the work has been done and there is every reason to expect that the original time limit set for completion, Nov. 1, will give ample margin. The station site at Leaside, where the line will terminate, covers twelve acres. Energy will be supplied from this station at 110 kv. to the Niagara system and at 13,200 volts to the Toronto Hydro system.

The seven oil circuit breakers will be approximately 22 ft. high to the top of the bushing and occupy 45 ft. by 10 ft. each. Each tank, of which there are three per circuit breaker, will require 5,000 gal. of insulating oil. In spite of the large size of these breakers and their heavy moving parts, it is expected that they will completely interrupt the circuit in one-half second.

The transformers are the biggest single-phase water-cooled units yet built in Canada. Four banks will be required to handle the Gatineau contract. The control of all circuit breakers, disconnecting switches, tap changers and synchronous condensers is centered in a room 35 ft. by 45 ft in size.

Active work at Leaside was started a few weeks ago, the first building to be constructed being the erection building required for the assembly of the electrical equipment. This building is fitted with a 75-ton electrically operated overhead traveling crane. It is to be of brick and concrete with structural steel framework. The manufacture of the electrical equipment is well under way at Peterboro, Toronto, Hamilton and St. Catharines. The schedule requires the first portion of the station to be ready to receive power by Oct. 1.

The Paugan Falls plant of the Gatineau Power Company, 32 miles above the mouth of the Gatineau River, in Quebec, rapidly nearing completion, which is designed for an ultimate capacity of 470,000 hp. and an initial output of 272,000 hp., will probably supply most of the 260,000 hp. called for under the contract, though the plants now operating at Chelsea and Farmers Rapids and serving the International Paper Company will take care of inequalities and emergencies. A dam being built below the Paugan Falls will back the water up to Chute Calumet, a distance of 30 miles, drowning out nine falls and rapids and creating a head of 136 ft. At Paugan Falls one unit of 34,000 hp. is now ready for service, and a second one is expected to be ready very soon.

*Paugan Falls development of the Gatineau Power Company*

# Denver Contractors Oppose N.E.L.A. Committee

Recommendations made by the wiring committee of the Commercial National Section of the N.E.L.A. have brought forth a strong protest from 65 Denver electrical contractors, which has been presented in writing to the Electrical League of Colorado. The contractors say:

"This report leads definitely toward the conclusion that the central stations should enter the electrical contracting business, employing electrical contractors or wiremen as their workmen on a piece-work basis, and that the cost of conducting such electrical contracting business should be absorbed by the central stations under the advantages which they are now employing in many cases to conduct merchandising departments without regard to costs or profits. Such a policy would inevitably establish the level of contracting and wiring prices in the minds of the public at such levels as to destroy the business of electrical contractors attempting to operate on a normal basis of profit."

# Northwest Association Ready for Portland Meeting

The program for the twenty-first annual convention of the Northwest Electric Light and Power Association, to be held at the Multnomah Hotel, Portland, Ore., on June 19 to 22, has been issued. Following are the events of main interest:

GENERAL SESSIONS

*Tuesday Morning, June* 19.—President's address, A. C. McMicken; address, P. S. Arkwright, vice-president N.E.L.A.; address, J. M. Thomson, president Idaho Public Utilities Commission.

*Wednesday Morning, June* 20.—Report Commercial Section, J. C. Plankinton; address, E. C. Greenwood, commercial director N.E.L.A.; address, J. T. Jardine, chairman Oregon C.R.E.A.; "The New Day in Merchandising," Stephen I. Miller, executive manager National Association of Credit Men.

*Thursday Morning, June* 21.—Report Engineering Section, O. L. LeFever; address, W. H. Onken, Jr., editor ELECTRICAL WORLD; report Accounting Section, F. W. Brownell; address, Prof. C. S. Dakan, University of Washington.

*Friday Morning, June* 22.—Report Public Relations Section, George L. Myers; finals in employees' and managers' public speaking contests and reading of winning essays in three competitions; address, P. S. Clapp, managing director N.E.L.A.

Dancing, boating, golf, cards and excursions will fill the afternoons and evenings.

# Getting Ready for Camp Co-operation VIII

Camp Co-operation VIII, the annual conference of representatives of electrical leagues, will be held at Association Island, near Henderson Harbor, N. Y., Thursday, Aug. 2, to Tuesday, Aug. 7, inclusive. The first three and the last two days will be devoted to business sessions. This camp will be held under the auspices of the League Council and sponsored by the Society for Electrical Development, as in the past. Attendance will be by invitation, which will be extended to officials of leagues and others actively interested in local and national co-operative development of the market.

The business program has already received consideration. It is the purpose to emphasize those features of local co-operative work and market promotion that will make the league productive of larger results and a force of greater influence in its community. To this end addresses and papers will be presented and discussions conducted on those league practices noteworthy for their successful results. Profitable objectives the league should strive for and elimination of wasted effort through the selection of worth-while activities will receive major attention. There will also be opportunity for discussion and exchange of experiences in the problems of league operation and management. The "red seal" plan and other national movements for widening the market will come in for their share of consideration.

## Purchases and Mergers

*Pennsylvania Power & Light Asks Authority to Buy Controlled Companies and Acquire Others—Southwestern Public Service Sold to Texas Utilities Company*

PLANS for consolidation of Lehigh Power Securities Corporation properties in Pennsylvania were revealed last week by the filing of applications with the Public Service Commission by the Pennsylvania Power & Light Company for authority to acquire outright 35 small operating properties already controlled by it and to obtain control of ten others. The new companies of which control is sought include, in addition to gas, railway and water concerns, the Harrisburg Light & Power, Lehighton Electric Light & Power, Pine Grove Electric Light, Heat & Power and Juniata River Water Power. The companies which the Pennsylvania Power & Light wishes to acquire outright include the East Penn Electric of Allentown and plants in various boroughs and towns. Among the larger places are Juniata, Honesdale, Hummelstown, Montgomery, Montoursville, Hughesville, Clymer and White Haven.

Purchase of the holdings of the Southwestern Public Service Company, consisting of fourteen public utility plants in Amarillo and other towns of the Panhandle of Texas and eastern New Mexico, by the Texas Utilities Company and the New Mexico Utilities Company is announced by Judge I. R. Kelso of St. Louis, president of the Texas Utilities Company. The purchasing companies are owned by the same interests and operate 43 plants in northwestern Texas and New Mexico. Transfer of the properties will be made on July 1. The merger will give the 43 towns in which the Texas Utilities Company has been operating a connection with the gas-fuel power plant erected in Amarillo last year by the Southwestern Public Service Company. The transferred properties are estimated to be worth upward of $4,000,000. The Southwestern Public Service Company operates to the northeast of Amarillo as far as Pampa, a power transmission line running from Amarillo through Panhandle to Pampa and west into New Mexico as far as Carlsbad. The Texas Utilities Company covers a wide territory coming as close to Amarillo as Canyon, 20 miles to the south.

Application has been been made to the Arizona Corporation Commission by the Public Utilities Consolidated Corporation of Arizona to purchase the American & Foreign Utilities Corporation of Delaware from the W. B. Foshay Company of Minneapolis. The Delaware organization controls the Alaskan Utilities Company of Alaska, the Managua Utilities Company of Nicaragua, the Eel River Power Company, near Indianapolis, and the East Minnesota Power Company of Minnesota.

The Western Public Service Company of Scottsbluff, Neb., has purchased the locally owned plant at Mitchell and will serve it by transmission lines.

The Kentucky holdings of the General Power & Light Company of New York have been bought by the Kentucky Utilities Company. They include an electric transmission system connecting the towns of Calhoun, Corydon, Rumsey, Poole, Slaughters and Sebree.

The Illinois Commerce Commission has granted the Central Illinois Power Service authority to purchase the Elizabethtown Power & Light Company system for $8,681.

The Midway electrical distribution system, near Kannapolis, N. C., has been acquired by the Southern Public Utilities Company from the Midway Lighting & Improvement Company.

The People's Hydro-Electric Corporation of Vermont, Montpelier, Vt., has petitioned the Vermont Public Service Commission for authority to acquire properties in Eden, Hyde Park and Wolcott, identified under the name of the Green River Power Development, for $163,571.

## Impetus to Hydro Development in New York

*Court of Appeals Decision in Niagara, Lockport & Ontario Case Removes a Source of Delay by Public Service Commission*

WATER-POWER development in New York State on a scale far greater than anything in the past may follow action by the Public Service Commission now that the Court of Appeals has upheld the validity of the so-called Miller water-power law. At least half a score of proposed mergers of power resources are awaiting action by the commission, which had postponed decision pending the outcome of the litigation which the Court of Appeals passed upon last week.

One of the first cases that will receive consideration is that of the Rochester Gas & Electric Company, which has an application to absorb a small neighbor under the terms of the water-power law. The provision of the law which had been challenged as unconstitutional was one which said in effect that a water-power company developing the major part of any specific site might, as a matter of public convenience and necessity, absorb by right of eminent domain another concern that was developing a minor part of the same site. As reported last week (page 1159), the Court of Appeals upheld this principle in the litigation that grew out of the application of the Niagara, Lockport & Ontario Power Company, made almost four years ago, to take over and develop certain power resources on the Salmon River in Oswego County owned and operated by the Horton interests, which had a minor devlopment on a power site there where the Niagara, Lockport & Ontario had a major development.

The Public Service Commission granted the request of the Niagara, Lockport & Ontario Company. The ruling was the immediate sequel for a battle of the courts. Attorneys for the Horton interests argued that approval of the application meant that the big water-power companies of the state would gobble up their smaller neighbors.

## International Union Meets at Paris on July 5-10

Announcement comes from Paris that the Union Internationale des Producteurs et Distributeurs d'Énergie Electrique will hold its next congress in that city on July 5 to 10. The program provides for the formal opening on Thursday morning, July 5; business sessions on Thursday afternoon, Friday morning and afternoon, Saturday morning and afternoon, Monday morning and Tuesday morning, July 10, and the closing session on Tuesday afternoon. There will be a reception at the City Hall on Saturday, excursions by automobile to Chantilly, Fontainebleau or Longchamp on Sunday, and visits to various power houses and industries on Monday afternoon, as well as the reception of a delegation by the President of the Republic and a banquet at the Cercle Interallié, followed by a "soirée artistique."

A provisional trip through the region of the Pyrenees, to follow the congress, has been arranged, though all the details cannot be finally determined until the number of participants is known. Those taking this trip will leave Paris on Wednesday morning, July 11, and journey to Bordeaux, whence they will depart on Thursday afternoon for Pau, leaving there next day for Lourdes. Sunday the trip will end at Carcassonne.

The National Electric Light Association is represented in the Union Internationale by John W. Lieb of New York, Samuel Insull of Chicago and Charles L. Edgar of Boston. To the coming congress William H. Onken, Jr., editor ELECTRICAL WORLD, has been appointed by President Sands as an additional delegate. Mr. Lieb will present reports on public relations, electric vehicles, and electrical accidents and resuscitation.

## London Sectional Meeting of World Power Conference

A sectional meeting of the World Power Conference, to be held at the Imperial Institute, London, from Sept. 24 to Oct. 6, will take the form of a fuel conference. This meeting, organized by the British national committee of the World Power Conference, with the approval of the international executive council, will be the second sectional conference since the plenary meeting in the summer of 1924, the first of these having taken place at Basle, Switzerland, two years ago. Representatives of the United States will participate.

The program is divided into five classes and four intersecting divisions. The classes are: (I) Solid fuel; (II) liquid fuel; (III) gaseous fuel; (IV) fuel utilization, general; (V) general aspects. The divisions are: (1) Composition and classification of fuels; (2) preparation of fuels; (3) storage, handling and transmission of fuels; (4) utilization of fuels. The divisions are subdivided into sections, and in the first three classes 35 subjects are in this way arrived at. Under "fuel utilization" come three topics—utilization of electricity for industrial heating, utilization of electricity for domestic heating, and waste-heat recovery. Under "general aspects" three further topics are included—the training of fuel technicians, a survey of the scope of organizations concerned with the efficient use of fuel in industry, and the economic possibilities in the better coordination of fuel utilization.

The papers may be written in English, French or German. They shall not exceed 7,500 words, and every paper is to be accompanied by a résumé not exceeding 500 words in either of the two languages other than that in which it is composed. O. C. Merrill, executive secretary of the Federal Power Commission, Washington, is the secretary of the American National Committee of the World Power Conference.

## Empire State Commercial Section to Meet at Utica

Meeting at Utica, N. Y., on June 28 and 29, the Commercial Section of the Empire State Gas and Electric Association will carry out a program including the following papers:

*Thursday Morning.*—"Commercial Department Organization and Management," W. J. Reagan, Utica Gas & Electric Company; "Home Service," Mrs. Sarai Waugh, Westchester Lighting Company; "Future Load Estimation," F. T. Bolster, Syracuse Lighting Company; "Rural Use of Service," R. F. Bucknam, State College of Agriculture.

*Thursday Evening.*—"Electric Refrigeration," Walter O. Howe, Niagara, Lockport & Ontario Power Company; "Electric Water Heating," H. C. Wilder, Northeastern Power Corporation.

*Friday Morning.*—"General Merchandising Policies," H. C. Wilder, Northeastern Power Corporation; "Merchandise Accounting," H. C. Davidson, chairman Accounting Section; committee reports.

H. O. Palmer, president of the association, will address the Friday meeting.

## Rural Electric Session for the Agricultural Engineers

The annual meeting of the American Society of Agricultural Engineers will be held this year at the Hamilton Hotel, Washington, on June 19 to 22. On Thursday, June 21, there will be morning and afternoon rural electric sessions, with E. A. White, of the Committee on the Relation of Electricity to Agriculture, in the chair. The following papers by prominent central-station officials, engineering-college professors and others are scheduled:

*Morning.*—"Organization of an Electric Light and Power Company for Rural Development," G. C. Neff; "The General-Purpose Motor," Charles P. Wagner; "Electric Characteristics of Rural Lines," Prof. Frank D. Paine; "Research in Rural Electrification, 1927," R. W. Trullinger; "Extension Methods for Rural Electrification," Prof. H. B. Walker; "Recent Developments in Rural Rates," E. A. Holloway.

*Afternoon.*—"Round table" on electricity in the farmhouse, Mrs. John D. Sherman, Miss Eloise Davison, E. C. Easter and H. J. Gallagher taking up respectively the general topic, cooking, refrigeration and water supply, and Dr. Louise Stanley, chief of the Bureau of House Economics, Department of Agriculture, leading the discussion.

# Briefer News

IOWA TOWN REJECTS COMPETITIVE PLANT.—Voters of Missouri Valley, Iowa, a place of 5,000 population, at a special election just held refused a petition of the Des Moines Utilities Company for permission to establish and operate an electric light plant in that city, which is served by the Iowa-Nebraska Light & Power Company.

AMPÈRE'S HOME PRESENTED TO FRENCH ASSOCIATION.—The boyhood home of Ampère, near Lyons, France, has, a cable dispatch to the New York *Times* says, been purchased by Sosthenes Behn, president of the International Telephone & Telegraph Company, and his brother Harmand, and presented by them to the Société Française des Electriciens for the purposes of an electrical museum.

VIRGINIA-CAROLINA POWER COMPANY PLANS 50,000-HP. PLANT ON THE ROANOKE.—The Virginia-Carolina Power Company has applied to the Federal Power Commission for leave to construct a concrete dam on the Roanoke River, in Brunswick County, Va., and Warren County, N. C., to be used for public utility purposes. There will be a head of 35 ft. and the dam will back water for about 20 miles. The surface area of the reservoir will be about 3,500 acres and the estimated storage about 500,000,000 cu.ft. A steel and concrete power house is planned with a proposed installed capacity of 50,000 hp., which will be used for public utility purposes.

I. E. C. ADVISORY COMMITTEE TAKES UP STANDARDIZATION OF STEAM-TURBINE TEST CODES.—Word has been received by cable that a meeting of the steam-turbine advisory committee of the International Electrotechnical Commission held at The Hague, Holland, during the week of May 20 was a noteworthy one, eight nations being represented by 23 well-known engineers. This committee is attempting to reconcile the various test codes for steam turbines now used throughout the world and to develop a standard code for international adoption. The United States was represented by I. E. Moultrop, Edison Electric Illuminating Company of Boston, and Francis Hodgkinson, Westinghouse Electric & Manufacturing Company.

TRANSMISSION LINES TO GO UNDERGROUND AT LONG BEACH, N. Y.—Following a spectacular fight in the endeavor to erect overhead transmission lines at Long Beach, a Long Island (N. Y.) seacoast resort, in which early-morning construction gangs, the police and court injunctions played a part, with wrangling municipal officials at odds over whether the lines should be permitted, the Queens Borough Gas & Electric Company has agreed, in deference to public sentiment, to the revocation of a permit previously issued, to remove lattice towers already erected, to fill in existing excavations and to place all wiring underground in conduits. The sandy nature of the soil has led to some doubt as to the feasibility of underground construction.

LIGHTING COURSE AT NELA PARK NEXT WEEK.—From June 11 to 16 a general course in lighting will be given by the Nela School of Lighting at Nela Park, Cleveland. In the last seven years 1,500 students have attended the 30 one-week courses that have been given, and advance registration proves that this month's course will be attended in excess of expectations. Registration is open to all men and women engaged in the lighting business.

ENLARGED TRANSMISSION SYSTEM OF MEMPHIS POWER & LIGHT COMPANY.—Completion by the Memphis Power & Light Company of a new substation in South Memphis has provided a link for its Mississippi and Arkansas interconnections and with a substation recently built in the northern part of Memphis, at Decatur Street and Lane Avenue, will play an important part in the enlarged service now given as the result of a program initiated when the company was reorganized five years ago. The South Memphis substation has a capacity of 15,000 kva. It is tied to the Memphis power plant through two 12,000-volt double four-phase circuits and to the Mississippi and Arkansas properties through a 110-kv. line running south to the Tennessee-Mississippi line. There will soon be completed also an interconnecting line with the transmission system of the West Tennessee Power & Light Company, adjoining the company's territory to the north.

BONBRIGHT & COMPANY ISSUE HISTORICAL ELECTRIC MAP.—"A historical map of the United States of America representing the development of the electric light and power industry" has just been issued by Bonbright & Company, New York, from a design by Ernest Clegg. This is a beautifully illuminated and lithographed map, 42 in. by 27 in. in size. Superimposed upon it, besides charts showing the capital invested, the energy generated and the voltages in use by the electric light and power industry in 1928, are 24 small pictures illustrating the outstanding events in electrical invention and progress from the production of the Brush arc lamp in 1876 down to the 220-kv. transmission, the gigantic steam turbo-generators and the huge hydro-electric dams of the present day. The map is drawn on the scale of 100 miles to the inch and will prove a worthy ornament for light and power offices and board rooms.

MISSOURI COMMISSION APPROVES NEW RATES OF UNION ELECTRIC LIGHT & POWER.—The Missouri Public Service Commission has approved the reduced rates of the Union Electric Light & Power Company of St. Louis, which became effective in that city on June 1. The new rates, explained in the ELECTRICAL

World for May 12 (page 984), will reduce the annual income of the company on the basis of present consumption $700,000. Large consumers benefit most from the cut rates. Residence rates for St. Louis remain unchanged, but residence rates for St. Charles, Washington, Festus, St. Clair, Pacific, De Soto, Union and other towns served by the company in St. François County were reduced. To meet the new rates of the Union Electric Company, the Laclede Power & Light Company, which supplies electricity to about 17,000 consumers in St. Louis, on June 1 filed a schedule of lower rates with the commission. The reduction, which affects only commercial and industrial consumers, will reduce the power and light bills of its large consumers $75,000, or 7 per cent, per year.

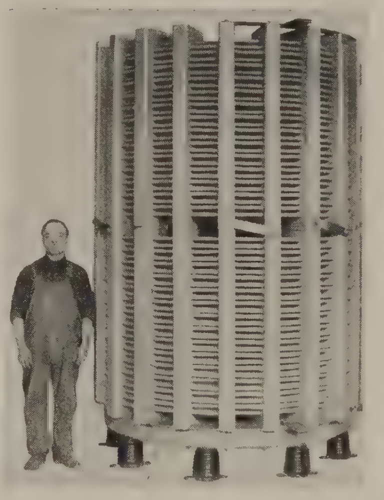
Foshay Purchases San Francisco Building.—Establishment of Pacific Coast headquarters of the W. B. Foshay Company, public utility operator, in its own building, recently acquired in San Francisco, and plans for expansion on the Pacific Coast, have been announced by W. B. Foshay, president. The building is on Kearney Street and after remodeling will be ready for occupancy Sept. 1.

Washington Water Power Company Buys a Site on the Spokane.—The Washington Water Power Company of Spokane has purchased a power site of the Spokane Valley Power Company on the Spokane River a few miles below the city. There is said to be a potential head of 80 ft. and a potential power development of 15,000 hp. at low water.

Colorado Public Service Company Will Not Impair Royal Gorge.—An announcement has been made by the Public Service Company of Colorado that it will abandon plans for developing power on the Upper Arkansas River near Cañon City rather than impair the scenic value of the Royal Gorge. It asks the Colorado Public Utilities Commission to determine what flow of water through the Gorge is necessary to preserve it as a scenic wonder and asserts that it will never reduce the flow below the volume held to be necessary. If engineers determine that the river's flow above the specified volume is insufficient to justify the hydro-electric development, the latter will be abandoned, the company states.

Survey of Lower Devil's River in Texas to Follow Filings on Upper Sites.—Application has been granted by the Texas Board of Water Engineers to James C. Kennedy of Dallas, understood to represent the Insull interests, for authority to make a power survey of Devil's River from the point where it empties into the Rio Grande for one-half of its length. The purpose of this exploration is to determine how much water power may be available for generating electrical energy. The Insull interests already have filed on the upper flow of Devil's River and will construct one or more hydro-electric plants under their original authority to appropriate water from that stream. If the survey of the lower flow of the river justifies such action, they also will construct a large hydro-electric plant above Del Rio. From these proposed plants a power transmission line will be constructed to San Antonio and other points.

A Giant Reactor for Baltimore.—A neutral grounding reactor rated at 80,000 kva. on a four-minute basis is being built by the General Electric Company at Pittsfield, Mass., and will be installed at the Westport station of the Consolidated Gas, Electric Light & Power Company of Baltimore, to ground its 25-cycle system. It stands over 9 ft. high and weighs 8 tons. The reactor is of standard cast-in concrete design and is supported on eight extra-heavy porcelain insulators. This apparatus is the largest of a number of giant reactors manufactured by the General Electric Company in recent months. Several of these have been supplied to the Brooklyn Edison Company for its Hudson Avenue station. Nineteen are to be used in sectionalizing the 22,000-volt bus of the State Line Generating Company's station at Hammond, Ind. Still another, of the iron-core type, was recently installed at the Amite (La.) substation of the Louisiana Power Company.



American and Mexican Engineers Fraternize.—Addresses by railroad executives, industrial managers and educators were features of the fourteenth annual convention of the American Association of Engineers, which was held in El Paso, Tex., this week. Simultaneously Mexican engineers were in convention at Juarez, across the Rio Grande, and opportunities for fraternizing were plentiful. After the convention four specially planned trips took delegates to Cloudcroft in the Sacramento Mountains, to the Elephant Butte Dam in New Mexico, to the Carlsbad Caverns in the Pecos Valley, and to the Boquilla Dam near Santa Rosaria, Mexico.

Pennsylvania Railroad's Plans for Electrification at Baltimore.—Reversing its position at the instance of the city authorities, the Pennsylvania Railroad has agreed to electrify its Calvert Street yards in Baltimore, instead of using storage electric or gas-motor equipment in that section, as at first planned. A question concerning overhead or underground transmission is still matter for negotiation, the railroad's plans for erecting its lines on 40-ft. poles above the streets of the city being strongly opposed by the Mayor and by many citizens.

"Narrow-Gage" Railroad to Be Electrified by November.—Electrification of the Boston, Revere Beach & Lynn Railroad, more familiarly known throughout eastern New England as the "Narrow-Gage," between Lynn and Boston, will be completed about Nov. 1, according to Vice-President G. W. Wells. Power for the Lynn end of the railroad will be supplied by the Lynn Gas & Electric Company and for the Boston end by the Edison Electric Illuminating Company of Boston. Contracts for furnishing motors and equipment for cars are being filled by the General Electric Company. Two substations, one in Lynn and the other at Orient Heights, will transmit power direct to the overhead trolley system, each car to be self-propelling and equipped with multiple-unit control. The railroad is expected to require 9,300,000 kw.-hr. annually, and the two substations will supply the power in parallel. The three-foot gage will be retained on the entire system, totaling 17 miles of double track. The service improvement program will cost more than $1,000,000.

Spectacular Sign for Republican Convention.—A jeweled "sunburst" depicting a huge American eagle, the emblem of the Republican party, is being erected in Kansas City for the Republican National Convention there next week. W. D'A. Ryan, director of the illuminating engineering laboratory of the General Electric Company, describes it as 19 ft. in diameter and covered with 7,500 "Novagem" jewels each about 2 in. in diameter and cut in the shape of a diamond. It was designed by J. W. Gosling of the General Electric Company. Two batteries of search-lamps will be turned on the sign at night. Its outer edge will be covered with jewels of canary yellow, next will come a circle of stars of white jewels, and over the center will be the eagle covered with white jewels on a background of ruby gems.

Newfoundlander Has Plan to Use Labrador's Water Power.—Possibility of the development of a big electrolytic steel project in conjunction with the water power available at Grand Falls on the Hamilton River, in Labrador, is emphasized by Victor Gordon, High Commissioner of Newfoundland in England, in a letter to the London *Times*. "It is an authentic fact," writes Mr.

Gordon, "that Labrador possesses a single great series of power resources which, if harnessed, could produce almost as much electricity as all the existing plants in the Dominion of Canada. Through the center of the peninsula of Labrador flows a mighty stream, the Hamilton River, and at one point in the course of the five miles it drops 200 ft. in tremendous rapids and then, with a roar audible 20 miles away, it makes a final plunge into a circular basin 315 feet below. Here is a cataract as large as Niagara, and experts have calculated that more than 4,300,000 hp. could be obtained from it." Mr. Gordon goes on to point out that there are within a radius of 75 miles in a northward direction from Grand Falls immense ore bodies of hematite, magnetite and siderite, rich in manganese, whose yield of metallic iron has been estimated as varying between 40 and 55 per cent. "There is no reason why the success which has attended the manufacture of electrolytic steel on the Italian side of the Alps should not be reproduced in Labrador," he declares.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.
Artistic Lighting Equipment Association—Hotel Sherman, Chicago, June 11-16. G. P. Rogers, 420 Lexington Ave., New York.
Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.
Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.
Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.
American Society of Agricultural Engineers—Rural electric session, Hamilton Hotel, Washington, June 19-22. Raymond Olney, St. Joseph, Mich.
Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.
American Institute of Electrical Engineers—Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.
Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.
American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.
Empire State Gas and Electric Association—Commercial Section, Hotel Utica, Utica, N. Y., June 28 and 29. C. H. B. Chapin, Grand Central Terminal, New York.
Public Utilities Advertising Association—Detroit, July 8-12. T. P. Pfeiffer, Byllesby Engineering & Management Corp., Chicago.
East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.
National Electric Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.
Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

# Commission Rulings

Prior Illegal Operation to Maintain Continuity of Service Not Ground for Refusing Certificate.—In granting an application from the Pacific Gas & Electric Company to supply gas under a franchise, the California Railroad Commission said that a certificate for the operation of a utility should not be denied on the ground that a private company in taking over a system previously constructed and operated by a municipality has functioned without authority for an unavoidable interim between the change of management and the subsequent formal grant of commission authority, because of the indispensable public need for the continuity of service.

Premises Astride Territorial Boundary May Be Served from Either Side.—Dismissing a complaint of territorial invasion made by the Vallejo Electric Light & Power Company against the Great Western Power Company, the California Railroad Commission said: "Where a structure or group of structures which might reasonably be considered as requiring one complete service, such as a toll house which is a necessary adjunct to a bridge, are so located as to lie across a territorial boundary of two competitive utilities, the consumer should be permitted to take service from either side of such boundary line." The complainant had held that its competitor had no right to render service on that portion of a bridge within the Vallejo company's territory. The commission, however, added: "The conditions to which this conclusion applies are to be carefully distinguished from an instance where the consumer might build his electric facilities over a boundary line established by the commission to defeat the purpose for which such boundary was established."

Capitalization of Estimated Saving by Development of Unused Water Sites Disapproved.—The Oregon Public Service Commission has for rate-making purposes ordered that the valuation of the ten utilities owned and operated in that state by the People's West Coast Hydro-Electric Corporation be fixed at $580,911. In arriving at the valuations of these properties, the commission states, it was impossible to make a finding in regard to the stocks and bonds of the corporation for the reason that neither class of securities is "currently quoted upon the market, nor does the record contain any testimony relative to their value." The commission also found it impossible to attempt to ascertain original cost data, owing to the absence of definite information relative to dates when portions of the properties were placed in service. The commission held that the consideration of possible values of water rights upon estimates based upon the capitalized estimated saving in cost of service which might be accomplished by the use of hydro-electric operation as compared with the operation of theoretical steam plants designed to produce an equivalent amount of power results in no practical value in so far as valuation of properties as a whole is concerned. "This capitalization theory," says the order, "would by its acceptance operate to deprive the community of one of its natural resources and permit its capitalization for the sole benefit of the operator. The commission cannot concede that any theory which will operate to this effect is sound in principle."

Commission Refuses to Compel Company to Pay for Putting Customers' Wires Underground.—The Massachusetts Department of Public Utilities has dismissed a petition from residents of Hyde Park to compel the Edison Electric Illuminating Company of Boston to bear the expense of placing underground the wires serving the petitioners' property on a street where the company is placing the wires underground by order of the fire commissioner. The department says: "The company is willing to do the necessary work on the customers' premises at their expense, or is willing to allow the work to be done by the customers or by any one employed by them so long as it meets the reasonable requirements of the service. The petitioners desire the work on their premises done by the company at its own expense." If additional legislation is contemplated, the department holds, there should be a provision for a public hearing by the fire commissioner on the proposed order after notice has been given to the company and to the owners of abutting property.

# Recent Court Decisions

Company Found Not Responsible for Results Following Breaking of Transmission Line by Felled Tree.—Five appeals from judgments in cases concerning the Kentucky Utilities Company, its plant engineer (Sandidge), the administrators of a farmer (Woodrum) and his son who were killed by electric shock, and the guardian of another son injured in the same accident, were heard by the Court of Appeals of Kentucky. Two of these appeals were brought by the defendant company and the others by the three plaintiffs. All were resolved in favor of the company. The farmer and his sons felled a tree so that it would fall parallel to the transmission line. In falling, a branch struck one of the wires and broke it. The accident caused the main line switch at the power house to "kick out," and consequently the farmer picked up the broken wire without injury to himself. While he was holding it the plant engineer threw the switch back, the sons rushed to their father's aid and the results just stated occurred. Damages were sought on three grounds: (1) That the transmission line was defectively constructed and not properly maintained; (2) that the act of Sandidge in reclosing the switch without investigating the cause of its opening was negligence; (3) that the company was a trespasser because it had no lawful right to maintain its line along the highway and because the line extended partly over the property line of the Woodrum farm. None of these contentions was held proved, the Court of Appeals pointing out also that the proximate cause of the accident was the victims' own action in felling the tree. Three judges, while sustaining the finding, dissented from the opinion that the plant operator's action in closing the switch without investigation was consistent with the highest degree of care, holding that the motive involved was the economic one of continuing service, which should be subordinate to that of safeguarding life. (5 S.W. [2d] 283.)*

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *H. H. Barnes, Jr., Appointed Manager in New York*

H. H. Barnes, Jr., has been appointed manager of the New York district of the General Electric Company to succeed Theodore Beran, who recently retired. Mr. Barnes has for many years been a prominent figure in the district and his experience and training make him eminently fitted for his new position. He was born in New York City in 1875 and was graduated from Stuttgart Polytechnicum in Germany in 1897. He worked with Siemens & Halske, Berlin, until 1899, then as superintendent of the Mexican Electric Works, Ltd., in the city of Mexico, until 1901. He was staff engineer and manager of the engineering department of the Stanley Electric Manufacturing Company, predecessor of the Pittsfield Works, until 1907. He was then made engineer of the New York district. He also became assistant district manager in 1920, and relinquished his duties as district engineer in 1927 to devote all of his time to executive work.

*H. H. Barnes, Jr.*

Mr. Barnes is a fellow of the American Institute of Electrical Engineers, of which he was a manager from 1910 to 1913 and a vice-president from 1913 to 1915. He was a trustee of the United Engineering Society, New York, from 1912 to 1917 and from 1921 to 1926 and is a past-president of the New York Electrical Society. He is a member of the American Society of Mechanical Engineers and of the Society of Naval Architects and Marine Engineers. On Saturday evening, May 12, the New York office committee met at the Engineers Club for a welcoming dinner to Mr. Barnes.

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William Chamberlain, since 1914 vice-president and general counsel of the United Light & Power Company, was elected president at the annual meeting of directors, succeeding Richard Schaddelee, resigned, who was elected chairman of the executive committee. Mr. Schaddelee, who was one of the organizers of the United Light & Railways Company, predecessor of the United Light & Power Company, had been general manager since 1904 and president since 1926.

Alex Dow, president of the Detroit Edison Company, sailed for Europe May 23 on the *Mauretania* for a six weeks' business and pleasure trip abroad.

J. B. Klump has been elected a director of the Central Indiana Power Company to succeed G. W. Curran on the board.

William H. Taylor was elected president of the Philadelphia Suburban-Counties Gas & Electric Company to succeed Arthur W. Thompson, who resigned to become chairman of the board. Mr. Taylor is also president of the Philadelphia Electric Company.

Philip G. Gossler, president and chairman of the board of the Columbia Gas & Electric Company, New York, sailed for Nassau and Miami on the Munson liner *Munamar* June 1 for a short stay in the South.

Dr. John B. Whitehead, dean of the School of Engineering of John Hopkins University, has consented to serve on an advisory commission appointed by Mayor Broening of Baltimore to act in a consulting and supervisory capacity over the activities of municipal agencies in connection with electrification work to be undertaken by the Pennsylvania Railroad in the city of Baltimore.

Carl N. Thomas has been appointed superintendent of distribution of the Narragansett Electric Company, Providence, R. I., succeeding S. B. Swan, who was recently promoted to the general managership of the company. Mr. Thomas joined the Narragansett organization in 1902 and has been active in its engineering development since that time. He is widely known in New England electrical circles. Ralph P. Ormsbee has been appointed assistant superintendent and Richard B. Parsons has been made underground engineer, in charge of underground transmission and distribution.

William Hunter has been appointed electrical superintendent of the Albany district of the New York Power & Light Corporation.

E. E. Arnold has affiliated himself with the Westinghouse Electric & Manufacturing Company in the capacity of mechanical engineer for special assignment. Mr. Arnold is returning to the Westinghouse interests after an absence of twenty years, having resigned in 1908 from the Westinghouse Machine Company to enter other fields of endeavor. He has a background of 30 years' experience in designing, testing, consulting and executive capacities.

## *W. S. Richhart to Manage Light and Power Department*

William S. Richhart, electrical engineer for the Indiana Service Corporation, Fort Wayne, Ind., for the past eleven years, has been named manager of the light and power division of that utility to succeed Robert L. Fitzgerald, whose resignation took effect May 1. Mr. Richhart has had a wide and varied experience in the course of his career, which has comprised academic work as well as practical engineering in both the manufacturing and central-station branches of the electrical industry.

Graduating from Purdue University in 1905, Mr. Richhart was engaged in research work at the university for approximately one year, leaving this work to become instructor of electrical engineering at the University of Pennsylvania, which position he held for five years. Following the work at the University of Pennsylvania he was employed for five years as division service engineer for the Westinghouse Electric & Manufacturing Company in the Philadelphia district. In 1916 he returned to Indiana, where he spent approximately one year as electrical engineer with the Public Service Commission of Indiana, before becoming connected with the Indiana Service Corporation as electrical engineer. Mr. Richhart is a member of the American Institute of Electrical Engineers.

*W. S. Richhart*

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J. T. Logan has been appointed operating engineer of the Georgia Power Company, succeeding A. H. Parham.

Walter S. Wyman of Augusta, Me., was elected president of the Cumberland County Power & Light Company at the recent annual meeting as successor to Harry M. Verrill, who became chairman of the board of directors. Mr. Wyman, who is prominent in utility circles in New England, is also president of the Central Maine Power Company.

## "M.U.I.T." Issues First Report

The Massachusetts Utilities Investment Trust, or "M.U.I.T.," as it is widely known in New England, has made public its first annual report, covering operations for 1927. The trust was organized March 31 of last year and controls utilities serving 116 cities and towns in the Bay State with either gas or electricity or both, either at retail or through wholesale contracts. It has acquired from 80.03 to 100 per cent ownership of the various companies operated. The total population served is about 620,000. The trust also owns, with affiliated groups, 20,000 shares of the common stock of the Edison Electric Illuminating Company of Boston, but this is only a small percentage of the total Edison shares outstanding. Forty-six utilities are included in the trust's operations.

The gross operating revenue for 1927 was $9,851,726 compared with $9,500,157 consolidated revenue for these companies in 1926 and $8,872,631 in 1925. Net earnings available for dividends and depreciation in these years were respectively $2,658,839, $2,459,995 and $2,417,351. Last year's electric operating revenue was $7,224,014. Based on holdings as of Dec. 31, 1927, the total net income available for 1927 for dividends, depreciation and reserves was $3,085,080. Dividends on the annual basis to preferred shareholders were $1,310,581 and to minority shareholders of operating, holding and leased companies $267,507, leaving a balance for depreciation, reserves and surplus of $1,506,991. The total assets Dec. 31 last were $40,950,486. Energy sales last year totaled 147,192,570 kw.-hr. and there were 103,526 electric and 61,189 gas customers on the books.

General Electric Declares Extra Dividend.—The General Electric Company declared an extra of $1 on the common stock and regular quarterly dividends of $1 on the common and 15 cents on the special stock (par $10), all payable July 27 to stock of record June 15. For the past two years the General Electric Company has paid an extra cash dividend of $1, previously having paid extras on common stock in the form of $1 in special stock.

Standard Gas Stockholders Offered Rights.—Holders of the $4 cumulative preferred stock of the Standard Gas & Electric Company have been offered rights to subscribe to additional stock of the same class at $66 per share in the ratio of one new share for each four held. Stockholders of record June 12 will be entitled to subscribe to the new stock. The $4 preferred stock was formerly the 8 per cent cumulative preferred, the change in the dividend having been authorized in conjunction with other changes in the corporation's capital structure at a special meeting held May 16. No increase in the authorized $4 preferred will be necessary since the authorized amount of this issue was increased to 1,500,000 shares from 600,000 shares at the meeting referred to.

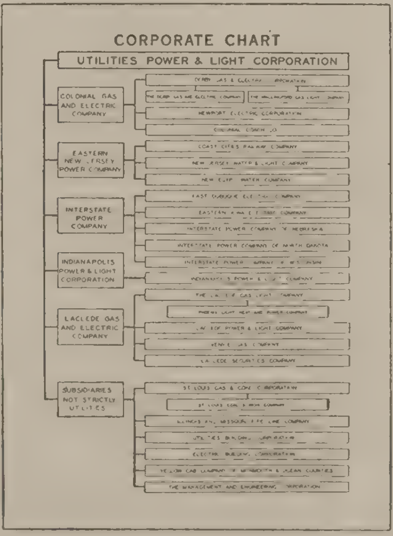
Quebec Power Offers New Shares to Stockholders.—Directors of the Quebec Power Company have voted to offer 100,000 shares of new stock to shareholders of record on May 21 at $50 a share in the ratio of one new share for four shares now held. The purchased shares will rank for dividend for the quarter ended Sept. 30, 1928.

## Southern California Edison to Redeem Bonds

All of the outstanding general and refunding mortgage twenty-five year 5½ per cent gold bonds of the Southern California Edison Company, amounting to $10,225,000, have been called for payment on August 1, 1928. This is the third time within two years that the company has availed itself of the advantages of lower money rates by refunding its high yield securities. Including the bonds presently to be retired a total of $70,644,000 of the company's underlying bonds have been retired since 1926. Upon completion of this financing the total outstanding bonds will be $123,629,700.

# Utilities Power & Light Corporation Doubles Its Size and Operations

Almost doubling in size and earnings during the past year, the Utilities Power & Light Corporation has come forward as one of the large public utility groups of the country. Total revenue increased 87 per cent, to $27,931,465; net earnings were up 80 per cent, to $13,225,213; net income accruing to parent company common stock was $2,640,034, against $2,147,915, and the company's total assets increased from $122,067,145 to $240,878,440.


CORPORATE CHART
UTILITIES POWER & LIGHT CORPORATION
COLONIAL GAS AND ELECTRIC COMPANY
NEWPORT ELECTRIC CORPORATION
EASTERN NEW JERSEY POWER COMPANY
COAST CITIES RAILWAY COMPANY
NEW JERSEY WATER & LIGHT COMPANY
INTERSTATE POWER COMPANY
INTERSTATE POWER COMPANY OF NEBRASKA
INTERSTATE POWER COMPANY OF NORTH DAKOTA
INTERSTATE POWER COMPANY OF WISCONSIN
INDIANAPOLIS POWER & LIGHT CORPORATION
INDIANAPOLIS POWER & LIGHT COMPANY
LACLEDE GAS AND ELECTRIC COMPANY
THE LACLEDE GAS LIGHT COMPANY
LACLEDE POWER & LIGHT COMPANY
VENICE GAS COMPANY
LACLEDE SECURITIES COMPANY
SUBSIDIARIES NOT STRICTLY UTILITIES
ST. LOUIS GAS & COKE CORPORATION
ILLINOIS AND MISSOURI PIPE LINE COMPANY
UTILITIES BUILDING CORPORATION
ELECTRIC BUILDING CORPORATION
YELLOW CAB COMPANY OF MONMOUTH & OCEAN COUNTIES
THE MANAGEMENT AND ENGINEERING CORPORATION

Utilities Power & Light shows an interesting picture of growth during the year. Population served more than doubled, to 2,100,000, the largest growth being in the production and sale of gas. Electric customers increased from 152,996 to 230,083 and the amount of energy generated and purchased grew from 378,203,043 to 585,577,052 kw.-hr. The operating ratio increased slightly, from a low of 50 in 1926 to 52 last year. At the present time the electrical department accounts for 60.7 per cent of total business done.

Per share earnings after paying $7 on the preferred stock last year amounted to $4.44 on the average number of class A shares outstanding. At a recent price of $42 this stock is not far above ten times earnings, while the average price of holding company common stocks in the power and light industry is nearer sixteen times earnings. This, however, does not take account of class B stock. The per share earnings on the combined class A and B stock amounted to $2.13 a share. The class A stock pays $2 and the Class B $1.

### Simplifies Capital Structures

Simplification of the corporate and financial structures of the Interstate Power Company was one of the year's important operations. For a considerable period the company has been acquiring new properties and consolidating them into one system. In this process fourteen hydro plants have been put in operation and 1,980 miles of transmission and 2,219 miles of distributing lines have been constructed and placed in service. In January of last year the company simplified the structures of a large group of its companies by calling and retiring twenty bond issues which bore interest ranging from 6 to 10 per cent and twelve preferred stock issues. It also liquidated nine subsidiaries.

The report for the current year to March 31, just issued by H. L. Clarke, president, showed consolidated revenues for the corporation and its subsidiaries of $28,255,087, an increase of $344,091 over the previous twelve months. Total net income for the year was $2,884,708, after all charges, including depreciation and federal taxes, an increase of $244,674. These results do not include the operations of the Central States Utilities Corporation and the Central States Power & Light Corporation, control of which was acquired late in 1927.

## Pacific Gas Earnings Show Marked Gain

Despite a material reduction in commercial lighting and domestic rates, effective during the last month of the first quarter of 1928, earnings of the Pacific Gas & Electric Company were highly satisfactory. Gross revenue for the quarter ended March 31 amounted to $14,848,009, an increase of $668,965 over the same period of 1927. Net income was $7,027,648, a gain of $649,921. After deducting for depreciation and preferred stock dividends there remained $2,317,921 for common, a gain of $564,512 over last year. This is equivalent to 3.58 per cent on the average amount of common stock outstanding during the quarter. The company's strong financial position and decline in money rates enabled it to refund higher interest bearing issues by a 4½ per cent bond issue. This resulted in a saving in interest charges during the first quarter of 1928 of $228,002.

Commenting upon the effect of rate reductions on gross, President A. F. Hockenbeamer says: "Lower oil costs, reduced money costs and other economies will offset these rate reductions to a substantial degree. Our experience has also demonstrated that increased usage follows the lowering of rates and we anticipate that this accelerated growth, aided by an energetic sales campaign, will, within a reasonable period, compensate for loss of revenue occasioned by the lower rates."

## Two New Loans Floated by Foreign Utilities

First mortgage twenty-five year sinking fund 6 per cent gold bonds of the Brandenburg Electric Power Company (Märkisches Elektrizitätswerk Aktiengesellschaft) were issued during the past week to the amount of $5,000,000, the price being 93½ and accrued interest, to yield over 6.50 per cent. This company, its subsidiary and affiliated companies, serve a territory of over 13,500 square miles, practically the entire Province of Bradenburg, including important metropolitan districts of the City of Berlin, and certain districts in the adjacent provinces of Silesia, Grenzmark and Pomerania. These bonds, dated May 1, 1928, mature May 1, 1953. Proceeds will be used for the purpose of the further development of the existing power plants of the company, for further acquisitions, and for other corporate purposes.

The Tokio Electric Light Company, Ltd., made an offering of 6 per cent first mortgage gold bonds, totaling $70,000,000, the largest foreign financing of the present year. These securities, maturing in 1953, were priced at 90½ and accrued interest, to yield about 6.80 per cent. Simultaneous offerings are being made of £4,500,000 6 per cent sterling series in England and 60,000,000 yen in Japan, the aggregate principal amount of all three series being equivalent, at parity of exchange, to $121,809,250. The present financing provides for the payment of all existing bank loans and $41,519,400 of funded debt of the company and for additional capital expenditures.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday June 5 | Low 1928 | High 1928 |
|---|---|---|---|
| **ABITIBI PWR. & PAPER, com., new— no par** | 66¾ | 64½ | 85 |
| Ala. Pwr., $7 cum. pf.—no par | *m*115½ | 114½ | 115½ |
| Allis-Chalmers Mfg., 6% com. | 122¾ | 115½ | 129¾ |
| Aluminum Co. of Amer., com. | 181 | 120 | 197¾ |
| Aluminum Co. of Amer., 6% pf. | 109¾ | 105½ | 110½ |
| Amer. & Foreign Pwr., 7% pf.—no par | 109 | 105½ | 110 |
| Amer. & Foreign Pwr., com.—no par | 37¾ | 22⅝ | 38½ |
| Amer. Bosch Magneto, com.—no par | 39 | 15⅝ | 41 |
| Amer. Brown Boveri Elec.† | 21½ | 10⅝ | 26¼ |
| Amer. Brown Boveri Elec., pf. $7 | 58¾ | 40½ | 65¾ |
| Amer. Gas & Elec., 6% pf.—no par | 107½ | 106¾ | 111 |
| Amer. Gas & Elec., com. †—no par | 169¾ | 117½ | 184 |
| Amer. Lt. & Trac., 6% pf. | 118 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 230 | 170 | 249 |
| Amer. Pwr. & Lt., 6% pf. | 107 | 106 | 107½ |
| Amer. Pwr. & Lt., com. †—no par ev.div. | 85¼ | 62½ | 95 |
| Amer. Pub. Serv., 7% pf. | *a*104 | 97½ | 102½ |
| Amer. Pub. Serv., com. † | *m* 65 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | *a* 97 | 87½ | 97 |
| Amer. Pub. Utilities, 7% pr. pf. | *a*103 | 95¾ | 102¾ |
| Amer. Pub. Utilities, com. | *m* 50 | ... | ... |
| Amer. States Sec., A | *a* 11¼ | 4 | 13¼ |
| Amer. States Sec., B | *a* 14½ | 4⅛ | 17⅛ |
| Amer. Superpwr., 6% 1st pf. | *l* 102½ | .... | .... |
| Amer. Super pwr., Class A†—no par | 42⅝ | 36⅜ | 56 |
| Amer. Super pwr., Class B†—no par | 43¼ | 37 | 56¼ |
| Amer. Wtr. Wks. & Elec., 6% pf. | 103⅝ | 101½ | 106 |
| Amer. W.W. & E., com. new—no par ex.div. | 62 | 52½ | 70⅝ |
| Anaconda Copper cap. $3 | 73 | 53¾ | 74⅝ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr., & Lt. 7% pf | 107½ | 107⅛ | 111 |
| Assoc. Gas & Elec., $3.50—50 | 54⅛ | .... | .... |
| Assoc. Gas & Elec., pf.—$6—no par. | 97 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 48⅛ | 47 | 52⅛ |
| **BABCOCK & WILCOX, 7% com.** | 123¾ | 117½ | 128 |
| Binghamton L., H. & P., $6 pf. | 107 | 102 | 109½ |
| Birmingham Elec., pf.—$6—no par. | 107 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf. | *m*109 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | *m*165 | 135 | 170 |
| Blaw-Knox, com.† | *i*101½ | 91 | 105 |
| Brazilian Trac., Lt. & Pwr., com., new | *f* 57⅛ | .... | .... |
| Broad River Pwr., 7% pf. | 105 | 105 | 108½ |
| Brooklyn Edison, 8% com | 252 | 206⅛ | 268¼ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | *l*26 | .... | .. . |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | *l* 43¾ | ..... | .... |
| **CALIFORNIA ELEC. GENERATING, 6% pf.** | 99 | 98 | 101 |
| Carolina Pwr. & Lt., pf.—$7—no par | *l*111½ | 109 | 111 |
| Central & S. W. Util., $7 pf.—no par | *a*102½ | 99½ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | *a*109½ | 103½ | 112 |
| Central Ark. Ry. & Lt., 7% pf. | 106 | 105 | 107½ |
| Central Ill. Pub. Serv., $6 pf. | *a* 99½ | 97¾ | 100⅛ |
| Central Ind. Pwr., 7% pf. | *a*100 | 95 | 101¼ |
| Central Maine Power, 6% pf. | 97 | 96 | 98½ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 112 | 104½ | 111½ |
| Central States Elec., 7% pf. | 116 | 104½ | 121⅛ |
| Cincinnati Gas & Elec., 5% com. | *g*100½ | .... | .... |
| Cities Service, $6 pf.—no par | *l* 103½ | 94½ | 103½ |
| Cities Service, pf. B—no par | *l* 9⅝ | 8½ | 9⅝ |
| Cities Service, pf. BB—no par | *l* 97 | 88½ | 97 |
| Cities Service com.—20 | *l* 71⅝ | 54 | 71⅝ |
| Cities Service, Bks. Shrs.—10 | *l* 35¾ | 26⅛ | 35¼ |
| Cities Service Pwr. & Lt., 7% pf. | 108½ | 105¼ | 109 |
| Cities Service Pwr. & Lt., 6% pf. | 101 | 95⅛ | 102 |
| Cleveland Elec. Illg., 6% pf. | 113 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 425 | 350 | 425 |
| Columbia Gas & Elec., 6% pf. | 109½ | 107½ | 110½ |
| Columbia G. & E. com. $5—no par. | 113 | 89½ | 118⅛ |
| Columbus Elec. & Pwr., $2 com.—no par | *n* 79 | 66 | 79¾ |
| Columbus Elec. & Pwr., 7% | 109 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 109 | 107 | 111 |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 109 | 105 | 111 |
| Columbus Ry., P.& Lt. com. no par | 125 | 120 | 125 |
| Commonwealth Edison, 8% com. | *a*184 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 103¾ | 102½ | 104½ |
| Commonw'th Pwr., $2, com.—no par | 82⅝ | 62½ | 87⅛ |
| Conn. Lt. & Pwr., 8% pf. | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117½ | 118 | 121 |
| Cons. Gas of N. Y., pf. | 101¾ | 101½ | 105 |
| Cons. Gas of N. Y., com. $5—no par. ex.div. | 158¾ | 119⅛ | 170½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | *e*111 | 110 | 114½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | *e*104¾ | 100½ | 105¾ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | *e* 88 | 67½ | 93 |
| Consolidated Pwr. & Lt., 7% pf. | *m*105 | ... | .... |
| Consumers Pwr., 6% pf. | 104¾ | 106 | 107 |
| Consumers Pwr., 6.6% pf. | 104½ | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108 | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par | *m*250 | 240 | 265 |
| Crocker Wheeler, com.† | 68 | 23 | 70 |
| Crocker Wheeler, 7% pf. | 99 | ... | ... |
| **DALLAS PWR. & LT., 7% pf.** | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf. | 109 | 108½ | 110½ |
| Derby Gas & Elec., 7% pf. | 101½ | 96 | 100½ |
| Detroit Edison, 8% com. | 205 | 166½ | 209¾ |
| Dubilier Condenser, com.—no par | 4½ | 2½ | 5⅛ |
| Duke Pwr., cap. | *m*140 | 130 | 145 |
| Duquesne Lt., 5% pf. | *m*104½ | 104½ | 116½ |
| **EASTERN NEW YORK UTIL., $7 pf.** | *m*110 | 111 | 112½ |
| Eastern States Pwr. B | 23¾ | 11½ | 26¾ |
| Eastern States Pwr., pf. | *m*100½ | 98 | 100½ |
| East. Tex. Elec., 7% pf. | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | *d*290 | 252 | 305 |
| El Paso Elec. 7% pf. | 111 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | *l*110 | 108¾ | 111⅜ |
| Elec. Bd. & Sh. Sec., com. $1—no par ex. rights | *l*108¾ | 76 | 127½ |
| Electric Household Util.† | *a* 26¾ | 13½ | 26¾ |
| Elec. Investors, 6% pf.—no par | 103 | 101 | 104¼ |
| Elec. Investors, com.†—no par | 73⅞ | 40½ | 79⅞ |
| Elec. Pwr. & Lt., ctfs. pf. | 109⅝ | 106½ | 110¼ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 40½ | 28¾ | 45½ |
| Elec. Ry. Securities, com.—no par | 6⅜ | ... | ... |
| Elec. St. Battery com. $5.25—no par | 81 | 69 | 84⅛ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 105 | 104 | 107 |
| Empire Pwr., ptc.† | 36 | 27⅛ | 39½ |
| Engr. Pub. Serv. $7, pf.—no par | 110¾ | 107 | 110¾ |
| Engr. Pub. Serv., com.—no par | 42 | 33 | 46⅝ |
| Eureka Vacuum Cleaner, com. $4—no par | *m*75½ | 69 | 79 |
| **FAIRBANKS MORSE, 7% pf.** | *m*109 | 104 | 114⅛ |
| F.-M., com.—$3—no par | 42½ | 32½ | 54 |
| Federal Lt. & Trac., com $1.40 | 55 | 42 | 56⅝ |
| Federal Lt. & Trac., $6 pf.—no par ex.div. | 104 | 98 | 109 |
| Florida Pwr. & Lt., 7% pf. | *m*107 | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf. | *l*114 | 113 | 114½ |
| **GALVESTON-HOUSTON ELEC. 6% pf.** | 80 | 75 | 85 |
| Galveston-Houston Elec., com. | 33 | 31⅛ | 42½ |
| General Cable, Cl. A | 74½ | 56 | 84¼ |
| Gen. Elec. $3 com.—no par | 158⅛ | 124 | 174⅛ |
| Gen. Elec., special—6% | 11½ | 11½ | 11¾ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par | 46 | 35½ | 50⅜ |
| Gen. G. & E. (Del.) pf. A. $8—no par | 135 | 122½ | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par. | 118 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 | 114 | 104 | 117 |
| Gen. Pub. Serv., $7 pf. | *m*117 | 110 | 120 |
| Gen. Pub. Serv., com., no par | 27½ | 16⅛ | 29 |
| General Public Utilities, $7 pf. | *m*102 | 98 | 103 |
| Ga. Lt., Pwr. & Rys., com. | *m* 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | *h*104 | .... | .... |
| **IDAHO PWR., 7% pf.** | 109 | 109 | 111½ |
| Ill. No. Utilities, 6% pf. | *m* 99 | 96 | 100 |
| Ill. Pwr. & Lt., 7% pf. | 105½ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 107 | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf. | 102 | 100 | 105 |
| Ingersoll Rand com. | 92½ | 90 | 98 |
| Int. Combus. Engr., com. $2—no par | 72½ | 45⅛ | 72½ |
| Int. Combustion Engr., 7% pf. | *m*108½ | 103 | 109 |
| Int. Util., Class A—$3.50—no par | 48⅜ | 44½ | 52 |
| Int. Utilities, Class B—no par | 17¾ | 6⅜ | 19½ |
| Interstate Pwr., pf.—$7—no par | 104⅛ | 99 | 103½ |
| Interstate Pub. Serv., 7% pf. | 106 | 103 | 108 |
| Iowa Ry. & Lt., 7% pf. | 101 | 102 | 103 |
| **JERSEY CENTRAL PWR. & LT. CO., 7% pf** | 107 | 106 | 108 |
| Johns-Manville. com.†—no par | 122⅜ | 111½ | 134 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 6. *m*Bid price Saturday, June 2. *n*Latest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday June 5 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY POWER & LIGHT pf $7 | 110¼ | 109 | 114 |
| Kansas Gas & Elec. 7% pf | l110 | 107 | 110 |
| Kelvinator Corp. | 19½ | 11⅛ | 22⅞ |
| Kentucky Hydro-Elec., 7% pf. | m104 | 100 | 105 |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 105 | 100 | 105 |
| LACLEDE GAS LT., 10% com. | m220 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | m 40⅞ | 19⅞ | 40⅝ |
| Long Island Ltg., 7% pf. | 110⅜ | 109⅞ | 112½ |
| Long Island Ltg., 6% pf. | m107½ | 107 | 109 |
| Long Island Ltg., com.†—no par | m250 | 170 | 250 |
| Los Angeles Gas & Elec., 6% pf. | h110½ | 105¼ | 112¼ |
| Louisville Gas & Elec., cl. A. $1.75 | 38½ | 28 | 41 |
| MAN. ELEC. SUPPLY, cap. $5—no par | 63⅞ | 50 | 65½ |
| Maytag Co., com. 50—no par | 21½ | 30 | 40⅜ |
| Memphis P. & L., pf.—$7—no par | 110 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 106½ | 103 | 109⅜ |
| Metropolitan Ed., pf.—$7—no par | 109 | 109 | 111½ |
| Metropolitan Ed., com. $8—no par | m170 | 125 | 185 |
| Middle West Utilities, 6% pf. | a 99⅞ | 93½ | 100½ |
| Middle West Util., 6% pr. lien | a105 | 99 | 108 |
| Middle West Util., com. $7—no par | a153¼ | 123¼ | 169 |
| Midland Utilities, pr. ln. 6% pf. | a 96¼ | 94½ | 97 |
| Midland Utilities, 7% pf. A | a104½ | 89⅞ | 92¼ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 100 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | l108 | 107 | 109 |
| Miss. River Pwr., 6% pf. | 115 | 113½ | 115 |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | m107 | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | m105 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 44 | 29½ | 53 |
| Montana Pwr., 5% com. | 167½ | 102¼ | 175 |
| Montreal Pwr., 7½% com. | f107 | .... | .... |
| Mountain States Pwr., 7% pf. | m104 | 97 | 105 |
| Mountain States Pwr., com.† | 18½ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110 | 98 | 110¼ |
| National Carbon, 8% pf. | a138 | 136½ | 139⅞ |
| National Elec. Pwr., A† | a 36½ | 27½ | 42 |
| National Pwr. & Lt., pf.—$6—no par | m104½ | 102 | 106 |
| National Pwr. & Lt., com.†—no par. | 34⅜ | 21⅞ | 36⅞ |
| National Pub. Serv., 7% pf. | 103½ | 99 | 103 |
| National Pub. Serv., 7% ptc., pf | n114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 27⅞ | 22 | 29⅝ |
| National Pub. Serv., B com.—no par | 30½ | 24⅛ | 34½ |
| Nebraska Pwr., 7% pf. | l110 | 110 | 111½ |
| Nevada-Calif. Elec., com. | 47½ | 33⅛ | 50⅞ |
| New Brunswick Pwr., 4% pf. | 64 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 110 | 98½ | 110½ |
| New Eng. Pub. Serv., pf. $7 | m106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 108 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 102 | 91 | 100 |
| N. Y. Central Elec., 7% pf | 105 | 101 | 107 |
| New York Power & Light 7% pf. | 114 | ... | ... |
| NiagaraFalls Pwr., 7% pf.—25. | m 28¼ | 27½ | 29¼ |
| No. Amer., 6% pf.—50 | m 58¾ | 53¼ | 55¼ |
| No. Amer., com.—10 ex. div. | 74¼ | 58⅝ | 78⅝ |
| No. Amer. Edison, $6 pf.—no par | 101⅞ | 102½ | 101⅞ |
| Northeastern Pwr., com | 28¾ | 19¾ | 31 |
| No. N. Y. Utilities, 7% pf. | 108 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 29 | 18 | 32 |
| Northern Ohio Pwr. & Lt., 6% pf. | 100 | 90 | 100 |
| No. Ont. Lt. & Pr. 6% pf. | m100 | 94 | 100 |
| No. States Pwr. (Del.), 7% pf. | 108⅞ | 108⅛ | 110¼ |
| No. States Pwr. (Del.), 8% com. | 143 | 123 | 152 |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par. | m 91 | 89 | 100½ |
| Ohio Brass, 6% pf. | m105 | 106 | 111 |
| Ohio Pwr., 6% pf. | 108 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | 104 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 112 | 107 | 112 |
| Ohio River Edison, 7% pf. | 109½ | 106 | 109⅞ |
| Oklahoma Gas & Elec., 7% pf. | 112½ | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 27¾ | 26¾ | 30 |
| Pacific Gas & Elec., 8% new com. | 49 | 43½ | 53¼ |
| Pacific Pwr. & Lt., 7% pf | l110 | 106 | 110 |
| Packard Electric | k 65½ | 47 | 68 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 80 | 79⅛ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 99 | 93½ | 101 |
| Penn-Ohio Edison, 7% pf. | 107 | 106¾ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 107 | 99 | 112 |
| Penn Pwr. & Lt.—$7—no par. | l109 | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 86 | 68 | 90 |
| Phila. Co., 5% pf.–50 | m 46½ | 45½ | 48½ |
| Phila. Co., 6% pf.—50 | 54 | 52 | 57 |
| Phila. Co., com.—50. | 169¼ | 145 | 174¾ |
| Phila. Elec., 8% com.—25 | 72 | 55½ | 74⅞ |
| Portland Elec. Pwr., 7% pf. | 105 | 100 | 104¼ |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 43 | 42½ | 52 |
| Potomac Elec. Power, 6% pf. | j111½ | .... | .... |
| Pwr. Sec., pf.—no par | 60 | 50 | 68 |
| Pwr. Sec., com.—no par. | m 13½ | 11½ | 14¼ |
| Public Serv. of Colorado, 7% pf. | 108 | ... | . |
| Pub. Serv. of N. J., 6% pf. | 113 | 103⅛ | 115 |
| Pub. Serv. of N. J., 7% pf. | 129½ | 118 | 129⅛ |
| Pub. Serv. of N. J., $2 com.—no par | 59⅜ | 41½ | 66⅞ |
| Pub. Serv. of No. Ill., 6% pf. | a112 | 110 | 115 |
| P. S. of No. Ill., com. $8—no par. | a182 | 159¼ | 190½ |
| Pub. Serv. of No. Ill., $8 com. | a186 | 159⅞ | 190 |
| Pub. Serv. of Okla., 7% pr. ln. | 109 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | m108⅞ | 108 | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | 101⅛ | 92 | 105⅞ |
| Puget Sound Pwr. & Lt., $6 pf.—no par | m100 | 96½ | 105¼ |
| Puget Sound Pwr. & Lt., com. | 70 | 34⅛ | 84⅛ |
| RADIO CORP. OF AMER., $3.50 pf.—50—ex. div. | m58¼ | 54½ | 60 |
| Radio Corp. of Amer., com.—no par. | 205¼ | 85¼ | 224 |
| Rochester Gas & Elec. 6% pf. D | 105½ | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107½ | 105 | 107 |
| Rochester Gas & Elec., 6% pf. C | m104½ | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 117 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | m 75 | 70 | 75 |
| Servel, Inc. | 14¼ | 4¼ | 17½ |
| Sierra Pacific Elec., 2% com. | m 36⅛ | 29 | 40⅛ |
| Sioux City Gas & Elec., 7% pf. | 106¼ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l108½ | . | ... |
| Southeastern Pwr. & Lt., ptc pf | l 89½ | ... | ... |
| Southeastern Pwr. & Lt., com.—no par | 55½ | 40⅛ | 61 |
| So. Calif. Edison, 8% pf. | 49 | 38½ | 53 |
| So. Calif. Edison, 7% pf. | 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 26⅛ | 25¾ | 27⅛ |
| So. Calif. Edison, 8% com. | 50¼ | 43½ | 53¼ |
| Southern Cities Utilities, 7% pf. | 84¾ | 75 | 92 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 70 | ... | ... |
| Southwestern Lt. & Pwr., $6 pf. | 94 | 88 | 96⅛ |
| Southwestern Pwr. & Lt., 7% pf. | m112 | 103 | 115 |
| Standard Gas & Elec., 8% pf | 70¼ | 65 | 71½ |
| Standard Gas & Elec., 7% pr. pf. | 113¼ | 108 | 115 |
| Standard G. & E., com. $3.50 | 69½ | 57⅞ | 74¼ |
| Standard Power & Light, com. | 57 | 29⅞ | 58¼ |
| Standard Pwr. & Lt., 7% pf | m105 | 98 | 106 |
| Staten Island Edison, pf.—$6—no par | 101 | 99 | 103½ |
| Superheater, $6 com.—no par | 150 | 155 | 178 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 112⅛ |
| Syracuse Lighting, 8% pf. | m120 | 114 | 121 |
| TAMPA ELEC., com. $2 | m 68⅛ | 62 | 71 |
| Tenn. Elec. Pwr., 6% pf. | 102¾ | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109½ | 107 | 110 |
| Tex. Pwr. & Lt., 7% pf | l113 | 113¼ | 115 |
| Tide Water Pwr., 8% pf. | 110½ | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 126⅛ | 112⅛ | 134 |
| Toledo Edison, 7% pf. | 109 | 103 | 113 |
| Toledo Edison, 6% pf. | 104 | 95 | 105 |
| Toledo Edison, 6% com. | m145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 97 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c145¼ | 114½ | 149⅞ |
| United Lt. & Pwr., pf.—$4—no par. | 56½ | 52⅞ | 58 |
| United Lt. & Pwr., pf.—$6.50—no par | a101 | 94¼ | 103½ |
| United L. & P., com. A .48—no par. | 23½ | 13¼ | 26¼ |
| United L. & P., com. B .48—no par. | m 25 | 16 | 30 |
| Utah Pwr. & Lt., 7% pf. | l111 | 109½ | 112 |
| Utica Gas & Elec., 7% pf | 105 | 105 | 106 |
| Utica Gas & Elec., 8% com. | m200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 103½ | 98 | 103 |
| Utilities Pwr. & Lt., com. A $2 | 42 | 28½ | 45¼ |
| Utilities Pwr. & Lt., com. B $1—no par | 31⅛ | 18½ | 32⅛ |
| VERMONT HYDRO-ELEC., 7% pf. | 99 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | m110½ | 108 | 111 |
| Virginia Public Service 7% pf. | 102½ | 97 | 103½ |
| WAGNER ELEC., 7% pf. | b107 | 96⅛ | 107 |
| Wagner Elec., com.—no par | b 80½ | 37 | 120 |
| Washington Ry. & Elec., 7% com | j450 | .... | .... |
| Washington Ry. & Elec., 5% pf. | j100½ | .. | .... |
| Washington Wtr. Pwr., 8% com. | 225 | 175 | 235 |
| West Penn Elec., 6% pf. | 102¼ | 100⅛ | 104½ |
| West Penn Elec., Cl. A $7 | 109½ | 106½ | 112 |
| West Penn Pwr., 7% pf. | 115¼ | 114⅞ | 117 |
| West Penn Pwr., 6% pf. | 109¼ | 108⅞ | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf | 104 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 99 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 103¼ | 88¼ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | 36⅞ | 30⅛ | 36⅞ |
| Weston Elec. Instrument, com.—no par | 25½ | 12⅛ | 25½ |
| Wheeling Elec., 6% pf | 106 | 95 | 109 |
| Worthington Pump, 7% pf. A | m 58 | 46¼ | 58⅛ |
| Worthington Pump, 6% B | 49½ | 41 | 51 |
| Worthington Pump, com | 34½ | 28 | 37⅛ |
| YALE & TOWNE com. $5—25. | 73⅛ | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 6. *m*Bid price Saturday, June 2. *n*Latest quotations available. †Dividend rate variable.

NORTHERN OHIO POWER & LIGHT COMPANY ELECTS NEW DIRECTORS.—At a meeting of the directors of the Northern Ohio Power & Light Company H. P. Stevens and W. L. Willkie were elected members of the board of directors to succeed J. C. Weadock and E. W. Moore.

INTERNATIONAL PAPER ORGANIZATION NEARING COMPLETION.—The organization of the new International Paper & Power Company, Boston, Mass., is being completed. The company is to acquire the International Paper Company through an exchange of stock and will also purchase the holding of John R. Macomber in the New England Power Association. The International Paper Company at the present time owns 45 per cent of this stock. The terms of exchange have not been announced, but it is understood the new company will have 7 per cent preferred stock $100 par value and no par value common stock, all of which will net old stockholders of International Paper Company stock an equal income to what has been received.

POWER CORPORATION OF CANADA INCREASES STOCK.—Stockholders of the Power Corporation of Canada, Ltd., on May 11 increased the authorized common stock, no par value, from 250,000 shares (200,000 shares outstanding) to 1,000,000 shares. There are 50,000 shares reserved for conversion of the 5 per cent debentures.

LOUISVILLE MINORITY SHAREHOLDERS DENIED PETITION.—In a decision just handed down Chancellor Wolcott of the Court of Chancery at Wilmington, Del., denied the petition of a small group of minority shareholders for an order prohibiting the Louisville Gas & Electric Company from amending its charter so as to provide for removal of the call price on the class A common stock and make a change in the dividend rights of the class A and B stocks. The amendment was authorized by the stockholders at their annual meeting held in Wilmington on May 16, but by agreement between attorneys for the company and the attorneys for the minority stockholders the filing of the certificate of amendment was postponed pending the decision of the court. Holders of approximately 95 per cent of the outstanding class B stock and approximately 70 per cent of the outstanding class A stock voted in favor of the change. The certificate of amendment will be filed immediately.

## *Ten Per Cent of Canadian Energy Exported*

Output of Central Stations in Canada (Thousands of Kilowatt Hours)

| Month | Generated |  |  |  |  |  | Exported |  |
|---|---|---|---|---|---|---|---|---|
|  | Total |  | Hydro |  | Fuel |  |  |  |
|  | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 |
| January | 1,318,115 | 1,131,212 | 1,297,957 | 1,113,899 | 20,158 | 17,313 | 124,019 | 130,894 |
| February | 1,274,120 | 1,065,850 | 1,256,268 | 1,050,057 | 17,852 | 15,793 | 122,906 | 121,829 |
| March | 1,332,752 | 1,150,008 | 1,314,812 | 1,133,785 | 17,940 | 16,223 | 135,910 | 133,702 |

## Public Service Increases Preferred Stock

Stockholders of the Public Service Corporation of New Jersey at a recent special meeting approved a resolution recently adopted by the board of directors to amend the certificate of incorporation and authorize an increase in the outstanding preferred stock from 2,000,000 to 4,000,000 shares, all the new stock being no par value cumulative preferred stock, entitled to dividends at the rate of $5 per share per annum.

## Customer-Ownership Sales

According to statistics received by the ELECTRICAL WORLD from companies taking part in customer-ownership campaigns, it is estimated that during March 172,400 shares of stock were sold, having a value of $9,720,000, in 14,500 transactions. Of this amount, somewhat more than $2,500,000 was in the form of $25 shares, the rest being sold at a price averaging very close to $100 per share.

Although this estimate may be revised upon the receipt of reports from a number of companies which were not in hand at the time the compilation was made, it is clear that there was a marked reduction in this form of financing during February and March. February sales, valued at $8,856,012, were somewhat below those of September, 1927, the last previous low month, and March sales show less than 10 per cent increase over February.

POWER IN CANADIAN MINING.—The growing use of water power in connection with mining developments in Canada is aptly illustrated in a report compiled by the Natural Resources Branch of the Interior Department. This report summarizes the location of important mining developments with the associated hydro-electric projects; it states that while no authoritative compilation of the amount of power used in the mining and metallurgical treatment of minerals in the Dominion has been published since 1924, when a total of 277,600 hp. was reported, it is probable that this figure now exceeds 400,000 hp. This involves a capital investment of approximately $75,000,000 in central electric stations for mining purposes alone.

SOUTHERN CITIES UTILITIES INCREASES PRIOR PREFERRED.—The Southern Cities Utilities Company has increased its authorized $6 prior preferred stock from 30,000 to 100,000 shares.

## Oregon Great Power State

The potential water-power resources of Oregon amount to 3,665,000 hp., as estimated from the stream flow available 90 per cent of the time, or 5,890,000 hp. as estimated from the flow for 50 per cent of the time, if storage is provided in feasible reservoir sites, according to a statement made public by the Department of the Interior based on field work and studies of the Geological Survey. Thus far only about 3 per cent of these water-power resources has been utilized; with complete development the installed capacity of waterwheels might be about 8,000,000 hp., or two-thirds as much as the present capacity of water-power installations in the whole United States.

Based on the flow available 50 per cent of the time, the estimated power within the state on certain rivers is:

|  | Horsepower |
|---|---|
| Columbia River | 1,408,000 |
| Klamath River Basin | 132,000 |
| Umpqua River Basin | 561,000 |
| Rogue River Basin | 532,000 |
| Snake River Basin | 823,000 |
| Deschutes River Basin | 734,000 |

CONSOLIDATED GAS COMPANY (BALTIMORE) PAYS DIVIDEND ON NEW STOCK.—The directors of the Consolidated Gas, Electric Light & Power Company of Baltimore have recently declared an initial quarterly dividend of 1¼ per cent on the 5 per cent preferred stock, series A, payable July 2.

CENTRAL STATES EDISON BONDS LISTED. — The Baltimore Stock Exchange has authorized the listing of $1,350,000 first lien 5½ per cent gold bonds, series A.

## *Security Issues of Electric Service Companies in May*

| Name of Company | Amount of Issue (Par Value) | Period Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Columbus Electric & Power Co. | $2,500,000 | 5 | Gold coupon notes | To retire notes | 4½ | 97.80 | 5 |
| Gulf States Utilities Co. | 2,940,000 | .. | Preferred stock | To liquidate floating debt of the company and for other corporate purposes | 5½ | 98 | 5.61 |
| Illinois Power & Light Corp. | 36,474,000 | .. | Cumulative preferred stock | To retire preferred stock | 6 | 100 | 6 |
| Puget Sound Power & Light Co. | 10,560,000 | .. | Prior preference stock | To retire preferred stock | 5 | 96 | 5.20 |
| Southern Cities Utilities Co. | 10,500,000 | 30 | First lien and collateral trust gold bonds, series A | To retire funded debt, to acquire or retire funded debt and preferred stock of subsidiaries and for other corporate purposes | 5 | 94 | 5.40 |
| Rumford Falls Power Co. (Maine) | 2,000,000 | 20 | General mortgage gold bonds | Proceeds will be used to retire maturing bonds | 4½ | 98½ | 4.60 |
| American Power & Light Co. | 19,000,000 | .. | Preferred stock, series A, stamped certificates | ........ | 5 | 95 | 5.25 |
| American Commonwealths Power Corp. | 4,500,000 | 25 | Gold debentures | For acquisition of stock and for other corporate purposes | 5½ | 96½ | 5.75 |
| American Gas & Power Co. | 6,500,000 | 25 | Secured gold debentures | To reimburse for cost of its holdings | 5 | 95½ | 5.30 |
| Public Utilities Consolidated Corp. | 1,500,000 | 10 | Secured convertible gold bonds | To retire funded debt of subsidiaries for the acquisition of additional properties and for other corporate purposes | 6 | 98 | 6.25 |
|  | 4,000,000 | 20 | First mortgage gold bonds | ........ | 5½ | 97 | 5.75 |
| Islands Edison Co. | 2,250,000 | 25 | Sinking fund secured gold bonds, series A | To purchase new company | 5½ | 96 | 5.80 |
| Indiana Electric Corp. | 3,268,000 | 23 | First mortgage and refunding gold bonds | ........ | 5 | 100 | 5 |
| Electric Public Utilities Co. | 3,000,000 | 3 | Gold notes | To retire maturing obligations and for general corporate purposes | 5 | 97½ | 6 |
| Associated Gas & Electric Co. | 2,650,000 | 40 | Gold debenture bonds | Proceeds to be used for retiring or acquiring bonds and preferred stocks of company and subsidiaries | 5 | 100 | 5 |
| Central Indiana Power Co. | 3,000,000 | 2 | Gold notes | Refunding and to reimburse for advances made or to be made to subsidiaries, for extensions and improvements | 4½ | 99.06 | 5.03 |
| Indiana Hydro-Electric Power Co. | 3,000,000 | 30 | First mortgage gold bonds, series A | To retire outstanding bonds | 5 | 99½ | 5.03 |
| Southern Cities Utilities Co. | 3,000,000 | 30 | Sinking fund gold debentures, series A | To retire securities and to acquire new properties | 6 | 99½ | 6.03 |
| Texas-Louisiana Power Co. | 1,700,000 | 14 | Gold debentures, series A | Acquisitions and improvements | 6 | 100 | 6 |
|  | 1,000,000 | .. | Cumulative preferred stock | ........ | 7 | 101 | 6.93 |

Total........ $123,342,000 (par value)
Total amount actually realized........ $120,375,100

Rights........ $1,405,700
Total financing for May........ $121,780,800

# Business News and Market Conditions

ACTIVE buying in the Eastern district, with an increase of inquiries in New England; reasonably satisfactory conditions in the Middle West, including the territory served largely from St. Louis, where the refrigerator demand is especially good—as it is also in the Southeast—and a big program of construction in California, with somewhat less cheerful reports from the Puget Sound region—this about summarizes market conditions as reported for the first part of the current week. Line material for service extensions is moving in New England. Electrical specialties in other Eastern states operate under a fair demand, though the cool weather is holding back the market for fans. May held its own well in the Great Lakes States. Meters and distribution transformers are reported from Atlanta as in active demand. Extensive street-lighting projects are under way in various cities on the Pacific Coast. Altogether, optimists find no reason for modifying their views or pessimists for applauding their own acumen.

## *Inquiries Increase in New England*

Manufacturers of New England report an increase in negotiations and a general quickening in activity in industrial equipment sales. Motor sales are well up, amounting to over $50,000 and meeting the level in volume reported a year ago. Fractional-horsepower motors are ahead of last year in sales volume. The demand for large-rating motors for loom drive and rolling operations is noted, a number, of 50-hp. and 75-hp. ratings, having been ordered during the week.

Central-station supplies are steady. According to one prominent manufacturer the demand for scheduled plant equipment, watt-hour meters, regulators, control and switch apparatus is encouraging. Two such orders for southern New Hampshire total about $8,000, one for Maine $2,000, and equipment for two Massachusetts plants $2,500. Line material for service extensions is moving. During the week two cars of material, poles, cross-arms and wire were shipped to northern New England and orders are pending for similar materials for southern Massachusetts. New constructions are heavy for residential and mercantile types. Appliance sales are at an even level as compared with last week. New projects include reorganization and installation of rayon products equipment in New Bedford, where the Delaware Company is planning extensive operations; a large laundry, to cost $300,000, at Quincy; a small refrigerator plant, $30,000, for the Cudahy Packing Company, Brockton; street signals, Boston, $250,000; Boston & Maine terminal warehouse, $3,000,000. In addition the Grafton (N. H.) Power Company has filed plans for development of 220,000 hp. (involving ultimately $40,000,000) at Fifteen-Mile Falls, adjacent to Littleton, N. H., on the Connecticut River. Other construction projects follow:

The Hartford Electric Light Company, Hartford, Conn., will make extensions in its power plant to cost $200,000. Springfield, Mass., plans an improved lighting system. The Public Service Company of New Hampshire, Manchester, N. H., will build a transmission line, 35 miles long, from Bristol to Ossipee and Conway, N. H.

## *Buying Continues Active in Eastern District*

Industrial buying is expanding in the Eastern district, with motor account developing a high level as a result of the greater variety of industries now in the market. Central-station business is satisfactory and shows signs of greater volume of commitments at an early date. A prominent manufacturer of turbogenerators and other prime movers reports contracts for equipment from two power companies in the South totaling close to $1,000,000. Metropolitan utilities continue their purchases of transformers and other substation apparatus for early delivery. A manufacturer of switching equipment states that sales show a decline in volume for the second quarter of the year, with indications for improvement during the third quarter. A municipality in Kansas has placed an order for several 200-kva. transformer units with a Pittsburgh maker. A cement mill in Wyoming has contracted with a leading manufacturer for motor-generator sets, as well as for about 50 induction-type motors. Cold-storage and meat-packing plants have been active in the market for motors for refrigerating service, varying from 30-hp. to 50-hp. rating. Motors for oil-burner installations show a tendency to lag, following sizable business in recent weeks. Smaller motors are in good demand from the shoe machinery and sewing-machine trades.

Electrical specialties in general are operating under a fair demand. Refrigerating units for domestic service are enjoying an active call and good turnover is current. Electric fans continue sluggish and present business is far from satisfactory. Elevator business is developing an improved tone, and a leading manufacturer in the New York district reports orders from apartments and commercial buildings varying from $25,000 upward for individual installations. According to a prominent producer of marine electric equipment, the immediate outlook in this line is promising. A transoceanic steamship company has contracted with an American manufacturer for a complete electric power plant for a new vessel of 19,000 tons rating now being built in England, the order including all main propelling machinery. There are several large orders pending with railroads for electrical equipment which are expected to mature within 60 to 90 days. Immediate construction activities in the Eastern district include the following:

The New York Edison Company has plans for an addition to its substation on East Thirty-ninth Street, New York, extending through to East Fortieth Street. The Yonkers Electric Light & Power Company has filed plans for an equipment storage and distributing plant to cost about $200,000. The Packard Motor Car Company will proceed with an eight-story service, repair and distributing plant on Eleventh Avenue, New York, to cost more than $1,500,000. Buffalo is having plans prepared for a vocational school to cost close to $1,000,000. The American Encaustic Tiling Company will build an addition to its plant at Maurer, N. J., to cost more than $100,000. The Public Service Electric & Gas Company will install an ornamental lighting system at Westfield, N. J. The Bureau of Yards and Docks, Navy Department, Washington, is asking bids until June 20 for ice-making and refrigerating machinery for naval air station at Lakehurst, N. J. (Specification 5423). The Quartermaster, United States Army, will rebuild and carry out expansion at the Picatinny Arsenal, near Dover, N. J., to cost about $1,500,000. Eternit, Inc., Philadelphia, manufacturer of asbestos shingles, is making plans for a new plant at Houston, Tex., to cost in excess of $1,000,000. The Pennsylvania Power & Light Company is merging 35 light and power utilities in several counties and will make extensions in transmission lines; this company will also install an ornamental lighting system at Berwick, Pa. John B. Sener & Sons, Kinzer, Pa., plan rebuilding of planing mill and lumber plant recently destroyed by fire with loss of about $100,000. Department of Public Welfare, Pittsburgh, is asking bids until June 21 for power equipment, power lines, ground lights, etc., at institution at Mayview. The Prudential Refining Company, Baltimore, will make extensions and improvements in oil-refining plant to cost more than $500,000. The Bureau of Fisheries, Washington, is asking bids until June 28 for one full-Diesel heavy-duty direct-connected reversible-type marine engine, 150 hp., for a power vessel at the Boothbay Harbor (Me.) fisheries station.

## *No Apprehension Felt in Middle West*

Comparatively good business continues in most sections of the Middle West. The slight acceleration of business noticeable at the beginning of May continued throughout the month and the consensus of opinion seems to be that May closed as favorably as could be expected. Apparently there is no reason for apprehension with regard to business conditions for the coming months, as each month of the year so far has seen some improvement. The condition of the steel, automobile, agricultural and railroad industries is encouraging, and indications seem to point to better business conditions as the year goes on. A larger amount of building construction is under way, with improved conditions among industrials and some reduction in the numbers of unemployed. The various utility companies are busy, a good deal of underground construction work going on. Maintenance purchasing was not quite so heavy this week, although the volume of business is practically the same. Jobbers' sales continue to hold up fairly well. Most appliances are moving in fair volume, with a particularly good demand noted for the smaller appliances of the gift type. The usual opening of the fan season has been delayed owing to the cool weather. Prices remain generally firm. Coming construction includes:

The Pera Pine Company, Rockford, Ill., plans a furniture-polish manufacturing plant to cost $80,000. The Southern Indiana Gas & Electric Company, Evansville, Ind., will make extensions in its power plant and system to cost $350,000. The Major Brothers Packing Company, Mishawaka, Ind., will soon take bids for an addition to cost $350,000. The Calumet & Hecla Company, Calumet, Mich., will install additional equipment at its copper properties, to cost $500,000. The Midland Steel Products Company, Detroit, plans an addition to cost $250,000. The Chrysler Motor Corporation, Detroit, plans a plant to cost $500,000. The Minnesota Power & Light Company, Duluth, Minn., will soon take bids for an equipment storage and distributing plant to cost $140,000. The Abbott Memorial Hospital Association, Duluth, Minn., will soon take bids for a power plant and a hospital addition, to cost $600,000. Wayne, Neb., will build a municipal power plant. The Seiberling Rubber Company, Barberton, Ohio, plans an addition to cost $160,000. The State Department of Public Welfare, Columbus, Ohio, will receive bids until June 14 for an ice plant at Gallipolis, Ohio, to cost $50,000. The Selby Shoe Company, Portsmouth, Ohio, plans an addition to cost $125,000. Urbana, Ohio, is considering a municipal electric light and power plant to cost $500,000. John Morrell & Company, Sioux Falls, S. D., will build an addition to their meat-packing plant to cost $250,000. The Wisconsin Power & Light Company, Madison, Wis., will soon take bids for a power plant at Janesville, Wis., to cost $100,000. The Bergstrom Paper Company, Neenah, Wis., will build an addition to its power plant, to cost $80,000. The Nekoosa-Edwards Paper Company, Nekoosa, Wis., plans an addition to cost $1,000,000. The Wisconsin Power & Light Company, Madison Wis., plans an equipment storage and distributing plant at Portage, Wis., to cost $30,000. Chicago and Lincoln, Neb., plan ornamental lighting systems.

## *Good Refrigerator Demand in St. Louis Section*

Slight change is noticed in business conditions in the St. Louis territory since the last report. No orders of contract size have been placed, but there is a somewhat better demand for stock sizes of apparatus. Unfavorable weather seems to have reduced the movement of transmission line supplies. A good volume of building construction materials is being shipped. Manufacturers of refrigerators report the demand holding up well. Coming construction includes:

The Hot Springs (Ark.) Public Utilities plans expansion in substation and distributing facilities to cost $45,000. The United States Cold Storage Company, Kansas City, Mo., plans a cold-storage plant to cost $1,000,000. The Union Electric Light & Power Company, St. Louis, plans a substation at 1408 Clark Street, to cost $35,000. The Oklahoma Gas & Electric Company, Oklahoma City, has acquired the municipal power plants at Elmore City and Calera, Okla., and plans transmission-line construction. The Western Light & Power Company is negotiating for the purchase of the municipal power plant at Woodward, Okla. The Texas Central Power Company has secured permission to build a hydro-electric power plant on the Guadalupe River, near Cuero, Tex. The Texas Utilities Company, Plainview, Tex., is planning a superpower plant to cost $750,000. Stamford, Tex., plans extensions in its municipal power plant. The Louisiana Power & Light Company, New Orleans, plans extensions in transmission lines to Ferriday and Vidalia, La., and vicinity. The Public Service Company of Oklahoma, Tulsa, Okla., will build a transmission line from Nowata to Bartlesville, Okla., and install a substation at Nowata to cost $50,000. The West Texas Utilities Company, Abilene, Tex., plans a 10-mile 6,600-volt transmission line from Wellington to Dodsonville, Tex. The Texas Electric Service Company, Dallas, Tex., will build a 60,000-volt transmission line between McCamey and a point near Chalk Oilfield, in the vicinity of Big Springs. Dallas, Tex., plans an ornamental lighting system on the Fort Worth-Dallas Pike.

## *Pacific Coast to See Extensive Construction*

Much large construction has just been announced in California. The Carquinez Straits train ferry, operated by the Southern Pacific Railroad since 1869, is to be replaced by a ten-million-dollar bridge 1¼ miles long with an electrically raised lift span to be 135 ft. above water level. A half-million-dollar glass factory is to be built at Vernon, and a Pittsburgh plate-glass concern is to build a plant in South San Francisco. Ecclesiastical construction includes $1,000,000 to be spent on the Sacred Heart Academy in Los Angeles, $300,000 for the Holy Cross Hospital in Fresno, $500,000 for a Los Angeles synagogue, and a drive is now on in San Francisco to get funds for the Episcopal Cathedral there, which will cost $3,500,000. School construction includes new high schools and additions for Placerville, Redwood City and Inglewood, averaging $400,000 each, while Alhambra has raised $1,400,000 for junior and senior high-school systems. Street-lighting projects include Tulare, with 28 single standards, awarded at $6,000; Torrance, estimated at $110,000; 116 standards for seventeen blocks in Bakersfield, awarded at $28,000; a system for San Leandro, estimated at $20,000; a duplex-light extension to the San Jose system and a single-light extension to the Sacramento system. Miscellaneous large construction includes a 300-kw. unit plant for the city of Alturas, the new Morgan Hill substation for the Pacific Gas & Electric Company, containing four transformers of 11,000 kva. each; an addition to a South San Francisco steel plant containing a 225-hp. synchronous motor and accessories; a market for Oakland to cost $750,000; the half-million-dollar Parr terminal in Richmond and a hotel for Tiajuana, estimated to cost $750,000.

General let-down in business is being experienced in the Puget Sound district with no definite explanation as regards the reason. However, indications for summer business are said to be comparatively bright, with orders of considerable magnitude in the immediate offing, these to emanate from lumber-mill and pulp and paper manufacturing sources. Last week's volume included about 80 small motors, from 100 hp. down, for pumping plants, cold-storage and lumber mills. Seattle's building permits for the first five months of the year show an increase in excess of $4,000,000 over the like period last year. Coming construction follows:

The Southern California Edison Company, Los Angeles, plans a substation on Madrid Street, Torrance, Calif. Idaho Falls, Idaho, is arranging bonds for $100,000 for a hydro-electric power plant on the Snake River. Nashua, Mont., plans a transmission line to connect with system of Montana Power Company at Glasgow, Mont. The Rocky Mountain Power Company, Butte, Mont., has applied for permission to build a hydro-electric power plant on the Flathead River, near Polson, Mont., to cost $1,000,000, with transmission line. Tacoma, Wash., plans a transmission line from the municipal power development at Cushman to Nisqually substation to cost $63,000. The Grays Harbor Pulp & Paper Company, Hoquiam, Wash., will build a transmission line from its power plant to the East Hoquiam Valley section. The National Paper Products Company, San Francisco, plans a unit at the Kraft paper mill at Port Townsend, Wash., to cost $1,500,000. The Moreland Truck Company, Los Angeles, is planning a motor-truck assembling plant at Seattle to cost $100,000. Sellers & Stone, Yakima, Wash., plans a cold-storage plant to cost $100,000. Cardiff, Monrovia and Pasadena, Calif., plan ornamental lighting systems. Santa Ana, Calif., plans an ornamental lighting system to cost $100,000.

## *Quiet Market with Active Spots in Southeast*

Activities in the electrical field in the Southeast have been quiet during the past week, a reasonable volume of business having been sustained by small-size orders. There is a more active demand for meters and distribution transformers, the largest individual transformer order last week coming from Mississippi and amounting to $15,000. In the past ten days one power company has ordered switching equipment totaling $10,000 and creosoted pine poles amounting to $5,300. Some other central-station orders include line construction materials amounting to $5,000, distribution transformers at $3,200 and metal conduit at $3,000. One of the larger power companies has sold $391,000 of electric refrigerators in the past 27 selling days, with the campaign to run 26 days longer. Another of the larger companies is this week getting under way with a large refrigerator campaign and has just completed an electric range campaign in which 1,115 ranges were sold in 40 working days.

Building permits in Atlanta for May amounted to $5,800,000, which is the highest monthly total in the city's history. Municipalities are ordering in less volume than has been the case in recent months, though one town ordered last week one carload of creosoted pine poles and another town is in the market for "white way" equipment costing in the neighborhood of $10,000. A town in Louisiana ordered in the past few days "white way" equipment amounting to $7,000. Such equipment is in active demand over the territory generally, but the individual orders are averaging only $1,000 each. New projects include:

Swift & Company, Chicago, will build a lard plant at Jacksonville, Fla., to cost $250,000. The Georgia Manganese & Iron Company, Hurt Building, Atlanta, plans a plant at Cartersville, Ga., to cost $1,000,000. Quartermaster, Fort Benning, Ga., will receive bids until June 15 for insulators, switches, reflectors and other electrical supplies (Circular 97). The Lexington (Ky.) Utilities Company is arranging for the purchase of the Georgetown (Ky.) Water, Gas & Electric Power Company. The Adrian Knitting Mills, Dyersburg, Tenn., plan a mill unit to cost $125,000. The Arrington Cold Storage Company, Arrington, Va., will build a cold-storage plant, to cost $200,000. The East Coast Utilities Company, Richmond, Va., will make extensions in the transmission lines in Matthews County. New Martinsville, W. Va., has voted bonds for $125,000 for a municipal light and power distributing system. The Universal Glass Products Company, Parkersburg, W. Va., plans an addition to cost $150,000. Greenville, Miss., plans a municipal light and power plant. The Mississippi Power Company, Gulfport, Miss., will make extensions in its ornamental lighting system at Meridian, Miss., to cost $35,000. The Stowe Thread Company, Belmont, N. C., plans a mill unit to cost $100,000. Corinth, Miss., and West Palm Beach, Fla., plan ornamental lighting systems.

### *Copper and Lead Active at Unchanged Prices*

The week ended Wednesday was characterized by better than average volume of sales of lead and copper, with substantially the same prices as obtained a week ago. Zinc continues dormant, also with practically no change in price.

NEW YORK METAL MARKET PRICES

| | May 29, 1928 Cents per Pound | June 6, 1928 Cents per Pound |
|---|---|---|
| Copper electrolytic..... | 14.525 | 14.525 |
| Lead, Am. S. & R. price. | 6.30 | 6.30 |
| Antimony............. | 11.0 | 10.50 |
| Nickel, ingot........... | 35 | 35 |
| Zinc spots............. | 6.475 | 6.487 |
| Tin, Straits............ | 50.625 | 49.50 |
| Aluminum, 99 per cent. | 24.30 | 24.30 |

Base copper wire price June 6, 1928, 16⅝ cents.

Both tin and silver are lower, prompt Straits tin having been continuously below 50 cents for the first time in four years. The reaction in silver to close to 60 cents is perhaps only natural after the recent rapid advance.

# Activities of the Trade

## Berger Brothers Buy Motor Department in Toledo

The purchase of the motor department of the Lake States General Electric Company, formerly the Nagle Electric Company, of Toledo, Ohio, is announced by Berger Brothers, 91 St. Paul Street, Rochester, N. Y. The motor department will be located at the same address, 34 St. Clair Street, Toledo, and will operate under the name of the Fred W. Kiemle Company. The business will be conducted in the future, as it has been in the past, under the supervision of Mr. Kiemle, who is vice-president and general manager. It is said that the affiliation with Berger Brothers will permit the handling of purchases and sales of used equipment on a much larger scale than in the past.

Berger Brothers also announce that after Sept. 1 they will be located in a new and larger plant at 1350 University Avenue. At the new plant the company will have 35,000 sq.ft. of floor space and every modern facility, including craneways, cranes and larger railroad sidings.

## Dudlo Manufacturing Adopts New Shipping Method

Instead of shipping wire on spools, with the consequent higher shipping cost and the necessity of handling and returning empty spools, the Dudlo Manufacturing Corporation, Fort Wayne, Ind., has developed the Dudlo demountable spool. The wire is properly spooled at the mill, tied, removed from the spools and shipped in condition for unspooling by the customer through the use of the demountable spool. The company claims a number of advantages for this method of handling, including the release of capital tied up in spools and the reduction of handling costs.

The Automatic Electric Heater Company, 1505 Race Street, Philadelphia, is now offering its "Sepco" line of water heaters in colors to meet the present-day trend of color in the home.

The Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago, manufacturer of high-tension equipment, announces that it is now offering a new line of unit type low-voltage spool-insulating supports.

The American Transformer Company, Newark, N. J., announces the appointment of the following district representatives: L. C. Herrmann, 4433 North Richmond Street, Chicago; H. C. Boulton, 1988 East 66th Street, Cleveland; Congleton Engineering Company, 914 Main Street, Cincinnati; Herr-Harris Company, 910 Fulton Building, Pittsburgh; L. D. Joralemon, 112 South Sixteenth Street, Philadelphia; W. O. Taylor & Company, Ltd., 415 Canada Cement Building, Montreal, Canada; Elliott Equipment Company, 708 Sixth Avenue, South, Minneapolis, Minn.; Arthur L. Pollard, Knoxville, Tenn.; James H. Southard, 682 Mission Street, San Francisco, and J. W. Jones, 432 Pennant Building, St. Louis.

The C. O. Bartlett & Snow Company, Cleveland, manufacturer of material-handling equipment, announces the appointment of J. R. Allison as its representative in Pittsburgh with headquarters at 406 Bessemer Building. Mr. Allison was formerly with the Carnegie Steel Company in the construction department of the Homestead Steel Works of that company.

The Botfield Refractories Company, Swanson and Clymer Streets, Philadelphia, manufacturer of "Adamant" firebrick cement, announces that since June 1, the distribution of its products in Toledo, Ohio, and vicinity has been handled by the Builders' & Industrial Supply Company, 4090 Detroit Street, Toledo, Ohio.

The Ingersoll-Rand Company, 11 Broadway, New York City, has received an order for three oil engines for use in connection with three 300-hp. oil-electric locomotives which are being built jointly by the Ingersoll-Rand Company, the General Electric Company and the American Locomotive Company. These locomotives are being built for the Ashland division of the American Rolling Mill Company.

The Northern Engineering Works, Detroit, manufacturer of cranes and hoists, has appointed the Interstate Supply Company, Commercial Trust Building, Philadelphia, as direct factory representative for the Philadelphia district. W. H. Beyer of the latter company, formerly connected with the Philadelphia office of Manning, Maxwell & Moore, will be in charge.

The Philadelphia Electrical & Manufacturing Company, 1228 North 31st Street, Philadelphia, has placed on the market the "Pemco" electric water heater, in which the current passes directly through the cold water. For normal use a single-plate electrode takes the load, while for large load demands a second set of electrodes goes into action automatically. The manufacturer claims high efficiency for this method.

The Westinghouse Electric & Manufacturing Company has appointed J. K. B. Hare as assistant central-station sales manager of the company. He will be associated with G. E. Wearn, central-station sales manager, and will have his headquarters at the company's office at 150 Broadway, New York City. Mr. Hare has been with the Westinghouse interests for the past sixteen years, with the exception of two years of army service during the war.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued May 15, 1928)

1,669,515. Current Transformer; J. B. Gibbs and G. A. Burr, Wilkinsburg, Pa. App. filed Sept. 6, 1923. For outdoor use.

1,669,516. Automatic Reclosing Circuit Interrupter; L. R. Golladay, Wilkinsburg, Pa. App. filed Nov. 2, 1921.

1,669,518. Elevator Control System; R. P. Higbee, Wilkinsburg, Pa. App. filed May 24, 1923.

1,669,519. Measuring Device; F. W. Hild, Los Angeles, Calif. App. filed Jan. 25, 1923. For use in connection with control systems for oil-well, and other earth drilling and similar operations.

1,669,520. Thermal Relay; H. D. Hineline, Pittsburgh, Pa. App. filed Feb. 3, 1923. Cartridge type.

1,669,521. Theater Dimmer and the Like; R. B. Hunter, Milwaukee, Wis. App. filed Nov. 26, 1923.

1,669,522. Turbine-Governing System; W. Innes, Monkseaton, England. App. filed Aug. 3, 1923.

1,669,524. Speed-Control System for High-Frequency Generators; S. M. Kintner, Pittsburgh, Pa. App. filed Nov. 2, 1921.

1,669,527. Method of and Apparatus for Producing Modified Currents, Etc.; F. W. Meyer, Schenectady, N. Y. App. filed Feb. 1, 1918.

1,669,529. Insulator; F. H. Miller, Wilkinsburg, Pa. App. filed Sept. 19, 1922. High-potential insulator of the suspension type.

1,669,531. Electric Switch; A. J. Mottlau, Pittsburgh, Pa. App. filed April 9, 1927. Quick-break-and-make type.

1,669,544. Thermal Control Device; C. Aalborg, Wilkinsburg, Pa. App. filed Sept. 3, 1919.

1,669,545. Switch; C. Aalborg, Pittsburgh, Pa. App. filed July 31, 1924. For use in the handles of vacuum cleaners.

1,669,546. Circuit Interrupter; C. Aalborg, Pittsburgh, Pa. App. filed Feb. 12, 1925. High-speed.

1,669,548, 1,669,549. Electrical Fixture-Supporting Device; R. B. Benjamin, Chicago, Ill. Apps. filed July 1 and 23, 1921.

1,669,558. Motor-Control System; W. L. Hartzell, Pittsburgh, Pa. App. filed Sept. 12, 1921. Employed in the drilling of oil wells.

1,669,560. Utility Drive; W. H. Himes, Pittsburgh, Pa. App. filed Feb. 18, 1925. Power drive for implements.

1,669,564. Burglar-Alarm System; W. E. Jones, Hennepin, Minn. App. filed May 15, 1920.

1,669,570. Terminal Cover; W. G. Mylius, Wilkinsburg, and B. G. La Bar, Turtle Creek, Pa. App. filed Nov. 14, 1925.

1,669,572. Electrical Measuring Instrument; C. Oman, Swissvale, Pa. App. filed Feb. 3, 1925. Polyphase induction watthour meter.

1,669,576. Rotary Phase Converter for Converting Alternating Current; M. Schenkel, Berlin-Charlottenburg, Germany. App. filed July 23, 1925.

1,669,577. Frequency Converter of Asynchronous Construction; M. Schenkel, Berlin-Charlottenburg, Germany. App. filed July 23, 1925.

1,669,582. Temperature-Control System; S. A. Staege, Pittsburgh, Pa. App. filed July 23, 1925. For controlling the temperature of a dryer unit.

1,669,588. Electric Heater; E. G. Burns and J. A. Davis, Sacramento, Calif. App. filed Nov. 3, 1925.

1,669,608. Thermostatic Switch; F. F. Forshee, Mansfield, Ohio. App. filed May 29, 1926.

1,669,609. Regulator System; C. LeG. Fortescue, Pittsburgh, Pa. App. filed March 18, 1925. For regulating the excitation current of dynamo-electric machines.

1,669,619. Electric Meter; A. J. Lush, Waltham, Mass. App. filed April 9, 1925. Of the double-pivot type.

1,669,626. Automatic Cut-Off Plug for Electric Irons; B. F. Ordway, Pasadena, Calif. App. filed Sept. 9, 1925.

1,669,660. Welding Rod; J. Birchard Green, Chicago, Ill. App. filed March 19, 1926. For metallic arc welding.

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Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

1,669,661. Coated Filler Material; J. B. Green, Chicago, Ill. App. filed Feb. 28, 1927. For fusion welding and cutting by the arc process.

1,669,666. Electrical Wall Socket; H. F. Laub, Logan, Utah. App. filed July 3, 1923.

1,669,687. Rheostat-Arm Mount; H. E. Adams and H. L. Decker, Toledo, Ohio. App. filed July 16, 1926. Liquid lever indicators of the type having a float actuated rheostat.

1,669,702. Fuse Box; A. F. Euchenhofer, Dayton, Ohio. App. filed Oct. 21, 1920.

1,669,719. Conductor Suspension Apparatus; J. R. Marshall, McKean, Pa. App. filed Oct. 5, 1925.

1,669,770. Time Switch; J. C. Miller, Oak Park, Ill. App. filed Dec. 24, 1925.

1,669,773. Electrically Heated Bathtub; K. H. Ober, Baltimore, Md. App. filed April 13, 1926.

1,669,802. Electric Stove; C. C. Armstrong, Huntington, W. Va. App. filed Aug. 3, 1925.

1,669,849. Cigar Lighter; C. Baia, West New York, N. J. App. filed Aug. 4, 1925.

1,669,938. Vertical Pump Motor with Top Adjustment; C. E. Johnson and E. Mendenhall, Los Angeles, Calif. App. filed July 2, 1925.

1,669,964. Electrical Water Heater; B. Barry, Mount Eden, Auckland, N. Z. App. filed June 19, 1926. In which heating element containers are inserted into a water circulating container.

1,669,972. Reciprocating-Bed Printing Press; C. B. Cottrell, 3rd, Westerly, R. I. App. filed July 9, 1924.

1,669,995. Water Purifier; W. M. Myers, St. Joseph, Mo. App. filed May 28, 1927.

1,670,009. Contact Clamp; P. A. Sawyer, Hasbrouck Heights, N. J. App. filed April 9, 1925. For use in connection with lead-in or ground wires as applied to telephone or wireless telephone connections.

1,670,030. Nonsynchronous Motor; V. A. Fynn, St. Louis, Mo. App. filed July 5, 1924. Improvement or control of the power factor or to the compensation of such motors.

1,670,031. Synchronous Motor; V. A. Fynn, St. Louis, Mo. App. filed Oct. 22, 1926.

1,670,032. Electric Water Heater; A. J. Gibbons, Indianapolis, Ind. App. filed June 5, 1926.

1,670,040. Dry Cell; E. H. McCabe, Madison, Wis. App. filed Dec. 22, 1924.

1,670,046, 1,670,047. Battery Plate and Method of Making Same; W. J. Plews, Detroit, Mich. Apps. filed June 27, 1921 and Dec. 29, 1927.

1,670,052. Electrode Mass for Self-Baking Electrodes; C. W. Soderberg, Oslo, Norway. App. filed July 22, 1924.

1,670,063. Load-Control System; A. G. Darling, Schenectady, N. Y. App. filed June 30, 1926. Which permits the plant to fully utilize the waste heat energy in certain forms of cheap fuel resulting as a by-product from industrial operations, in the generation of motive fluid for the prime movers, while the plant is interconnected with other sources of electrical energy in a power supply system.

1,670,073. Rotary Snap Switch; L. A. Kempton, Bridgeport, Conn. App. filed Dec. 16, 1926.

1,670,075. Cloth or Fabric; T. H. McComsey, Los Angeles, Calif. App. filed Aug. 18, 1925. Adapted for use in the manufacture of electro-magnetic therapeutic devices such as blankets, pads, garments and the like.

1,670,081. Induction-Motor-Control System; W. Seiz, Baden, Switzerland. App. filed April 16, 1926. Which will enable the induction machine torque to be controlled independently of speed.

1,670,083. Turbine-Regulating Means; R. G. Standerwick, Marblehead, Mass. App. filed April 20, 1927.

1,670,088. Electric Switch; L. S. Walle, Scotia, N. Y. App. filed Dec. 31, 1923. For reverse current or normal overload, the tripping of the switch being effective regardless of the position of the switch closing mechanism.

1,670,089. Flow Meter; J. Walsh, Swampscott, Mass. App. filed Nov. 5, 1926. With compensating means.

1,670,091. Electrical Receptacle Construction; R. B. Benjamin, Chicago, Ill. App. filed March 9, 1923.

1,670,093. Control System; H. Bany, Schenectady, N. Y. App. filed June 17, 1924. For effecting a desired connection, such as a connection between the field winding of a synchronous machine and a suitable source of excitation, when a synchronous machine reaches synchronous speed after being started.

1,670,121. Circuit Breaker; E. D. Moore, Cleveland, Ohio. App. filed July 23, 1924.

# New Trade Literature

UNIT PULVERIZER.—The Riley Stoker Corporation, Worcester, Mass., has issued a catalog which describes and illustrates the new improved "Atrita" unit pulverizer and gives information on the reliability, low maintenance, ability to handle wet coal and the sustained fineness of pulverization. The new Riley flare type burner also is described and illustrations are given showing many installations of the unit pulverizer.

REFRACTORIES. — Technical bulletin No. 20 issued by the Crescent Refractories Company, Curwensville, Pa., contains notes on the design of fire-clay shapes. Technical bulletins 1 to 19 inclusive, which contain charts, formulas and simple rules compiled for the use of persons interested in refractory linings also are available.

SHOP EQUIPMENT. — The Hobart Brothers Company, Troy, Ohio, is distributing a catalog covering the HB shop equipment, including the eight-hour battery chargers, electrical testing equipment, upright automatic air service, spray painting equipment, hydraulic car washers and ball bearing buffers and grinders.

PLUGS AND RECEPTACLES. — The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletin No. 2111, covering its type BP plugs and several types of plug receptacle condulets.

MOTORS.—Bulletins 504, 505, 506 and 502-A issued by the Louis Allis Company, Milwaukee, describe and illustrate respectively its slip-ring induction motors, its polyphase squirrel-cage motors, its single-phase squirrel-cage condenser motors and its inverted rotary converters. The bulletins cover the construction features. A number of illustrated applications are shown.

REFRIGERATOR CABINETS.—The Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, is distributing a portfolio entitled "Building up Profits in Electric Refrigeration with Benjamin All-Porcelain Cabinets and the 1928 Sales Profit Plan." This portfolio describes a step-by-step method of building up a prospect list, the preparation of direct-by-mail and newspaper advertising, the development of sales follow-up, and presents an actual exhibit of the advertising material prepared by the Benjamin company for its distributors and dealers to use in selling all-porcelain cabinets for electric refrigeration. The company also has issued a catalog describing and illustrating its new line of all porcelain cabinets for electric refrigeration for apartment house installation.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Sydney, Australia (No. 31,526), of hard-rubber battery containers, covers and vents.

An agency is desired in Luebeck, Germany (No. 31,533), for diaphragm sheets for telephones, loud speakers, etc.

An agency is desired in Munich, Germany (No. 31,531), for electric hand and hair driers.

Purchase or agency is desired in Gruenberg, Germany (No. 31,525), for electric hand driers.

An agency is desired in Mannheim, Germany (No. 31,528), for electrical hot-air drying apparatus, motor-driven household electrical appliances and electric washing machines.

An agency is desired in Dresden, Germany (No. 31,532), for electrical hot-air drying apparatus, and another (No. 31,504) for electric portable tools.

Purchase is desired in Amsterdam, Netherlands (No. 31,524), of electric floor polishers and electric washing machines.

An agency is desired in Port au Prince, Haiti (No. 31,522), for household electrical appliances and electric refrigerators, and another (No. 31,523) for household electrical appliances and electric refrigerators.

An agency is desired in Bradford, England (No. 31,536), for colored porcelain lighting fixtures and vacuum cleaners.

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## *Unfair Conduct of the Utility Investigation*

DISTORTION of the acts and motives of the various committees on public utility information by the Federal Trade Commission and its serious reflections on the electric light and power industry suggest the desirability of a radical change in the conduct of the hearings being held in Washington. No man should be subjected to the kind of examination meted out by the commission without also being heard in his own defense. Common justice demands it, and the public utilities should see to it that the men summoned to testify are not cast to the lions, but have their rights defended by competent counsel.

Enough has already developed in these Federal Trade Commission hearings to indicate that an inquisition is being conducted and that the commission is both judge and jury in the case. Justice may in the end prevail, but meanwhile innocent persons are being maligned and an outstanding and public-spirited industry, smeared with the vilest calumny. Must this be endured in the United States? Is there none to say, "Enough of this malicious misrepresentation"? Shall the rights of citizens be denied them by a federal bureau? It is time to administer a rebuke and time also for the public utility industry to contend boldly and resolutely for its right to defend itself against being forced into the position of a criminal from whom confession is extorted when its real attitude is that of a candid witness with nothing to conceal, eager and unafraid to publish the truth.

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## *Duty of Engineers to Go to the Aid of Congress*

POCKET veto of Muscle Shoals and the failure of Congress to pass on Colorado River except to make provision for an examination by an engineering board may be accepted by the electric light and power industry as a respite, but the situation is far from that. Granting that a board of high-grade and impartial engineers is appointed to pass on the plans for the Colorado River dam at Boulder Canyon—and the industry asks for nothing more—the Swing-Johnson bill with all its menacing features will be up again for consideration next December. Its passage or defeat then will depend somewhat on the report of the engineering board, but also on the attitude of the country toward the proposition of government in business. Hence the importance of painting and keeping ever before the eyes of the public, and especially of industry, a picture of what government in business means.

With reference to Muscle Shoals, the evident incompetency of the government to handle the development satisfactorily should cause the electric light and power industry some concern. Between now and December an effort should be made to find a workable solution of the problem which has perplexed Congress so long. True, Congress has not shown much ingenuity or flexibility in its handling of Muscle Shoals legislation; but why expect economic or engineering sense from legislators? It is the duty of those who are expert in such matters to help Congress toward a solution, and inasmuch as Muscle Shoals has resolved itself into a power development, the obligation to help lies heavily on the power industry. Congress having tried and failed, our engineers and executives should unselfishly show it the way.

* * * *

## *Friendly Neighbors*

THE secret of good public relations lies in the Golden Rule. It is unreasonable for any business organization to expect the members of a community to be friendly and of an understanding and patient spirit if it does not make a sincere and consistent attempt to be neighborly with them. To have friends a man must prove himself friendly. He must, if he is to be widely welcome, possess a sincerely responsive personality. There is no hidden charm or fetish about public esteem, nor is it likely to be acquired through an excess of conscious effort. Our friends often admire us for qualities not knowingly possessed or cultivated.

Utility-owned tracks and buses that hog the road, metermen who are tongue-tied before civil questions, linemen who endeavor to prove the possession of "hard-boiled" characteristics, and elevator starters whose brains are subject to unconscionable delay in replying to a customer's inquiry, have no place in building friendships. Electric light and power companies serve many masters of high and low degree, but they should never forget that human nature is so formed that individuals seldom resent the compliment of being treated as though they were a bit better, a bit more intelligent, a bit wealthier, a bit more influential than they really are—or if you prefer—than you think them to be.

* * * *

## *The Association's Pledge in Aid of Research*

ACTION by the National Electric Light Association at Atlantic City last week whereby it virtually pledged itself to contribute three million dollars for pure research indicates the public spirit and broad-mindedness of that body. In the face of the charge that they seek to pollute public instruction by bribing professors to teach untruths about the public utility business or to write what is not so regarding municipal or government ownership, the utilities turn the other cheek.

Favorable action on research was taken by the National Electric Light Association before the present investigation of public utilities was started or even suggested. The fund will be dispensed by the National Research Council of Washington, which body, we understand, will make allotment to the universities and colleges of the country interested in pure science research. Thus the electric light and power industry will have no control over the fund or the work to be done with it, but it will benefit with all other industry and with the country at large from the discoveries that result from the research thus made possible. These benefits are too great and too patent to any thoughtful man to leave room for cavilers to dispute the value of the association's large-visioned pledge.

* * * *

## *Electrical Wholesalers Take a Step Forward*

AT LEAST the beginning of a more progressive policy is seen in the action that was taken last week at Hot Springs, Va., at the annual convention of the jobbers. They changed the name of their organization to the National Electrical Wholesalers' Association and they appointed a managing director. This realigns this organization in conformity with the other national associations of the electrical industry and also serves to emphasize the fact that the "jobber" is not a mere middleman but performs a function that is inescapable in the flow of the products of the factory. As Chairman Cullinan pointed out, the "jobber" does not merely buy and then resell. He warehouses and distributes. Some one must do this. The manufacturer may, if he will, assume this function in addition to that of production, or it may be put into the hands of the wholesaler, who is a specialist. But the services of wholesaling and distributing must be performed if the goods are to be made available to the local trade and to the consumer. Whoever performs this function, it costs money.

What are the economics of the case? The industry in general does not know and the burden of proof naturally rests upon the wholesaler. Here obviously is work for the N.E.W.A. to do that the manufacturer, the installer and the retail trade may know that distribution as organized in the electrical industry is orderly and efficient. And there are other problems, particularly concerning the wholesalers themselves, to which the reorganized association can well direct its attention. Employee insurance, employee stock ownership, cost of trucking—there are many such issues on which light is needed, as was pointed out by McKew Parr in discussing the opportunity for a broader service to the membership. The class relations of the wholesalers with the other organized branches of the industry also present many questions of pressing importance, such as excess warehousing by central stations and the tendency of many manufacturers to bypass their own jobbers on large orders. How can the wholesalers' service be made proof against this? It is apparent, too, that the jobbers now lack the close contact with the organized industry needed to keep the wholesaler in intimate and sympathetic touch with national trends. Here also the N.E.W.A. can help.

Undoubtedly there was at this meeting a much better spirit of harmony between the independent group of jobbers and the so-called "big three," meaning the houses affiliated with the Graybar, General Electric and Westinghouse companies. This, of course, is vital to the development of a constructive program. For what the wholesalers need most today are clear-cut industry purposes and well-defined policies based on the economic facts of distribution.

* * * *

## *System Economy More Important than High Unit Economies*

A NEW thought is cropping out in the electric utility field which may seem old because utility companies thought they were achieving the result at which it aims by old methods. This thought, as expressed by H. P. Liversidge of the Philadelphia Electric Company, is that the industry is "not aiming to build generating stations with the highest individual economy but is seeking the best system economy."

As any company can judge for itself, erecting a new station with record economy does not improve the system generating economy much if there are a number of greatly inferior stations on the system. Likewise, erecting the most economical transmission lines in the country does not necessarily bring up the entire transmission and distribution economy greatly. Still, much construction in various parts of the country has been characterized by concentration on the economy of new units, stations and lines installed.

The recent trend has been toward more moderate capital expenditures for high economy in new components of a system and apportionment of the money which could be invested for super-economy in new units among old components for rehabilitation that will bring the best system results. By following this procedure and not forgetting that distribution losses quickly offset economies in generation, one company has brought its system economy to the unusual value of 19,000 B.t.u. per kilowatt-hour sold. The analysis of twenty-five large systems in the issue of the Electrical World for January 8, 1927, would indicate that many companies have given more thought to the economy of new stations than to system economy.

* * * *

## *Electricity and the Human Body*

IF ELECTRICITY can have performed so many remarkable services in lightening labor, if it can have raised the standard of living throughout the world, must we continue to say that it is impotent in repairing bodies and in keeping them in repair?

Not for long, certainly. Electrotherapeutics has passed the stage of charlatanism and magic and has settled down to sober and honest progress. The alluring but entirely fictitious powers of "electronic reactions" and all their breed have been exploded and electricity has at last taken an active hand. Chemistry, once the only reliance of medicine, has a new and powerful ally whose purpose, like that of its colleague, is sound investigation and reproducible results. Ultra-violet light from electrical sources, far more powerful than sunlight and yet more controllable, has already gained a substantial reputation in medicine. It is conceded to be a cure for rickets, a powerful assistant in the treatment of tuberculosis and a bactericidal agent of great value in surface infections. It is also receiving much attention as an active force in the production of the still mysterious vitamins in foods. X-rays, thanks to the intensive developmental work done by science, are now under effectual control and with each new advance in the art of their production they are finding new applications in the war against disease and disability. At first their value lay principally in their great assistance in medical diagnosis, but they are now the basis of a complete new therapy, having well established uses in the treatment of certain kinds of cancer and kindred ailments.

These two—ultra-violet light and X-rays—are already firmly established. But there are other electrical phenomena that may soon serve the doctor in his fight for men's bodies. High-frequency currents, whose curative power has been in dispute for years, are now being suggested in medical circles as a possible means of aiding natural convalescence by producing artificial fevers. And recently has come the announcement of the cathode-ray tube, which can produce many hundred times more radiation than is given off by all the radium in the world and, unlike that rare metal, is under perfect control. Neither doctor nor scientist can say at present what the cathode ray may do for medicine, but it is quite possible that great benefits may come from it.

These are a few of the contributions and the promises which electricity, turning from the remodeling of industry, has made to man himself. Research in its unending perseverance, supported by an open public mind, may turn these promises to realities, and it may reasonably be hoped that pain and suffering will steadily decrease throughout the world.

* * * *

## *Follow Through in Plant Betterment*

A HOMELY adage about putting one's hand to the plow and keeping on to the end of the furrow without turning back deserves consideration in power-plant betterment work in cases where a transfer of ownership results in new management. Few, if any, utility systems are ever finished, and almost invariably the acquisition of a property by a new group of investors finds improvements of greater or less importance under way in plant and field. The temptation to save money at every possible turn is often very strong upon a new management, and this often means a temporary slowing down of outlays for betterment which actually should be followed through in order to realize the best service and the lowest unit costs of operation in the long run.

It seems incredible that economically justified work should be curtailed, if not stopped entirely, by a new régime which is overanxious to make a better showing financially for the first year or so than did its predecessor; but such practice is by no means imaginary. To stop the installation of an automatic electrical control system, for instance, upon which perhaps $2,000 has already been expended and which might be completed for $500 more, may lengthen the period of risk associated with manual operation and perhaps do great harm in an emergency. Certainly one of the earliest engineering jobs to be done in taking over a plant should be a thorough check of all unfinished construction work, and if it appears that the previous management made a sound decision in starting it and carrying it forward, only the most convincing reasons should be allowed to interfere with its completion.

* * * *

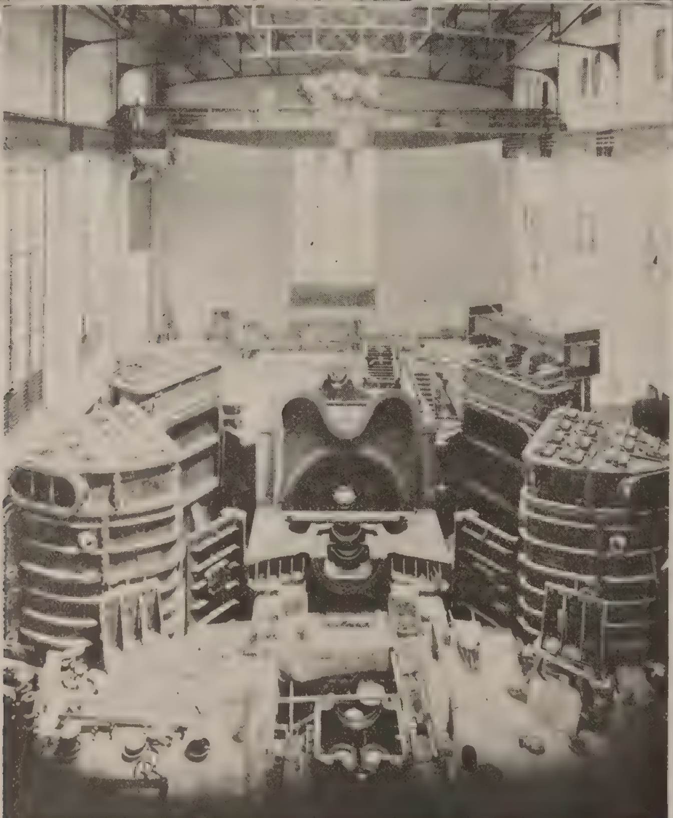
## *Heavy-Duty Appliances Beckon*

FOR its sales objective the power industry has the electrification of the civilized world. As a potential load builder the modern home challenges the best efforts of the manufacturer, the dealer and the energy vender, defining load in broad terms. The ultimate consumer is interested in convenience, in saving himself or herself work, and in devices which contribute to the pride of life, to comfort and to service of high quality. James H. McGraw touched a responsive chord in his Atlantic City address when he referred to the luxury appeal of many nationally advertised commodities. The American viewpoint is focused on better living rather than upon parsimonious existence, and the development of the market for electric service in the homes of the United States should never fail to capitalize this distinction.

Heavy-duty household devices, typified by ranges, refrigerators and water heaters, are moving into the center of the commercial stage. Amazing success has been attained in selling many devices in a market of striking diversity as to buying power. Utility executives brought up as engineers are rapidly realizing the sales problems of the industry and turning their powers of analysis and constructive thinking to commercial expansion. Idle investment in plant and lines is being attacked and overcome by discriminating load building. Without neglecting devices ministering to convenience and enjoyment of life at the cost of low energy consumption, sales departments are concentrating upon the real load builders this year as never before. We shall see the results as the index of per capita energy consumption rises and as the pitifully small kilowatt-hour usage per residence customer so many companies still manifest grows toward adequate development. The heavy-duty appliance is the key to economic utilization of the investment required to serve electrically the far-flung homes of this favored land.

It is true that competition for the consumer's dollar is acute, but if the want is created by suitable advertising and other sales effort, our industry need not fear of getting its share of popular expenditures for better living. Business in volume is affected materially by prices, but ease of buying seems to be the key to growth of sales in the residential field, when coupled with the right appeal. It is significant that progressive power companies are widely establishing prices representing complete installation coverage and that they are getting away from the step-by-step method as fast as possible. "So much total" for an installed range or water heater, rather than "so much for the equipment" and "so much more for wiring and plumbing," if needed, is the line of least resistance. The deferred payment plan is a time-honored method and needs no defense. Rates are fast settling into a sphere of usefulness which enables the advent of heavy-duty devices at reasonable operating cost; the products of American electrical manufacturers of rank are unexcelled in beauty, durability and convenience, and the stage is set for profitable performance and satisfaction on the part of all who are prepared to play their parts according to sound business principles.

# Long Beach Steam Plant Nears Completion



WORK on the Southern California Edison Company's Long Beach steam plant No. 3, which will have an ultimate capacity of 720,000 kw., is progressing rapidly and the first unit will go on the line shortly. The first of eight 90,-000-kw. units is noteworthy because of its size and the terminal voltage of 16,500. The turbine is a single-shaft, tandem-compound unit which will utilize steam at 400 lb. gage and a temperature of 725 deg. F. The condenser circulating water discharges into a 22-ft. tunnel. The furnaces are constructed so that pulverized coal may be used in the future if desirable.

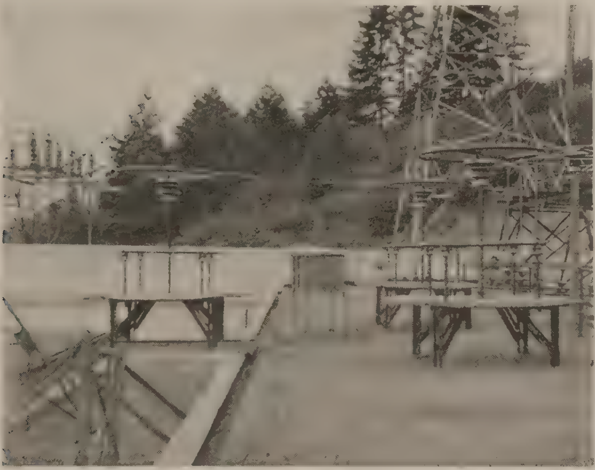
## *Surge Tests on*

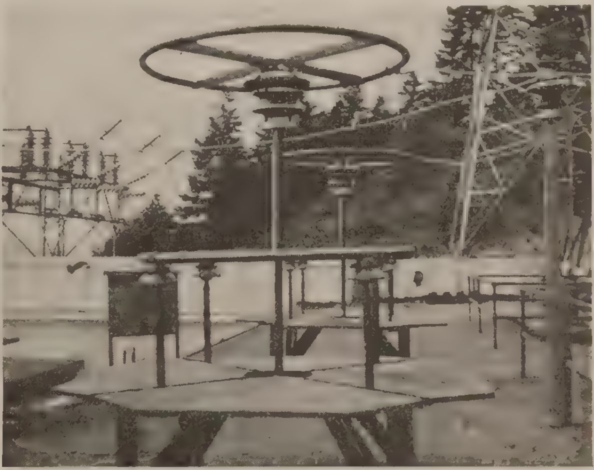
# Isolated Neutral Network

Klydonographs showed 26 per cent of surges on 55-kv. system to be above three times normal voltage

### By R. Rader and V. B. Wilfley*

During the summer of 1927 tests were made on the 55-kv. isolated neutral system of the Puget Sound Power & Light Company to determine more accurately the causes of insulation breakdown, flashovers and kindred troubles resulting from switching operations, grounds, short circuits and other causes of transients. The 55-kv. system of the company consists of a network of 356 miles of line and is one of the few larger systems still operating with neutral isolated. As a consequence, the problem of minimizing troubles from faults occurring on the system is one of major importance.


*Complete three-phase potentiometer installation*


*Assembled potentiometer for klydonograph test*

Three klydonographs placed at salient points on the system were used in making the tests. The klydonograph as an instrument for recording high-voltage surges has been described a number of times since its development by J. F. Peters in 1924 and will be discussed only briefly here. The mechanism is contained in a compact case which includes a photographic film revolved slowly by clockwork to produce a continuous record. One 8-ft. film will last a week, or, if operated non-automatically, the time and spacing of the pictures can be governed at will. The proper normal voltage of 2,500 to 3,000 volts, crest value, across the instrument is obtained by means of potentiometers between line wires and ground. Fig. 1 shows a simple diagram of the electrical circuit.

The potentiometers were constructed by the Puget Sound Power & Light Company, the plan of a single unit being shown in Fig. 2. Three such units are necessary for each three-phase klydonograph. It may be noted that the two rings consist of 1½-in. iron pipe bent into circular form with ends welded. The upper ring was mounted on a 73-kv. insulator and the lower ring on four 13-kv. insulators. The four sections of the ground plate when clamped together formed an octagonal shaped plate which was mounted on wooden supports and connected solidly to ground. The four rods supporting the 13-kv. insulators and the lower ring were clamped between sections of the ground plate, making it possible to regulate the elevation of the lower ring. Each unit was adjusted separately, since the sphere gap calibration took care of any variation. The rings were approximately 4 ft. 6 in. in diameter, which is recommended for voltages of the class under test, although reasonable variations are permissible where space is a limiting factor. A small wooden housing with glass window was used for protecting the klydonograph from the weather. The potentiometers were placed in the form of an equilateral triangle, as shown in one of the accompanying illustrations, with approximately 9 ft. between adjacent live parts. In the center of this triangle was placed the klydonograph in its wooden housing.

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*Office engineer Puget Sound Power & Light Company and engineering division, Westinghouse Electric & Manufacturing Company, respectively, Seattle, Wash.

The recording operation of the klydonograph is comparatively simple. A surge of any magnitude on the transmission line will appear in the same magnitude on the upper ring and for any fixed position the potential on the lower ring will always be proportional to the potential on the upper ring, hence the line. The klydonograph, being connected between the lower ring and ground, receives a certain proportion of this potential, the ratio or multiplying factor being determined for each set-up by

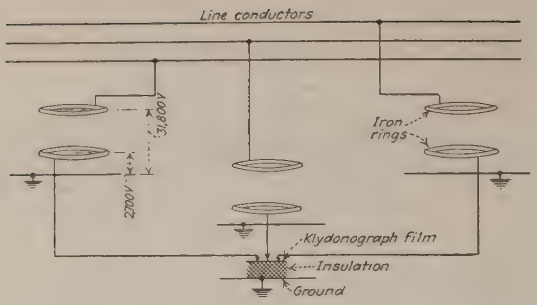
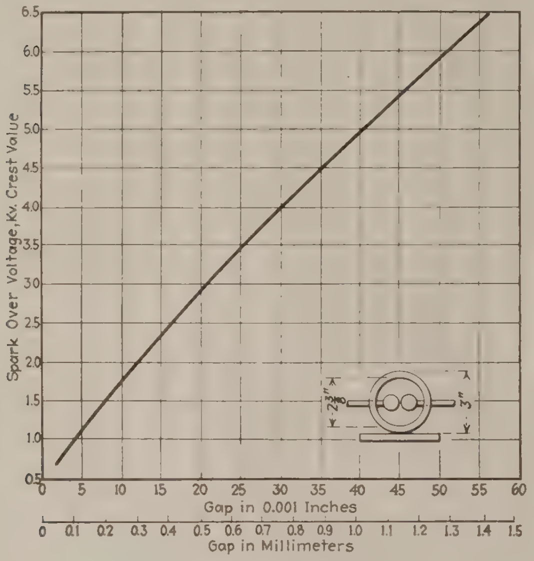
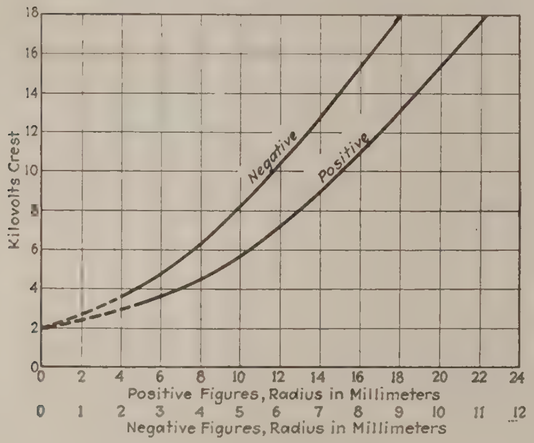


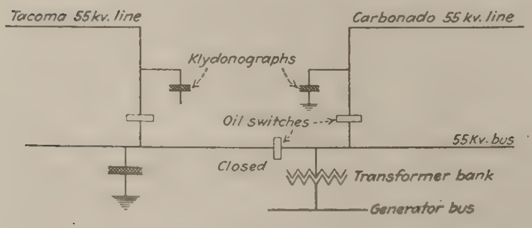
*Fig. 1—Schematic diagram of klydonograph connections*



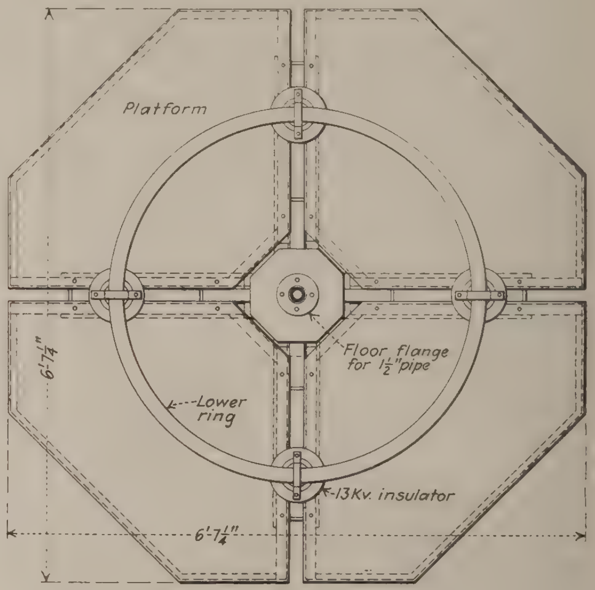
*Sphere gap calibration curve*



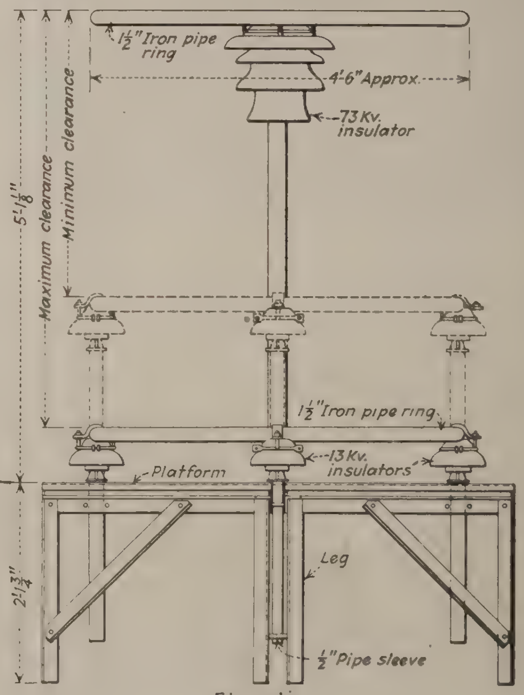
*Klydonograph calibration curves*



*Single-line diagram of klydonograph set-up for measuring switching surges*



Plan



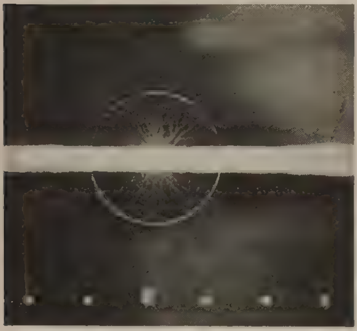
Elevation

*Fig. 2—Plan and elevation of potentiometer unit*

calibration. Normal line voltage was obtained by means of the station potential transformers and instruments. Voltage between the lower ring and ground was obtained under normal voltage conditions with ⅜-in. spheres adjusted so an arc would just break over. The voltage corresponding to this separation was read from the sphere gap calibration curve illustrated.

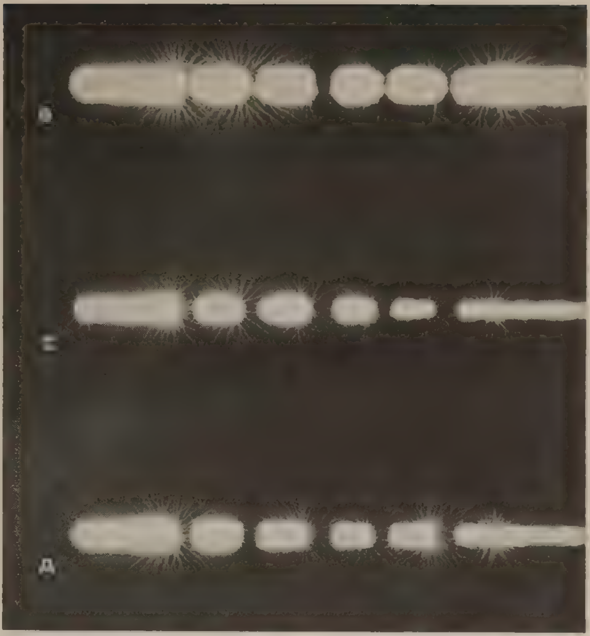
Knowing the ratio of line voltage to that on the lower ring, it was next necessary to determine the actual voltage on the lower ring produced by a surge as recorded on the instrument. This involves a knowledge of the relationship of the picture appearing on the film and the voltage producing it. The calibration curves illustrated showing this relationship had been made previously by the manufacturer as a result of extensive experimental work. In these curves crest voltage on the lower ring is plotted against the radius of the figure on the film.

As an example of the calibration of one of the potentiometer units, it was found that after the height of the lower ring had been adjusted the sphere gap arced over at 0.020 in. separation as measured with a thickness gage, corresponding to a crest voltage of 2,930 on the sphere gap calibration curve. The line voltage read 55,000 volts between wires or a line to neutral potential of 32,100 r.m.s. volts. Assuming a sine wave, the crest value was therefore 45,400 volts, which, divided by 2,930, gave 15.4 as the calibration factor for this potentiometer. For this calibration the upper ring was about 5 ft. above the ground plate and the lower ring about 2 ft. above the ground plate. The two other units were calibrated in like manner.



*Surge record marked for measurement*

Klydonograph studies were begun at White River, the largest and most central generating station on the system with a capacity of 60,000 kw., three three-phase instruments being located there for several weeks. The location of the instruments and related lines and bus sections is shown in an accompanying diagram. Later the instruments were moved to the Massachusetts substation in Seattle and to the Beverly Park substation, some 30 miles north of Seattle. Three instruments were found desirable on this extensive system to expedite tests and allow analysis of surges from simultaneous records taken at different points.

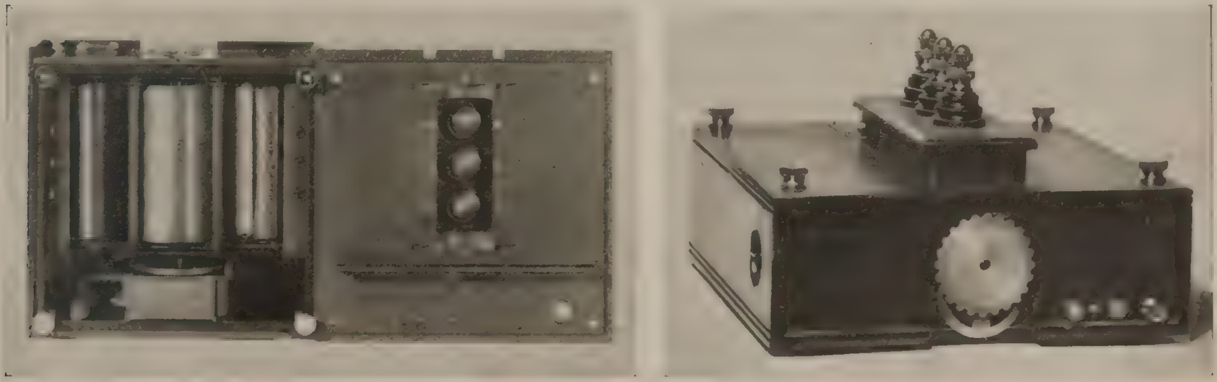


*Section of developed klydonograph film*

The discontinuous line indicated is the daylight line produced by admitting light through a small hole in the instrument case. It serves as a check on time, also recorded by the dots shown. Beginning at the left of the film the lines representing the phases are caused by the normal voltage and are continuous until a circuit breaker operation removes the potential from the instrument. Widths of the lines vary due to differences in calibration of the instruments on the three phases. It is characteristic of the instrument for slight changes in voltage in the lower part of the operating range to produce considerable change in width of the normal voltage line.

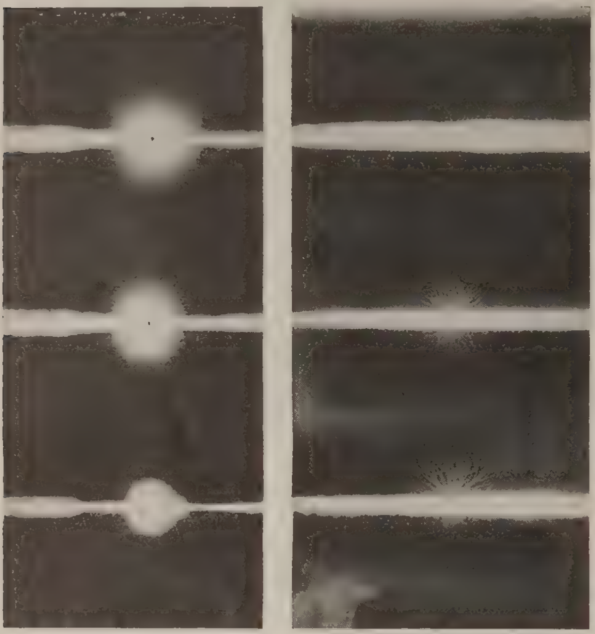
Oil circuit breaker switching tests, totaling 144 operations at various points on the system, disclosed that practically every operation produced surges on one or more phases, ranging in voltage value from normal to 3.9 times normal. A classification of surge values follows:

| Magnitude of Surge | Per Cent Total Number of Operations |
|---|---|
| Three to four times normal | 8.3 |
| Two to three times normal | 26.6 |
| One to two times normal | 65.1 |



*Standard three-element klydonograph*

High surges were obtained on both opening and closing of circuit breakers, those obtained on opening being somewhat more frequent. Lines under test were equipped with lightning arresters, but no discharges due to surges were observed. However, few of the surges were above the operating voltage of the lightning arresters and in general the higher the voltage of a switching surge, the briefer its duration, so that probably the higher surges recorded had a total duration of less than enough to warrant the operation of the type of arrester on the system.



*Figs. 3 and 4—Typical examples of klydonograph pictures produced by short circuits, arcing grounds and transformer bushing failures*

The size of the images in Fig. 3 is due to repeated surges from arcing and from switching operations. The surge on one phase reached 4.9 times normal voltage, or 220,000 volts to ground.

After completing the switching tests the instruments were installed at three salient points on the system and left in continuous operation to record the effects of faults which might develop. Twenty-two records were thus obtained, including trouble from short circuits, arcing grounds and transformer bushing failures. Figs. 3 and 4 represent typical examples. The intensity of Fig. 3 is due to repeated surges from arcing and from switching operations. The maximum surge occurred on the upper phase and reached 4.9 times normal, or 220,000 volts to ground.

Surges from line troubles proved to be greater than those caused by switching, 26 per cent being above three times normal. Operating experience shows that arcing grounds give the most trouble, and although each surge is of short duration, continued arcing very frequently causes insulation breakdown at several points on the system before the line can be cleared.

The tests proved conclusively the existence of high-voltage surges on the system during times of line trouble and during switching, either with or without the interruption of load current. The measurements were sufficiently accurate for practical use and have given the operating engineers a clearer vision of what actually occurs under the conditions described. The information has proved useful in planning ways and means of preventing equipment failures and service interruptions. Results are in line with other limited experiments on the magnitude of surges to be expected on ungrounded systems and accentuate the advisability of using star-connected transformers with grounded neutral for high-voltage transmission. This seems especially true in connection with the rapid strides being made in the development of protective equipment, whereby all classes of system trouble may be quickly isolated and localized.

## Cost of Fuel-Handling Equipment

EXCLUDING overheads, the following data give the installed costs of miscellaneous fuel-handling equipment estimated on a 1927 basis by the engineers of a New England light and power company. To all items 5 per cent may be added for contractor's compensation, but no allowance for engineering, interest during construction, taxes during construction, etc., is included.

*Miscellaneous Fuel-Handling Equipment Net Cost Data (1927)*

(Installed, Without Overheads)

| | |
|---|---|
| Coal unloading tower structure, hopper and service equipment, 22 ft. x 25 ft. x 167 ft. high, with four reinforced concrete piers on 40-in. thick reinforced concrete mat on hard pine grillage supported on wooden piles; superstructure structural steel tower with outrigger arm for bucket hoist trolley; receiving hopper, ½ in. thick plate; lighting equipment and heating equipment (65 sq.ft. exhaust steam radiation) included .................... | $62,607 |
| Raw coal bunker in boiler house, reinforced concrete on steel beams and girders, hopper-shaped bottom, bunker 40 ft. wide, 224 ft. 6 in. long, 24 ft. deep, maximum capacity 20 tons per linear foot ...................... | 67,635 |
| Three fuel oil riveted steel storage tanks, each 95 ft. diameter, 30 ft. high, with extended bottoms 105 ft. diameter, 12 ft. 6 in. high for fire wells; foundations 8-in. thick cinder concrete mat with 1-in. plastic cement top; tanks equipped with wrought-iron ladders, fire protection plank float over entire oil surface, steam line supply and lightning protection of galvanized wire network on poles over tanks with ground connection...... | 136,862 |
| Fuel oil service tank, foundation and fire protection, riveted steel, 42 ft. diameter, 20 ft. high with extended bottom 52 ft. diameter and 5 ft. high, foundations similar to above ...................................... | 8,794 |
| Fuel oil sludge tank and house, riveted steel 7 ft. diameter, 34 ft. 6 in. long, supported on concrete cradles, corrugated-iron sides and roof ...................... | 1,309 |
| Pulverized coal bunkers, four in number, 80 tons capacity each, structural steel frame supported on building steel, shell of bunkers 5/16 in. thick steel plate with exterior covered with 1½ in. thick layer of asbestocel with ½-in. layer plastic cement; inside of bunker has air pipe for circulation ........................................ | $47,109 |
| Coal pulverizing house building, 40 ft. x 85 ft. x 22 ft. high, with upper portion 40 ft. x 69 ft. 3 in. x 60 in. high; foundations reinforced concrete mat without piles, superstructure steel, brick and reinforced concrete, tar and gravel roof, 1925 cost ......................... | 167,676 |
| Lighting installation of above with 100-watt lamps, etc., including conduit, vapor-proof fittings, etc., 1925 cost.. | 1,498 |
| Heating installation for above...................... | 3,430 |
| Plumbing for above ................................ | 842 |
| Unloading tower, Hunt 1½-ton bucket, King 15-in.x15-in. hoisting engine, 160 lb. pressure, two cylinders; also 10-in.x12-in. two-cylinder hoisting engine, with hoisting ropes, track, etc. ...................................... | 13,176 |
| One single roll 24-in.x40-in. crusher, Pennsylvania armor type, driven by 50-hp., 550-volt, three-phase Westinghouse motor ........................................ | 4,201 |
| Two 300-ton per hour, 36-in. belt conveyors, 30 ft. center to center, 15-hp. motor ............................ | 12,334 |
| One 134-bucket conveyor, 15-hp. motor, buckets 24 in. x 18 in. x 11 in. ........................................ | 14,414 |
| One weightometer for 36-in. belt conveyor............. | 2,905 |
| One 2-ton coal railway, automatic, with two platform scales and 230 ft. of 19-in. gage track and car (wooden) | 2,613 |
| Two fuel oil rotary pumps, 753 gal. per minute each, 50 lb. working pressure and motor drive ................ | 10,030 |

# The Trouble with Buying

### The basic causes of price cutting. Where the seller and the buyer are responsible. Three things to do about it and two recommendations for a course of action

By Earl Whitehorne

*Commercial Editor* Electrical World

EXECUTIVES of American industry realize today that they have made a serious mistake through the last quarter century. They have allowed themselves to become so absorbed in the problems, the achievements and the fascinations of production that they have neglected distribution. Our methods of distributing our goods have grown by main strength and awkwardness. And so the American business man faces this well-known problem. It is constantly discussed, and if all the paper that has been used up in writing about distribution were placed in one pile it would probably interfere with the orderly progress of some star. Also, something else has been happening that has not been generally noticed. This tremendous increase in production has brought with it an intense pressure on sales. The growing output of the factory—everybody's output—has been driving the salesman to desperate ingenuity. And American industry has also become so engrossed in selling that it has neglected the efficiencies of purchasing. The world has honored and courted the salesman, while the purchasing agent has gone his way unseen and unsung. And yet for every sale there must be a purchase and the practices and the policies and the principles of the man who buys have as much influence upon the success of the transaction as the methods and the motives of the man who sells.

*This article, which concludes a series of discussions by Mr. Whitehorne on the very pertinent problem of price cutting, was presented before the recent annual convention of the National Association of Purchasing Agents in Kansas City.*

*His first article, entitled "Who Pays the Cost of Price Cutting?" was published on Feb. 18 and was followed March 17 and May 19 by an analysis of experiences and opinions of both buyers and sellers. And these, in turn, have called other writers to expression.*

*The subject is of universal interest because every business organization must both buy and sell and pay a price. Certain recommendations are made in this article and the editors will welcome frank opinion.*

The time has come, therefore, to turn some thought upon this business of buying that has so much to do with whether sales are profitable or not. We have got to throw the searchlight on the present status of the purchasing function in industry just as we have got to study and reform the process of distribution in this country.

### By Guess and By God

For we have reduced our manufacturing to a science. We think in terms of B.t.u.'s per ton of coal. We invest thousands of dollars in machines that will make possible the continuous saving of a fraction of a cent. We select and organize our labor and support each operation with four-and-a-half horsepower. We govern the very motion of a man's hand. Yet we do our purchasing too often "by guess and by God," we sell at whatever price will get the order and we deliver the goods by an overgrown mechanism of distribution so cumbersome that it often costs more to get the shipment into the hands of the customers than it costs to manufacture it. In other words, while we pour science and efficiency into our production we proceed with the selling and the buying of these commodities that we have so zealously and skillfully produced by a system so hit or miss that as soon as we get into a buyers' market the sellers start cutting prices and the purchasers begin to profiteer, and there is a general warfare between the very men who must depend upon each other for the conduct and prosperity of business. And economic warfare is no less destructive of dollars than the battling of armies. And so today we have many branches of industry very much exercised over the prevalence of price cutting, with nobody knowing just what to do.

Well, what should be done? One thing is certain, there is no general cure-all for price cutting—no panacea that will save the world. The only sensible approach that I can see is to examine into the causes and see if any common sense corrections can be found. Obviously, there are two causes—what the seller does and what the buyer does.

Well, what do they do that causes price cutting and demoralizes markets? Let's take the seller first.

The seller in a buyers' market becomes afflicted with overproduction. This brings on an acute attack of "volume-itis" and pressure is put on his salesmen to get orders. At the buyer's doorstep his salesmen meet other salesmen who are suffering from the same anxiety. Some of them are armed with the weapon of cut price. To get orders, to get volume for the factory, they have been told to sacrifice the profit. They do. And when one does, many do. And this induces a kind of hysteria, a state of mind that is just a form of fear. It is price cowardice. It is a kind of mob psychology that will sweep right through the salesmen of any branch of any industry.

There is only one thing that cures this kind of demoralization. If the salesman's boss possesses the intestinal fortitude to control him and to lead him out of his fear it can be stopped. Otherwise it runs its course till it ceases from exhaustion.

### Price Courage

It is a simple thing—price courage. When a manufacturing company enters the market with a line its officials set a schedule of prices based on their costs, which in turn are regulated by competitive conditions. If the president of that company will permit his sales manager to come in and talk him into permitting a price cut to get some big order and the salesmen find it out, then the salesmen will everlastingly be importuning the sales manager to let them cut to meet another bidder on this job and that. But when the sales manager knows that the president has price courage, that gives him the guts to stand up against the salesman. And when this salesman knows that the sales manager also has price courage he will battle with the buyer and refuse to telephone the office and ask for a better price. To put it flatly, the salesman who believes in his boss carries price courage wherever he calls. Price cutting is not the salesman's fault. It is the fault of the executive who cannot face the fact that the only relief in a market demoralized by overproduction and price cutting is reduced production. It is the fault of the executive who lacks the pluck to reduce his output rather than sell at a loss. Industrial America at present is volume mad. But manufacturers ultimately will have to face the economic law that to sell at a loss is waste and an offense against industry. And when prices fall below cost they will have to accept their individual responsibility voluntarily to curtail production as their contribution toward restoring the market to a balance.

## *What to Do*

*1. If the purchaser would demand firm bids, then general price cutting would soon cease. For a firm bid is like a signed order. It's the word of the house. It puts industry on the one-price basis just as solidly as the modern department store. It means that a price made is the best and final price and the buyer is expected to place the business by selecting the firm bid that offers the best value—not price alone but value.*

*2. While this practice of firm bids is crystallizing into a custom, whenever bidders are called back by a purchasing agent and asked for a better price, let the bidder demand that the other bids be shown to him, so that he will know that he is not being lied to, and that his price is indeed high for equal value.*

*3. And while the trickery of baiting bidders still continues in the world of business let bidders hold post-mortem comparisons of bids, by submitting their bids on closed business to their trade associations for comparison and report.*

*4. And let the buyer frankly and publicly proclaim that he will thereafter shun the man who cuts his price, because the first price is supposed to represent the honest value of the goods, and the man who cuts stands self-convicted either of trickery or weakness.*

This sounds very idealistic. I realize that. But price cutting today is due more to the folly of the seller than to the cupidity of the buyer, and the seller will have to provide his share of the reform. And, of course, he can, for he always has the power to refuse to sell. He can control the price at which he himself sells, if he is willing when necessary to sacrifice volume for profit.

### The Buyer's Weakness

Now let's take a look at the buyer.

The purchasing agent has always been the redheaded stepchild of industry. In the beginning the boss did the buying in odd times. Then he detailed a young man to help him. As buying has grown in volume purchasing agents have become more important, until today in many progressive corporations the buying is done by a vice-president with an able staff, and he is a big man with a broad knowledge of markets and men. But in too many cases the purchasing agent still lacks the responsibility and authority he needs to make his job measure up to his titular function. Too often he is just expected to buy what he is told and his performance is measured by his ability to save money on price.

He is more or less in the unenviable position that the policeman occupied say twenty years ago. The policeman's job as he saw it then was to walk his beat and swing his club and hope that he could catch some son-of-a doing something. And the whole world hated the cop. And then came the automobile and traffic, and we took the cop and set him on the crosswalk to help the people and to keep the cars moving. Now the world is for him. He is our friend. Just so there are too many purchasing agents today working with a mental attitude that is protective, detective and combative. They are working with the defensive idea of getting what they must buy for the lowest price instead of the constructive, productive idea of developing the greatest possible value for the dollar spent. Financially it may be the same. But phsychologically and economically it is very different. One is positive and the other is negative. One stimulates and the other depresses. One promotes co-operation and good service and the other doesn't. In the last few months I have discussed this business of buying with a good many men—purchasing agents and sales executives both. I have discovered one very interesting thing. Man after man has told me with pride and enthusiasm of the ideal relations which they have established with some buyer or some seller.

With this customer or this vender they have understanding and reciprocity. They know each other. The seller appreciates just what this buyer needs in quality and in service. He knows the organization and how it works. He and the purchasing agent pull together like a team of good gray horses. They keep each other advised as to the trends of the market. When the factory is running slack they anticipate requirements a bit. They discuss costs and profits at times and protect each other. The buyer knows that in an emergency that seller's factory will turn itself inside out to serve him.

There is no price cutting between this pair. They are dealing in values.

I know one purchasing agent who tries each year to call at least once upon the presidents of the principal companies from which he buys. He wants to get acquainted, to see the factories and judge whether or not they are efficient, to size up the organizations, the plants and the principles that stand behind the goods.

### Sales Executive Calls on Buyers

I know of one very large industrial buyer—one of the greatest in the country—who not so long ago sent a vice-president, no less, traveling the country calling on the presidents and sales managers of the manufacturing companies from which he buys, just to inquire whether they were entirely satisfied with the treatment they were receiving from his people. I daresay he carried smelling salts to administer to those who were overcome by the shock. And when this vice-president returned home and had recovered from the entertainment he said that he believed this trip to have been one of the best investments his company had made, reckoned in terms of good will and insurance of the material and service being supplied.

There are many enlightened buyers who are doing this kind of thing. They do it because it helps them in their business. It costs money in the long run to scatter business in small purchases, now from one and now from another. It costs money to haggle with salesmen. It costs money to bicker over bids. It costs money to break in new venders, to establish specifications and assume quality.

As one large buyer stated it to me, "There are four factors in every purchase that should be given consideration in the order named:

"1. Suitability to the need.
"2. Quality of the article.
"3. Responsibility of the vender.
"4. Price.

"Price is only one of the elements that must be weighed in establishing a value, and it should not be considered until the three other factors have been established as satisfactory." That is a pretty broad statement, but I believe it is a true one. This man knows what he is talking about.

Therefore, if the purchasing agent is to contribute his share toward overcoming this practice of price cutting that industry is suffering from and stewing about right now he must face these facts, and, facing them, he will bring new dignity to his profession and new opportunity to himself. He must recognize that nothing short of this ideal relationship between the seller and the buyer is really efficient and profitable. He must set his entire operation as nearly as possible on that plane and make value, not price, the chief objective. He must study the cost of buying as well as the cost of goods.

For who knows today which costs the most—to shop among fifty venders or to establish a close co-operative relationship with twelve? How much more does it cost to interview fifty salesmen than to give the same time to representatives of six selected suppliers who qualify completely in all the other factors of value?

Oh, I know the arguments! There are good ones a-plenty on both sides. But the point I make is that we have too little accurate knowledge of what it costs to buy, too little recognition of the relative importance of value as compared with the mere price factor, too little measuring of price against the other factors. And, in a word, industry will have to learn more about the economics of buying and organize its purchasing on a more constructive basis for the production of better values in trade before we put an end to the ruthless waste of price cutting.

How do we start? That is the pertinent question. There is a simple way, I believe. There are four things to be done. I have mentioned them on other occasions, but they need much repeating. I have listed them, therefore, in the box on page 1286.

Price cutting is just an economic disease. It can be cured. It can be cured by public opinion within industry. And immediate relief can only be sought through the building of public opinion among buyers and sellers. But the only way there is to develop public opinion is by discussion that corrects loose thinking and makes clear the moral and economic principles which all men desire to follow once they are generally understood.

## *Suggestions for Immediate Results*

*1. That the trade, industrial and business publications of the country promote the widest possible discussion of the economic inequity of price cutting, drawing out the opinions, principles and practices of the leading men of the field and developing a more common acceptance of the truth of it and a more general adoption of these simple resources of correction.*

*2. That the trade and industrial associations of each branch of industry support this purpose by calling a conference of the leading purchasing agents of the group to meet with a representative number of their prominent sales executives, for a discussion of the ethics and economics of this business of buying to the end that trade practice in that field may be improved both in selling and in purchasing in so far as price cutting is concerned.*

This calls for leadership, and I believe that in this kind of a situation this leadership can best come from two sources—the industrial associations and the industrial press. I, therefore, offer these two suggestions, which I believe will bring more immediate influence to the correction of the practice of price cutting than any other action which might now be attempted:

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I have asked a good many sales executives this question, when they have been discussing this buyer market:

"What is your own purchasing agent doing? Is he buying in the way that you would like to have your own customers buy? Does he foster price cutting?"

To many of them it has been a new slant on the subject. And yet there is no single influence more important to success in sales than the methods and principles of the man who buys. It is worth while, therefore, for the sales-minded chief executives of industry to see that their own purchasing methods are right.

The industrial press can help promote such a check-up. And a systematic discussion of the business of buying by such groups of purchasing agents, with executives present, would have a far-reaching effect in automatically applying common sense and curing this malady.

## Three-Power Locomotive for Switching Service

By S. T. Dodd

*Railway Engineering Department, General Electric Company*

A THREE-POWER electric locomotive has recently been placed in service by the New York Central Railroad. It is, primarily, an electric switching locomotive operating from either a 600-volt trolley or third-rail supply. In addition to this, when used in yards or sidings where no electrification has been installed, storage batteries enable operation for considerable periods.

In order to charge the battery an oil engine-driven generator set, having sufficient capacity to operate the locomotive at slow speeds without the battery, is provided. In normal service the load factor of a switching locomotive is about 10 to 30 per cent and this design provides that the engine generator set will furnish the average power required, while the battery will furnish the intermittent surges or fluctuations. Using the engine and battery together, the locomotive is able to operate continuously in "off-trolley" service.

Overloading of the generator by the engine is avoided by providing the former with a drooping characteristic. At light loads the maximum voltage of the generator will balance the voltage of the battery at the finishing rate on full charge. The motor equipment consists of four geared motors rated at 415 hp. apiece. The locomotive will develop tractive efforts as high as 60,000 lb. The control power is the same for either trolley or battery operation.

The current for the secondary operating circuits, such as control, lights, etc., is taken from the storage battery. The interesting feature of the control system is the transfer between battery and trolley as a source of power. A main transfer relay is provided to change from battery to trolley or third-rail power. If the "battery run" button is open the locomotive will operate as a straight electric locomotive and no transfer from trolley to battery will take place. If this button is closed and the locomotive passes a gap in the third rail, or for any other reason is deprived of external power, the motor connections are automatically changed from trolley to battery.

While operating this way on the battery, if the locomotive again makes connection with the trolley operation will continue on the battery until the controller is thrown to the "off" position.

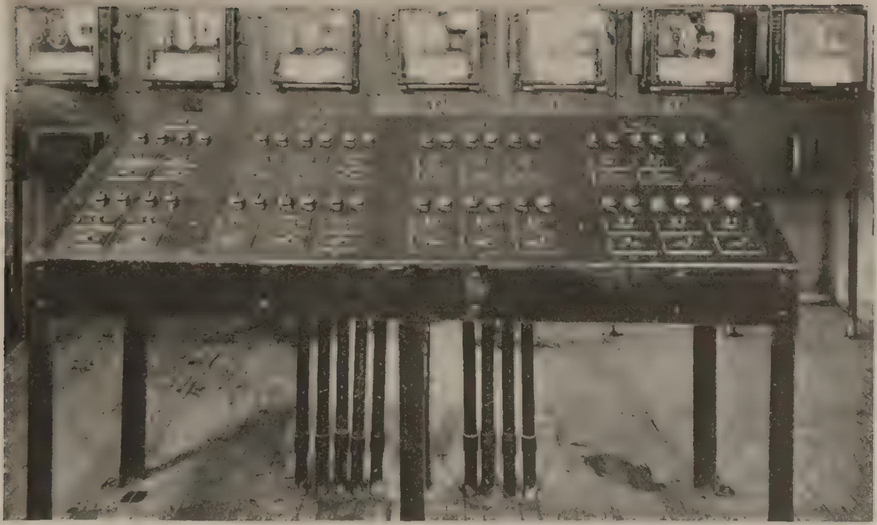
## *Analysis of Twenty Utility Companies or Groups in New York, Pennsylvania, New Jersey, Maryland and Delaware Handling Over 100,000,000 Kw.-Hr. in 1927*

Showing percentage of generating capacity in hydro, margin of generating capacity above system peak, extent to which energy is purchased, per cent utilization of generating equipment, system losses (including transmission, conversion and distribution), per cent of output to different markets, kilowatt-hour per domestic customer and generating capacity. Based on reports received from companies and presented in the May 5 issue of the ELECTRICAL WORLD.

| | Buffalo, Niagara & Eastern | N. Y. Edison-United & Allied Cos. | Mohawk-Hudson | Brooklyn Edison | Northern N. Y. Utilities | Rochester Gas & Electric | Central Hudson Gas & Electric | Philadelphia Electric | West Penn Electric | Duquesne Light | Pa. Power & Light | Pa.-N. J. Power | Pa. Water & Power | Assoc. Gas & Elec. (Pa.) | Penn Cent. Lt. & Pwr. | East Penn Electric | Public Service Elec. & Gas | Atlantic City Electric | Consol. Gas Elec. Lt. & Pwr. | Delaware Elec. Pwr. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Per cent of generating capacity in hydro | 75 | 0 | 52 | 0 | 94 | 39 | 58 | 0 | 11 | 0 | 16 | 9 | 83 | 30 | 5 | 0 | 0 | 0 | negl. | 0 |
| Ratio 30-minute kilowatt peak to generator kva. (per cent) | 79 | 63 | [2]69 | 55 | 87 | 49 | [2]103 | 60 | [2]52 | 71 | [7]66 | [2]54 | [2]83 | 55 | 47 | [7]71 | 68 | [7]71 | [2]60 | [2]80 |
| Per cent utilization of maximum theoretical capacity... | 46 | 27 | 19 | 23 | 40 | 22 | 28 | 29 | 30 | 37 | 22 | 26 | 50 | 29 | 26 | 38 | 29 | 29 | 17 | 36 |
| Per cent of purchased power to total energy... | 22 | negl. | 50 | negl. | 6 | 17 | 41 | 21 | 1 | 6 | 33 | 30 | 0 | 11 | 1.3 | 12 | 8 | 19 | 48 | 11 |
| Per cent losses (transmission, conversion, distribution) .... | 8.3 | [1]18.3 | 15½ | 15.2 | 8.7 | 16½ | 14 | 10.6 | [4]12.5 | 8.2 | 8.8 | 12.6 | [4]9.8 | 17 | 13 | 11.3 | 15.8 | .... | 9.8 | 10 |
| Sales (kw.-hr.) per cent of total output.... | | | | | | | | | | | | | | | | | | | | |
| Railways and other utilities | 17 | 9 | 21 | 21 | 36 | 14 | 42 | [3]29 | 11 | 17 | 12 | 38 | 90 | 5 | 18 | 41 | 14 | .... | 16 | 14 |
| Residences.... | 3 | ..... | 6 | 21 | 3 | 11 | 5 | 8 | 5 | 11 | 5 | 4 | 0 | 7 | 8 | 3 | 24 | .... | 10 | 9 |
| Commercial.... | 6 | ..... | 6 | 18 | | 49 | 6 | 12 | 5 | [5]7 | 5 | 5 | 0 | 6 | 5 | 3 | | .... | 11 | 8 |
| Power.... | 64 | ..... | 43 | 36 | 52 | | 27 | 37 | 65 | [6]48 | 66 | 37 | 0 | 64 | 49 | 41 | 42 | .... | 50 | 45 |
| Kw.-hr. per domestic customer | 716 | ..... | 327 | 320 | .... | 437 | 291 | 390 | 428 | 600 | 330 | 286 | 0 | 335 | 450 | 267 | .... | .... | 487 | 360 |
| Total gen. capacity (1,000 kva.) | [8]730 | [8]972 | 373 | 482 | 111 | [8]119 | 52 | [8]597 | [8]515 | 384 | [8]247 | 243 | 145 | 159 | 97 | [8]41 | [8]624 | [8]40 | [8]222 | 31 |
| Thousand domestic customers | 212 | ..... | 234 | 632 | .... | 88 | 33 | 390 | 189 | 240 | 143 | 96 | 0 | 84 | 40 | 21 | .... | 56 | 164 | 23 |

[1] Due partly to suburban losses. [2] Based on 60-minute peak. [3] Includes railroad supplies. [4] Includes intracompany use.

[5] Retail light and power. [6] Wholesale power. [7] Based on instantaneous peak. [8] Expressed in kilowatts.



*Pyrometers and control bench of Packard enameling ovens*

# Electric Enameling Used
## *in Packard Plant*

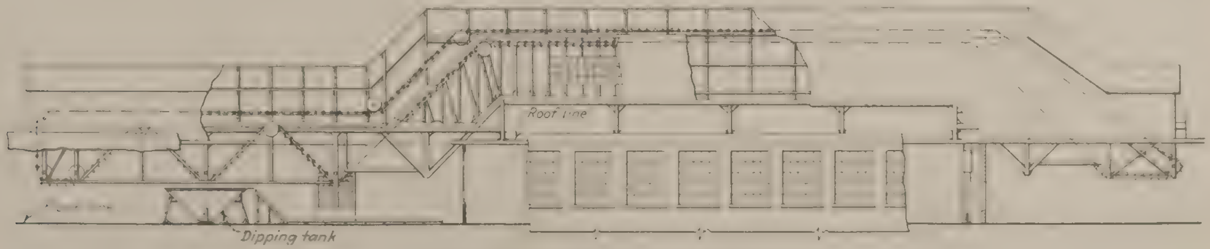
Ovens for continuous process effect large savings over batch method. Use of filtered air in counterflow to work assures quality of product and economy of heat

By R. J. Gaudy
*Executive Engineer Sessions Engineering Company, Chicago, Ill.*

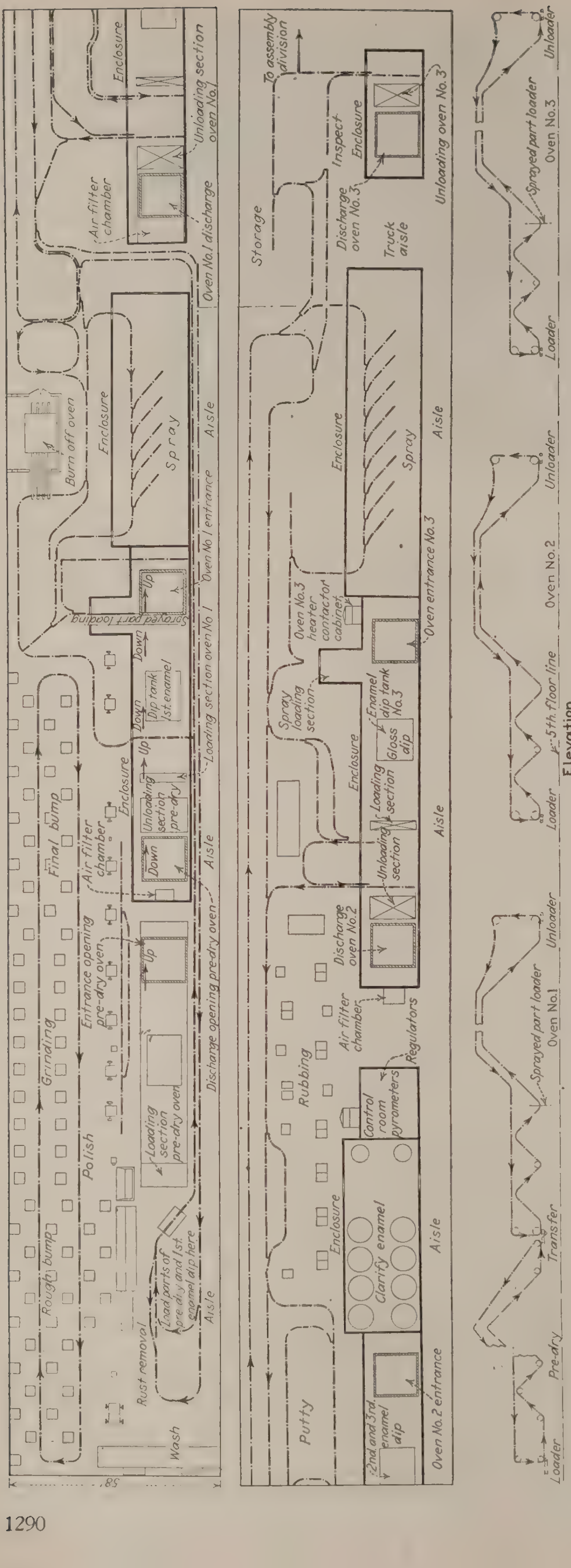
An added quality of enthusiasm may now be noted when you "ask the man who owns one" about the enamel job on the fenders and other parts of his Packard car. This is not to say that Packard enameled parts were ever less than the best job that could be done, but simply to state that Packard takes full advantage of advances in the enameling art as it does in all others. The latest forward step is the use of continuous process electric ovens which were designed and installed by the Sessions Engineering Company under the direction of R. R. Rees, manager of the construction division of the Packard company.

At its principal factory in Detroit the company has for a long time done all the enameling on the parts, so finished, in electrically heated ovens. A battery of 26 batch type ovens served for many years. These ovens were of the best pattern of the type, each oven being loaded by hand and carried automatically through a carefully determined time-temperature cycle. Such a production plant wherein batches of work are prepared, processed and released intermittently called for excessive, selective handling and spasmodic progress, which is conspicuously absent in all other manufacturing and assembling procedure in this plant.

The continuous operating enameling plant has distinct advantages which result from:



*Longitudinal section of oven construction*



General layout of enameling department shown by plan of work floor and profile of conveyor travel in ovens

1. A sequence of several continuous conveyor ovens, allowing the multiple coat work to be processed without interruption or storage, thus greatly reducing the chance of faulty product.

2. The manufacturing of parts ahead of finishing in a continuous stream of delivery. This continuity means that with conveyor ovens the flow is uninterrupted on through to the finish, and thence to the continuous assembly lines.

3. The inspection of work in progress being rigorously followed from the time the work enters the department, and the uniform flow of similar pieces to the inspectors permitting a well-timed inspection, which results in better selective criticism than possible with batch-by-batch inspection.

4. The power input and the attained temperatures and time of passing through the baking cycle being fixed over the length of each oven and all pieces by their uniformly rapid travel through the oven being, for each coat, subjected to exactly the same flow, baking and recooling cycle.

5. The dipping of work for each of several coats being done in single tanks of stock, continuously conditioned and perfectly controlled as to temperatures.

The greatest virtue of the continuous process in enameling is obvious. It is that, after their determination, the conditions which result in a perfect product may be maintained with great precision throughout the whole production flow. These conditions of heat, air properties, etc., must be re-established during each operation in the batch process and consequently they are more liable to error and change than if, once arrived at, they are maintained. It is much easier to hold oven conditions constant than it is to duplicate in following cycles the perfection of the first.

The oven layout, as evidenced from the drawing, shows the relative location of four ovens; these units are in the order of pre-dry oven, two-body coating ovens, Nos. 1 and 2, and finish coat ovens. The work after preparation, polishing and chemical cleaning is cleaned by torrent washing and immersion rinse, after which it dries rapidly and thoroughly in the pre-dry oven and is dipped immediately in the first coat of finish. The bond between metal and coat for which the Packard enameled parts are notable is assured by this unbroken series of preliminary steps. Thereafter, the parts are removed from the line of progress and inspected and prepared for each of a number of body coats. The two ovens, Nos. 1 and 2, are more densely loaded than is either the pre-dry or finish oven, as the work is passed through either No. 1 or No. 2 as many times as there are coats ahead of the gloss coat. After the body of the finish is built up as required and is rubbed this body is given the final gloss coat by a single passage through oven No. 3.

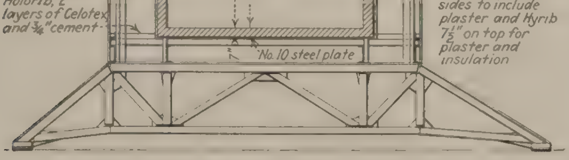
If the parts pass the final test for perfection a pendent conveyor system delivers the work as needed to the assembly lines. In addition to the constant speed conveyors through each oven, the complete mechanical handling system throughout the department is arranged so that the work is handled to and from each operator with the entire elimination of storing, trucking or rehandling. The work passing through the department comprises a wide variety of pieces that undergo an equally wide variety of treatments as to preparation and number of coatings. Certain pieces and assemblies are sprayed and introduced onto the oven conveyors between the dip tank and oven entrance.

As shown in the accompanying illustrations the work is handled to and from the ovens in sealed inclosures in which the supply of filtered (dust-free) air is applied under such pressures and in such quantities as to maintain the counterflow of air within the ovens. This counterflow opposes the flow of work and preheats the make-up air, unavoidably lost to the volatile removal, by cooling the discharging work. The thermal economy of such counterflow is pronounced.

The ovens are of the extended A type, rising over the roof of the building in which the department occupies the upper floor. The space below the oven runs is fully effective working area. The ovens consist of an internal structure fully dust-tight and carrying the conveyor runway. Around this interior is a continuous envelope of insulation.

The electric heaters are mounted on the floor and walls within the oven. The most perfect control and maintenance of temperatures is possible by the multiple circuit arrangement of heaters. The perfection of location and control and the predominance of radiant heat delivery, and, further, the lack of need for excessive movement of the gases within the oven far offset, for quality production, any possible differential inferred by the lower unit cost per heat unit of other classes of heat source.

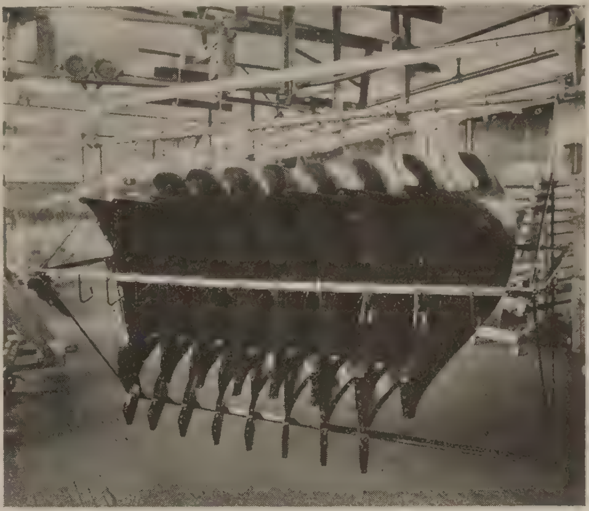
As this oven cycle is designed to maintain a fixed curve of temperatures throughout the oven length, all circuits which are required to supply the constant losses are placed on manual switching and are held constantly on the line. The very small increment or decrement of input required by the heat carried out by the work is controlled by the oven temperature. Perfect performance as to load factor is limited only by the adjustment of the small variable input so that its "off" time may be minimized.


Celotex and roofing on Holorib
20-lb. standard rail
Plaster and Celotex on Holorib
8½"
8¼"
5"
8'-11"
10'-4" c to c rails
11'-2"
8'-3"
7'-1/16
7"
No. 10 steel plate
7" insulation for top, sides, and bottom. 8'-4" allowed on sides to include plaster and Hyrib 7½" on top for plaster and insulation
Walkway of Holorib, 2 layers of Celotex and ¾" cement

Cross-section of oven construction

There are two controlling recorders with elements located near both ends of each coating oven. The automatic control of the small amount of intermittent input may be assumed by either recorder. Both instruments are continuously recording, but only one is normally in control. If, due to variation in the heat drift caused by changing interception of counterflow, it is required to transfer the control to the opposite end, this is accomplished by a simple three-way flush switch.

The heaters are operated at the power service voltage for machine tool motors (460 volts, three phase, 60 cycle) from the company's standard power substations, which are supplied with primary energy by the Detroit Edison Company. The heater installation, as a non-inductive load with a power factor of unity, improves the over-all plant power factor. For example, if one-third of a load block were heater load, then the other two-thirds could operate at a power factor below 60 per cent, with a resultant for the total of 80 per cent.



*Work rack with fenders in process*

The improvement in electrical load factor of the enameling department is apparent from a comparison of the demand of the batch type ovens with the demand of the continuous oven that replaced them. The old ovens had a concurrent demand of more than 4,000 kw. A far greater amount of work is being done every day with the continuous oven, which has a connected load of less than 1,000 kw. The total energy consumed per set of parts for one finished car for all coats is less than 140 kw.-hr., as compared with more than 270 kw.-hr. with the batch type ovens. The conveyors, pumps, fans, polishers and all power tools are individually motor driven and operate at very high load and power factors.

The prime requisite of the Packard management for high quality of product has been thoroughly met by the performance of this finishing plant. The new equipment, with its wide variety of operations and the exact requirements in the control of the many variable conditions, is able to deliver product (1) in greater quantity; (2) at less cost; (3) with perfect uniformity; (4) of highest quality, and (5) with full freedom from troubles due to the recurring cycles in non-continuous plant.

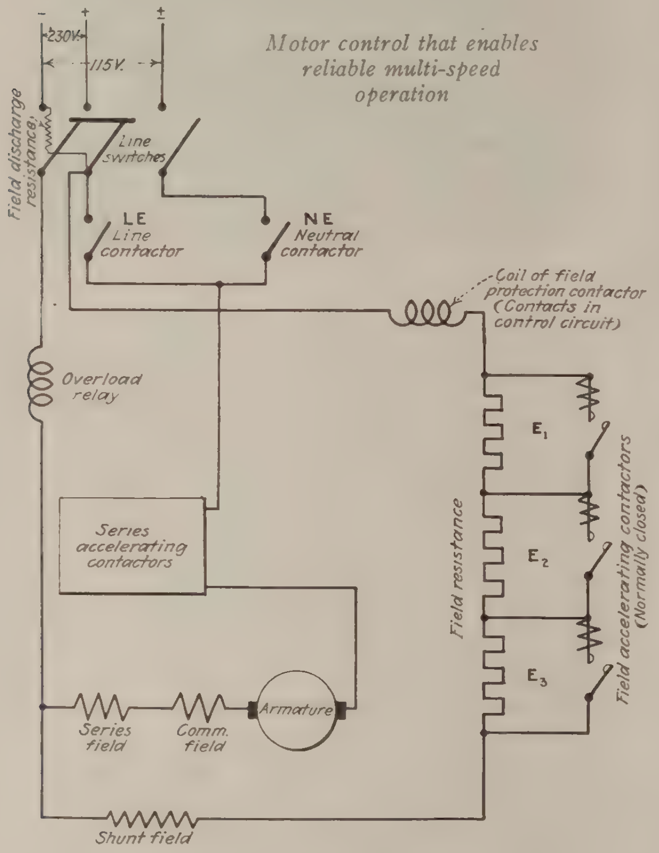
The installation would have been fully justified by the improvement in the quality attained alone, but in addition the saving in power cost, handling labor, wasted enamel, rejects after baking and other direct benefits are of such value as to represent, at present production, a gross annual return of half of the total outlay.

# Multi-Speed Pump Control Maintains Water Level

By L. Stone
*General Electric Company, Schenectady, N. Y.*

PUMPS ARE used in the Waterside No. 1 station of the New York Edison Company to force water, in excess of the boiler requirements, from the surge tank to the mixing boxes of the feed-water heaters in Waterside No. 2. A special panel and control was found necessary adequately to regulate the operation of three centrifugal pumps functioning in parallel and which are driven by three 30-hp., 230-volt, variable-speed direct-current motors.

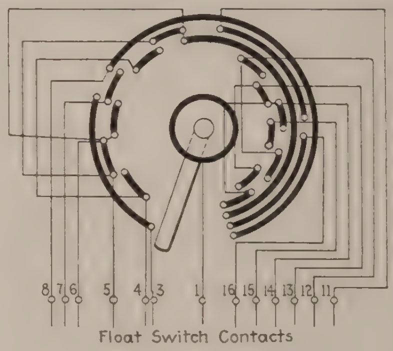
As originally installed, a special float switch was mounted over the discharge well and connected to a large float in a 12-in. pipe. This float switch had a number of contact points connected through throwover switches on the panel so arranged as to start one motor automatically when the level of the water rose to a predetermined point, and, as the water rose, to speed this motor up in three steps, and finally to cut in the second motor and speed this up in the same way as the level of the water in the well rose. It was found, however, that the characteristics of the pumps and the head against which the water was forced varied somewhat from the original analysis, and that the motors were continually accelerating and decelerating between points in order to hold the water level at the proper point and prevent loss through overflow. It seemed desirable to get a larger number of speed points, and the space available would not allow much increase in equipment.


-
+
±
230V.
115V.
Field discharge resistance
Line switches
LE
Line contactor
NE
Neutral contactor
Coil of field protection contactor (Contacts in control circuit)
Overload relay
Series accelerating contactors
Field resistance
E1
E2
E3
Field accelerating contactors (Normally closed)
Series field
Comm. field
Armature
Shunt field

*Motor control that enables reliable multi-speed operation*

**Points of Acceleration**
Controlled by Float Switch
● = *Closed*

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st Motor | NE | ● | ● | ● | ● | | | | | | | | | | | | |
| | LE | | | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | $E_1$ | ● | | | | ● | | | | | | | | | | | |
| | $E_2$ | ● | ● | | | ● | ● | | | | | | | | | | |
| | $E_3$ | ● | ● | ● | | ● | ● | ● | | | | | | | | | |
| 2nd Motor | NE | | | | | | | | | ● | ● | ● | ● | | | | |
| | LE | | | | | | | | | | | | | ● | ● | ● | ● |
| | $E_1$ | | | | | | | | | ● | | | | ● | | | |
| | $E_2$ | | | | | | | | | ● | ● | | | ● | ● | | |
| | $E_3$ | | | | | | | | | ● | ● | ● | | ● | ● | ● | |



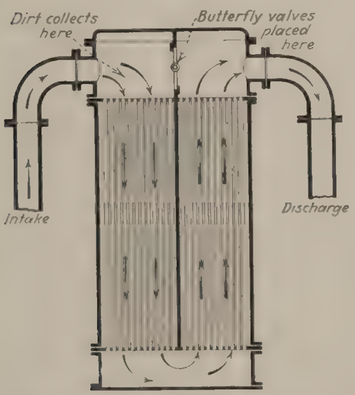
It was therefore decided to connect the armature of the motor first across 115 volts; that is, between one leg of the 230-volt Edison service and ground, accelerating with the three field resistance points, then to throw over to 230 volts and, again, by field acceleration, get the other increases in speed. This would give, instead of four points, eight points of speed regulation for each motor, or sixteen points in all. The additional equipment necessary was one neutral contactor, one auxiliary relay and a few changes in the interlocking and holding coils of the series accelerating contactors used in starting the motor. The float switch contacts were changed in the customer's shop, giving a final layout as shown in the accompanying figure.

The sequence of operations follows: The operator decides which pump he desires to run and throws the selector knife switches over to connect one motor in as No. 1, another as No. 2. The throw-over switches on the third motor are left open, although it is possible to close the third motor switch and use this in parallel with one of the others in case of an especially heavy demand. As the float rises, it closes the neutral line contactor and the motor accelerates by means of the series contactors to the low speed. Voltage and current coils of the series accelerating relays are all in circuit. If the water continues to rise the float switch moves on to segments 4, 5 and 6, which operate the three accelerating contactors, each cutting in a section of field resistance. When segment No. 7 is reached the contactor coil is energized on one side, but does not pick up until the moving arm runs off of segment No. 6. At this time the accelerating contactor is open, allowing the auxiliary contactor to close. The arm has, at the same time, run off of the segment holding the neutral contactor closed, which allows the line contactor to close and throw full voltage on the armature with all field resistance short-circuited. As the water continues to rise faster than the pump can pump it out the three accelerating contactors operate, which brings the pump up to maximum speed. The second pump starts and its speed increases in the same manner.

If the flow of water into the well decreases, the float lowers and cuts down the speed of the motor. The auxiliary contactor prevents reduction to low speed until the water level has fallen sufficiently to assure that there will be no hunting due to a small motion of the moving arm.

## Flushing Condenser Tube Sheets

THE Northeast station of the Kansas City Power & Light Company takes its condensing water from the Missouri River. This stream is not noted for its pellucid depths, but very much the reverse. At times it is necessary to keep a man continually at work removing débris from the trash bars and the revolving screens really revolve; they don't stand in one position for a day or so at a time, as is the case in more favorably located plants. In spite of trash racks and screens, however, there is an appreciable amount of more or less finely divided rubbish that must pass through the circulating water system. The condensers in the station are of the vertical double-pass design and it not infrequently happens that this rubbish will accumulate in such quantity on the surface of the tube sheet of the first pass as seriously to impede the flow of water through the condenser. The newer condensers in the station are arranged so that the water circulation in them may be reversed, and in this way the refuse collected on the tube sheet may be washed off. It was not possible, however, to reverse the flow in the older condensers and some means of cleaning the sheet, other than shutting the unit down and removing the dirt by hand, was highly desirable, and the means was found.



*Tube sheet flushing arrangement*

The accompanying illustration shows the general design of the condensers in question. Two butterfly valves, each one extending about half the length of the separating wall between the intake and discharge chambers, were installed. The only reason for two valves is that they are easier to handle than a single one. The valves are operated by levers attached to the valve shafts which are brought outside of the condenser shell. The first idea was that the valves could be thrown to the open (horizontal) position, indicated by the dotted line in the sketch, while the unit was in operation and that the water would rush across from the intake to the discharge side and wash the dirt off the tube sheet in its mad career. This result was not achieved, however, because the time required to open the valves permitted a gradual equalization of pressure between the intake and discharge sides and the water flowed smoothly across without the excited turbulence expected.

It looked as though the idea was impractical. Then it was suggested that the operating procedure be modified, the intake be reduced considerably, the valves then opened and the intake flow be released with a rush. It worked. The water dashed across the tube sheet and scoured the dirt off the tube sheet in a very gratifying manner. The whole operation takes only a minute or so. As a measure of precaution the load on the turbine unit is cut down while the flushing is going on, but it can be done, if necessary, with the turbine at full load. The only effect is a momentary loss of a few inches of vacuum, which are immediately regained when the butterfly valves are swung into the vertical position.

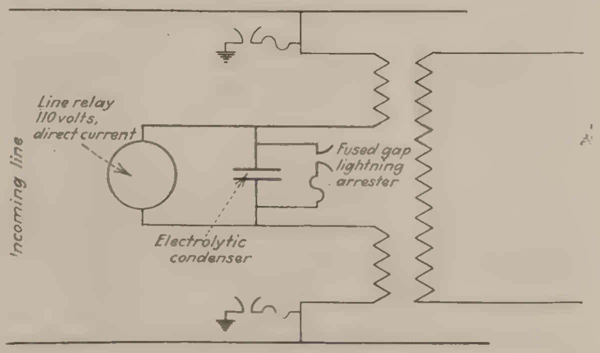
## Protection of Control Circuits

By John H. Nelzen

*Wisconsin Public Service Corporation, Crivitz, Wis.*

CONTROL circuits that are carried on pole leads with power lines are subject to occasional overvoltages caused by lightning, by crosses with the power lines and by induction from power line faults. These disturbances are dangerous to the control equipment and to operators. After a great deal of experience with different types of lightning arresters, none of which afforded perfectly satisfactory protection on 36 miles of control line, the Wisconsin Public Service Company tried out and found to be quite successful the scheme detailed here.

The control circuits are so devised that all operations are performed through the functioning of a single master relay connected across the control pair. The problem was to arrange some means by which this relay might be protected from extraordinary line conditions. A telephone insulating transformer of one to one ratio with the line winding parted and brought out in the center was installed. The relay was then placed between the two halves of the primary winding, which was connected across the control line. A condenser with a capacity of 6 mfd. was shunted across the relay terminals, as was also a gap-type lightning arrester. The secondary of the transformer is connected to the telephone and supervisory apparatus that also makes use of the control line.


Line relay 110 volts, direct current
Fused gap lightning arrester
Incoming line
Electrolytic condenser

*Equipment used to protect control apparatus connected with power lines*

# 24 Points on Range Selling

Analysis of potential market and sales methods made by C. J. Eaton,
commercial manager Middle West Utilities Company, for
the N.E.L.A. domestic electric range committee

AN EXCELLENT cross-section of electric range selling methods used by central-station companies in different sections of the country has been compiled by C. J. Eaton, commercial manager of the Middle West Utilities Company, in a report for the domestic electric range committee of the N.E.L.A. Commercial Section. With a view to studying these sales methods Mr. Eaton asked 24 pertinent questions bearing particularly on employees' use of electric ranges, campaign methods, quotas and advertising practices. From the replies received he was able to select those from 24 companies, which gave sufficiently complete data to tabulate and analyze. A study of the summarized replies to each question reveals a number of significant facts about development of the electric range market and raises some further questions to which both the central-station companies and electric range manufacturers should give thoughtful consideration.

The potential market for electric ranges as viewed by the various companies ranged between 50 per cent and 100 per cent of the customers in non-gas areas. On this basis, with 17,596,400 domestic customers connected to the lines of the power companies and approximately 10,500,000 artificial and natural gas ranges in use in the country, there remain 7,096,400 residential electric customers who should be using electric ranges. Only 590,000 electric ranges are in use, leaving a potential market of 6,500,000 in territories not served by gas. The question naturally arises in the minds of electrical men, why should not the other 10,500,000 domestic

## *Twenty-four Range-Selling Points*

*1. Basis of Making Quotas.*
It seems that most of the companies base their quotas upon the number of residential meters connected, taking into consideration the sales of past years, and general business conditions. One company points out that it does not deduct from the number of residences the number of ranges in use, for it finds that where there are a few ranges in use sales are more easily made.

*2. The Potential Market for Electric Ranges.*
The potential market is stated as being anywhere between 50 and 100 per cent of the lighting customers of non-gas areas. Some of the companies qualified their estimates by saying that a reasonable rate and a reasonable purchase price would be necessary.

*3. Methods of enlisting the support of the company employees in promoting electric range sales.*
Six of the 24 companies do not seem to encourage employee support in any way. Eighteen companies give bonuses for leads. Eight allow their employees to purchase ranges at reduced prices, usually at cost, and the same number of companies hold special meetings for the purpose of instructing employees in the desirable features of electric ranges, method of operation, etc. One company, besides selling ranges at cost to employees, gives them a half rate on energy used. The great majority of companies believe that employee support is very desirable, if not necessary, especially during campaigns.

*4. Basis of paying employees for turning leads in which result in range sales.*
Eighteen of the companies give bonuses ranging from $1 to $5. Some of them have time limits of 30 or 60 days. One company pays an extra bonus if a definite appointment for the salesman is made, and finds that this is most satisfactory. Another company requires that the employee talk personally with the prospect in order to be sure that the employee is actually boosting the company's sales and service.

*5. Merchandising relations with local dealers.*
Of the companies reporting, twelve have satisfactory relations with local dealers and twelve do not solicit dealer co-operation. The form of co-operation in most cases was allowing the dealers to tie in with the company during campaigns. Some of the companies carry the customer's account when sold by a dealer and allow the dealer a commission on sales. Several of the companies turn over the work of installation to the local dealers, which is very satisfactory to both parties.

*6. Plans for securing the support of domestic science schools.*
Fourteen companies have no special plans for securing the support of schools. Six companies give reduced prices, two of which also give special lectures and demonstrations. Four of the companies give special lectures to classes, but offer no inducement in the matter of price.

*7. Plans for working with the county home agents.*
Only five companies have any relations with county home agents and only one sells ranges to the agents at reduced prices. The other companies help in giving demonstrations and cooking schools in the county home agent's home.

*8. How the women's committee of the N.E.L.A. can be utilized.*
Few of the companies state how this committee can be utilized. There are some companies, however, that use the suggestions of the women's committee through their own women's organizations, giving lectures before women's clubs and societies.

*9. Developing electric range business outside of the gas district.*
With the exception of two companies, all of them leave gas areas very much alone, either because gas is used outside the company's territory or because of the fact that the company is also interested in the gas business and does not wish to compete with itself. In the case of the two companies, it was stated that they competed favorably with cheap gas and that they thought gas was a very small factor in retarding electric range sales.

*10. Basis of establishing the selling prices.*
Eleven of the companies sell at list prices suggested by the manufacturers. Twelve companies have their own method of establishing prices; three of them base it upon actual cost plus a mark up of 50 per cent. Two companies sell at list plus installation cost. One company establishes the price on basis of average overhead plus special advertising cost plus the salesman's commission and cost of installation. This gives a price equivalent to an 85 per cent mark-up on invoice cost. Six of the companies are careful to quote prices to their customers in lump sums, including the charge for installation.

*11. Methods of training the retail salesmen.*
The general method of training new salesmen is by means of the experienced salesmen and the manufacturers' representatives. Many of the companies hold frequent sales meetings for the proper instruction of salesmen, and manufacturers' representatives are usually asked to address these gatherings.

*12. Advantages of newspaper cooking schools and how they can be promoted.*
In regard to newspaper cooking schools, it seems that twelve of the companies have not tried the idea. One company has found the plan unsatisfactory, three have had only moderate success and eight companies believe them to be very valuable in stimulating sales. Most of the companies using the schools agree that they should be promoted by the manufacturer, keeping the utility company more or less in the background.

## *Twenty-four Range-Selling Points (Continued)*

*13. What advertising mediums can be effectively used, and the limitations of each media?*

The opinions of the companies in the matter of effectiveness of advertising mediums differ very much. Seven companies put their faith in direct-by-mail advertising and state that newspaper advertising is of the least use to them. Fourteen companies report that the newspaper suits their purposes best and two state that direct-by-mail is unproductive compared to its cost. One company uses recipe books to very good advantage in campaigns. Some of the companies operating in rural districts are of the opinion that displays at fairs and carnivals help their sales materially. Three companies had tried billboard advertising without expected results, one report stating that the effect of billboards could not be judged in any way.

*14. How can range business be developed in small towns, many of them without stores or daily newspapers?*

Eight of the companies believe that small towns can be developed only by solicitation. Some think that a demonstration in some rented place should be given before an attempt is made before solicitation. Two companies find that cooking schools run under the auspices of some local club, or sponsored by a grange or church society, are very effective in developing small towns. One company has a model kitchen built upon a truck body which it uses in giving demonstrations in smaller towns and they find that they get a great deal of publicity and noticeable results.

*15. Methods of compensation for retail range specialists.*

Three of the companies using range specialists pay them a straight salary, four pay on the basis of commission only and eight pay both salary and commission. Those companies using the latter system of payment find that they can get better men with that method and that there is a smaller turnover for salesmen.

*16. Time payments and down payments, and limits of each.*

Only one company of those reporting sells for cash and does not use the time payment plan. The down payment required by the others ranged from $1 to 25 per cent of the retail price. The time limit was from one to two years. The most general plan was 10 per cent down and a year to pay. Many of the companies emphasized the fact that the down payment should be large enough to insure the company of the customer's interest in keeping up with his proposed payments. Most companies charge from 5 to 12 per cent extra for purchase on the time payment plan.

*17. Advisability of utilizing general salesmen or employing specialty salesmen.*

Nine of the companies use general salesmen only, five use specialty salesmen exclusively and four use both. It seems that where the utility company is operating in cities specialty salesmen are used, and in a territory of small towns general salesmen are used. Companies operating in both cities of some size and smaller towns too use specialty salesmen in the cities and general salesmen in the territory covering small towns.

*18. Value of campaigns and form which they should take.*

Not many of the companies gave opinions as to how campaigns should be conducted, although all but one thought campaigns were valuable. This one company stated that the usual campaign stimulates sales, but a slump follows the campaign that destroys all effect of the stimulation. The commercial manager of this company uses contests between districts every three months that last for a period of two months each, and finds that system much more satisfactory. Another company, although it believes campaigns valuable in stimulating sales effort, does not offer special inducements to purchasers. It found that the prospective customer would always hold off buying until the campaign period. Many of the companies give premiums during the campaign period, or allow a smaller than usual down payment. None of the companies cut prices during campaigns.

*19. The seasonal characteristics of the range business and whether ranges can be sold throughout the entire year.*

The season characteristics of selling ranges seem to depend on the climate of the territory in which the utility operates. While all companies stated that ranges could be sold throughout the year, in most cases the spring and fall seasons seem to be the best for sales. In territories where the climate is moderate through the year the Christmas season seems to be the best.

*20. The farm market and how it can be developed.*

In the case of eleven companies the farm market has not been developed and they have no plans for the future development of that territory. It is the opinion of five companies that house-to-house solicitation is the only method of development. Four companies hold demonstrations at farm center meetings and gatherings of grange societies. Three companies carry on extensive work with state experimental farms and obtain much publicity and very good results from this activity. One company endeavors to interest rural districts by getting ranges used for church suppers. The company representative is present to see that the range is used properly and to answer questions. He allows the women of the church do all the cooking. A power company whose customers in rural districts nearly all use electric pumps sells the farmers transformers so that the customer can use power for household use at the power rate. This promotes range sales especially, the company finds.

*21. The effective forms of appeal to be used in advertising in the order of their relative importance.*

The most effective appeal used in advertising seems to be "convenience." Cleanliness, economy and dependability of operation are almost as important. Pride of ownership, modernity and safety are of only average importance. In the South the most effective appeal is the lack of heat radiating from the stove, which enables the housewife to cook in comfort during the hot part of the day.

*22. Store demonstrations—their value and how conducted.*

Eleven companies find store demonstrations valuable and three find them of no use. Four companies use store demonstrations once in a while, but their experience shows that a demonstration in a hall or theater is of much more value because of the fact that people are more apt to be open-minded and are more easily approached away from their store. Those companies that think the store demonstration valuable agree on the fact that it is best if food is actually cooked and served to those attending the demonstration. They also agree that the demonstration should be conducted by some one who is very well experienced in the operation of electric ranges.

*23. The value of demonstration in the home after the sale has been made.*

All of the companies agree to the value of a demonstration after the installation, some stating that it is the most important part of the sale. It is reported by some that it not only insures satisfaction to the customer but also enables the company's salesman to secure prospects from among the user's friends.

*24. Promotional work with architects.*

From the reports it would seem that not much has been done in promotional work with architects. A few companies, however, have understandings with local architects who draw plans for apartment houses. One company suggests that the best way to promote architects is to sell them electric ranges for their own use. The companies on the Pacific Coast believe that the Red Seal idea has materially helped their electric range sales.

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customers at least be given a fair opportunity to use an electric range?

In the matter of selling electric ranges on rural lines eleven of the 24 companies apparently have not and do not contemplate the sale of electric ranges to their farm customers. It would seem that nearly half of the 24 companies are overlooking one of the best possibilities for giving the farmer the full advantage of electric service and at the same time boosting the energy consumption to a point profitable to the utility and advantageous to the customer. Furthermore, many companies are not taking full advantage of possible support from domestic science schools, the women's committee of the N.E.L.A. and the benefits of cooking schools.

A hopeful indication is seen in the attitude toward overworking the campaign method of selling. A number of companies have found that the reactionary slump following the stimulation of a campaign just about offsets any benefits derived and there is therefore a tendency toward continuous selling. Some advantage may be taken of seasonal characteristics, with special stress during the spring and fall.

# Taxes About 9.6 per Cent of Revenue

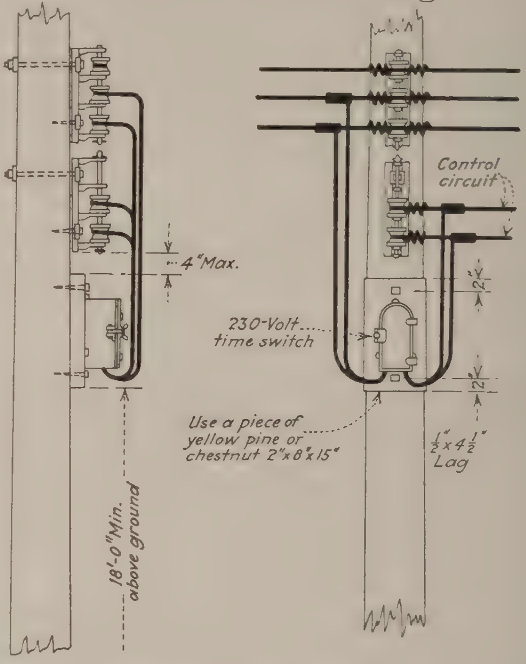
THE very considerable extent to which electric light and power companies have been utilized for the task of helping to collect national, state and local taxes is evident from a review of the operating revenue, operating expenses and taxes in those states for which the necessary data are obtainable from official sources.

The preparation of the accompanying table has been made possible primarily through the courtesy of public utility commissions, supplemented by data from published commission reports. An effort was made to cover every state in the Union in this survey, but owing to the lack of jurisdiction of commissions in some of the states the securing of complete data was impossible. However, the figures here presented account for about 64 per cent of the operating revenue of the industry during the year in question, 1926, and in view of the circumstances that municipally operated utilities are in most instances omitted the percentage of commercial companies is, in fact, somewhat greater. The omission of municipal systems, which usually pay either no taxes at all or a smaller percentage on their operations, makes the ratios deduced fairly representative of the situation for the commercial companies.

As might be expected, there is quite a wide variation between the states, but certain general conclusions may readily be drawn. Nearly 10 cents out of every dollar paid for electric service goes for taxes. For the states tabulated taxes consumed 9.6 per cent of the operating revenue. Assuming that the same ratio holds for the missing states, it follows that the industry paid, in 1926, about $160,000,000 in taxes. If the figures for Kansas are not added in, on the supposition that the inclusion of one-town companies in that state might affect the ratios, the total revenue for the remaining states becomes $1,026,163,248; operating expenses are $543,515,355; taxes, $99,303,840. The ratio of taxes to revenue then rises slightly, becoming 9.7 per cent.

Another striking feature is the relatively low revenue in proportion to valuation. Data on assessed valuation were not in all cases obtainable. In some a related figure, such as capital investment, could be secured. Here again the ratios vary among the states, but, taking all the figures in the valuation column together, regardless of the difference in basis, the average for the eleven states reporting on that item is $4.32 per dollar of revenue. The totals are: Valuation, $1,725,596,730; revenue, $399,780,862. The estimated total capitalization of the electric light and power industry in the United States corresponds to $5.40 per revenue dollar. The two ratios are in reasonable agreement, since assessed valuations are almost of necessity well below the actual cost of the property in question.

# Time Switch Mounting



*Standards of West Penn System*

*Electric Light and Power Industry Financial Data, by States, 1926*

| State | Assessed Valuation | Operating Revenue | Operating Expenses | Taxes | Ratio of Taxes to Revenue, Per Cent | Remarks |
|---|---|---|---|---|---|---|
| Alabama | $151,987,815 | $20,575,780 | $9,436,566 | $1,373,917 | 6.7 | Municipals not included |
| California | *765,399,676 | 101,176,751 | 45,223,807 | 11,069,036 | 10.9 | *Capital investment. |
| Connecticut | Not available | 28,993,722 | 16,546,145 | 2,274,207 | 7.8 | .... |
| District of Columbia | *36,139,724 | 7,931,095 | 3,491,790 | 928,839 | 11.7 | Private companies. *Value upon which rate of return is computed |
| Idaho | 20,257,963 | 4,949,090 | 2,027,237 | 520,932 | 10.5 | Municipals not included |
| Illinois | Not available | 129,927,875 | 72,688,964 | 11,203,339 | 8.7 | .... |
| Indiana | Not available | 45,444,558 | 24,559,359 | 3,243,569 | 7.1 | .... |
| Kansas | 42,467,000 | 25,614,987 | 14,403,015 | 1,271,794 | 5.0 | Includes no municipals nor private companies serving only one city or town |
| Maine | Not available | 9,871,865 | 4,428,972 | 749,947 | 7.6 | .... |
| Maryland | Not available | 29,250,953 | 13,846,636 | *2,493,156 | 8.5 | *Includes $36,546 applicable to gas and electric property which is not segregated |
| Massachusetts | *182,507,185 | 77,734,689 | 42,089,916 | *9,597,691 | 12.3 | *Municipals not included |
| Michigan | Not available | *74,213,571 | 40,543,795 | 7,157,181 | 9.7 | *Includes $17,894 revenue of the Champion Copper Company with no expenses given |
| Nevada | 3,493,045 | 1,819,912 | 1,285,423 | 191,146 | 10.5 | Municipals not included |
| New Jersey | Not available | 60,216,183 | 32,896,012 | 6,264,146 | 10.4 | Non-municipal |
|  |  | 1,005,372 | 634,652 | .... | .... | Municipal |
| New York, up-state | Not available | 106,181,211 | 55,795,500 | 9,833,716 | *9.5 | *State average |
| New York City | Not available | 131,021,348 | 76,150,127 | 12,639,873 | .... | .... |
| Ohio | *429,065,046 | 106,736,095 | 56,895,953 | 10,980,296 | 10.3 | Municipals not included. *Capital investment |
| Oklahoma | 24,472,569 | 15,028,015 | 7,440,568 | 1,085,676 | 7.2 | Municipals not included |
| South Carolina | Not available | 12,574,776 | 6,972,749 | *1,700,298 | 13.5 | *Approximate figures |
| Utah | Not available | 10,277,549 | 3,666,841 | 1,351,179 | 13.1 | Municipals not included |
| Vermont | Not available | 13,018,390 | 6,459,678 | 1,041,359 | 8.0 | Does not include Brownsville Electric Light Company |
| Virginia | 18,554,857 | 16,400,241 | 9,040,355 | 1,498,559 | 9.2 | .... |
| West Virginia | 51,251,850 | 21,814,207 | 11,394,310 | 2,105,778 | 9.6 | Municipals not included |
| Totals |  | 1,051,778,235 | 557,918,368 | 100,575,634 | 9.6 |  |

# Draining High Voltages *from Lines*

New device uses resistance column of electrolyte inclosed in composition tubes. Construction and operation

By CHARLES E. BENNETT
*General Engineer Georgia Power Company*

*Drainage devices installed on a 22-kv. line using disk gaps and pipe frame support*

THE question of lightning protection is one of great interest at the present time and much of a very technical nature has been written recently on this subject. There are, as a general rule, only four typical layouts of construction to be protected. In Fig. 1 *A* it is assumed that the line is highly insulated as compared with the terminal steel structure of the substation or generating station, but Fig. 1 *B* is one in which the line conductors are supported on steel towers or poles and where the substation is insulated much better than the line. In Figs. 1 *A* and *B* it is assumed that the substation or power house is at the end of the line. Fig. 1 *C* indicates a well-insulated line of wood pole construction and, connected to it, a lower insulated steel substation in the middle of the line or a part of it. Fig. 1 *D* shows a steel tower line with the substation of higher insulation than the line. In Figs. 1 *C* and *D* the stations are located in the center or a part of the line and in which a line extends beyond them. In Fig. 1 *A* it is apparent that the arrester should be located close to the steel structure so as to protect the weak link of the combination and its valuable equipment. In Fig. 1 *B* the opposite is necessary, for the reason that the insulation of the line is of lower flashover value than that of the substation, and as a result protection to the line is apparently essential. In this case the high induced potential will not travel far on the line as the substations are materially better insulated than the line and it will flash over and relieve the stress before damage is done to substation equipment. Each insulator support can therefore act as a safety valve. In Fig. 1 *C* it is necessary to locate arresters or drains on each side of the substation equipment in order to have full protection. In Fig. 1 *D*, if the line is to be protected from flashovers, the ideal layout would be to distribute arresters along the line.

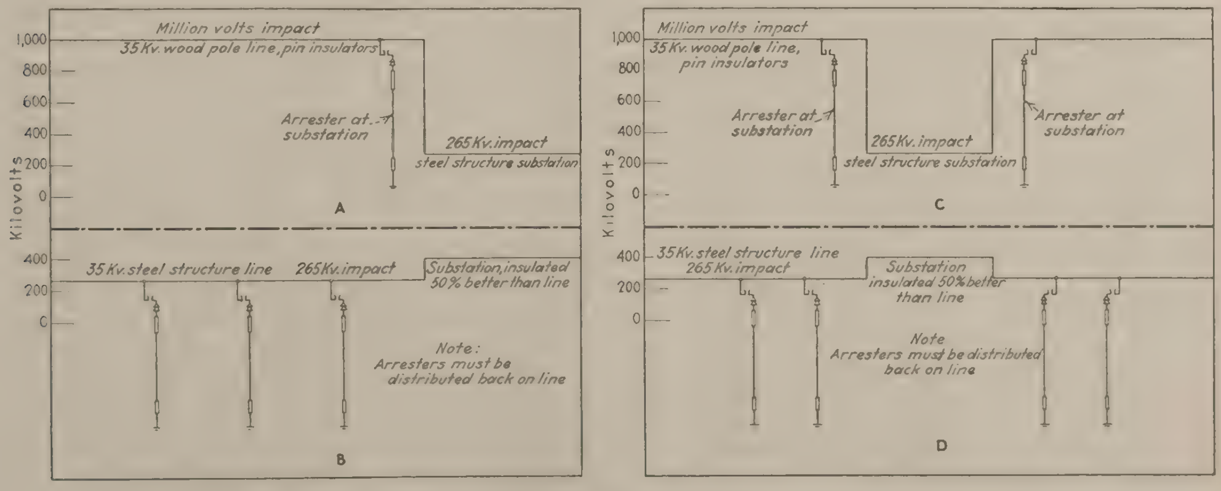

Million volts impact
35 Kv. wood pole line, pin insulators
Arrester at substation
265 Kv. impact
steel structure substation
A
Kilovolts
1,000
800
600
400
200
0
35 Kv. steel structure line
265 Kv. impact
Substation, insulated 50% better than line
Note: Arresters must be distributed back on line
B
Million volts impact
35 Kv. wood pole line, pin insulators
Arrester at substation
265 Kv. impact
steel structure substation
Arrester at substation
C
35 Kv. steel structure line
265 Kv. impact
Substation insulated 50% better than line
Note
Arresters must be distributed back on line
D

*Fig. 1—Typical line and system layouts*

A—Line highly insulated relative to terminal steel structure.
B—Terminal structure highly insulated relative to line.
C—Wood-pole line with steel terminal structure.
D—Steel tower line with highly insulated terminal structure.

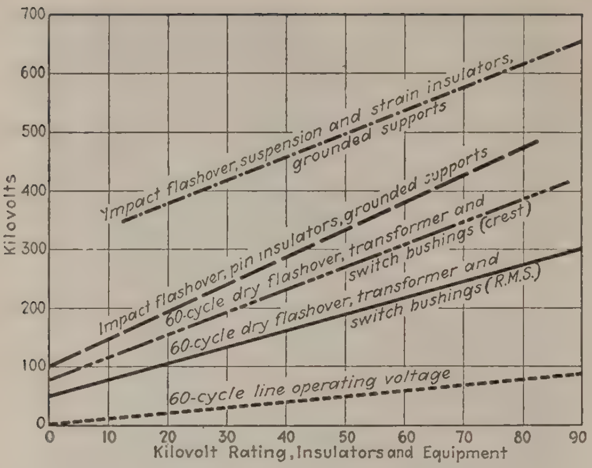
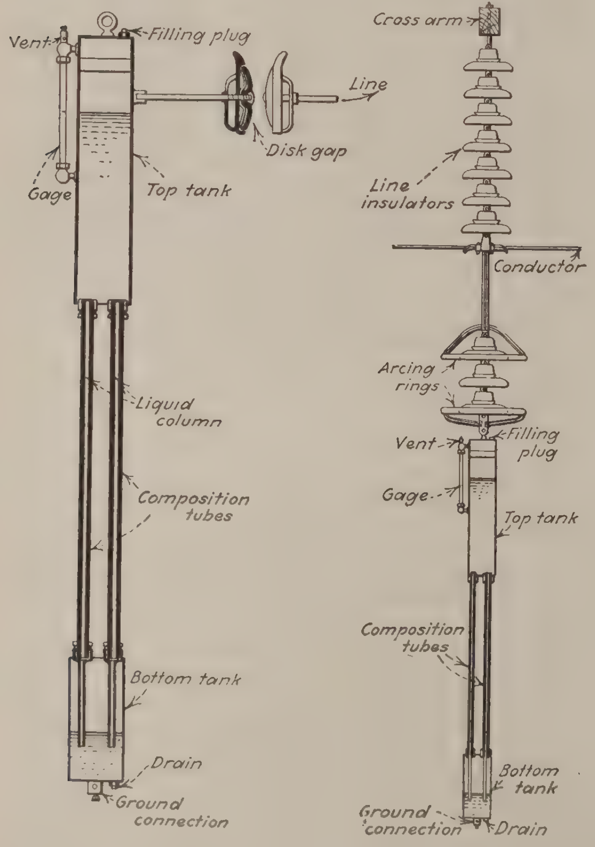


*Fig. 2—Relative values for impact flashovers on lines of 15 kv. to 85 kv.*

In Figs. 1 *A* and *C* the dead end stations are subjected to more severe conditions than *B* and *D*, as the voltage may rise to double the incoming potential when the transformer acts first as a condenser and later as an inductance.

In simple words, the problem is this: The incoming lightning voltage must be reduced from the impact flashover value of the line to a potential below the flashover of the equipment to be protected.



*Figs. 3 and 4—Details of construction of station type drain device for line protection and installation of line type drain device on a line*

As in Figs. 1 *B* and *D*, distributed drains along the line may prevent frequent flashovers, so detrimental to good operation. The impulse flashover value of the insulation on the line is known and the insulation value of the transformers, the bushings and station equipment is also known. The problem now is to drain the potential from the station if the line insulation is higher than that of the station and to drain the lines if the station equipment is of higher insulation than the line. In the first case it is much easier to protect the station than it is to attempt to protect the line. This applies solely to induced potentials and not direct strokes, as experience has been that it is not economical to protect against a direct lightning stroke.

### Principle of New Protector

A new type of drain has been developed for the purpose of freeing the lines from impulse and high-frequency potentials that are above the normal transmission voltage and frequency. This device has many interesting features, both in its construction and operation. It consists essentially of a high-speed gap and liquid current-limiting resistance columns in series with the gap. The gap is a compensated impulse gap and was described in an article appearing in the Electrical World, May 27, 1922, and subsequently explained again in a paper before the American Institute of Electrical Engineers at the spring convention, April 7, 1924. The gap has the unusual characteristic of having the same arc-over value when wet as when dry, and has a somewhat lower arc-over value under impulse or steep wave-front potentials than for normal line frequency. The gap does not require housing or protection from the weather, since weather conditions do not affect its rating.

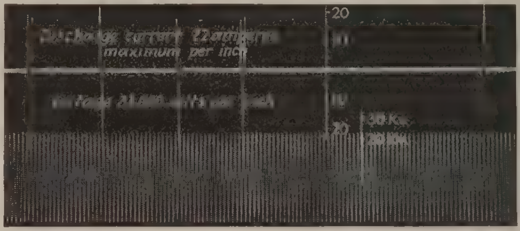


*Fig. 5—Oscillogram showing five discharges on the drain device*

The liquid resistance columns of this arrester act as high-speed current interrupters and function to limit the 60-cycle current that usually follows the high potential discharge over the compensated gap which is connected ahead of the arrester. These liquid columns are connected to tanks at the top and bottom. The tanks contain a solution of calcium chloride which does not freeze above 50 deg. F. below zero. The upper tank has a suitable gage to indicate the amount of liquid in the container and has suitable baffles above it to prevent the liquid escaping when the arrester functions. It is also vented at the top to allow any pressure that might be generated to escape. Connected to the bottom of this tank are two specially constructed composition hose which make the resistance columns and which are not affected by the calcium chloride solution nor by electrochemical action. While two hose sections are usually used, any number of them can be used in multiple, as they function simultaneously while the apparatus is in operation.

The hose for the columns is $\frac{7}{32}$ in. inside diameter and has a wall about $\frac{3}{4}$ in. thick. The lower ends of the hose are connected to the bottom tank, which forms the ground terminal of the device. The lower tank has in it a small air chamber, as shown in the cross-section view, to act as an air cushion and to aid the rapid operation of the device.

The operation of this apparatus in relieving the lines of high potentials is as follows: The impulse potential breaks down the gap and energy flows through the top metallic tank into the reservoir containing the highly conducting liquid and through the hose filled with the electrolyte to the bottom tank, which is, in turn, connected to the ground. If the 60-cycle dynamic current follows over the gap as it usually does, it is cut off by the interrupter action in the hose column. The interruption takes place because a small portion of the electrolyte is changed to vapor very rapidly and this results in a path of high resistance with unstable liquid electrodes on both sides of the vapor. This condition has a very definite and quick interrupting action on the dynamic current. Oscillograph records show that approximately one to two cycles are required to quench the arc at the gap. An oscillograph record of the action is shown in Fig. 5. If a surge is of very large energy content the worst that can happen is the bursting of a hose because of the quickly generated vapor and its resulting pressure effect. For surges of low energy content the resistance column acts as a slow drain for the excess potential.

*Drainage devices of line type installed at 110-kv. terminal station using suspension ring gaps*

Another interesting feature of this arrester is its rapid change in impedance under different voltages, as indicated in Fig. 6. This also shows the relative discharge current under different voltages and impedances. For example, if an impulse voltage of 60 kv. be applied to the arrester terminals the surge impedance of the arrester will be about 430 ohms and the surge current flowing through the arrester will be about 140 amp. Should the impulse voltage be 120 kv. the surge impedance of the arrester becomes about 270 ohms and the surge current through the arrester will be about 445 amp.

Some of the advantages of this type of protective device are as follows:

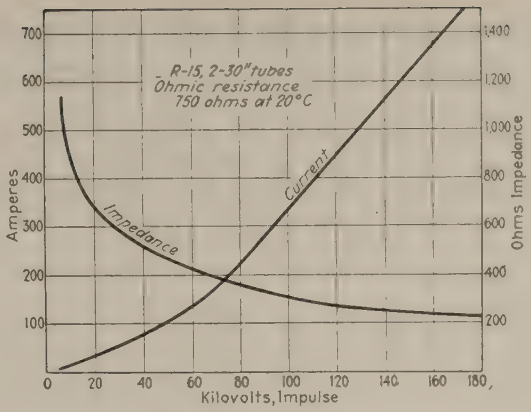


*Fig. 6—The impedance of the electrolyte decreases as the voltage increases*

1. Due to its rather high 60-cycle resistance, the gap is set for only 10 per cent above line voltage, as frequent spillovers are not detrimental to the device. This means less energy to every high potential discharge as the drain acts at low values of surge voltage and tends to prevent an accumulation of charge.
2. The current discharge increases with increase of voltage and does not follow Ohm's law because of the change in impedance of the electrolyte.
3. The surge energy is better dissipated from a system by distributed resistances and, due to low cost, this device is economical to use at short intervals along a line.
4. Any surge impedance to ground that may be desired is possible by adding additional tubes to the resistance column.
5. It cannot be an operating hazard because a broken tube simply opens up the ground connection.
6. It can be tested at any time by short circuiting the gap with an insulated stick.

### General Features of Application

Two general types of this arrester have been developed, the station type and the line type. Assuming a potential gradient of 50 kv. per foot for a line, we have approximately 1,500,000 volts on a line 30 ft. high and

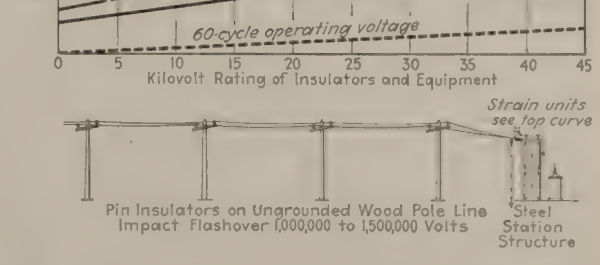


*Fig. 7—Wood-pole line with drainage device installed to protect substation equipment*

steel lines with low insulation will flash over insulators at this value, resulting in bad operation. The line type is designed for installation along the line at intervals justified by the cost of remedying this condition when the several factors involved are considered.

On highly insulated lines, where tapered insulation near the receiving or sending end is desirable, these drains may be used on the approaching two or three tower supports where flat spacing is possible, giving ideal protection to the station and with no operating hazard.

Fig. 7 shows a typical wood-pole line construction with conductors more than 30 ft. above the ground. The impact charge on such a line will reach 1,500,000 volts, providing no weak link in the insulation is present to prevent such a rise. If no arrester equipment is present the weak link for limiting this potential will probably be the dead end strain unit at the substation frame, and this will probably flash over under the circumstances. In this case the device should be connected to the line just ahead of the substation frame in order that full protection be given to the substation by limiting the impact potential to a value below the flashover on all insulators and equipment in the station.

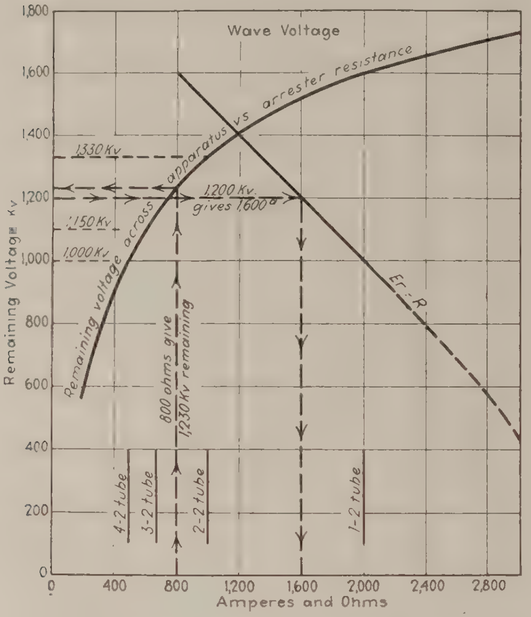


*Fig. 8—Relative effect of multiple electrolyte columns on surge potentials*

It is not necessary to set the gaps widely apart when installed at a generating station where line operating voltages may rise to 150 per cent more due to loss of load or other conditions, as such a rise would only continually discharge the arrester until the governors operated, without harm to the arrester.

The value of low gap settings (10 to 20 per cent above line voltage) cannot be underestimated, as waves with low crest potentials may pass considerable energy by an arrester of wide gap setting before it operates and reach the transformer bushings, having time to charge up the various capacities to ground and causing double potential at transformer terminals.

The much-discussed subject of discharge rate is definitely settled in this new type of drain as its surge impedance values can be lowered by the use of as many multiple tubes in each ground leg as may be desired or required for this purpose.

Fig. 8 shows the relative values for different multiples in reducing a 2,000-kv. wave of two microseconds. For example, if one tube is connected to the line the surge voltage will be reduced to 1,600 kv. and if four tubes were connected in parallel across the line the voltage would be reduced to 1,000 kv.

Where the reduction in voltage for lower insulated lines is necessary the shorter tubes have lower surge impedance and therefore less resistance and more shunting effect. It is well known that the dissipation of transients through resistance in the form of heat is the ideal way of reducing the potentials of harmful surges, and this is accomplished by this device.

## Lighting Rural Highways

LIGHTING of rural highways is a rapidly growing development in the vicinity of Milwaukee. Within the last eighteen months governmental units have arranged with the Milwaukee Electric Railway & Light Company for installation and maintenance of highway lights. Last year Milwaukee County contracted for illumination of prominent highway intersections.

The most significant step, however, has most recently been taken by the town of Lake, a partly suburban and partly rural township adjoining the city of Milwaukee to the south. This township has decided to illuminate every street corner, highway intersection and railroad crossing within its confines. In addition, it will light its main country highways with lamps every quarter mile. The program will make this the most brightly lighted township in Wisconsin. Three hundred and seven lamps are to be installed with a combined brilliance of 124,600 cp.

The illumination program results from the recent action of the town electors in approving establishment of a $200,000 fund to provide "a complete and modern highway lighting system." The fund is expected to finance the cost of such lighting for twenty years. Preliminary work on the new lighting system is already under way and actual installation will be started within a month. The lamps are to be of the incandescent type and arranged in size according to the need of the place to be lighted. Plans call for 81 lamps of 600 cp. each, 130 of 400 cp. and 96 of 25 cp.

## The New 10-Watt Lamp and Central-Station Revenue

By M. Luckiesh
*Director Lighting Research Laboratory, National Lamp Works, Nela Park, Cleveland, Ohio*

IN RESIDENCES the opportunities for using the new 10-watt small-bulb, intermediate screw-base tungsten lamps are largely in the decorative field. However, it has some purely utilitarian uses, such as in night lights, in illuminated house numbers and certain other lighting equipment, in which it is particularly suitable owing to its small physical dimensions. When employed for such purposes the lamps may easily be used about 1,000 hours a year.

Under this condition the 10-watt tungsten lamp competes very favorably with the common household appliances as a revenue producer for central stations. From data which we have available we have determined the number of these 10-watt lamps which should produce as much revenue per year as various electrical appliances. If only "average sockets" are assumed the number of lamps must be trebled.

| No. of 10-Watt Tungsten Lamps | Kw.-Hr. Equivalent |
|---|---|
| 2 | 1 clothes washer |
| 3½ | 1 grill |
| 4 | 1 toaster |
| 7 | 1 iron |
| 4 | 1 percolator |
| 2½ | 1 cleaner |
| 3 | 1 fan |

This apparently insignificant 10-watt lamp opens a new field and it is interesting to note that two of them in "active sockets" in each wired home in this country would increase the central-station revenue as much as the completion of the present iron or washer field to a saturation point.

## Refunding Customers' Deposits

By J. W. Williams

*Director of Public Relations*
*Binghamton Light, Heat & Power Company*

GREATER public confidence and good will have been established by adopting the policy of refunding customers' deposits. This policy was started about a year ago. First, all deposits made previous to 1923 were refunded with 6 per cent interest to all customers who had established their credit by paying bills promptly for the past fourteen months. After this series was refunded, deposits made in 1924 and 1925 were refunded on the same basis. For the present we are continuing to refund deposits on a two-year basis.

The deposits were refunded in geographical order to prevent any run on the local office with inquiries as to why certain customers did not receive a refund while others did so.

A letter is inclosed with the deposit check which has an appended form of deposit release attached, in case the customer has lost the original receipt which was issued when deposit was made. More than $13,000 has been refunded during the past year and more than $3,600 paid in interest. In spite of these refunds the deposits have been reduced only $4,700 over deposits carried a year ago.

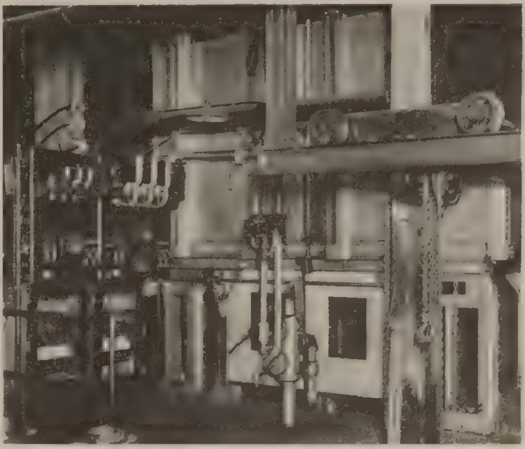
Hundreds of letters have been received commending our policy in refunding these deposits. All express the same sentiment as the few excerpts quoted:

> Thank you for fine service and fair dealings to the rural folks in Willett.
>
> I never did just understand what this deposit was for and had always assumed that it was a forfeit for taking on the light and power. I see now, however, that I was mistaken and apologize for the inadvertent omission of the perspective that should prevail when an individual is permitted by a corporation to do business with an honorable company.
>
> I have made a research in the archives—I don't locate the receipt. If the inclosed receipt is not satisfactory I will refund the six dollars and twenty cents.
>
> I am inclosing receipt for my deposit which you have returned to me.
>
> I cannot pass up the opportunity to congratulate the management of your company on its wisdom in doing things like this, which break down the impersonal attitude that has always been one of the main causes of misunderstanding between public service corporations and the people whom they serve.

In addition to these favorable comments a study of conditions reveals that customers who were in the habit of paying their bills every two or three months are endeavoring to pay bills monthly in order to establish their credit so deposit may be refunded.

## Century Electrically Anneals Lamination Sheets

SOME manufacturers using electric sheet steel for laminations find that they must pay close attention to the kind of steel used and the method of processing after receipt, otherwise the magnetic losses may be more than they should. To secure more accurate and uniform heat treating of the electrical sheets used in the construction of its products the Century Electric Company has recently installed in its plant in St. Louis an elevator-type electric furnace for annealing lamination iron. This furnace was supplied by the Gas Equipment Engineering Corporation. The material cars are moved to and from the furnace by standard squirrel-cage motors. The load is hoisted into the furnace or removed by a hydraulic elevator.



*Elevator-type electric annealing furnace with control panel at left*

While one load of steel is being treated, the next load is prepared so there is little delay between heat cycles. This relatively continuous operation enables the furnace to work at a high efficiency and without the deterioration which comes from alternate heating and cooling when less rapid operation is employed.

The load of hot sheets when removed from the furnace is pushed to the end opposite the loading end and covered with a hood for the purpose of controlling the oxidation of the metal while cooling. Approximately eight hours is required to heat a charge and about six hours for cooling. The two hours' difference between the heating and cooling time is sufficient to carry on loading and unloading with two cars. The furnace will accommodate the car and approximately 6 tons of steel, giving it a capacity of 18 tons daily.

The heating elements are divided into two 75-kw. sections. When the furnace is first loaded the two heating units are operated in parallel until the iron reaches the proper annealing temperature. From that time on the temperature is maintained and radiation losses are offset by one heat element alone. Heat control is entirely automatic, being handled through thermocouple pilots and automatic control panels.

Since the furnace has been in operation it has been found to have four definite advantages over other methods of annealing electrical sheets: (1) Reduced iron losses; (2) increased permeability; (3) less oxidation losses; (4) decreased cost of annealing.

## Financing Street Lighting

"IT IS desirable for central stations to provide two plans for financing street-lighting installations," said L. A. S. Wood at the recent convention of the Missouri Association of Public Utilities, "one for lighting units with overhead construction and the other for lighting units with underground construction. For overhead construction with suspension units a flat rate should be established which would include, besides the operating and maintenance costs, the interest and depreciation on the equipment and its installation. Owing to the comparatively small initial cost of suspension units and overhead construction," said Mr. Wood, "this plan does not impose any undue burden on the annual rate and the fixed charges are reasonably small.

"For underground construction with ornamental units experience has shown that this class of service can best be developed with a flat rate which includes operating and maintenance expenses only, with no provision for interest and depreciation on the equipment which would be installed and financed by the municipality." Mr. Wood recognized a considerable difference of opinion among operating men in regard to the latter plan, but stated that it is quite evident that since the municipality pays its bills out of annual appropriations for street-lighting maintenance the city will have more money available for the purchase of street-lighting service if the street-lighting rate is relieved of the burden of the fixed charges incident to expensive underground construction. In some cases the fixed charges were estimated to amount to as much as 60 per cent of the total rate. Mr. Wood also suggested that when a municipality pays for the installation it is financed by a bond issue, assessment of abutting property owners, public subscription or by some other means, but never out of the annual maintenance budget for street lighting.

*Customer-Owner Growth in California, Utah and Arizona*

| Company | —Customer Owners— 1918 | 1922 | 1927 | Approx. Value of Securities, 1927 |
|---|---|---|---|---|
| Southern California Edison Co. | 3,300 | 43,000 | 102,000 | $130,000,000 |
| Pacific Gas & Electric Co. | *4,670 | 18,076 | 39,374 | 92,353,000 |
| Utah Power & Light Co. | ..... | 2,422 | 10,242 | 13,992,000 |
| San Joaquin Light & Power Corp. | ..... | *5,417 | *5,938 | 4,193,000 |
| Los Angeles Gas & Electric Corp. | ..... | 3,102 | 4,765 | 9,814,000 |
| Great Western Power Co. | ..... | ...... | *4,270 | 3,500,000 |
| Central Arizona Light & Power Co. | ..... | 228 | 665 | 470,000 |
| Totals | 7,970 | 72,245 | 167,254 | $254,322,000 |

*Approximate.

## Fundamental Economics of Rural Service Declared

AN ECONOMIC platform for rural service development was recently prepared for the New England Council by the co-operating committee on farm power, headed by Samuel Ferguson, president of the Hartford Electric Light Company, other public utility representatives being F. A. Belden of the Edison Electric Illuminating Company of Boston and J. W. Leland, agent for rural lines Central Maine Power Company, Augusta, Me. Discussion has been invited by the committee from members of the council. The platform follows:

1. It is not economically sound that the rural user should be permanently served at a loss with consequent burden to other customers, nor does the rural customer desire such a subsidy.

This involves one of two alternatives—either the rural customer shall use a sufficient excess of current over the average use to carry the excess line costs or he should pay the fixed charges on the excess of line costs which his service requires.

2. It is not essential that the rural customer should pay his full cost from the start provided his business can be built up to self-sustaining proportions within a reasonable period.

This means, just as in the case of the development of any new business, the existing customers bear the cost of the development period with the expectation of ultimate benefit to themselves.

3. To develop the business to self-sustaining proportions, it is essential that a low price be offered for use of current in excess of the average used by the urban customer, otherwise the cost of liberal use is prohibitively high.

This makes essential the use of a two-part rate having a low energy charge.

4. It is preferable that the customer should not pay any part of the cost of the line extension because his available funds should be conserved for the purchase of electrically operated labor saving machinery. If customers furnish poles and labor, same should be paid for and cost charged to the line.

5. The customer who intends to use liberally should be allowed a resonable time in which to build up his use of current without being burdened at the start with payments as large as a reasonable guarantee would require.

This can be readily accomplished by a graduated guarantee rising from nothing to a self-sustaining figure over a period of five years.

## Letters from Our Readers

### *Resents Indictment of Lower Quality*

*To the Editor of the* ELECTRICAL WORLD:

On page 1019 of the May 19 issue of the ELECTRICAL WORLD there appears a communication entitled "Price Squeezing and Impairing Quality," and as a manufacturer of high-tension equipment we are obliged to take issue with this statement. Price and profits are low, but a charge or even an intimation that all manufacturers are lowering their quality is untrue and we will not submit to such an indictment.

In this highly competitive era the only way to meet conditions is to improve a product steadily and at the same time, by means of improved methods, reduce its manufactuing cost. The manufacturer who is not doing this today is a horse and buggy traveler on a high-speed highway and bound to trail behind. The manufacturer who blindly tries to produce equipment under the same conditions his "Uncle Ezra" did ten years ago, in the days of long profits, is pretty close to the border line of industrial sensibility.

As for us, full steam ahead with better and better equipment.

H. W. YOUNG,
President.

Delta-Star Electric Company,
Chicago, Ill.

# Digest of Electrical Literature

## *Transmission, Substations and Distribution*

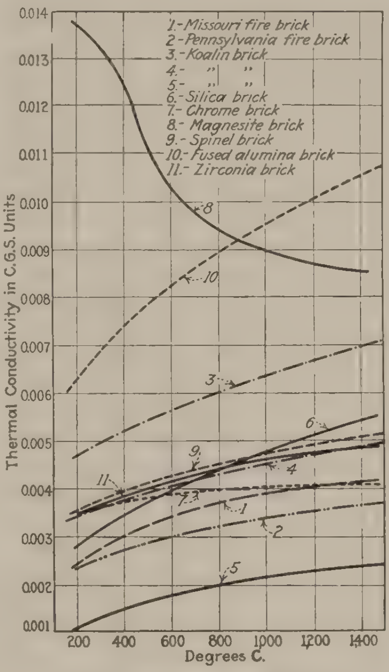
*A.-C. Substation Design Practice—1927.*—The principal features of alternating-current substation practice among the member companies of the N.E.L.A. as evidenced by stations designed or constructed in the period following the release of a similar report for 1925 are covered in this discussion. The subject has been divided into three sections: Attended transmission, attended distribution and full automatic substations. Simplified plans, cross-sections, one-line diagrams, use of electrical equipment and devices and tabulations of substation details are included. Among the indicated tendencies are: An increasing use of automatic substations; segregation of equipment operating at lower voltages; the use of three-phase, four-wire, 4-kv. circuits for distribution involving several varying practices for switching and operating work; appreciation of the reliability and operating advantages of self-cooled transformers, and a definite tendency toward outdoor substation design. —*Serial Report National Electric Light Association*, April, 1928.

*Design Theory of the Transformer.*—M. Vidmar.—The author claims that all known theories of transformer design suffer under the inaccuracy involved in determining exactly the fill-factors of iron cores and windings. To eliminate these, a new method is presented in this paper, in which iron and copper are introduced by weight only. To obtain the most economic design certain definite ratios must be maintained between dimensions, losses and costs. These ratios are mathematically derived in a logical manner and lead to the final conclusion that the expenditures for active materials in a transformer become a minimum when the cost of the iron core is as much higher than the cost of the winding as the losses in the copper are greater than the iron losses.—*Elektrotechnik und Maschinenbau*, April 15, 1928.

## *Hydro-Electric Development and Steam Equipment*

*Fluid Governors for Prime Movers.*—Henry F. Schmidt. — The pressure-volume characteristics of the three well-known types of centrifugal pump runners offer the basis for this discussion of fluid governors. This article, which is one of a series, offers a consideration of the effect of temperature and atmospheric pressure; methods of compensating for physical characteristics of media; method of supplying fluid to the pumps, and similar factors of significance in such work. It is stated that for ideal conditions the governing device itself should be mounted on and be a part of the main turbine shaft without the intervention of gears, links or moving parts. No sliding parts between the governor and the valve-operating mechanism should be included; the connection between the rotating and stationary parts should be through the oil pumped by the impeller.—*Electric Journal*, May, 1928.

*Properties of Refractories and Their Relation to Conditions in Service.*—Stuart M. Phelps.—An analysis of the physical properties of various refractory materials and their service characteristics has been prepared by the author. The results of a number of investigations have been compiled and tabulated with particular reference to strength, resistance to destruction and confinement of heat properties. The resistance to destruction has been classified to include abrasion, slagging, spalling and melting of the material.—*Transactions of the American Society of Mechanical Engineers*, January-April, 1928.



*Relative thermal conductivity of refractory materials*

*Peak-Load Equalization in Power Plants by Ruths Steam Accumulators.*—J. Tobolla.—The influence of fluctuating loads upon the economy of steam and water-power systems is discussed with special emphasis on the question of amortization and interest charges. The author has directed particular attention to the economic value of the steam accumulators of both the variable pressure and constant pressure type.—*Journal of the Institute of Electrical Engineers of Japan*, April, 1928.

## *Units, Measurements and Instruments*

*Electro-Dynamometer with Nearly Uniform Scale.*—D. I. Bubert.—Electro-dynamic voltmeters or ammeters have a stationary and a moving coil. Passing the measured current through these two will cause attraction, which is proportional to the product of current times field density, or the torque in any one point is proportional to the square of the measured current. The scale of such instruments will therefore be a quadratic division. By winding the stator coils in a peculiar, irregular moon-shaped cross-section, embracing completely the path of motion of the rotor coil, the author succeeded in so distributing the stationary field as to make the torque almost directly proportional to the passing current. The new instrument has 172.5 amp. turns on the stator and 15 amp. turns on the rotor coil. The 150 voltmeter consumes 0.9 watts. Neglecting the difference of one-tenth per thousand, the calibration is the same for alternating current or direct current. —*Elektrotechnik und Maschinenbau.*—April 22, 1928.

*Oscillating Meters.* — D. Broido. — Direct-current watt-hour meters, based upon the oscillating principle, were among the first to achieve practical use. Their great simplicity and approximately nine times longer life prompted designers in recent years to improve and to modernize them, with the result that a new line of oscillating meters is now available, exceeding in accuracy the established motor type meters. While this new model can be made to operate either across a shunt or directly in the line, it is the latter application where the new meter excels. Models for up to 10,000 amp. are available, which can be mounted directly upon the busbars, with no interruption of the bar. A 5,000-amp. meter starts at 30 amp. and has an inaccuracy of less than plus ½ per cent. Simplicity of mounting, no watt loss in a shunt, practically no temperature correction, readily possible recalibration and a maximum of measuring accuracy are the chief advantages of this new type.—*Elektrotechnische Zeitschrift*, April 19, 1928.

## *Illumination*

*Four Fundamental Factors in Vision.*—Percy W. Cobb and Frank K. Moss.—An experimental analysis of the quantitative interrelation of four characteristic variables of the visual object at the border of visibility, with a discussion of the applicability of the results in lighting practice which aims at clear vision. The four fundamental variables in a visual object as developed by the authors in this discussion are the size of its critical detail, conveniently expressed as minutes visual angle subtended at the eye by the detail; the contrast between the object and its background, which may be defined as the ratio of the brightness-difference to the brightness of the background and for simplicity designated as per cent contrast; the brightness-level to which the object is illuminated, and the time during which the image of the object is allowed to rest upon the retina of the eye.—*Transactions of the Illuminating Engineering Society,* May, 1928.

*The Manufacture and Properties of Glass and their Application to Illuminating Engineering.*—S. ENGLISH.—The various properties of glass as related to its lighting application have been considered by the author with particular reference to the factors of transparency and color, diffusion qualities, opalescence and frosted coating.—*Journal of Good Lighting (England),* May, 1928.

## *Motors and Control*

*Synchronized Asynchronous Motor.*—J. L. MONNIER.—A French steel manufacturer has installed a 2,000-hp. synchronized induction motor for the direct drive of a six-pass blooming mill. The machine has a normal speed of 167 r.p.m. and is directly connected to a 600-amp., 60-volt direct-current exciter. Overloads of up to 4,000 hp., such as may occur during the rolling process, can be readily delivered without the danger of falling out of step. Considering only the mechanical output of the motor, an efficiency of 92.8 per cent can be reached. But since the motor can furnish simultaneously up to 1,200 kva. reactive power, correcting the phase displacement caused by other motors in the mill, an electric efficiency of 94.7 per cent has been recorded. Characteristic curves and vector diagrams are given to explain the exact operation of this motor, which is claimed to be the largest of its kind.—*Revue Générale de l'Electricité,* April 21, 1928.

## *Heat Applications and Material Handling*

*Molybdenum Furnace.*—P. W. DÖHMER.—Platinum begins to evaporate at a temperature of slightly more than 1,300 deg. C. If higher degrees of heat are required for certain chemical or electrometallurgical investigations heating units of platinum wires cannot be used. A German concern has found molybdenum wire to be suitable for temperatures up to 1,500 deg. C., provided the surface of the wire is prevented from oxidizing. It was customary to establish around the heating unit an atmosphere of hydrogen or water gas, but methods of supplying these gases and making necessary hose or pipe connections were found cumbersome. The new method provides on the furnace a small vessel with methylated alcohol. This liquid is made to drip slowly through a heated tube, in which it is evaporated, and the vapor so formed provides a steady stream of protecting gas around the molybdenum heating unit. One filling of the vessel is sufficient for an operation of two hours. The gas escapes through an exhaust tube and burns with a non-luminous flame. The maintenance of this flame is an indication of the proper functioning of the evaporator.—*Zeitschrift des Vereines Deutscher Ingenieure,* April 28, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*The Drying and Storage of Secondary Battery Plates in the Charged State.*—SAKEE MAKIO.—The results of a preliminary investigation to be applied to a general research on the best methods for preparing secondary battery plates fully charged in the dried condition are given in this report. A successful process of this kind, it is stated, will serve certain useful purposes, namely, the transportation of the battery without electrolyte and the saving on the part of the purchaser of the battery of applying the first charge to it. A number of positive and negative plates were fully charged, washed and dried in carbon dioxide gas, wrapped in paper and stored for six months. The tests upon which this report is based were made indicating the characteristics of these dried plates. Voltage time curves, specific gravity time curves and temperature time curves of the cell were studied upon immersing the plates in the electrolyte.—*Report of the American Electrochemical Society,* April, 1928.

*Electrochemistry and Electrometallurgy.*—W. W. E. FRENCH.—The electrothermal processes used in the fixation of nitrogen and in the manufacture of nitrogen products have been classified under electric arc process, the calcium cyanamide process and the synthetic ammonia process, while the electrometallurgy of iron and steel and of the ferro-alloys and non-ferrous metals have been offered a separate consideration. Electrolysis and the electrolytic refining of metals have also been considered.—*Journal of the Institution of Electrical Engineers (England),* May, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*High Angle Radiation of Horizontally Polarized Waves.*—S. UDA.—The results of experiments made to determine the directional property of horizontal antennas with special reference to the high angle radiation of horizontally polarized short waves have been described by the author. In these experiments short waves of 260 cm. length were employed and the sending antenna of nearly a half wave in length was placed horizontally above the ground. The receiving antenna forming a Hertz's resonator was also supported horizontally and made to move up and down along a vertical line by means of a pulley device The field intensity due to the horizontal antenna was measured in various angular directions above the ground by placing the receiver at various heights. It is concluded that if several wave directors are arranged in front of the radiating antenna along an inclined line, making a certain angle with the horizontal, the radiated energy along this line will become greatly augmented, due to the existence of wave directors, and the direction of maximum radiation will not strictly coincide with the line of directors, but will be of a somewhat higher angle than this line. It is stated that the sharpness of the beam can be much improved by increasing the number of wave directors.—*Journal of the Institute of Electrical Engineers of Japan,* April, 1928.

## *Miscellaneous*

*Electric Purification of Blast Furnace Gases.*—M. KERALY.—Exhaust gases from blast furnaces represent a considerable calorific value and can be used for heating purposes or as fuel for internal combustion machines. The large amount of dust carried by these gases makes their direct use impossible. A thorough filtering process has to be carried on, to remove from 6 to 50 grams of solid matter from every cubic meter of gas. This represents a total of about 50 tons of dust per day from an iron output of 220 daily tons. Mechanical filtering processes are cumbersome, require water and are not thorough enough. The article describes modern electric dust precipitation with rectified 50,000-volt alternating current. Several installations on a large scale have demonstrated excellent results with a minimum of attendance. The purified gas does not contain more than an average of 0.013 grams of dust per cubic meter; that is, the precipitation removes up to 99.8 per cent of the solid contents of the gas.—*Bulletin de la Société Française des Electriciens,* Vol. 78, 1928.

*Unusual Features in the Microstructure of Ferrite.*—HENRY S. RAWDON and TORKEL BERGLUND.—Ferrite in the form of electrolytic iron, open-hearth iron and wrought iron is usually considered to have a very simple microstructure, but sometimes shows rather unusual features indicating that it may exist in various allotropic forms. It is stated by the authors that two of these features apparently related to the delta and gamma form of iron can usually be associated with tiny inclusions distributed in such a manner as to record the grain structure which existed in the high-temperature allotropic condition. A thorough investigation of the microstructure of ferrite has been undertaken and the factors affecting the material, including casting, heat treatment and mechanical deformation, have been considered, as well as the effect of "working" irons of different compositions. The results of tension tests of open-hearth iron at elevated temperatures and miscellaneous factors effecting the "veining" of the material are discussed.—*No. 571 Scientific Papers of the Bureau of Standards.*

# News of the Industry

## Promotional Rate Is Made General at Boston

*Department of Public Utilities Modifies Boston Edison Company's Schedule B and Applies It to Domestic Customers in Metropolitan District*

DOMESTIC consumers of electricity on the Boston Edison company system will save about a million dollars yearly, according to a decision of the Massachusetts Department of Public Utilities handed down on Wednesday of this week. Customers in Watertown, Somerville, Chelsea, Roxbury and other localities recently petitioned for a reduction in residential service rates. After a series of hearings the commission has reached the conclusion that the establishment of a zone rate would be undesirable at present; that if a flat reduction in the present maximum rate of 8.5 cents per kilowatt-hour were to be ordered, only 0.5 cent could be cut off, and that the proper course is to modify the company's so-called domestic lighting and appliance rate (Schedule B) so that the consumers and the company may enjoy in greater degree the advantages of an inducement-type rate.

Accordingly the board orders that after Aug. 15 the company's Schedule B shall be available for lighting and other domestic uses in residential premises, excluding hotels and apartments where the bills are not rendered by the company directly to the individual tenants. Under this schedule as modified by the board the rates are to be 8.5 cents per kilowatt-hour for the first 2 kw.-hr. per month per 100 sq.ft. of floor area, 5 cents per kilowatt-hour for the next 70 kw.-hr. per month and 3 cents for the excess, the minimum area being 1,000 sq.ft. This indorsement of the inducement-rate principle is regarded as highly important in Massachusetts utility circles. Various points discussed by the commission will be covered more fully in a later issue.

## Elephant Butte Contract for El Paso Company

Following the withdrawal by the Texas-Louisiana Power Company of its proposal to construct a hydro-electric plant at Elephant Butte Dam, the boards of directors of the El Paso County Water Improvement District and the Elephant Butte district in New Mexico have signed the contract submitted by the El Paso Electric Company, subsidiary of the Stone & Webster interests, providing for the development of hydro-electric power at the dam. A co-operative agreement between the Elephant Butte and El Paso districts will be worked out at once, after which the contract will be submitted to the water users for approval. The Secretary of the Interior must also sign the contract.

A lease with the government for the development of power by the districts for a period of 50 years also was signed by the board of directors. It provides that after all expenses have been deducted in operating the plant the amount left shall be applied on the current bill of the districts to the government. M. H. Lewis & Company, Huntley & Company and the Merchants' National Bank of Los Angeles have submitted a proposition for financing the project. It is expected that the plant will be constructed speedily so that delivery of power can be started about the middle of next year.

## Lightning on Conowingo Line "Never Touches" Service

A report from engineering sources says that the first real test of the Conowingo transmission system under lightning disturbance was had on Tuesday night, June 5, when what was apparently a direct stroke hit the line near Philadelphia about 10:30 o'clock. The steam units at Philadelphia took up the load immediately, it is reported, probably without more than a dip in lamp voltages. Conowingo at the time was delivering 185,000 kw., of which 150,000 kw. was being transmitted to Philadelphia. Apparently all the relays and governor equipment concerned functioned 100 per cent, and Conowingo was on full service again in ten minutes.

## Two Years' Growth of the N.E.M.A.

### Executives of Association and Delegates to Annual Meeting at Hot Springs, Va., Evince Satisfaction with Outlook for Its Growth and Usefulness

MORE than three hundred electrical manufacturers gathered at Hot Springs, Va., this week to attend the annual meeting of the National Electrical Manufacturers' Association. Though this organization is less than ten years old, it already has proved its value both to the manufacturers and to the entire electrical industry. In making this assertion President Gerard Swope declared that the manufacturing industry is now co-ordinated and articulate and that the N.E.M.A. is a necessary organization. He urged patience and still more patience in the development of the body, quoting figures and facts to show that the membership was increasing and that important work had been completed or started. Each of the divisional vice-presidents reported progress and expressed firmly a belief that the new organization is working out most successfully. A. E. Waller, the managing director, reported a good year. He said the headquarters staff had been increased to give engineering aid to the work of the association and emphasized the importance of section activities.

The five days at Hot Springs were devoted almost entirely to section meetings where men in each group of manufactured products discussed standardization, basic business policies and organization procedure. These meetings were well attended and much progress was made. There was only one general meeting. At it the addresses just alluded to by President Swope, Managing Director Waller and the vice-presidents of the divisions were made. Vice-President Clarence L. Collens of the Policies Division stated several national business policies which this division had discussed and stressed the elements of policy involved in the tariff and in legislation on industry and the interrelations of the N.E.M.A. with other industry groups.

According to the reports of the executives, the Apparatus, Radio, Supply and Appliance Divisions have much work under way and look forward to substantial achievements during the coming year. Standardization, cost accounting, industry statistics and market development were put forth as common objectives. W. E. Sprackling reported very favorably on the work of the Industry Trades Conference.

H. B. Crouse was elected president for the coming year. The divisional vice-presidents elected were as follows: Apparatus, N. A. Wolcott; Appliance, M. C. Morrow; Policies, C. L. Collens; Radio, L. B. Raycroft; Supply, W. E. Sprackling. Members of the board of governors elected for three years were H. B. Crouse, R. Edwards, A. L. Eustice, Otto H. Falk, W. L. Jacoby, J. M. Curtin, D. H. Murphy, R. J. Russell and Frank E. Wolcott. I. A. Bennett was elected a member of the board for one year.

## Radio Division, N.E.M.A., Has Session at Chicago

Meeting at Chicago on June 4 to 7, the Radio Division of the National Electrical Manufacturers' Association went on record as favoring the early adoption of the engineers' plan of broadcasting allocation by the Federal Radio Commission and the increased use of higher power by broadcasting stations. Publication of "The Radio Market," a comprehensive statistical compilation, was announced.

A feature of the meeting was a speech by Representative Clyde Kelly of Pennsylvania, joint author of the "fair trade" bill, which is aimed at "cut-throat competition encouraged by unjustified application of anti-trust laws."

## Cullinan Re-elected Chairman of Electrical Wholesalers

George E. Cullinan, vice-president of the Graybar Electric Company, was re-elected chairman of the executive committee of the electrical wholesalers at their twentieth annual convention, held at Hot Springs, Va., last week. A report of the convention, where the name of the association was changed from the Electrical Supply Jobbers' Association to the National Electrical Wholesalers' Association, appeared on page 1260 of last week's ELECTRICAL WORLD. Edwin M. Keatley was elected vice-chairman, succeeding L. T. Milnor of the Milnor Electric Company, Cincinnati. Mr. Keatley is president of the Virginian Electric, Inc., Charleston, W. Va.

## Six Thousand to See Artistic Lighting Exhibit

Upward of a million dollars' worth of the most modern of lighting fixtures and accessories were shown at the national lighting equipment exhibition held in connection with the convention of the Artistic Lighting Equipment Association at the Hotel Sherman, Chicago, June 11 to 15. With registration of delegates in excess of two thousand on the second day, indications were that visitors would reach a total of five or six thousand by the end of the week, making this the best attended exhibit yet staged by the association.

Lighting equipment was displayed by 125 or more manufacturers, and the design of fixtures showed many advances and changes in styles both in the finer grades and in moderate-priced lines. A trend toward modern and exotic art was apparent in some styles of wall fixtures and table lamps, while adaptations of period styles and more liberal use of color were much in evidence. Visiting dealers expressed themselves as well pleased with the exhibition, which, being held in the summer, affords ample opportunity to prepare for the busy fall.

During the convention the different manufacturing groups held meetings on Tuesday, Wednesday and Thursday. On Tuesday evening the Chicago sections of the Illuminating Engineering Society and Artistic Lighting Equipment Association held a joint meeting and dinner, at which Prof. H. H. Higbie, past-president of the I.E.S., addressed the meeting on "Practical and Proper School Lighting.

# Load Building Uppermost at Pasadena

### Pacific Coast Electrical Association Holds a Unique Convention in Southern California City, in Which Playlets, Pictures and Employees' Oratory Play Part

LOAD building was the theme that dominated the twelfth annual convention of the Pacific Coast Electrical Association (geographic division of the N.E.L.A.), held at the Huntington Hotel, Pasadena, Cal., June 12 to 15. President W. L. Frost, in addressing the six hundred delegates, pointed out that the industry has before it the greatest load-building opportunity in its history and said that now the problems of engineering and production have been solved the industry must squarely face its selling problem. He saw little to fear in the investigation of the Federal Trade Commission and said that the industry can confidently stand upon its record, a record of improvement in service, constant reduction in rates and fair dealing with the public.

The convention was unique in that many of the committee reports were presented in "skit" or picture form and the program was dramatized and animated throughout. A three-minute speaking contest held at a luncheon on the first day was of unusual interest. Six young men and women of the industry displayed an unusual grasp of the selling problem in their addresses on the subject "Electricity Is Cheap—Use More of It." A prize of $100 went to the winner in this contest, and the expenses of all to the convention were borne by their employers.

An innovation in convention programs was a contest between the Accounting, Commercial, Engineering, Transportation and Purchasing and Stores sections to see which could make the best demonstration of how it could assist in load building. Able presentations were made by all, some by slides, some by playlets and some by motion pictures, and all were dramatized. A prize of $100 was to be awarded to the winner on the last day of the convention.

At the one meeting of the Engineering Section F. M. Farmer, chief engineer of the Electrical Testing Laboratories, New York, took his audience on an illustrated "word trip" through the testing laboratories and pointed out the value of the co-operative work carried on by the organization, which he said really supplements the laboratories maintained by various manufacturers and utility companies. Irl C. Martin of the Woodward Governor Company described the requirements and functioning of governing equipment.

Wednesday afternoon, at a general session, reports of the public speaking, industrial relations and customer relations committees were presented, and the winning essay in the contest conducted by the customers' relations bureau was presented by the author. Addresses by Ruth E. Creveling, Eloise Davison and Clotilde Grunsky dealt with the very creditable work which the women's committee is doing and the excellent organization which has been built up to conduct this work.

Officers of the association for the ensuing year, elected at the business meeting which opened the convention, are: President, P. M. Downing, Pacific Gas & Electric Company; first vice-president, E. B. Griddle, Southern Sierras Power Company; second vice-president, A. M. Frost, San Joaquin Light & Power Corporation. The convention was to conclude with general sessions on Thursday and Friday.

## Federal Trade Commission Enters Texas

*Questions Director of Information Bureau Concerning Newspaper and School Activities in That State—Ballinger and Blain Also Testify*

TEXAS had its turn when the Federal Trade Commission resumed its investigation of the public utility companies on Tuesday of this week. William C. Grant, director of the Texas Public Service Information Bureau, a newspaper man still retaining a connection with the Associated Press, told of the bureau's activities. He informed the investigators that he had furnished news items, "feature stories" and occasionally editorials for newspapers and admitted that drafts of two or three editorials which he wrote for the Dallas *Times-Herald* had been submitted to executives of Dallas utility companies before publication.

The witness, under questioning from Mr. Healy, the commission's counsel, said that the bureau had prepared a set of four pamphlets dealing with public utilities for school distribution and last year had circulated 20,000 sets, or 80,000 copies. Of the 1,000 high schools in the State of Texas, he said, 350 had made requests for copies of the pamphlets.

Throughout the testimony Mr. Grant asserted that the purpose of the Texas Public Service Information Bureau was to give the people of Texas the facts regarding the public utilities, and he denied that it was "a propaganda organization" unless the commission's counsel saw fit to include as propaganda "about 75 per cent of all that is published in newspapers" on all subjects of business activities.

"Isn't the prime purpose of your committee to put out information against government ownership such as is provided in Muscle Shoals and the Boulder Dam project?" asked Mr. Healy.

"We conceive it to be our duty to give the public the facts," said the witness, "If the public utilities don't give the public the information on these subjects, the public has no place to get the information."

The information bureau, Mr. Grant said, got about $16,000 to $18,000 annually to spend from the public utility companies of Texas.

On Wednesday C. W. Davis, chairman of the Texas bureau, told about the contacts made by his bureau with Texas colleges. He testified that the Texas Agricultural and Mechanical College was used by the Southwestern association as an agency through which a survey of rural electrification was made by John E. Waggoner. Documents introduced into the record showed that in 1927 the association spent $3,241 for the survey and that in 1928 the survey expenses have amounted to $5,419. Mr. Davis said that the money was paid to the college, which turned the funds over to Mr. Waggoner.

S. J. Ballinger, secretary of the Southwestern Division of the N.E.L.A., said his organization planned to spend $20,000 this year on public relations work. He said that it already had paid the expenses of a meeting of professors called by Dean C. O. Ruggles, formerly of Ohio State University, at New Orleans to discuss utility courses in colleges. He added that the expenses of many professors to this gathering had been paid by the organization.

Hugh M. Blain of New Orleans, director of the Louisiana-Mississippi Committee on Public Utility Information, declared that T. H. Harris, Superintendent of Education for Louisiana, granted him permission on Dec. 13 last to distribute thousands of utility pamphlets to the schools in that state. He added that the pamphlets were welcomed in the schools of Louisiana.

Mr. Healy at this session produced two canceled checks for $2,500 made out to the Fuel, Power and Transportation Educational Foundation of Ohio, which bore the indorsement of that organization and that of S. S. Wyer, who made an unfavorable survey of the Ontario Hydro-Electric Power Commission's system about three years ago. The checks were drawn by the National Electric Light Association. Mr. Healy's object was to try to show that the N.E.L.A. was concerned with financing the survey—a matter previous testimony was thought to have left uncertain.

## Santeetlah Plant Almost Ready for Aluminum Company

The Santeetlah hydro-electric plant in North Carolina on the Tennessee border, which will rank with the largest hydro-electric projects in the South, will go into operation soon, officials of the Tallassee Power Company, its builder, announce. Actual construction work was completed and water turned into the dam on Dec. 7, but it has taken the intervening time to fill the reservoir, which covers an area of approximately 3,000 acres with a 100-mile shore line. The dam is 202 ft. high at the highest point and more than 800 ft. long. A system of tunnels and pipe lines, nearly five miles of which is under mountains, has been constructed to carry the waters in a fall of approximately 600 ft. to a power house with two generating units on the south bank of the lake formed by the Cheoh Dam on the Little Tennessee River.

This project will develop 66,000 hp. and is the second unit on the generating system planned by the Aluminum Company of America at Alcoa, Tenn., where the power will be used. That company's power projects will entail an expenditure of $20,000,000 when completed. It is understood that plans are already under way for an expansion of its manufacturing plants at Alcoa in order to utilize the power from the Santeetlah Dam and also from the Calderwood Dam when it is completed next year.

## Purchases and Mergers

*Control of Rochester Gas & Electric Corporation Passes from New York Central Railroad to Phillips Interests with Mohawk Valley Company*

ANNOUNCEMENT was made at New York on Wednesday, June 13, by A. H. Harris, chairman of the executive committee of the New York Central Railroad Company, that that company had concluded negotiations for the sale of its controlling holdings of the stock of the Mohawk Valley Company of Rochester at $75 per share and of its controlling holdings of common stock of the New York State Railways, which owns Rochester and interurban transit lines, at $25. The announcement did not include the name of the purchaser, but subsequent news from the office of the Long Island Lighting Company in New York confirmed a statement made in Rochester that E. L. Phillips, president of the Long Island Lighting Company, and his associates were to be the new owners. The total sale price is figured at $41,758,325.

The Mohawk Valley Company has for its chief subsidiary the Rochester Gas & Electric Corporation. It also controls four smaller companies—the Cooper Electric Corporation and the Hilton Electric, Light, Heat & Power Company, both of Hilton; the Geneseo Gas Light Company, which does a light and power business, and the Mount Morris Illuminating Company. The Rochester Gas & Electric, capitalized at more than $60,000,000 and with 72,000 kw. in steam-electric and 34,000 kw. in hydro-electric equipment, ranks among the chief upstate light and power organizations. Robert M. Searle is the president.

Mr. Phillips announced that the minority stockholders of the acquired companies have the privilege of accepting the same terms as the railroad or of receiving securities in a new company to be formed in exchange for their present holdings. The new company will take over the Mohawk Valley properties and contiguous properties already owned by the Empire Power Company, bringing into a single organization electric and gas properties in New York State having an aggregate value in excess of $150,000,000, among them being the New York Central Electric Corporation, which in turn controls the Empire Gas & Electric Company; the Seneca Power Corporation and the United Gas & Electric Corporation.

Capitalization of the many small utility companies—largely light and power—which, as noted last week, the Pennsylvania Power & Light Company is seeking authority to merge with itself is placed at more than $13,000,000 in the application pending before the Pennsylvania Public Service Commission. The largest of the companies to be acquired if the company's plans are approved, the East Penn Electric, is capitalized at more than $6,500,000, the Panther Valley Electric at $720,000, the Juniata Public Service Company at $300,000, the Hummelstown Water & Power Company at $200,000, the Franklin Township Carbon Electric Company at $110,000, and the Schuylkill Electric Company at $100,000. About ten of the other companies are "paper" concerns. The total price to be paid for the properties was put at $56,000,000 and their value as $63,000,000.

Some weeks ago newspapers announced the purchase by the Georgia Power Company of the Winder (Ga.) municipal electric plant for approximately $300,000, the company to pay part of the price in cash and assume the bonded indebtedness of the city. This announcement was premature, since the arrangement provided that the plan must be submitted to the voters if a certain proportion of them signed a petition to that effect within three weeks after the proposal had been advertised. The time set having expired without such action, the Winder plant is now to be taken over.

The Southern Public Utilities Company has been negotiating with the Town Commissioners of Huntersville, N. C., for the purchase of the electric lighting system, and an election will be held to determine whether or not the town shall sell.

The New York Public Service Commission has authorized the Mohawk-Hudson Power Corporation to acquire control of the common stock of the Cortland County Traction Company, which operates an electrical distributing system.

The Western Light & Power Company is reported to be negotiating for the municipal power plant at Woodward, Okla.

An offer of $90,000 for the Medicine Lodge (Kan.) municipal electric plant has been made to the City Council by the Western Light & Power Company, with headquarters in Salina. The company's offer includes a rate reduction and an agreement to retain and operate the plant on a part-time basis. The Kansas Power Company, Topeka, has entered a proposal for the purchase of the municipal distribution system of Glen Elder, Kan. The city now receives service from that company. The same company's offer to purchase the municipal distribution and street-lighting system of Natoma, Kan., was defeated by a small majority. Negotiations are under way for the sale to the Kansas Power & Light Company, Topeka, of the distribution system of Everest, Kan., supplied with electricity from the Atchison district of the company. Sale of the municipal distribution system of Circleville, Kan., to the Kansas Power & Light is announced. Circleville formerly received its electric service from the municipal plant at Holton.

# "Electrical World's" London Letter

## Development of Transatlantic Radio Telephony—Engineers and the New Overhead Line Regulations—Grandmotherly Restrictions—To Check Shoddy Wiring

BY BERNARD C. HOLDING
Editor of *The Electrician*

LONDON, June 1.

THE penning of this written monthly link between England and the United States of America reminds one of the progress which continues to be made in the development of another, and immeasurably quicker, link—the transatlantic radio-telephone service, the use of which is increasing at a rate so satisfactory that one London hotel with a large American clientèle has spent for its clients nearly $23,000 in nine months on transatlantic calls.

An outstanding event of recent weeks has been the long-awaited issue by the Electricity Commissioners of the new overhead line regulations. The dissatisfaction which has been expressed as to the unnecessary restrictions imposed by the old regulations has been so vocal, and their effect on line construction here has been so obvious to visitors from the United States, that you cannot fail to be aware of the importance which electricity supply authorities in this country attach to this question. Following frequent representations pointing out the unduly conservative requirements contained in the old regulations, hopes were entertained that substantial relief might be forthcoming. Actually, however, the degree of amelioration afforded cannot be regarded as other than slight. For instance, there has been no reduction in the factors of safety, either for supports or for conductors. Despite the fact that reinforced-concrete supports are finding increasing employment in many countries, the new regulations still require a safety factor of three and one-half for these supports. As the figure for iron or steel is two and one-half, it seems that it must be assumed that reinforced concrete is weaker than one of its constituent parts—a proposition that would puzzle a modern Euclid. Another irksome condition is that requiring the use of duplicate insulators to support conductors erected along a public road or canal or within 50 ft. thereof.

As has been seen in the above and in earlier instances, the development of electricity supply in this country is still hedged about with grandmotherly restrictions, and nowhere is this more obvious than in connection with the obtainment of rights-of-way for overhead lines. Matters have indeed become so bad that the Overhead Lines Association has held a special meeting to discuss the possibility of obtaining a standardized form of agreement. As the result of this discussion some concrete—not reinforced—proposals will probably be offered to the Electricity Commissioners.

The opinion that the new regulations will not afford a great deal of relief to electricity supply authorities is fairly general, though some engineers, including Borlase Matthews, president of the Overhead Lines Association, have recently stated that the new rules will permit a reduction of from 12 to 30 per cent in the cost of these lines.

Engineers concerned are also keenly feeling the need of some standard of overhead erection practice and materials. There is at present no definite ruling as to the spacing of conductors relative to sag. Then there are various devices for earthing fallen wires on low-tension lines, all with their individual good points—but no standard. Other directions in which the need for standardization is felt include types of poles and the sizes of stay wires and stay blocks. With regard to reinforced-concrete supports, it is understood that the Electricity Commissioners are continuing their consideration of the possibilities of this material, as the result of which it is hoped there will be some modification of the ridiculous factor of safety which is now applied to this form of construction.

The National Register of Electrical Installation Contractors—an independent professional authority which exists to protect the public from shoddy wiring, by registering contractors who can produce satisfactory evidence of experience and ability—recently held its third annual meeting, when it was disclosed that 1,066 electrical contractors are now enrolled. The Register is being much discussed in contracting circles, it being felt that the existence of a large number of shoddy wiring installations affords a strong reason for making the existing voluntary registration scheme into a compulsory one. With one section of the industry clamoring for the removal of restrictions and another fervently demanding restrictive ordinances, we have a curiously contrasted picture. At present there seems little likelihood that either will receive full satisfaction.

A young body which, except indirectly, is less fettered by regulations is the Electrical Association for Women. It is, I believe, the first organization of its kind in the world and in its three years of existence has attracted a membership of two thousand, divided among eight branches. Under the directorship of Miss Caroline Haslett, it has done excellent work. Its new president is Mrs. Wilfrid Ashley, the wife of the Minister of Transport.

An educative force which functions within the electrical industry and which has already achieved remarkable success is the E.L.M.A. Lighting Service Bureau in London, which recently gave the seventeenth of its special illumination design courses. These are open to any member of the industry, and the lectures and demonstrations are held in premises completely equipped with experimental apparatus and a full range of modern lighting equipment.

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# Rebuilding San Francisquito Power House

ONE of the two 17,500-kva. generators which were running when the St. Francis Dam in the San Francisquito Canyon, California, gave way on March 12 was damaged beyond repair. The other will be placed in operation after thorough cleaning and drying and reconstruction of the power house. Operations to this end are now in full blast, and the city of Los Angeles, owner of the plant, expects to have the unit in operation in June. A new unit has been ordered and will, it is expected, go into service by November. Enforced idleness of the plant is reported to be costing the city $2,000 a day.

## President-Elect Arkwright on Power Investigation

*He Calls for Constructive Criticism Based on Facts Concerning the Conduct of the Electrical Industry and on the Dissipation of Prejudice.*

IN A PRESS interview at Atlantic City just after the adjournment of the National Electric Light Association convention, the president-elect, Preston S. Arkwright, talked of the investigation into the light and power industry now in progress under the direction of the Federal Trade Commission.

"We welcome an opportunity to get the facts about the conduct of our business before the public," Mr. Arkwright said. "We shall be grateful if the Federal Trade Commission permits to be brought out the facts showing what we have done, what we are doing and what we hope to do.

"Our industry has felt for many years that a continuation of its success in expanding its service to wider and wider areas, from city to town, to hamlet, to farm, and in improving its service to existing customers and in making more economical its cost, depends upon public understanding of the industry. Prejudice is born of ignorance and will disappear when the facts and economic principles governing the industry are understood. A knowledge of the truth by the people will confuse the demagogues. If the industry is unjustly burdened, if it is subjected to repressive or unduly restrictive regulation, if it is constantly menaced with confiscation through government competition with limitless power of taxation to support uneconomic operation, it will of necessity be unable to perform this duty. The service will grow poorer, the territory of its usefulness will be narrowed, further beneficial applications of the service curtailed, its costs will grow higher, and while the industry will suffer loss, of course, the injury to the public in lessened helpfulness and in greater cost will be immeasurable.

"Knowing the facts and the detrimental consequences to the public of acts which result from a lack of understanding, the industry would fail in the trust reposed in it if it should neglect to employ every fair means to offset misrepresentations by knowledge. Constructive criticism would be helpful to it. Mere abuse or effort to create prejudice will accomplish harm alone. We trust that the criticism, if any is leveled at us, may be of a constructive character, capable of producing results that would be helpful."

## Canadian Convention Will Sail up the Saguenay

Sailing from Montreal on Wednesday morning, June 20, the steamship *St. Lawrence* will be the theater of the 1928 convention of the Canadian Electrical Association, which is affiliated with the National Electric Light Association, functioning as a geographic division. A stop will be made on Thursday at Port Alfred, where a motor trip of inspection will be made. The delegates will visit Arvida, Chute á Caron, Riverbend, Ile Maligne and other places which are the sites of large hydro-electric installations and projects. On Friday afternoon the boat will reach Murray Bay, where the annual banquet will be held at the Manoir Richelieu. The tour will end when Montreal is again reached on Saturday afternoon.

Besides the usual committee reports, there will be a paper on "The Economics of Supervisory Control Systems" by R. J. Wensley, Westinghouse company, and one on "High-Voltage Power Transmission" by H. H. Dewey, General Electric Company. Dancing on the boat and sports on land will provide amusement.

## Oregon Municipal-Plant Case Arouses Interest

In recognition of the national importance attached to litigation involving the jurisdiction of municipalities operating their own utilities outside of corporate limits, the Oregon Supreme Court has advanced on the docket for hearing the suit of the Yamhill Electric Company, respondent, vs. the City of McMinnville et al., appellants. This is a suit in equity brought by the private company to enjoin the city from constructing and operating a power line entirely outside and beyond the corporate limits and delivering energy over it to private consumers until the city shall have procured from the Public Service Commission a certificate of convenience and necessity. The lower court sustained the utility company and issued a restraining order. The city of Eugene, which also owns a municipal plant, has intervened, maintaining that to hold that all except corporate business belongs by law to private utility companies is to make the law discriminatory and hence unconstitutional.

When the Supreme Court renders its decision the authority of blanket-franchise privileges in Oregon will also be finally decided, one of the main points at issue affecting the jurisdiction of a county court in granting these franchises. The Yamhill company contends that the municipal utility is attempting to ignore such a franchise owned by its antagonist.

In the event of the decision affirming the findings of the lower court, it will be mandatory on the part of the regulatory commission to order that all municipalities owning and operating utilities outside of city limits comply with the law requiring public service corporations to file annual reports, adhere to the uniform accounting rules, remit gross income taxes and otherwise submit to regulation by the commission in matters of rates, charges and practices affecting those portions of lines and service beyond corporate boundaries. Another effect will be that a certificate of convenience and necessity will have to be obtained before any extension of a municipal plant outside city limits can be made.

## S.P.E.E. Meets at Chapel Hill on June 26-29

A four-day program has been arranged for the thirty-sixth annual meeting of the Society for the Promotion of Engineering Education, which will be held at the University of North Carolina, Chapel Hill, N. C., on June 26-29. President R. L. Sackett will preside at the opening session on Tuesday, when President H. W. Chase of the University of North Carolina will welcome the delegates. Herbert Schofield, principal of Loughborough College, England, will address this session on "A Productive Industrial Plant on College Premises," and there will be committee reports in the morning and teaching conferences in the afternoon. Other conferences will be held on subsequent afternoons.

On Wednesday R. I. Rees, American Telephone & Telegraph Company, will speak on "College Experience in Its Relation to Achievement in Industry"; Dr. C. F. Scott and W. E. Wickenden, director of investigations, will report for the board of investigation and coordination, and the annual dinner will be held in the evening. On Thursday Dean Sackett will make his official address, taking as his subject "The Changing Emphasis in Engineering Education,'" Governor A. M. McLean will speak, Prof. J. B. Davidson of Iowa State College will discuss agricultural engineering, and there will be a barbecue in the evening at the Cape Fear plant of the Carolina Power & Light Company. H. P. Hammond, associate director of investigations, will talk on "A Practical Step Toward Improving Methods of Teaching" on Friday morning.

## Dissatisfaction Expressed as to New St. Louis Rates

City Counselor Muench of St. Louis, in a statement filed with the Missouri Public Service Commission, contends that the Union Electric Light & Power Company should reduce its rates at least $1,418,000 instead of the voluntary cut of $706,467 provided in the schedules that became effective on June 1. The city authorities, for whom Mr. Muench speaks, ask that the commissioners make a complete investigation and audit of the Union Electric's books and records as well as an investigation of the operations of the company. They contend that a proper adjustment of the company's depreciation account would permit a total reduction of $2,000,000 in annual revenue and that even with so drastic a decrease the company could still earn 7 per cent return on its claimed valuation.

"The proposed rates offer no reduction to the small or domestic consumer in St. Louis, and in this respect, too, we believe that the schedule is unreasonable and unjust," Counselor Muench declares. He maintains that while the Union company claimed $1,698,164 for depreciation in 1926 and $2,336,400 in 1927, in reality it has never expended more than $429,616 over a period of eleven years for maintenance of its properties. The city contends that not more than $950,000 should be charged off for depreciation. In eleven years the company's depreciation reserve increased from $989,726 to $9,663,001 in 1927.

The Public Service Commission in an order issued on June 6 asked the Union company to answer or satisfy the city's demands for a general reduction in electric rates within ten days. The company will oppose the additional cut.

## Saranac Program for International Lighting Congress

After a tour of cities in the northeastern part of the United States and attendance at the Toronto convention of the Illuminating Engineering Society on Sept. 17 to 20, the delegates from foreign countries to the coming International Illumination Congress, together with American members, will, as previously announced, assemble at the Saranac Inn, Saranac Lake, N. Y., for their first world congress, to be held in connection with the plenary meeting of the International Commission on Illumination. The Saranac sessions will last from Sept. 22 to Sept. 28 inclusive, and a preliminary program has been drafted as follows:

A. Sessions under auspices of international technical committees: Automobile headlighting, C. H. Sharp, United States, chairman; daylight illumination, secretariat, Great Britain; factory and school lighting, L. B. Marks, United States, chairman; research on glare, secretariat, Italy; street lighting, W. Wissmann, Germany, chairman.

B. Open committee meetings, for discussion of other topics assigned to international technical committees; subjects to be announced later.

C. International symposia, arranged by program committee: Residence lighting practice, show-window lighting practice, lighting for aviation, status of lighting education.

D. Papers by leading authorities sponsored by national committees, including both scientific and practical subjects of outstanding interest in fields not covered by technical committees; subjects to be announced later.

The tour of inspection for the foreign visitors will begin at New York, where they are expected to meet about Sept. 5. Outstanding lighting installations and the important laboratories and manufacturing establishments devoted to illumination in the metropolitan area will be the first objectives. The visitors will then journey by special train to Philadelphia, Washington, Boston, Cleveland, Detroit, Chicago, Niagara Falls and Toronto. Opportunity will be extended to Americans desiring to accompany the foreign delegates on the tour. Reservations and plans are being handled by G. S. Merrill, chairman tour committee, Nela Park, Cleveland, Ohio.

# Briefer News

Increase of Generating Capacity at San Benito.—The power plant of the Central Power & Light Company at San Benito, Tex., is to be enlarged by the installation of a 10,000-kw. turbogenerator. The unit will almost double the capacity of the plant, which is now approximately 13,000 kw.

New York Electrical Society Elects Officers.—The annual meeting of the New York Electrical Society for the election of officers was held on Tuesday, June 12, when the following were elected: President, E. E. Dorting, Interborough Rapid Transit Company; vice-presidents, A. K. Baylor, E. B. Meginniss and H. H. Sheldon; treasurer, E. B. Meginniss (re-elected); secretary, H. E. Farrer, (re-elected). R. B. Grove, H. Rentschler and W. T. Teague remain as vice-presidents for one year.

Northern Maryland Power Company Was Sold for $821,275.—The purchase price of the property of the Northern Maryland Power Company in Havre de Grace, Aberdeen and vicinity, recently bought from the Philadelphia Electric Company by the Consolidated Gas, Electric Light & Power Company of Baltimore, has been revealed as $821,275 in the petition filed with the Maryland Public Service Commission seeking approval of the transaction. The commission set June 26 as the date for hearing.

Steam Plant to Aid Hydro Stations in British Columbia.—A contract has been let by the British Columbia Electric Railway Company for the construction of a steam plant for the generation of electrical energy on Burrard Inlet. It will cost $2,500,000 and will serve as an emergency source of supply in case of interruption of service from any of the hydro-electric plants normally used. It will be the first unit of what is to be known as the Hastings plant of the company.

Kentucky Utilities Company's New Construction Program.—A new program of construction and expansion has been developed by the Kentucky Utilities Company since May 1 which when completed will have entailed an outlay of about $150,000. It includes an outdoor high-tension switching station at Pocket, Va., and the building of new transmission and distribution lines in various parts of the company's territory, as well as the installation of additional apparatus.

Plans for Electragists' Convention.—Arrangements for the 1928 convention of the Association of Electragists International, at the Stevens Hotel in Chicago, Aug. 6 to 10, are going forward rapidly. The preliminary program includes addresses by Philip Cabot, School of Business Administration, Harvard; E. O. Shreve, General Electric Company; L. K. Comstock, National Councilor United States Chamber of Commerce; John F. Gilchrist, vice-president Commonwealth Edison Company; Victor Tousley, National Fire Protection Association, and others with pertinent messages for the members.

"White Ways" for Rural Roads.—First-hand information on what highway lighting of the future may be was imparted to one hundred county supervisors, city and town officials and engineers recently at an inspection of 7.3 miles of rural highway "white way" installed as a demonstration unit by the Rochester Gas & Electric Corporation. The "white way" link connects East Bloomfield and Canandaigua, N. Y.

Lower Rates in North Dakota.—The North Dakota State Railroad Board has approved new combination electric rates filed by the Montana-Dakota Power Company and applicable to homes where electricity is used for lighting, refrigeration and cooking; also new rates for commercial refrigeration and cooking purposes applicable to hotels and restaurants. The former will affect 46 North Dakota towns served by the company and the latter 39 towns.

Repairing Flood Damage at St. Johnsbury, Vt.—The Twin State Gas & Electric Company is rebuilding the power plant above St. Johnsbury Center, Vt., which was destroyed in the November flood. An automatically operated station of 200 kw. rating, the first of its kind in the section, will be built. Another automatic station is planned on the Passumpsic River above Arlington Bridge, and the St. Johnsbury dam which went out with flood will be rebuilt. Construction cost is estimated at $150,000.

Two California Utilities Reduce Rates.—The Vallejo Electric Light & Power Company and the Coast Counties Gas & Electric Company have been authorized by the California Railroad Commission to place in effect reduced rates applicable to commercial and domestic lighting. In the case of the Vallejo company the new rate will save customers approximately $25,000 a year, and on the lines of the Coast Counties company about 15,000 customers will benefit from an annual reduction of $70,000.

New Power Contract Between Hartford Light and Power Railway Utilities.—The Hartford (Conn.) Electric Light Company has entered into contract with the Connecticut Company, a traction utility, whereby the latter will purchase additional power from the former. The Connecticut Company will maintain the Commerce Street power plant and the Hartford company will install new equipment. At the present time the Hartford Electric Light Company is furnishing 1,500 kw. to the traction concern. It will add $200,000 worth of equipment to bring the energy furnished up to 6,500 kw. The contract will become operative as soon as the new equipment is installed.

Rate Reductions in Eastern Idaho for Street Lighting. — The Oregon Public Service Commission has ordered reductions ranging from 5 per cent to 20 per cent in rates for incandescent street lighting in all municipalities in eastern Oregon served by the Idaho Power Company. The new schedule became effective June 1.

New York Edison Rate Case Adjourned Until Fall. — At another hearing held last week by Public Service Commissioner William R. Pooley on the five-year-old complaint filed by John F. Hylan as Mayor against the rates charged by the New York Edison Company the only witness was Henry Brady, who testified concerning values of the real estate owned by the company. The city's valuation was $9,042,000, the company's $11,168,000. The hearing was adjourned until Sept. 15.

Norwalk, Ohio, Seeks Ejectment of Power Company.—The Court of Appeals of Toledo has ordered the Ohio Electric Power Company of Oberlin, a Middle West Utilities subsidiary, to cease operations at Norwalk, Ohio, by Sept. 1. The company has been operating for two years in competition with the municipal power plant, and the city about a year ago sought to eject it on the ground that it had no franchise. The Norwalk municipal plant is rated at 2,000 kva. It is believed here that the Ohio Electric Power Company will appeal to the State Supreme Court.

South Carolina City Claims an Electrical Record.—The little city of Chester, S. C., with less than ten thousand population, is the most completely electrified city in America, if one takes into consideration the number of homes equipped with electric ranges, according to John Paul Lucas, vice-president of the Southern Public Utilities Company of Charlotte, N. C. Two out of three of the white customers of the Southern Public Utilities Company in Chester are using electric ranges in their homes. It is little more than ten years ago since the first one was sold there.

Nova Scotia's New Hydro Enterprise.—The projected newsprint industry on the Mersey River, Nova Scotia, reported a few weeks ago, will lead the provincial government to undertake three separate power developments, at Upper Lake Falls, Lower Lake Falls and Big Lake Falls. The Lower Great Brook Falls site will still be available, as well as further capacity at "the Guzzle," where the Liverpool plant is situated, these providing for further ultimate development of 6,200 hp. It is expected that the three developments first named will be ready to deliver power by Oct. 1, 1929. The initial 20,000-hp. undertaking calls for the delivery of 105,000,000 kw.-hr. annually. The capital cost is estimated at $3,659,000. The power will be supplied to the company at cost, put at approximately $20 a horsepower, for a period of 40 years.

Centralia, Wash., Plans Municipal Plant.—As a preliminary to embarking on a municipal power project entailing an estimated expenditure of $300,000, the Mayor and City Commissioners of Centralia, Wash., have filed water right application at Olympia to take 25 sec.-ft. from the Skookumchuck River in Thurston County. The plan would require construction of a 24-mile pipe line, which would provide power for the electric plant and give the city added water supply. At present the city gets its electric energy from the Western Cross Arm & Manufacturing Company, using its own distributing system. It is planned to begin work on the project by Sept. 1.

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]**

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

American Society of Agricultural Engineers—Rural electric session, Hamilton Hotel, Washington, June 19-22. Raymond Olney, St. Joseph, Mich.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

American Institute of Electrical Engineers—Cosmopolitan Hotel, Denver, June 25-29; Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

Society for the Promotion of Engineering Education—University of North Carolina, Chapel Hill, N. C., June 26-29. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Empire State Gas and Electric Association—Commercial Section, Hotel Utica, Utica, N. Y., June 28 and 29. C. H. B. Chapin, Grand Central Terminal, New York.

Public Utilities Advertising Association—Detroit, July 8-12. T. P. Pfeiffer, Byllesby Engineering & Management Corp., Chicago.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

National Electric Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

National Electrical Manufacturers' Association — Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

Albert Lea, Minn., and Osage, Iowa, to Be Joined by 60,000-Volt Line.—The Central States Power & Light Company, with headquarters at Dubuque, Iowa, expects soon to begin the construction of a transmission line between Osage, Iowa, and Albert Lea, Minn., a distance of about 50 miles. It will cost $3,500 a mile and will carry a maximum load of 66,000 volts.

National Commissioners' Association Will Meet at New Orleans in November.—The place first selected for holding the 1928 convention of the National Association of Railroad and Utilities Commissioners has, as the result of a referendum, been changed from Glacier National Park, Mont., to New Orleans. The opening date of the convention has also been changed from Sept. 10 to Nov. 13. The reason for the change was the desire to wait until the presidential election was over and the fact that the climate of the Montana resort would be inclement at the later date.

Rocky Mount (N. C.) Municipal Plant Found Inadequate. — Rocky Mount, N. C., which finds its municipal electric plant inadequate, has engaged an electrical engineer to make a survey of the situation and transmit recommendations to the Board of Aldermen. Three solutions have been suggested—the addition of another unit to the power plant, connection with the Rocky Mount mills, which generate their own power, and interconnection with the privately owned transmission line already built. Aldermen desired to add a unit to the present plant at a cost of $90,000, but strong opposition has arisen.

Wisconsin Accountants Will Meet.—The Accounting Section convention of the Wisconsin Utilities Association, to be held in Milwaukee, June 21-22, promises some interesting discussion. A certified public accountant will give his professional view of public ownership, the chairman of the Wisconsin Railroad Commission will discuss state versus national control and regulation of utilities, and the auditor of the Wisconsin Power & Light Company, which is a leader in rural electrification, will talk on cost accounting as involved in the operation and maintenance of farm-line extensions.

Underground Transmission Agitated for Cincinnati Subdivisions.—Members of Cincinnati's city planning commission, in session June 4, were told by the Union Gas & Electric Company that underground installation of all service wires in subdivisions of the city, as proposed in a special order pending before the commission, would cost five times as much as overhead construction. As this would be the opening of a campaign to extend this method throughout the city, it would result in doubling the present cost of service. The company expressed willingness to proceed with the improvement in a gradual manner.

ITINERARY OF THE 1928 INTERNATIONAL "POWER TOUR."—The Midwest Power Conference announces the following program for the "power tour" to Europe arranged by it: Aug. 18, sail from New York; Aug. 26-28, Glasgow; Aug. 29, Newcastle; Aug. 30, Manchester; Aug. 31, Rugby; Sept. 1-4, London; Sept. 5-6, Cologne; Sept. 7-9, Berlin; Sept. 10-11, Leipzig; Sept. 12, Zurich; Sept. 13, Zurich and Baden; Sept. 14-15, Milan; Sept. 16-17, Milan or Turin; Sept. 18-21, Paris; Sept. 22, sail for New York. The New York City offices of the Midwest Power Conference, 25 Broadway, may be addressed for reservations.

UTAH COPPER COMPANY TO EXTEND ELECTRIFICATION.—Complete electrification of the Bingham (Utah) mining properties of the Utah Copper Company, involving a minimum of 20 electric locomotives and a maximum of approximately 40, has been announced by that company. Although the actual mining operations are already electrified, utilizing electric shovels, the haulage system of the property has up to the present been of the steam type. When completed, the project will, it is said, be the largest electrified metal mine in the world and will involve the largest number of electric locomotives ever applied to an open-cut mining operation. The decision to change over from steam to electric haulage, electrifying the entire project, follows a test of about a year with a trial installation of a 75-ton combination storage battery, trolley and cable-reel locomotive built by the General Electric Company.

IRON AND STEEL ELECTRICAL ENGINEERS TO GO TO CHICAGO.—In connection with its annual exposition the Association of Iron and Steel Electrical Engineers will hold technical sessions at the Hotel Stevens, Chicago, on June 25 to 28, when reports and papers will be presented on electric heat, electrical developments, electric welding, standardization, high-tension practices, motor-driven rollers, selection of motors for main drives of strip and skelp mills, selection of motors for main drives of merchant, bar and rod mills, insulation of open-hearth checkers, boiler pressures above 350 lb., factors governing the purchase of coal, anti-friction bearings for roll necks, anti-friction bearings for motors and anti-friction bearings for auxiliaries. There will be a conference on fuel savings.

THE PROPOSED VALUATION OF THE PORTLAND (ORE.) COMPANIES.—Departing from the usual procedure, the Oregon Public Service Commission officially invited customers concerned to present to it on June 14 their views concerning the mode of action to be adopted in connection with the pending examination of the rates and valuation of the Portland Electric Power Company and the Northwestern Electric Company. The investigation involves the establishment of a rate schedule for residential lighting and cooking and commercial lighting in districts served by the two utilities outside of the metropolis only. The commission desires to be guided as to whether it shall undertake to establish entirely new valuations or shall use the valuations found as of Dec. 13, 1916, based on 1914 prices, and, if the latter, whether the valuation of 1916 shall be treated merely as evidence of the extent and value of the property at that time.

# Commission Rulings

DISTRIBUTING COMPANY MAY INCLUDE IN RATE BASE THE VALUE OF LINE ADVANTAGEOUSLY LEASED BY IT.—Dismissing a complaint of alleged excessive rates brought against the La Jara Electric Company, the Colorado Public Utilities Commission discussed an objection raised to the inclusion in the rate base of the value of a transmission line owned by the company but leased by it to the Colorado Power Company, from which the La Jara company purchased energy for distribution. The commission pointed out that the arrangement was a financially advantageous one and said: "If the defendant had not entered into this contract, it could hardly be contended that the value of the line should not be included in its entirety in the rate base. It is, therefore, difficult to conclude that after the defendant has entered into a contract saving the consumers $587 per year the value of the said line should in large part be eliminated from the rate base."

GROWTH OF BUSINESS WITH REDUCED RATES WILL OFFSET PART OF APPARENT LOSS.—The fact that in a prosperous community the natural growth of business will be accelerated by the reduction of rates was dwelt upon by the Massachusetts Department of Public Utilities in its order, previously reported in the ELECTRICAL WORLD, reducing the maximum price of the Cambridge Electric Light Company from 8 to 5½ cents a kilowatt-hour. The department said: "On the basis of the consumption in 1926 this would mean a reduction on all electricity sold for domestic and commercial purposes of a maximum of $318,805 and, in our opinion, would be considerably less. Such a reduction would leave as a net amount available for dividends, after setting aside the same depreciation as in 1926, the sum of at least $345,000. It is clear, however, that the actual reduction would be less than the amount above stated. Experience has demonstrated that a reduction of rates charged for electricity will effect a substantially increased use for domestic and commercial purposes, resulting in increased gross income without corresponding increases in expense. In addition, the reduction in income will result in decreased taxes. Both of these factors will operate to make an actual reduction in income considerably less than the maximum amount stated."

# Recent Court Decisions

INDIANA ACT ALLOWING APPEAL TO COURTS FROM COMMISSION DECISIONS DECLARED UNCONSTITUTIONAL.—A ruling affecting public utility patrons of Indiana and utilities themselves, made in the Circuit Court at Frankfort, has declared unconstitutional the 1927 statute permitting individuals, corporations and municipalities adversely affected by orders of the Indiana Public Service Commission to appeal to circuit and superior courts. The ruling was in an appeal taken by telephone patrons at Kirklin, Ind., from a commission order granting rate increases to the company in that town. The court held the statute unconstitutional on the ground that the law delegated a duty to the court which it was not empowered to fulfill. The statute was one of the so-called remedial measures passed by the last Legislature. Harvey Harmon, a member of the Public Service Commission, had declared it to be a disastrous piece of legislation which virtually vitiated the commission's powers of regulation.

COMMISSION DECISION ON VALUATION PRESUMPTIVELY CORRECT.—In the decision of the United States District Court in Massachusetts vacating the restraining order granted to enjoin the Department of Public Utilities from enforcing its rate decision in the case of the Cambridge Electric Light Company (ELECTRICAL WORLD, April 14, page 776) the chief argument for upholding the decision pending the report of a special master was phrased as follows: "The parties are in disagreement as to the value of the property, the legal rate of return and the amount of net return which the new rate will produce. Upon the first point we are asked to accept for present purposes the valuation of the company's expert and officers against that of the department made after hearing the same expert and presumably the same officers. This ought not to be done unless we are satisfied that the department valuation, which carries a presumption of correctness, is based upon some fundamental error of fact or of law. The plaintiff contends that the department has proceeded upon the Massachusetts theory of valuation in disregard of the principles established by the United States Supreme Court. In the case of the Worcester Electric Light Company the court evidently so viewed the findings of the department, and the injunction was granted. In the present case, which was decided by the department after the Worcester case had been decided by the court, the department explicitly states that its valuation has been arrived at under the rules of the United States Supreme Court. There is nothing in the record which warrants us in ignoring or disregarding this statement. The value found is a fact, in determining which the department declined to accept the evidence of value now submitted to us by the plaintiff. We are not dealing with the case on full proofs, but only in a preliminary way and on the evidence as it stands. No sufficient reason is shown for rejecting the decision of the department, which is presumptively correct, in favor of affidavits submitted by the plaintiff, largely from the same witnesses whose testimony *in extenso* was regarded as unconvincing by the commissioners."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

## *P. S. Arkwright New President of N.E.L.A.*

Preston S. Arkwright, who was elected president of the National Electric Light Association at the convention held last week in Atlantic City, has been nationally prominent in electrical circles for a number of years. Following graduation from the University of Georgia law school in 1891 with the degree of LL.B., Mr. Arkwright practiced law in Atlanta for about a decade before entering the public utility field. To the electrical industry he brought brilliant legal attainments, coupled with sound executive ability, which enabled him to build up a consolidated system in Atlanta out of a troubled and disorganized situation. This achievement, perhaps more than any of his other accomplishments, attracted the attention of the light and power executives throughout the country and it was not long before he was recognized as one of the industry's energetic leaders, famous for his ability to establish good public relations.

*P. S. Arkwright*

When Mr. Arkwright became president of the Georgia Railway & Power Company, successor to the Georgia Railway & Electric Company, in 1912, hydro-electric power development was practically unknown in the South. During his presidency the company has acquired the Bull Sluice development and harnessed the waters of the Tallulah and Tugalo Rivers, one of the biggest hydro-electric projects undertaken in the southern part of the country. Mr. Arkwright has been chairman of the civic development committee of the N.E.L.A. during the past year and by virtue of his election to the presidency becomes chairman of the Charles A. Coffin prize committee.

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Roy A. Hunt has been elected president of the Aluminum Company of America to succeed Arthur V. Davis, who has been made chairman of the board. Mr. Hunt has been a vice-president and director. Edward K. Davis has resigned as a vice-president and director of the company and has been elected president of Aluminum, Ltd.

Samuel Insull, Jr., arrived in New York aboard the Cunard liner *Mauretania* June 8 after a short sojourn abroad.

Edward N. Hurley, chairman of the executive committee of the Electric Household Utilities Corporation, returned from abroad June 11 on the *Leviathan* of the United States Lines after a sojourn in Europe.

Frederick A. Scheffler, special representative of the Fuller Lehigh Company, New York, is at the present time touring Europe. His itinerary includes Lisbon, Naples, Rome, Florence, Venice, Paris and London. Mr. Scheffler will return to New York about July 10.

C. A. Kittredge, who has been connected with the distribution department of the Alabama Power Company, has been transferred to Gadsden in the capacity of district manager. Mr. Kittredge was formerly identified with the company's southern division for several years as superintendent.

John W. Sheehey, for the past ten years superintendent of distribution of the Burlington (Vt.) Light & Power Company, has been appointed manager of the company on behalf of the Peoples Light & Power Company, which lately acquired it from the United Gas Improvement Company. He succeeds D. W. Jardine, who has been transferred to the Philadelphia offices of the U.G.I. organization.

O. J. Miller, for the past five years superintendent of production for the Tennessee Electric Power Company, has been appointed manager of the production and transmission departments of the company, in which capacity he will be responsible for the operation of all of the company's power stations and the construction and operation of the transmission lines throughout the territory served by the company in middle and east Tennessee. A native of Ohio and a graduate of Ohio State University, Mr. Miller first entered the employ of E. W. Clark & Company Management Corporation at Columbus, Ohio, working on various civil and mechanical matters in connection with the operation of public utility properties. In 1920 he removed to Chattanooga with the Tennessee Power Company on various problems of operation and construction and in 1923 he was appointed superintendent of the production department of the company, in which capacity he had active charge of power generating equipment at all of the company's plants.

## *H. B. Crouse Elected President of N.E.M.A.*

Huntington B. Crouse, president of the Crouse-Hinds Company, Solvay, N. Y., was elected president of the National Electrical Manufacturers' Association at the convention held during the past week in Hot Springs, Va. For many years Mr. Crouse has held a position of prominence in the electrical industry not only as a manufacturer of a product of unusual quality but also as a counselor to the industry and its representative associations.

A native of Fayetteville, N. Y., Mr. Crouse became identified with the electrical business immediately following graduation from Andover. He entered the organization already established by his father for the manufacture of panels and switches, the business which later became the Crouse-Hinds Company. Advancing consistently, he came into control in 1905. During his tenure of office the organization attained an enviable position and reputation in the industry and he himself a position of acknowledged leadership.

*H. B. Crouse*

In spite of the time and energy which Mr. Crouse devoted to the upbuilding of the Crouse-Hinds Company he has shown a marked interest in the representative associations of the industry. At the present time he is a member of the board of governors of the N.E.M.A. and of its executive and policy committee, in addition to being chairman of the finance committee and a member of the business policies committee and the labor committee. He is a past-president of the Associated Manufacturers of Electrical Supplies and has been a stanch supporter of the National Electrical Code.

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R. J. Russell, vice-president and a director of the Century Electric Company, has been elected president of the St. Louis Electrical Board of Trade. Mr. Russell is a prominent figure in electrical manufacturing circles, being also a member of the board of the National Electrical Manufacturers' Association.

## *F. G. Hamilton Receives New Appointment*

Fred G. Hamilton has been appointed manager of operations for the Southern California Edison Company. Mr. Hamilton has had 30 years of service with the Edison company and its predecessor organizations. Beginning in 1899 as a lineman for the Mount Whitney Power Company in Visalia, he has continuously advanced through the various ranks until at the time of the consolidatión of the Mount Whitney and Edison companies, in 1917, he was made division superintendent of the San Joaquin Valley district. In 1924 he was transferred to the general office of the Edison Company of Los Angeles as general superintendent of distribution, which put him in charge of all distribution and transmission systems and substation operation. In 1925 he was made assistant manager of operations, which position he held until his recent appointment as head of the operating department.

Prof. A. G. Christie of Johns Hopkins University sailed for England on the *Mauretania* June 13 to be engaged in consulting engineering work during the summer with some British interests.

N. B. Hinson, who since 1922 has been system-planning engineer for the Southern California Edison Company, has been appointed assistant manager of operation. Mr. Hinson has had 22 years of electrical experience, all of which has been with the Southern California Edison Company, having entered the employ of that company immediately after leaving school in 1906. He spent the first few years in the test department of the company in various capacities. In 1912 he was transferred to the general office as assistant distribution engineer. In 1914 he was appointed distribution engineer and in 1919 he was promoted to be assistant superintendent of distribution. In 1922 he became system planning engineer, in which capacity he determined the needs for service and decided upon locations of substations, transmission lines and general system layouts.

Edward B. Meyer, chief engineer of the Public Service Production Company, Newark, N. J., was the guest of honor at a testimonial dinner given May 31 in commemoration of his quarter century connection with Public Service companies. The dinner was given at the Washington Restaurant, Newark, with about sixty friends and associates in attendance. A silver platter, a loving cup and a scroll containing the signatures of those present were presented to Mr. Meyer. Having joined the Public Service Corporation of New Jersey, successor to the United Electric Company, in 1903 as engineering assistant, Mr. Meyer has passed successively through all of the engineering branches of the central-station industry and is today a recognized authority on central-station practice. He is widely known in the engineering world for the contributions he has made to the literature on electric transmission and distribution and he has always given generously of his time to the activities of the various engineering societies, being a member of the American Institute of Electrical Engineers, the American Electric Railway Association, the American Society of Mechanical Engineers and in addition he has served on several committees of the National Electric Light Association.

## *W. H. Burke New President of Southwestern Association*

Walter H. Burke, who was elected president of the Southwestern Public Service Association at the recent convention in Dallas, as announced in the May 12 issue of the Electrical World, has been Southwestern district manager of Stone & Webster, Inc., for the past year. Mr. Burke has been identified with Stone & Webster for some years and has had engineering experience with that organization in various sections of the country. He was graduated from the University of Maine in 1906 and after a short connection with the General Electric Company he entered the public utility field. He spent one year in the Boston office of Stone & Webster and then removed to Dallas, Tex., these properties being under the executive management of Stone & Webster. He relinquished his duties as assistant to the manager of the Dallas utility to join the Milwaukee Electric Railway & Light Company. Rejoining the Stone & Webster organization, he served as manager of the Houghton County Electric Light Company and the Houghton County Traction Company, Houghton, Mich., and in the same capacity with the Keokuk (Iowa) Electric Company. He was manager of the Northern Texas Traction Company and the Tarrant County Traction Company before assuming the managership in the Southwest, comprising the plants in Texas, Louisiana, New Mexico and Mexico, with headquarters in Houston, Tex.

*W. H. Burke*

C. Harold Berry, for nearly three years associate editor of *Power*, a McGraw-Hill publication, has been appointed professor of mechanical engineering in the engineering school of Harvard University, to succeed Dr. Harvey N. Davis, who was recently elected to the presidency of Stevens Institute. The appointment is effective Sept. 1, 1928. Prior to his connection with *Power*, Mr. Berry was with the Detroit Edison Company as technical engineer of power plants, responsible for testing and operating economy in the four steam generating stations of that company. He has been active in the American Society of Mechanical Engineers as a member of the power tests code committee and of the subcommittee on steam turbines.

Louis Larsen, formerly connected with the Sundh Electric Company, Newark, N. J., is now vice-president and secretary of the Wagner Engineering Company, Inc., contracting engineers of New York. Mr. Larsen's resignation as general manager of the Sundh Electric Company followed a period of service which covered 26 years. He started with the organization when it was formed by Mr. Sundh and before becoming general manager he served as works manager and chief engineer. During his connection with the company he was granted many patents on control equipment and in addition he represented the company as executive member in the old Electric Power Club and later in the National Electrical Manufacturers' Association.

## Obituary

John W. Robb of Clinton, Ind., one of the organizers of the Clinton Electric Company in 1890 and past-president of the Indiana Electric Light Association, recently died. Mr. Robb had been identified with the business, church and philanthropic life of his home city for many years. A native of Highland County, Ohio, he entered the mercantile business in Bainbridge, O. Subsequently he took an active part in the affairs of the Wabash Valley Electric Company, which absorbed the Clinton Electric Company some years ago.

John B. Thomas, who had been identified with the Westinghouse company for the past 52 years, died recently at his home in Pittsburgh, Pa. At the time of his death Mr. Thomas was assigned to special duty with the company. Mr. Thomas entered the employ of the Westinghouse company in 1876 and had been with Westinghouse companies since that date. In 1886 he was sent by George Westinghouse to Paris to manage the French branch of the air-brake company. He returned in 1888 and was transferred to the Westinghouse Electric & Manufacturing Company, with which organization he remained until his death.

# Financial and Statistical News

## *Stocks Recover Sharply*
## *Earnings Up 7 Per Cent*

THE extent to which the drastic selling movement in the security markets early this week affected the power and light stocks is seen in an eleven-point drop in the ELECTRICAL WORLD index of common stocks. This index opened the year at 122, rose fairly steadily to 157 on May 19, and then receded to 142, a fifteen-point drop from the year's high. Its position over a longer period is seen by a comparison with this week last year, when it stood at 108, and the same week two years ago, when it stood at 90. The power and light stocks, however, were among the first to recover after the selling wave subsided.

Power and light company annual reports for 1927 continue to show an increase in gross revenue of about 7 per cent, on the average, over 1926. This is regarded as a normal increase and, as normally, the utilities continue to show a decided stability in earnings in the face of a revenue decline in the case of many of the large transportation systems and industrial companies.

Power and light company bond prices have been well maintained without much change from recent levels. There is evidence in the bond market in general of some fluctuation in quotations from recent peaks and fractionally lower prices are recorded in several issues.

## New Italian Loan Floated

The Piedmont Hydro-Electric Company (Società Idroelettricà Piemonte) made an offering of first mortgage gold notes to the amount of $4,000,000, the price being 99¾ and interest, to yield about 5¾ per cent. These one-year 5½ per cent notes were dated June 15, 1928, and mature June 15, 1929. Proceeds will be applied to the acquisition and construction of generating plants, substations and transmission and distribution lines, or to the reduction of debt incurred for these purposes, and for other corporate purposes.

## Date Set for Indiana Merger

A compromise basis for exchange of securities, announced by Halsey, Stuart & Company, of Chicago, indicates that the proposed merger of the Terre Haute, Indianapolis & Eastern Traction Company and the Central Indiana Power Company, under the title of the Indiana Electric Corporation, either is to be declared operative or entirely abandoned soon after July 1. It is believed that the exchange plan will be acceptable because it was proposed by committees of affected bondholders and stockholders and that the merger will be consummated. The proposal follows:

That holders of the first mortgage bonds of three companies—Indianapolis & Northwestern Traction Company, Indianapolis & Martinsville Rapid Transit Company and Indianapolis, Crawfordsville & Danville Electric Railway Company—are to receive one share of Indiana Electric Corporation preferred stock, series A, for each $100 principal amount of bonds.

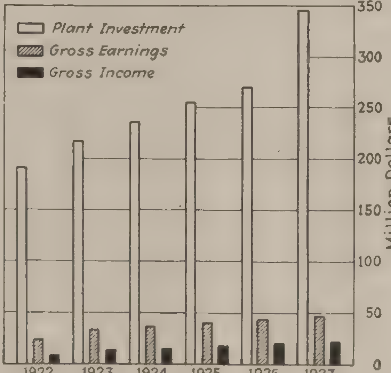
That holders of the 5 per cent cumulative preferred stock of two companies—Indianapolis & Northwestern Traction Company and Indianapolis, Crawfordsville & Danville Electric Railway Company—are to receive Indiana Electric Corporation preferred stock, series B, on a par for par basis.

## German Company Offers Debentures

Gesellschaft für elektrische Unternehmungen (Corporation for Electrical Enterprises), or Gesfürel, issued during the past week 6 per cent sinking fund gold debentures (with stock purchase warrants) to the amount of $5,000,000 at 100 and interest, yielding 6 per cent. The organization, formed in 1894, is one of the leading factors in the development of the electric light and power industry in Germany and in Europe generally.

# American Water Works & Electric Builds More Economical Structure

AN INCREASE of 11 per cent in the operating costs of the American Water Works & Electric Company held the rise in gross income to slightly over 4 per cent, although gross earnings increased approximately 8 per cent.



*Six years development of American Water Works*

The operating ratio rose slightly from 51 per cent in 1926 to 53 per cent last year.

Serving sections of Pennsylvania, Maryland, Virginia, West Virginia and Ohio through a group of subsidiaries operating electric, gas and transportation properties, this holding company has gradually added new units and consolidated them into its system. The group has property, plant and investments valued at approximately $346,500,000 and, with earnings of $48,727,401, showed a property investment of slightly over $7 per dollar of gross earnings last year.

The capital structure of the American Water Works & Electric Company was revamped last year. The entire issue of 7 per cent preferred stock of the old company was called for payment or exchangeable into a 6 per cent preferred stock of the new company. Common stock of the old company was exchanged for common of the new on the basis of two new shares for one old. Per share earnings on the old $20 par common stock were $5.47 in 1926. Last year there was a balance for dividends and surplus of $4,860,146. Preferred dividends would require $1,200,000, leaving $3,660,146 for 1,361,413 shares of no-par common stock, or about $2.70 a share. The stock is currently selling around $56, or about twenty times earnings.

American Water Works & Electric common stock incidentally has proved more than ordinarily remunerative to holders over a period. The average price in 1923 was about 36. In 1924 there was a five-for-one split from $100 to $20 par. This, along with last year's two-for-one split, brings the current value of the new stock to around $630. This growth compares very favorably with that of any comparable company.

The purpose of the recapitalization plan was to produce a more economical means of providing new capital for the rapid growth and profitable extension of the company's business. The change to a Delaware charter allowed the issuance of preferred stock bearing a lower dividend rate than was possible under the old company. There was also a saving in the annual tax bill, and since the stock of a Delaware corporation is not subject to the Delaware inheritance tax when held by non-residents of Delaware it would be of importance to the vast majority of common stockholders, who were subject to the Virginia inheritance tax.

## Buffalo, Niagara & Eastern Sells Stock Issue

In connection with its large-scale simplification and consolidation program the Buffalo, Niagara & Eastern Power Corporation will now issue 350,000 shares of 5 per cent cumulative first preferred stock at a price of 95½ and accrued dividend. Around 290,000 shares were placed through exchange for preferred stocks of subsidiaries and the balance is being offered subject to prior sale. In other words, the issue is entirely for refunding purposes and is an important step in the simplifying of the new capital structure. After completion of the present financing the capitalization of the parent company will comprise two preferred issues, two common issues and a small amount of scrip, and the stocks of the corporation junior to the first preferred stock, which is the present issue, have a market value, based on current quotations, in excess of $150,000,000.

CENTRAL STATES ELECTRIC DECLARES INITIAL STOCK DIVIDEND.—An initial quarterly stock dividend of 2½ per cent (1/40 of a share) in common stock, together with the regular cash quarterly dividend of 25 cents per share, was declared on the common stock of the Central States Electric Corporation at a meeting of the board of directors held June 5, payable July 2 to stockholders of record June 11. It is expected that this 2½ per cent quarterly stock dividend marks the inauguration of regular dividends at the annual rate of 10 per cent in common stock and $1 in cash. The directors also declared a regular quarterly dividend of $1.75 per share on the 7 per cent preferred stock, payable June 30 to stockholders of record June 9, and $1.50 per share on the 6 per cent cumulative preferred stock, payable July 2 to stockholders of record June 11.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of 49,310 shares of $6 preferred stock of the American & Foreign Power Company, Inc., without par value, on official notice of issuance, in exchange for securities of the Mexican Utilities Company. Recently there has also been authorized for listing (a) 38,736 additional shares of common stock of the American Power & Light Company on official notice of issuance and distribution in payment of a stock dividend and 65,000 shares of common stock on official notice of issuance for a consideration of cash at the rate of not less than $83 per share, making the total amount of common stock applied for 2,085,758 shares; (b) 787,601 shares of preferred stock ($6 cumulative dividend) now outstanding in the hands of the public and 9,727 shares of preferred stock ($6 cumulative dividend) on official notice of issuance in exchange for common stock of the Washington Water Power Company, making the total amount of preferred stock applied for 797,328 shares. Preferred stock of the Standard Gas & Electric Company ($4 cumulative preferred) has been authorized for listing to the amount of 535,259 shares on official notice of issuance of temporary interchangeable $4 cumulative preferred stock certificates in exchange, share for share, for the 8 per cent cumulative preferred stock (par $50 per share) which at the present time is listed on the big board.

FURTHER EXPANSION ANNOUNCED FOR SHAWINIGAN COMPANY.—Stockholders of the Shawinigan Water & Power Company will be asked at a spe-

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday June 12 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new — no par | 61½ | 57 | 85 |
| Ala. Pwr., $7 cum. pf.—no par | 115¼ | 114 | 116 |
| Allis Chalmers Mfg.,6% com. | 117 | 115⅛ | 129¾ |
| Aluminum Co. of Amer., com. | 159½ | 120 | 197¾ |
| Aluminum Co. of Amer., 6% pf | *m*109⅞ | 105¼ | 110¼ |
| Amer & Foreign Pwr., 7% pf.—no par | 108½ | 105¼ | 110 |
| Amer & Foreign Pwr., com. no par | 32⅝ | 22⅝ | 38⅞ |
| Amer. Bosch Magneto, com.—no par | 31⅞ | 15⅜ | 41 |
| Amer. Brown Boveri Elec †. | 16⅞ | 10⅝ | 26¼ |
| Amer. Brown Boveri Elec., pf. $7 | 58½ | 40¼ | 65¾ |
| Amer. Gas & Elec., 6% pf.—no par | *m*107¾ | 106¾ | 111 |
| Amer. Gas & Elec., com †—no par | 156 | 117½ | 184 |
| Amer. Lt. & Trac., 6% pf. | *m* 114 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 216½ | 170 | 249 |
| Amer. Pwr. & Lt., 5% pf. | 81⅛ | 81 | 87 |
| Amer. Pwr. & Lt., com. †—no par | 77¼ | 62½ | 95 |
| Amer. Pub. Serv., 7% pf. | *a*103½ | 97½ | 104 |
| Amer. Pub. Serv., com. † | *m* 60 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | *a* 96 | 96 | 97½ |
| Amer. Pub. Utilities, 7% pr. pf. | *a*102 | 95¾ | 103 |
| Amer. Pub. Utilities, com | *m* 50 | ... | .. |
| Amer. States Sec., A | *a* 11 | 4 | 13⅞ |
| Amer. States Sec., B | *a* 14 | 4⅞ | 17⅞ |
| Amer. Superpwr., 6% 1st pf. | *l* 102¼ | .... | ... |
| Amer. Super pwr., Class A†—no par | 36¾ | 35¼ | 56 |
| Amer. Super pwr., Class B†—no par | 37⅛ | 36⅛ | 56⅞ |
| Amer Wtr. Wks. & Elec, 6% pf.—ex.div. | 102½ | 101½ | 106 |
| Amer. W W. & E., com new—no par | 57 | 52 | 70¾ |
| Anaconda Copper cap $3 | 65¾ | 53¾ | 74⅞ |
| Appalachian Electric Pwr., 7% pf | *m*108½ | 108½ | 110 |
| Arkansas Pwr., & Lt 7% pf | 107½ | 108 | 109¾ |
| Assoc Gas & Elec, $3.50 50 | 52 | .... | . |
| Assoc Gas & Elec., pf.—$6—no par | 93 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 48 | 46⅛ | 56⅞ |
| BABCOCK & WILCOX, 7% com. | 119½ | 117½ | 128 |
| Binghamton L., H. & P., $6 pf. | 106 | 102 | 109¼ |
| Birmingham Elec., pf.—$6—no par | *m*106 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf. | *m*109 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | *m*165 | 135 | 170 |
| Blaw-Knox, com † | *i*106½ | 91 | 108 |
| Brazilian Trac., Lt. & Pwr., com., new | *f* 54 | . . | . |
| Broad River Pwr, 7% pf | 105 | 105 | 108¼ |
| Brooklyn Edison, 8% com | 239¾ | 206¼ | 268½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf.—25 | *l*26 | .... | .. |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | *l* 39 | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | *m* 99 | 98 | 101 |
| Carolina Pwr. & Lt., pf.—$7—no par | *l*111½ | 109 | 111 |
| Central & S. W. Util., $7 pf.—no par | *a*104 | 99¼ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | *a*109 | 103½ | 112 |
| Central Ark Ry. & Lt, 7% pf | 106 | 105 | 107½ |
| Central Ill. Pub. Serv., $6 pf. | *a* 99 | 97⅛ | 100⅞ |
| Central Ind. Pwr., 7% pf. | *a* 99½ | 95 | 101¾ |
| Central Maine Power, 6% pf. | 97 | 96 | 98½ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 108 | 104½ | 114 |
| Central States Elec., 7% pf. | 117 | 104¼ | 121⅞ |
| Cincinnati Gas & Elec., 5% com. | *g*100⅛ | .... | .... |
| Cities Service, $6 pf.—no par | *l* 102½ | 94½ | 103½ |
| Cities Service, pf. B—no par | *l* 9½ | 8⅛ | 9⅛ |
| Cities Service, pf. BB—no par | *l* 96 | 88½ | 97 |
| Cities Service, com—20 | *l* 71⅜ | 54 | 71⅜ |
| Cities Service, Bks. Shrs.—10 | *l* 33¼ | 26⅛ | 35¼ |
| Cities Service Pwr. & Lt., 7% pf. | *m*108 | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf. | 100¾ | 95½ | 102 |
| Cleveland Elec. Illg., 6% pf. | 113 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 425 | 350 | 425 |
| Columbia Gas & Elec., 6% pf. | 109 | 107⅛ | 110⅛ |
| Columbia G & E. com. $5—no par | 104⅞ | 89½ | 118⅜ |
| Columbus Elec. & Pwr., $2 com.—no par | *n* 79 | 66 | 79⅞ |
| Columbus Elec. & Pwr., 7% | 110 | .... | .... |
| Columbus Ry., Pwr. & Lt., 7% | 108 | 107 | 111 |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 107 | 105 | 111 |
| Columbus Ry., P. & Lt. com. no par | 125 | 120 | 125 |
| Commonwealth Edison, 8% com. | *a*181 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 103⅛ | 102⅛ | 104⅞ |
| Commonw'th Pwr., $2, com.—no par | 72¾ | 62¼ | 87½ |
| Conn. Lt. & Pwr., 8% pf. | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117½ | 118 | 121 |
| Cons. Gas of N. Y., pf | 101 | 101 | 105 |
| Cons. Gas of N. Y., com. $5—no par. | 144⅜ | 119⅛ | 170¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | *e*111 | 110 | 114½ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | *e*100 | 100½ | 105¾ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par | *e* 82 | 67½ | 93 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | ... | .... |
| Consumers Pwr., 6% pf. | 104 | 105½ | 106½ |
| Consumers Pwr., 6.6% pf. | 105 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 108 | 106½ | 108½ |
| Contl. G. & E. com. $4.40—no par | *m*250 | 240 | 265 |
| Crocker Wheeler, com.† | 65 | 23 | 70 |
| Crocker Wheeler, 7% pf. | 96 | ... | ... |
| DALLAS PWR. & LT., 7% pf. | 110½ | 110 | 111½ |
| Dayton Pwr & Lt., 6% pf. | 108 | 108½ | 110½ |
| Derby Gas & Elec., 7% pf. | 101½ | 96 | 100½ |
| Detroit Edison, 8% com. | 194½ | 166½ | 209¾ |
| Dubilier Condenser, com.—no par | 4 | 2⅛ | 5⅛ |
| Duke Pwr., cap. | *m*140 | 130 | 145 |
| Duquesne Lt., 5% pf. | 101 | 101 | 116½ |
| EASTERN NEW YORK UTIL., $7 pf. | *m*110 | 111 | 112½ |
| Eastern States Pwr. B | 22 | 11¼ | 26½ |
| Eastern States Pwr., pf. | *m*108 | 98 | 100½ |
| East Tex Elec., 7% pf | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | *d*277 | 252 | 305 |
| El Paso Elec. 7% pf. | 115 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | *l*110⅛ | 108⅞ | 111⅞ |
| Elec. Bd. & Sh. Sec., com. $1—no par | *l*110½ | 76 | 127½ |
| Electric Household Util.† | *a* 23½ | 13⅛ | 27 |
| Elec. Investors, 6% pf.—no par | 102 | 101 | 104¼ |
| Elec. Investors, com.†—no par | 64¾ | 40⅛ | 79⅞ |
| Elec. Pwr. & Lt., ctfs. pf. | 109½ | 106½ | 110¼ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 35 | 28⅞ | 45½ |
| Elec. Ry. Securities, com—no par | 6¾ | . | .. |
| Elec. St. Battery com $5.25—no par | 76½ | 69 | 84⅞ |
| Elmira Wtr., Lt. & R.R., 7% pf. | *m*114 | 104 | 115 |
| Empire Pwr., ptc.† | 34¼ | 30 | 39½ |
| Engr. Pub. Serv. $5, pf.—no par | *m* 99½ | 99½ | 102 |
| Engr. Pub. Serv., com.—no par | 38⅜ | 33 | 46½ |
| Eureka Vacuum Cleaner, com. $4—no par | 67 | 66 | 79 |
| FAIRBANKS MORSE, 7% pf. | *m*108¼ | 104 | 114⅞ |
| F.-M., com.—$3—no par—ex.div. | 39¼ | 32½ | 54 |
| Federal Lt. & Trac., com. $1.40 | 54⅞ | 42 | 56⅞ |
| Federal Lt. & Trac., $6 pf.—no par | *m*105 | 98 | 109 |
| Florida Pwr. & Lt., 7% pf. | 106⅞ | 104⅝ | 108½ |
| Ft. Worth Pwr. & Lt., 7% pf. | *l* 113 | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf. | 80 | 75 | 85 |
| Galveston-Houston Elec., com. | 35 | 31⅞ | 35 |
| General Cable, Cl. A | 66½ | 56 | 84¾ |
| Gen. Elec. $3 com.—no par | 148½ | 124 | 174½ |
| Gen. Elec., special—6% | 11⅜ | 11¼ | 11¾ |
| Gen. Gas & Elec. (Del.) com A $1.50—no par—ex. div. | 42⅜ | 35¼ | 50⅞ |
| Gen. G. & E. (Del.) pf. A $8—no par | *m*133 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par. | *m*111 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 | *m*111 | 104 | 117 |
| Gen. Pub. Serv., $7 pf. | 126 | 115 | 140 |
| Gen. Pub. Serv., com., no par | 23⅞ | 16⅞ | 29 |
| General Public Utilities, $7 pf. | *m*101½ | 98 | 103 |
| Ga. Lt., Pwr. & Rys., com. | *m* 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | *h*103 | .... | ... |
| IDAHO PWR., 7% pf. | 108 | 109 | 111¼ |
| Ill. No. Utilities, 6% pf | *m* 99 | 96 | 100 |
| Ill. Pwr. & Lt., 7% pf | 105¼ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | 107 | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf. | 101 | 100 | 105 |
| Ingersoll Rand com. | 92¼ | 90 | 98 |
| Int. Combus. Engr., com. $2—no par | 59 | 45½ | 72⅞ |
| Int. Combustion Engr., 7% pf. | *m*108½ | 103 | 109 |
| Int. Util., Class A—$3.50—no par | 47⅞ | 44⅞ | 52 |
| Int. Utilities, Class B—no par | 14⅞ | 6⅞ | 19½ |
| Interstate Pwr., pf.—$7—no par | 103 | 99 | 105 |
| Interstate Pub. Serv., 7% pf. | *m*105½ | 103 | 108 |
| Iowa Ry. & Lt., 7% pf. | 106½ | 105 | 107 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf | 106½ | 105 | 107 |
| Johns-Manville, com †—no par | 113 | 107 | 134 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 13. *m*Bid price Saturday, June 9. *n*Latest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday June 12 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY POWER & LIGHT pf. $7 | m110½ | 109 | 114 |
| Kansas Gas & Elec. 7% pf. | i109 | 107 | 110 |
| Kelvinator Corp. | 16 | 11⅛ | 22¾ |
| Kentucky Hydro-Elec., 7% pf. | m104 | 100 | 105 |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | m104 | 100 | 105 |
| LACLEDE GAS LT., 10% com. | m200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | m 65 | 19⅜ | 65 |
| Long Island Ltg., 7% pf. | m110 | 110½ | 112½ |
| Long Island Ltg., 6% pf. | m107⅜ | 107 | 109 |
| Long Island Ltg., com.†—no par | m250 | 170 | 250 |
| Los Angeles Gas & Elec., 6% pf. | 111 | 105 | 112 |
| Louisville Gas & Elec., cl. A. $1.75 | 34½ | 28 | 41 |
| MAN. ELEC. SUPPLY, cap. $5—no par | 63¼ | 50 | 66¾ |
| Maytag Co., com. 50—no par | 19⅞ | 19 | 40¼ |
| Memphis P. & L., pf.—$7—no par | m109¼ | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 105½ | 103 | 109⅞ |
| Metropolitan Ed., pf.—$7—no par | 109 | 109 | 111⅛ |
| Metropolitan Ed., com. $8—no par | m170 | 125 | 185 |
| Middle West Utilities, 6% pf. | a 99¾ | 93⅝ | 100½ |
| Middle West Util., 6% pr. lien | a103 | 99 | 108 |
| Middle West Util., com. $7—no par | a145½ | 123½ | 169 |
| Midland Utilities, pr. ln. 6% pf. | a 95¼ | 94⅜ | 97 |
| Midland Utilities, 7% pf. A | a 90¼ | 89⅞ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | m104 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | m108 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | i108½ | 107 | 109 |
| Miss. River Pwr., 6% pf. | 111½ | 94 | 112½ |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | m107 | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | m105 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 39¼ | 29½ | 53 |
| Montana Pwr., 5% com. ex. div. | 163 | 102⅞ | 175 |
| Montreal Pwr., 7½% com. | n 107 | .... | .... |
| Mountain States Pwr., 7% pf. | m104 | 97 | 105 |
| Mountain States Pwr., com.† | 18⅜ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 110 | 98 | 110½ |
| National Carbon, 8% pf. | a138 | 136½ | 139⅞ |
| National Elec. Pwr., A† | a 32¼ | 27½ | 42 |
| National Pwr. & Lt., pf.—$6—no par | m103 | 102 | 106 |
| National Pwr. & Lt., com.†—no par. | 32¾ | 21⅞ | 36¼ |
| National Pub. Serv., 7% pf. | 103 | 99 | 104 |
| National Pub. Serv., 7% ptc., pf. | n114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 27¼ | 22 | 29⅝ |
| National Pub. Serv., B com.—no par | 30 | 24⅛ | 34½ |
| Nebraska Pwr., 7% pf. | i110 | 110 | 111½ |
| Nevada-Calif. Elec., com. | m 47 | 33¼ | 50 |
| New Brunswick Pwr., 4% pf. | m 63 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | m110 | 98½ | 110½ |
| New Eng. Pub. Serv., pf. $7 | m106 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 107½ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 102 | 91 | 104 |
| N. Y. Central Elec., 7% pf. | m106 | 101 | 107 |
| New York Power & Light 7% pf. | 114 | .... | .... |
| NiagaraFalls Pwr., 7% pf.—25 | m 27½ | 27⅛ | 29½ |
| No. Amer., 6% pf.—50 | 55 | 53¼ | 55⅞ |
| No. Amer., com.—10 | 68¾ | 58⅞ | 78⅞ |
| No. Amer. Edison, $6 pf.—no par | 100¾ | 100¼ | 105⅞ |
| Northeastern Pwr., com. | 28⅞ | 19⅞ | 31 |
| No. N. Y. Utilities, 7% pf. | 108 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 26⅞ | 18 | 32 |
| Northern Ohio Pwr. & Lt., 6% pf. | m 99 | 90 | 100 |
| No. Ont. Lt. & Pr. 6% pf. | m 99 | 94 | 100 |
| No. States Pwr. (Del.), 7% pf. | m109½ | 101 | 110 |
| No. States Pwr. (Del.), 8% com. | 137 | 123 | 152 |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par. | m 97⅞ | 89 | 100½ |
| Ohio Brass, 6% pf. | m105 | 106 | 111 |
| Ohio Pwr., 6% pf. | m107 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | m103 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 111 | 107 | 112 |
| Ohio River Edison, 7% pf. | 109½ | 106 | 109⅞ |
| Oklahoma Gas & Elec., 7% pf. | 109 | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 26½ | 26⅛ | 30 |
| Pacific Gas & Elec., 8% new com. | 46 | 43⅛ | 53¾ |
| Pacific Pwr. & Lt., 7% pf. | l110 | 106 | 110 |
| Packard Electric | k 68 | 47 | 68 |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 80 | 79⅛ | 82 |
| Penn-Ohio Edison, 6% pf. no par | m 98 | 78 | 99 |
| Penn-Ohio Edison, 7% pf. | 106½ | 106 | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 109 | .... | .... |
| Penn Pwr. & Lt.—$7—no par | l110 | 109⅞ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 80 | 68 | 90 |
| Phila. Co., 5% pf.-50 | m 46⅛ | 45⅛ | 48⅛ |
| Phila. Co., 6% pf.—50 | m 54 | 52 | 57 |
| Phila. Co., com.—50 | 160 | 145 | 174¾ |
| Phila. Elec., 8% com.—25 | c 68 | 55½ | 74¾ |
| Portland Elec. Pwr., 7% pf. | 104 | .... | .... |
| Portland Elec. Pwr., 6% pf. | 95 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 43 | .... | .... |
| Potomac Elec. Power, 6% pf. | j111½ | .... | .... |
| Pwr. Sec., pf.—no par | m 65 | 50 | 68 |
| Pwr. Sec., com.—no par | m 14⅞ | 11⅛ | 14½ |
| Public Serv. of Colorado, 7% pf. | 108 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 111 | 103⅞ | 115 |
| Pub. Serv. of N. J., 7% pf. | m129⅛ | 118 | 129½ |
| Pub. Serv. of N. J., $2 com.—no par | 54½ | 41½ | 66⅞ |
| Pub. Serv. of No. Ill., 6% pf. | a117 | 110 | 117 |
| P. S. of No. Ill., com. $8—no par | a180⅛ | 159½ | 190½ |
| Pub. Serv. of No. Ill., $8 com. | a181 | 139⅞ | 190 |
| Pub. Serv. of Okla., 7% pr. ln. | m105 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 107⅜ | 107¼ | 110⅛ |
| Puget Sound Pwr. & Lt., 7% pf. | m110 | 105 | 110 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 101 | 92 | 105¾ |
| Puget Sound Pwr. & Lt., com. | 68⅞ | 34⅞ | 84⅞ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | m57 | 54½ | 60 |
| Radio Corp. of Amer., com.—no par. | 196½ | 85¼ | 224 |
| Rochester Gas & Elec. 6% pf. D. | m105 | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B. | 107½ | 105 | 108 |
| Rochester Gas & Elec., 6% pf. C. | 105 | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | m115 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | m 75 | 70 | 75 |
| Servel. Inc. | 14½ | 4¼ | 17½ |
| Sierra Pacific Elec., 2% com. | 35½ | 29 | 40½ |
| Sioux City Gas & Elec., 7% pf. | 106½ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l109 | . | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 88 | .... | .... |
| Southeastern Pwr. & Lt, com.—no par | 49¼ | 40⅛ | 61 |
| So. Calif. Edison, 8% pf. | m50 | 38½ | 53 |
| So. Calif. Edison, 7% pf. | 29 | 28⅛ | 30 |
| So. Calif. Edison, 6% pf. | 26 | 25½ | 27⅛ |
| So. Calif. Edison, 8% com. | 45⅞ | 43⅛ | 53½ |
| Southern Cities Utilities, 7% pf. | m 83 | 75 | 92 |
| Southwestern Lt. & Pwr., A $3 | 80 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 70 | ... | ... |
| Southwestern Lt. & Pwr., $6 pf. | 93 | 88 | 96⅛ |
| Southwestern Pwr. & Lt., 7% pf. | m111 | 103 | 115 |
| Standard Gas & Elec., 8% pf., ex. rts. | 69½ | 65 | 71½ |
| Standard Gas & Elec., 7% pr. pf. | 113½ | 108 | 115 |
| Standard G. & E., com. $3.50 | 64⅛ | 57⅞ | 74⅞ |
| Standard Power & Light, com. | 51 | 29¾ | 58½ |
| Standard Pwr. & Lt., 7% pf. | m105 | 98 | 106 |
| Staten Island Edison, pf.—$6—no par | 100 | 99 | 103½ |
| Superheater, $6 com.—no par | 153½ | 149¾ | 178 |
| Syracuse Lighting, 7% pf. | m111 | 103 | 112½ |
| Syracuse Lighting, 8% pf. | m120 | 114 | 121 |
| TAMPA ELEC., com. $2 | m 67⅞ | 62 | 71 |
| Tenn. Elec. Pwr., 6% pf. | 101 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109¼ | 107 | 110 |
| Tex. Pwr. & Lt., 7% pf. | i113½ | 113¼ | 115 |
| Tide Water Pwr., 8% pf. | 110 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 119¼ | 112⅛ | 134 |
| Toledo Edison, 7% pf. | 109 | 108 | 111 |
| Toledo Edison, 6% pf. | m104 | 95 | 105 |
| Toledo Edison, 6% com. | m145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | m 92 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 97 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c137⅛ | 114⅛ | 149⅞ |
| United Lt. & Pwr., pf.—$4—no par. | m 56½ | 49 | 56½ |
| United Lt. & Pwr., pf.—$6.50—no par | m100 | 95 | 101½ |
| United L. & P., com. A .48—no par. | 21⅛ | 13¾ | 26¾ |
| United L. & P., com. B .48—no par. | 27¼ | 20 | 31 |
| Utah Pwr. & Lt., 7% pf.—ex. div. | i109½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 104 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | m20[illegible] | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 103 | 98 | 104 |
| Utilities Pwr. & Lt., com. A $2 | 37¼ | 28½ | 45⅞ |
| Utilities Pwr. & Lt., com. B $1—no par | 27½ | 18½ | 32⅞ |
| VERMONT HYDRO-ELEC., 7% pf. | m100 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | m108 | 108 | 111 |
| Virginia Public Service 7% pf. | 104 | 97 | 104 |
| WAGNER ELEC., 7% pf. | b106½ | 96⅛ | 107 |
| Wagner Elec., com.—no par | b 77⅛ | 37 | 120 |
| Washington Ry. & Elec., 7% com. | j450 | .... | .... |
| Washington Ry. & Elec., 5% pf. | j100½ | .... | .... |
| Washington Wtr. Pwr., 8% com. | m227 | 175 | 235 |
| West Penn Elec., 6% pf. | 111 | 108⅞ | 115 |
| West Penn Elec., Cl. A $7 | m109 | 106½ | 112 |
| West Penn Pwr., 7% pf. | 116¼ | 114⅞ | 117 |
| West Penn Pwr., 6% pf. | m108½ | 108 | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | m 95 | 94 | 100 |
| Western Pwr., 7% pf. | m104 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 99 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | ... | ... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 95¼ | 88½ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | 34½ | 30¾ | 36⅞ |
| Weston Elec. Instrument, com.—no par | 22¼ | 12⅛ | 28½ |
| Wheeling Elec., 6% pf | m 108 | 95 | 109 |
| Worthington Pump, 7% pf. A | m 52 | 46¼ | 58⅞ |
| Worthington Pump, 6% B | m 47 | 41 | 51 |
| Worthington Pump, com. | 32½ | 28 | 37⅞ |
| YALE & TOWNE com. ($5—25) | 72 | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 13. *m*Bid price Saturday, June 9. *n*Latest quotations available. †Dividend rate variable.

cial meeting called for June 26 to approve an increase in the authorized common stock from 1,600,000 to 2,600,000 shares, the additional 1,000,000 no par shares to be issued from time to time as deemed necessary by the directors. This represents the second increase which has been made in the capitalization this year, the former increase, which was from 1,200,000 to 1,600,000 shares, having been authorized at a special meeting of the shareholders held Feb. 21.

MAYTAG COMPANY PLACES COMMON STOCK ON ANNUAL DIVIDEND BASIS.—The directors of the Maytag Company have declared an initial quarterly dividend of 37½ cents per share on the new common stock of the Maytag Company, no par value, payable July 1 to holders of record June 15.

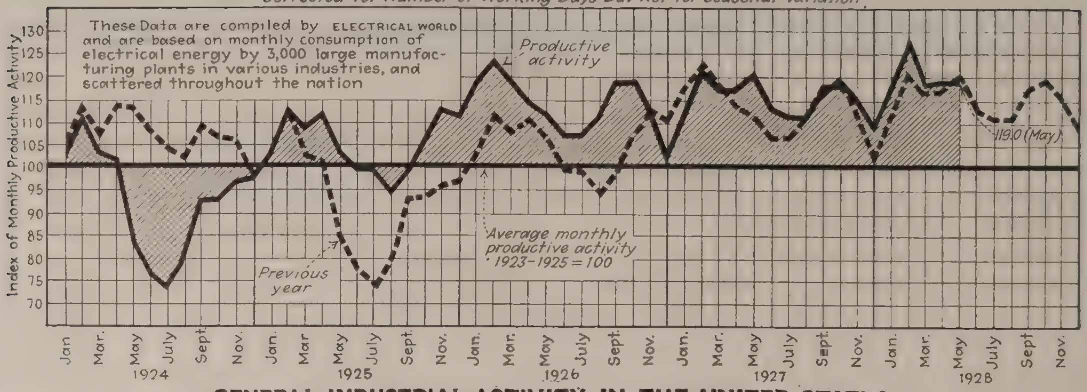
## Southeastern Power Plans Capital Increase

Directors of the Southeastern Power & Light Company have proposed increasing its capitalization from 7,000,000 shares to 8,000,000 shares through the creation of 1,000,000 shares of $5 dividend preferred stock. Shareholders will be asked to approve the proposal at the annual meeting on July 11.

The present capitalization of Southeastern comprises 750,000 shares of $7 preferred, 250,000 shares of $6 preferred, 1,000,000 shares of participating preferred and 5,000,000 shares of common, all of which have no par value. The new $5 preferred issue would rank *pari passu* with the $6 and $7 preferred stock. The company announces it has no plans for issuing the new preferred stock immediately, and that it will be created solely to provide a means for more economical future financing.

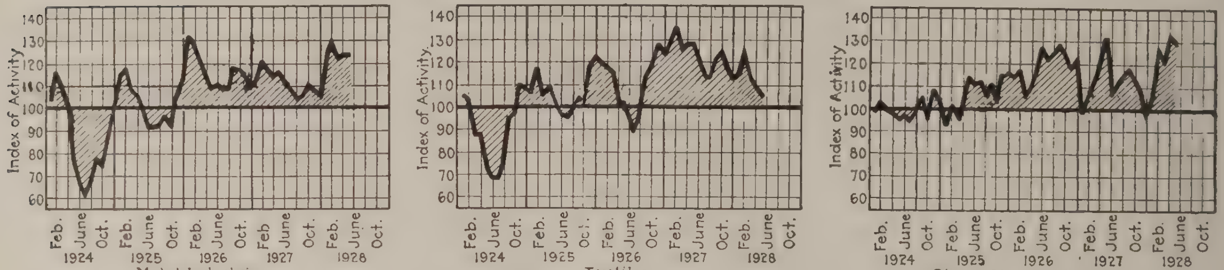
GENERAL PUBLIC SERVICE TO INCREASE PREFERRED STOCK.—The directors of the General Public Service Corporation have called a special meeting of stockholders for June 21 to vote on an increase in preferred stock from 75,000 to 175,000 shares as a preliminary to reconstruction of the capital base of the company. In a statement explaining the proposed increase, C. W. Kellogg, president, said the corporation had an exceptionally large equity base, more than 50 per cent of its asset value being represented by common stock and an additional 14 per cent being represented by convertible preferred stock which was junior to the preferred stock.

Corrected for Number of Working Days But Not for Seasonal Variation



These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,000 large manufacturing plants in various industries, and scattered throughout the nation

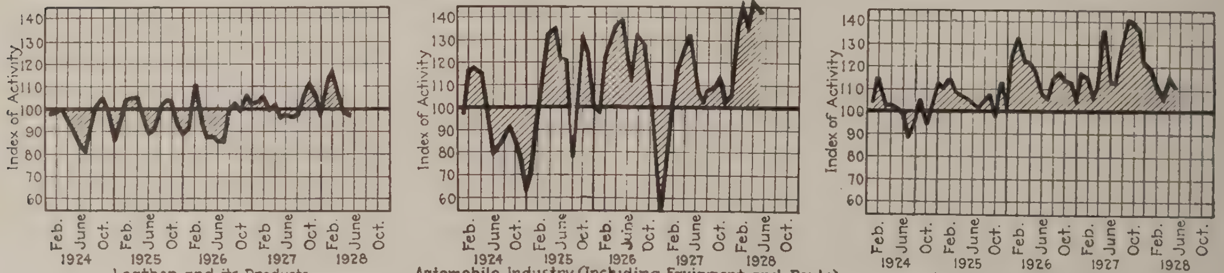
**GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES**



Metal Industries

Textiles

Stone, Clay, and Glass



Leather and its Products

Automobile Industry (Including Equipment and Parts)

Lumber and its Products

**PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES**

# High Productive Operations Maintained During May

THAT the volume of general production during the first five months of the current year has been about 2.7 per cent above that during the same period in 1927 is indicated by reports on electrical energy consumption received by the ELECTRICAL WORLD from approximately 3,000 large manufacturing plants scattered throughout the nation and in various industries, plants consuming more than 15,000,000,000 kw.-hr. of electrical energy per annum. The basic figures indicate that eight of the primary industrial groups—rolling mills and steel plants, ferrous and nonferrous metal working plants, leather and its products, automobile, stone, clay and glass, rubber and its products, chemicals and allied products, and food and kindred products—turned out a volume of products during the period greater than in 1927, although in some of the groups the increased volume was only slight. On the other hand, four just as important industrial groups—textiles, lumber and its products, paper and pulp, and shipbuilding — were operating during these five months as a whole at a lower rate than in 1927.

The rate of industrial production during May was about 0.2 per cent under April and about 1.3 per cent under May of last year. This is the first time since last September that the index of industrial activity has been under that of the same month in the year previous. May was the peak month of industrial activity last year, while the indications seem to be that the peak of activities during the current year were reached in February.

The index of activity in general industry based on consumption of electrical energy stands at 119.0 for May, as compared with 119.3 for April. Comparative index of productive activity referred to the average activity for the period 1923-25 as 100 and adjusted for number of working days are as follows:

| | |
|---|---|
| May, 1928 | 119.0 |
| April, 1928 | 119.3 |
| March, 1928 | 118.2 |
| May, 1927 | 120.7 |
| Average first five months of 1928 | 120.5 |
| Average first five months of 1927 | 117.3 |

The rate of operations in the rolling mills and steel plants was quite significant, standing at almost the same in April and even above that of March. The usual seasonal decrease in the rate of activities of this industry has not been made apparent so far this year. The May operations were about 2.1 per cent over those of May last year. The ferrous and non-ferrous metal working plants have also increased their rate of operations during the past two months, and in May were operating on a plane about 12.5 per cent over last year. The volume of production in these plants since the opening of the year has been about 10 per cent over that of last year. Decreased activities are evident in the automobile industry, May operations being about 4.7 per cent under April, but still 7.6 per cent above May last year.

# Business News and Market Conditions

## Sales Conference Undertakes Market Study

In furthering its work of developing a selling program for all branches of the industry, the Electrical Industry Sales Conference, through its sales plan committee, has engaged marketing counsel to undertake immediately a research study into all consumer and industry factors governing the market for adequate wiring in the home. Out of the facts obtained will be built the co-operative selling plan for early presentation to the industry. The sales plan committee investigated the field of research and advertising and, after receiving the presentations of a number of representative firms, selected the J. Walter Thompson Company, New York. Messrs. J. E. Davidson, chairman; G. E. Cullinan, vice-chairman; W. E. Sprackling, L. W. Davis, J. E. North and J. L. Ray comprise the sales plan committee, which is also to function as the working contact committee through the study and development of the selling plan.

It will be recalled that, in approaching its work in a definite way, the Electrical Industry Sales Conference, appointed for the purpose of considering and developing a national sales program for the industry, adopted at its first meeting the following resolutions:

That the Industry Sales Conference make as its first objective the development of a broad industry program for its promotion of more adequate house wiring through an organized national movement to rewire the houses now connected to power systems of America where the installations provide inadequate facilities

### *Value and Destination of Electrical Exports for March, 1928, Compared With Corresponding Month in 1927*

| Article | March | |
|---|---|---|
| | 1927 | 1928 |
| Generators: | | |
| Direct Current: | | |
| Under 500 kw | $56,347 | $146,014 |
| 500 kw. and over | 30,919 | 143,124 |
| Alternating current: | | |
| Under 2,000 kva. | 11,210 | 3,665 |
| 2,000 kva. and over | 36,879 | ....... |
| Steam turbine generator sets | 22,265 | 23,502 |
| Accessories and parts for generators | 76,108 | 127,028 |
| Self-contained lighting outfits | 99,716 | 114,140 |
| Batteries: | | |
| Flashlight batteries | 191,328 | 284,246 |
| Other dry and wet cell primary batteries | 181,574 | 276,606 |
| Storage batteries | 270,270 | 347,215 |
| Transforming or converting apparatus: | | |
| Power transformers | 237,214 | † |
| Power transformers, 500 kva. and over | * | 162,597 |
| Distribution transformers, less than 500 kva | * | 70,581 |
| Other transformers | 73,818 | † |
| Instrument transformers | * | 5,590 |
| Other transformers, not elsewhere stated | * | 60,301 |
| Battery chargers under 15 amp | * | 22,638 |
| Rectifiers, double current and motor generators, dynamotors, synchronous and other converters | 95,197 | 143,731 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephone | 81,931 | 222,124 |
| Switches and circuit breakers over 10 amp | 230,130 | 120,911 |
| Fuses and fuse blocks | 26,730 | 35,408 |
| Watt-hour and other measuring meters | 43,476 | 87,708 |
| Volt, watt, and ampere meters, and other recording, indicating, and testing apparatus | 164,092 | † |
| Electrical indicating instruments | * | 24,450 |
| Electrical recording instruments | * | 25,207 |
| Other electrical testing apparatus | * | 72,758 |
| Lightning arresters, choke coils, reactors and other protective devices | 45,723 | 69,504 |
| Motors, starters and controllers: | | |
| Motors under 1 hp | 187,983 | ‡ |
| Motors ⅛ hp. and under | * | 171,165 |
| Motors over ⅛ hp and under 1 hp | * | 75,057 |
| Stationary motors: | | |
| 1 to 200 hp | 302,247 | 327,147 |
| Over 200 hp | 49,902 | 41,078 |
| Railway motors | 37,130 | 175,459 |
| Electric locomotives: | | |
| Railway | ........ | ........ |
| Mining and industrial | 58,396 | 22,379 |
| Station and warehouse electric motor trucks | 21,529 | 3,238 |
| Starting and controlling equipment: | | |
| For Industrial motors | 116,754 | 130,332 |
| For electric railway and vehicle motors | 9,100 | 6,237 |
| Portable electric tools | 83,495 | 131,601 |
| Accessories and parts for motors | 183,541 | 214,585 |
| Electric appliances: | | |
| Electric fans | 107,316 | 136,907 |
| Electric lamps: | | |
| Metal filament | 151,758 | 131,202 |
| Other electric lamps | 31,224 | 101,353 |
| Flashlights | 246,591 | 312,590 |
| Searchlights and projectors | 45,558 | 55,898 |
| Motor-driven household devices: | 237,307 | † |
| Electric vacuum cleaners | * | 125,131 |
| Other motor-driven devices, except tools | * | 79,124 |
| Electric flatirons | * | 29,321 |
| Domestic heating and cooking devices: | 136,841 | |
| Electric cooking ranges | * | 26,979 |
| Other domestic heating and cooking devices | * | 78,464 |
| Industrial electric furnaces and ovens | 33,039 | 17,845 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc. | 112,357 | 167,563 |
| Signal and communication devices: | | |
| Radio apparatus: | | |
| Transmitting sets and parts | 69,368 | 42,726 |
| Receiving sets | 196,622 | 272,024 |
| Tubes | 105,534 | 93,681 |
| Receiving-set components | 138,768 | 209,110 |
| Receiving-set accessories | 146,180 | 240,761 |
| Telegraph apparatus | 76,780 | 57,178 |
| Telephone apparatus: | | |
| Telephone instruments | 21,167 | 22,797 |
| Telephone switchboards | 182,259 | 11,237 |
| Other telephone equipment | 360,509 | 160,352 |
| Railway signals, switches and attachments | 129,364 | 35,572 |
| Bells, buzzers, annunciators, and alarms | 30,913 | 41,058 |
| Other electric apparatus: | | |
| Spark plugs, magnetos, and other ignition apparatus | 203,221 | † |
| Spark plugs | * | 108,646 |
| Other starting, lighting, and ignition equipment | * | 100,096 |
| Insulating material | 99,242 | 119,034 |
| Metal conduit, outlet, and switch boxes | 72,635 | 120,630 |
| Sockets, receptacles, and lighting switches | 162,297 | 190,271 |
| Electric lighting fixtures, interior and street | 140,708 | † |
| Electric interior lighting fixtures | * | 216,389 |
| Electric street lighting fixtures | * | 49,661 |
| Other wiring supplies and line material | 93,811 | 90,057 |
| Other electrical apparatus not elsewhere stated | 829,310 | 624,940 |
| Rubber and friction tape | 46,283 | 47,078 |
| Globes and shades for lighting fixtures | 53,301 | 53,891 |
| Electrical glassware except for lighting | 16,839 | 21,369 |
| Electrical porcelain: | | |
| For less than 6,600 volts | 36,704 | 58,710 |
| For 6,600 volts and over | 60,220 | 88,453 |
| Carbons, carbon brushes, and electrodes: | | |
| Electrodes for electric furnaces | 182,040 | 184,306 |
| Other carbon products | 108,580 | 57,538 |
| Insulated wire and cable (iron or steel) | 30,106 | 22,847 |
| Copper, bare wire | 97,022 | 159,610 |
| Copper, insulated wire and cable | 460,328 | 432,989 |
| Refrigeration sets up to 1 ton capacity | 303,957 | 417,153 |
| Domestic washing machines | 87,016 | 168,412 |
| Totals | $8,668,079 | $9,668,279 |

* Not collected in 1927 in that form. † Data for 1928 collected in more detail as given.

DESTINATION OF ELECTRICAL EXPORTS

| Country of Destination | March, 1928 Values |
|---|---|
| EUROPE: | $2,118,948 |
| Belgium | 120,478 |
| France | 187,886 |
| Germany | 111,176 |
| Italy | 138,132 |
| Netherlands | 121,519 |
| Spain | 247,463 |
| Sweden | 48,133 |
| United Kingdom | 766,900 |
| Other countries | 377,261 |

| Country of Destination | March, 1928 Values |
|---|---|
| WESTERN HEMISPHERE: | $5,001,867 |
| Canada | 2,150,849 |
| Mexico | 560,607 |
| Cuba | 299,048 |
| Argentina | 641,556 |
| Brazil | 497,588 |
| Chile | 119,030 |
| Colombia | 159,541 |
| Peru | 44,081 |
| Venezuela | 108,938 |
| Other countries | 420,629 |

| Country of Destination | March, 1928 Values |
|---|---|
| ASIA, AFRICA, AND OCEANIA: | $2,547,464 |
| British India | 193,158 |
| China | 226,587 |
| Japan | 755,772 |
| Philippine Islands | 160,135 |
| Australia | 528,907 |
| New Zealand | 121,801 |
| Union of South Africa | 150,681 |
| Other countries | 410,423 |

for the use of complete electrical equipment and also to establish a higher standard of adequacy in the wiring of new houses.

That the conference recognizes that the present status of the electrical house wiring contractor will prove a fundamental factor in the carrying out of any program to promote house wiring and that careful study should be given to this problem in the hope that a way may be found to increase his effectiveness as a creative influence in the development of the electrical market.

The problem of increasing the effectiveness of the house wiring contractor is being considered as the subject of a special program for industry action and is not within the scope of the work assigned to the agency, although, of course, the house wiring contractor will be one of the elements to be considered in the development of the main selling plan.

The scope of the work for which the agency has been engaged is stated as follows:

1. Approaching the problem with the attitude of fundamental analysis, the necessary investigation is to be made which will provide a clear understanding of the market to be influenced, geographically and psychologically, with regard to this problem, as a basis of definite knowledge on which to proceed. This investigation will refer to the present objectives of the conference, as distinguished from a broader investigation of the whole marketing situation of the industry.

2. Interpret the findings of this investigation in the light of broad merchandising experience and with an outside viewpoint.

3. Prepare a comprehensive all-industry selling program founded on the conclusions reached, and comprised of two parts, viz.:

(a) A complete and self-contained localized selling plan, suited to successful promotion and operation in any community. This would be designed as a local co-operative plan, with participation by the electric utility, jobber, contractor, dealer and manufacturer's local representatives.

(b) A national phase to give a national background of advertising and publicity, and to provide the bond for tying the local programs into a national movement.

(It is expected that the program will be built around a new and effective approach that will grip public imagination.)

4. Develop an effective plan for presenting the main selling program to the electrical industry in a way to secure the necessary financial support and participation throughout the country. The industry's existing national and local facilities would, of course, be counted on to perform their proper functions.

Funds for the preliminary investigation and development of the plan have been made available by the national associations. The conference is handling the business arrangements through the board of directors of the Society for Electrical Development and members of the staff are assisting the sales plan committee and the agency in their work.

# Market Conditions

STEADY sales reached an aggregate good volume in New England, although individual orders were small. Motor sales were strong and negotiations for heavy equipment are promising. A Massachusetts mill bought $8,000 worth of control equipment. In the Eastern district central-station business shows an upward trend, both as to contracts and inquiries. A Diesel engine unit was purchased by a power company in Georgia and two substation equipment orders from New Jersey and New York totaled $53,000. The market for street-lighting equipment has improved.

The volume of business in the Southeast is up and consists of many small orders. An order for $125,000 worth of power transformers, placed by a company in Alabama, was the only sale of moment. Motors and other electrical equipment purchased by textile mills in Georgia amounted to $23,000. In the St. Louis district general conditions are fair, but sign business is reported as especially good. A substantial volume of business is noted in the Middle West and appears to be increasing from month to month. On the Pacific Coast many equipment orders were placed. Mining and lumber companies were prominent buyers. The Utah Copper Company ordered apparatus for its Bingham plant at a cost of $175,000, and the Miami Copper Company purchased $550,000 worth. The Weyerhauser Company closed a contract for two 750-kw. turbines, costing $230,000, for its mill at Longview, Wash. Seattle will build a substation to cost $1,000,000 complete. Contract for the construction of the Leaburg unit of the Eugene-Oregon hydro-electric project has been let to A. Guthrie & Company of Portland at a cost of $1,029,230.

## *Non-Ferrous Metals Firm at Unchanged Price Levels*

Firm and steady markets for the major non-ferrous metals, tin alone excepted, are the feature. Copper is in fair demand in the domestic market and in exceptionally strong demand from abroad, prices are firm and the possibility of another price advance in the near future is heard. Lead is firm with sales but little below normal. Buyers have re-entered the market for zinc in fair volume and the price is slightly higher than a week ago. Tin is easier and statistics continue to show a mounting production rate.

NEW YORK METAL MARKET PRICES

| | June 6, 1928 Cents per Pound | June. 13, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic..... | 14.525 | 14.525 |
| Lead, Am. S. & R. price | 6.30 | 6.30 |
| Antimony.............. | 10.50 | 9.75 |
| Nickel, ingot........... | 35 | 35 |
| Zinc spots.............. | 6.487 | 6.50 |
| Tin, Straits............. | 49.50 | 48 |
| Aluminum, 99 per cent... | 24.30 | 24.30 |

Base copper wire price June 13, 1928, 16⅞ cents.

## *Utility Demand Improves in Eastern District*

Central-station business shows an upward trend in the Eastern district, both with regard to contracts and inquiries. A power company in Georgia has placed an order for a Diesel engine unit for a stand-by steam-electric station with a leading manufacturer in northern New York. A municipality in Missouri has contracted for a turbo-generator unit, with condenser and auxiliaries. A New Jersey central-station company has given an order for transformers and accessory apparatus to total about $25,000, and other contracts are anticipated from this same quarter. A metropolitan utility has placed a similar commitment for substation service, the order aggregating about $28,000. Switching equipment sales give signs of improvement and sizable transactions are expected at an early date. The market for transmission cables, fittings, etc., likewise gives indication of better conditions, following several weeks of lagging interest. Electric equipment for marine service is another branch in which demand is anticipated.

Industrial account continues to be an appreciable factor in the Eastern district, even though the call for motors of industrial ratings shows a little decline, which is considered only as temporary. Meantime, a number of contracts have been placed for prime movers and kindred heavy machinery. A chemical company in New Jersey has ordered a turbo-generator unit, with air-cooled equipment, to cost more than $110,000. An order also was placed for a motor-generator set, with switchboard panel, etc. [illegible] mach[illegible] [illegible]t in northern New York [illegible]. Another [illegible] [illegible]ator sets re[illegible] [illegible]ective c[illegible] telegraph company, one order being placed for 125 such units, from 300 to 750-watt rating. Metal-working plants are still in the market for electrical equipment requirements, with other inquiries coming from cement mills, shoe and leather factories, and textile mills. Ice-manufacturing plants are also seeking apparatus and a sizable account is looked for from this branch of activity. In connection with industrial equipment, a leading manufacturer reports that the price trend is downward, while central-station machinery shows development in the other direction. Resale motor business is becoming more pronounced in this section and a considerable quota of recent commitments are of this character. Construction operations in the Eastern district are as follows:

The Westchester Lighting Company, Mount Vernon, N. Y., plans a substation on Waverly Avenue, Mamaroneck, N. Y., to cost $45,000. The Nichols Copper Company, Laurel Hill, L. I., has purchased property at El Paso, Tex., and will build an electrolytic copper refinery to cost $3,000,000. The Royal Typewriter Company, New York, will add to its factory at Hartford, Conn., to cost $150,000. The West Virginia Pulp & Paper Company, New York, plans an expansion program at its mill at Mechanicsville, N. Y., to cost $650,000. County Supervisors, Rochester, N. Y., plan a highway lighting system for Pittsford, Brighton and other communities. Niagara Falls, N. Y., plans extensions and improvements in the street-lighting system. The Public Service Electric & Gas Company has approved plans for a substation at Jersey City, N. J., to cost $85,000.

J. Lichtman & Sons, Newark, N. J., will add to its leather tannery to cost $300,000. Matawan, N. J., contemplates an improved street-lighting system. The Deborah Sanatorium, Lake Hopatcong, N. J., will build a power plant in connection with new institutional buildings, to cost $800,000. The Ward Baking Company plans a new baking plant at Elizabeth, N. J., to cost $350,000. The United Varnish Company, North Bergen, N. J., will build a factory to cost $90,000. The Atlantic Refining Company, Philadelphia, plans an electric-operated storage and distributing oil works at Jacksonville, Fla., to cost $100,000. The George K. Hale Manufacturing Company, Philadelphia, plans a new bone button factory at Mount Airy, N. C., to cost $75,000. The Pennsylvania Power & Light Company plans extensions in transmission lines from Nescopeck to Dorrance Township, Pa. The Bethlehem Shipbuilding Corporation, Baltimore, Md., plans a fabricating and machine shop addition to cost $400,000.

### Substantial Business Noted in Middle West

There is a substantial volume of business being transacted in the Middle West in a varied line of industry, which appears to be increasing from month to month. An increasing amount of construction work is under way, with a slightly decreasing number of unemployed. Indications seem to point to better business ahead, with a favorable month for June. The various utility companies are busy with construction and line extension work and a large amount of underground construction work is in [illegible]

[illegible] ordered were two [illegible] minute air filters, one [illegible] 12,[illegible] distribution transfor[illegible] 550 direct-current watt-hour meters, 250,000 lb. weatherproof wires and cables, 161 overcurrent relays and a quantity of current transformers. Construction projects are as follows:

The Western Packing Provision Company, Chicago, plans a plant to cost $185,000. The Sanitary District of Chicago is planning a power substation, near Western Avenue Terminal to cost $75,000. The Toledo, Peoria & Western Railroad, Toledo, Ohio, will build an engine house and shops at East Peoria, Ill., to cost $100,000. The Central Illinois Public Service Company, Springfield, Ill., is planning an equipment storage and distributing plant to cost $55,000. The Penberthy Injector Company, Detroit, plans an addition to cost $100,000. The Fountainway Corporation, Cincinnati, Ohio, plans a factory to cost $90,000. Steel & Tubes, Inc., Cleveland, plans a plant at Ferndale, Mich., to cost $750,000. The Puritan Dairy, Inc., Beloit, Wis., plans an ice cream plant to cost $85,000. Austin, Minn.; Biwabik, Minn.; Lincoln, Neb., and Madison, Wis., plan ornamental lighting systems. New Ulm, Minn., will soon ask bids for an improved lighting system. Neenah, Wis., will ask bids about July 1 for an ornamental lighting system.

### Small Orders in Good Volume Mark New England Sales

Sales of electrical equipment in the New England district were steady and the volume good, according to reports from several manufacturers. Small motor sales were strong. A number of 50-hp. and larger motors were placed. Negotiations for heavy equipment are promising, especially for turbo-generators. Small switches and power apparatus sales were encouraging; in fact, the trend appears stronger in this line. Orders for about $8,000 worth of control equipment were received from a Massachusetts mill, and smaller orders are quite numerous. A number of loom motors were ordered and contractors' equipment is in good demand. An order for a 145-hp. motor and control for rock-crushing machinery is noted and two laundry installations are of interest, including motor drives throughout amounting to over $5,000 in electrical equipment.

Specialties are attracting interest. Arc welders are being considered for assembly work in tool machines with attention, in particular, to new types of loom machinery. Eleven electric clocks, regulated from a master clock of the Boston Edison Company, will be installed in the new North Station. Electric refrigerators are gaining rapidly in popularity. Electric appliances show a substantial gain in volume. An important construction project reported is as follows:

The Grafton Power Company, Lebanon, N. H., plans a hydro-electric power plant on the Connecticut River, near Littleton, N. H., to cost $25,000,000.

### Volume of Sales Up Despite Small Orders in Southeast

With the exception of a power transformer order, amounting to $125,000, from a power company in Alabama, no orders of moment are being placed by central-station companies in the Southeast except in connection with merchandising activities. A power company in Mississippi ordered small power transformers totaling $2,500 and a Georgia company ordered creosoted pine poles amounting to $2,000 and distribution transformers costing $1,100. Two municipalities in Georgia ordered four carloads of creosoted pine poles each. The total volume of business is holding up remarkably well, even though the bulk of orders is individually small.

Inquiries from industrial plants are on the increase and a satisfactory amount of business in this field is reported. One textile mill in Georgia has undertaken electrification and ordered $10,000 worth of motors and approximately the same amount in wiring materials. Two other cotton mills in the same state ordered motors and miscellaneous electrical equipment amounting to $7,000 and $6,000, respectively. Plans have been made for moving South a textile mill which will form the second unit of a Georgia mill and the wiring materials in this unit will approximate $25,000. Construction projects are as follows:

The Volunteer Knitting Mills, Athens, Ala., plan an addition to cost $100,000. The Alabama Power Company, Birmingham, Ala., has applied for permission to construct 200 miles of transmission lines in different parts of the state. The Louisville & Nashville Railroad Company, Louisville, Ky., will make improvements in repair shops and terminal at Mobile, Ala., to cost $125,000. The West Florida Power Company, Jasper, Fla., plans a transmission line from Quincy to Gretna, Fla., to cost $85,000. The Commodore Point Terminal Company, Jacksonville, Fla., plans an ice plant to cost $100,000. The Baker County Power Company, Newton, Ga., plans a steam power plant to cost $200,000. The Kentucky Utilities Company, Louisville, Ky., has acquired properties of the General Power & Light Company at Calhoun, Rumsey, Poole, Sebree, Ky., and plans transmission line construction, etc. The Mississippi Power Company, Gulfport, Miss., has acquired a power plant at Picayune, Miss., and plans new transmission lines. The company will also build transmission lines to Russell and Kewanee, Miss. Bennettsville, S. C., plans extensions in its municipal power plant. The Plough Chemical Company, Memphis, Tenn., plans an addition to cost $500,000.

### Sign Business Especially Good in St. Louis District

No change in general conditions is reported in the St. Louis district. An order for transformers and substation equipment was placed at a cost of $3,500. The electric sign manufacturers report the demand is holding up unusually well. Orders for small motors and transformers continue about normal. Fan business has been good and all appliances are moving in good volume. Construction projects are as follows:

The Wilson Power & Light Company, Wilson, Ark., plans extensions in its power plant and system, to cost $100,000. The Eldorado Refining Company, Eldorado, Kan., will build an oil refining plant to cost $100,000. The Satanta Terminal Elevator Company, Satanta, Kan., plans a grain elevator, to cost $100,000. The Gulf Public Service Company, New Iberia, La., is negotiating for the purchase of municipal power plant at Lafayette, La., and plans extensions and transmission line construction. The West Coast Kalsomine Company, San Francisco, plans a plant at New Orleans, La., to cost $85,000. The Page Milk Company, Merrill, Wis., plans a plant at Marshall, Mo., to cost $200,000. The Universal Cutter Company, St. Louis, plans a plant to cost $80,000. The St. Louis Smelting & Refining Company, New York, will build an ore mill at Quapaw, Okla., to cost $125,000. The Burton Packing Company, Burton, Tex., plans a meat-packing plant at Houston, Tex., to cost $100,000. The Texas-Mexican Refining Company, Laredo, Tex., plans extensions in its oil refinery to cost $125,000. Smith Brothers Properties, Inc., San Antonio, Tex., is planning a cement mill near the city to cost $1,000,000, and a power plant is projected. Waco, Tex., has authorized a fund of $3,500,000 for municipal waterworks. Jonesboro, Ark.; Fort Stockton, Tex.; San Antonio, Tex., and St. Louis, Mo., plan ornamental lighting systems. The Empire District Electric Company has concluded a contract with Joplin, Mo., for an ornamental lighting system.

## *Many Equipment Orders Placed on Pacific Coast*

Power companies and industrial plants, especially mining and lumber companies, bulk large in the week's orders on the Pacific Coast. The Utah Copper Company has bought four 1,000-kva. rotary converters and complete automatic substation equipment for its Bingham plant at a cost of $175,000. The Miami Copper Company of Miami, Ariz., has ordered a 15,625-kva. turbine, twelve locomotives, five 200-kva. transformers, three 150-hp. motors and a seven-panel switchboard at a value of $550,000. Power company ordering has included $4,500 worth of miscellaneous hardware, one-half carload of bare copper wire, etc. Prospective power company business includes 1928 pole requirements for the San Joaquin Light & Power Corporation, comprising 8,200 poles for delivery during September, October and November, with an estimated value of $115,000.

The Seattle City Council has authorized the immediate construction of the Spring Street substation to cost $1,000,000 complete. A contract was let by the British Columbia Electric Railway Company for the first 20,000-kw. turbo-generator unit for its Vancouver plant. A. Guthrie & Company, Portland, will construct the Leaburg unit of the Eugene-Oregon hydro-electric project at a cost of $1,029,230. A contract for two 7,500-kw. turbines costing about $230,000 was placed by the Weyerhauser Company for its lumber mill at Longview. Motor and transformer orders pending total $160,000. Construction projects are as follows:

The Big Jim Mines, Inc., Patagonia, Ariz., plans a milling plant to cost $100,000. The Wenden Copper Mining Company, Wenden, Ariz., plans a mill and reduction plant to cost $100,000. The People's Hydro-Electric Corporation, Alturas, Calif., plans a hydro-electric power plant on Pine Creek to cost $100,000. The Illinois-Pacific Glass Company, San Francisco, plans a plant at Vernon, near Los Angeles, to cost $300,000.

The Pacific Lumber Company, Scotia, Calif., plans a power project on the Eel River, Humboldt County, in connection with proposed pulp and paper mill to cost $2,000,000. The Commonwealth Utilities Corporation, Colorado Springs, Colo., plans a transmission line from the Manitou power plant to cost $30,000. The Farm Light & Power Company, Howell, Wyo., plans extensions in transmission lines. Los Angeles and Bakersfield, Calif., and Vancouver, Wash., are planning to add to their ornamental lighting systems.

# Activities of the Trade

### Malleable Iron Fittings Appoints General Sales Agent

Announcement has been made by the Malleable Iron Fittings Company, Branford, Conn., of the appointment of the Line Material Company, South Milwaukee, Wis., as general sales agent throughout the greater part of the United States for the pole hardware department of the company. The territory reserved for direct sales by the Malleable Iron Fittings organization consists of all the New England states, Westchester County and Metropolitan New York, including Long Island, Staten Island and the five northeasterly counties of New Jersey. The company manufactures Williams pole mounts, reinforcing and extension clamps for tubular iron poles, cable suspension clamps, catenary clamps, wood pole top extensions and other pole hardware.

### Salesmen and Purchasing Agents Elect Officers

A. H. Jones, Bryant Electric Company, Bridgeport, Conn., was elected president of the Salesmen's and Purchasing Agents' Association of America at a recent meeting. At that time R. T. Phipps, Bullard Machine Tool Company, Bridgeport, was chosen vice-president; W. B. Osborne, Erie Malleable Iron Company, Erie, Pa., secretary, and W. H. Bradley, Hunter & Havens, Bridgeport, treasurer.

R. T. Phipps, past treasurer, was given a gold watch and chain in recognition of his work in promoting the first exhibition of the association. It is expected that a second exposition will be held in Bridgeport early in 1929. The retiring president, H. J. Behn, Hunter & Havens, Bridgeport, also was given a unanimous vote of thanks.

### Economy Fuse Buys Federal Fuse Business

The purchase of the "Federal National" renewable fuse department, including all material, physical property, patents and good will of the "Federal National" renewable fuse from the Federal Electric Company of Chicago, has been announced by the Economy Fuse & Manufacturing Company of Chicago. The Economy company is already under complete production and will market this fuse under the trade name "National." The company states that slight modifications in the original design of the fusible element have been made. The National renewable cartridge fuse is now listed as standard in all capacities up to 600 amp. in both the 250 and 600-volt types in the April, 1928, list of inspected electrical appliances, under the label service form of supervision by the Underwriters' Laboratories.

The plan of the company in marketing the "National" fuse will be to serve the users, contractors and dealers through the electrical wholesalers under a plan similar to its policy in the marketing of Economy renewable cartridge fuses. The company also announces that T. D. Halliwell, formerly manager of the wiring device and thermal control sections of the Westinghouse Electric & Manufacturing Company in its merchandising department at Mansfield, Ohio, has been appointed assistant to the president.

The Buffalo Foundry & Machine Company, Buffalo, N. Y., manufacturer of driers, evaporators and chemical equipment, announces the opening of an office in San Francisco, in charge of Charles O. Lavett.

The O. C. White Company, Worcester, Mass., manufacturer of adjustable electric light fixtures, announces the appointment of James A. Vaughan, 1104 Packard Building, Philadelphia, as its representative in the Philadelphia territory.

The Ohio Electric & Controller Company, Cleveland, manufacturer of lifting magnets and small motors, announces the appointment of the Charles L. Ward Company, 701 Midland Building, Kansas City, Mo., as its representative in Kansas City; Omaha, Neb.; Dallas, Tex., and the territories adjacent to these cities. J. Dale Reynolds, Apartado 428 Monterey M. L., Mexico, has been made the company's representative in Mexico.

Baker & Spencer, Inc., 117 Liberty Street, New York City, engineers, announce that after June 1 their address will be 17 Battery Place, New York City.

Landers, Frary & Clark, New Britain, Conn., manufacturers of appliances, announces the "Universal" vacuum auto cleaner, which also is adapted for use in stores, offices, etc., and as a complement to the regular cleaner in the home.

Kliegl Brothers, 321 West Fiftieth Street, New York City, manufacturer of stage-lighting equipment, announces that electromagnetic operation of color frames on Kliegl spotlights is now available.

Curtis Lighting, Inc., Chicago, manufacturer of "X-Ray" reflectors, announces the appointment of Roy D. Myers as resident engineer for northern California with offices at 414 Foxcroft Building, San Francisco. Mr. Myers has been in charge of the lighting service bureau of the Northern States Power Company, St. Paul, Minn., for the past nine years.

# New Equipment Available

## Insulation Which Can Be Punched Cold

Improvement in the punching grades of Formica, manufactured by the Formica Insulation Company, 4638 Spring Grove Avenue, Cincinnati, has now made it practical to shear the stock cold and punch it cold up to and including 3/32 in. thick. The material is available in natural brown or black colors. The manufacturer claims that this workability has been attained in a stock that has been fully cured. There is no increase in price for the material as compared to the former grade. A sample can be secured from the manufacturer for testing.

## Corrosion-Proof Coating

A corrosion-resisting coating which the manufacturers claim can be applied economically and which has been successfully applied to products ranging from battery handles to copper conductors and various classes of sheet metal is being offered by the "Amaloy" division of the American Machine & Foundry Company, 511 Fifth Avenue, New York. Any metal subject to corrosion may be Amaloy-coated. Amaloy is a single continuous coating of practically pure lead which forms a chemical bond with the coated metal without alloying or impregnating it. It is said to form a perfect corrosion-proof adherent incasement that will not crack, check or split off the base metal.

In a test conducted at the New York Testing Laboratories two identical 6-in. wrought-iron pipe nipples were submerged in a bath of 18 per cent by weight sulphuric acid for 44 hours after one had been coated with Amaloy and the other had been coated with zinc spelter galvanized in the same manner as commercial galvanized pipe. At the end of the test the Amaloy-coated pipe showed a loss by weight of 1.6 grains. The galvanized pipe showed a loss of 134 grains.

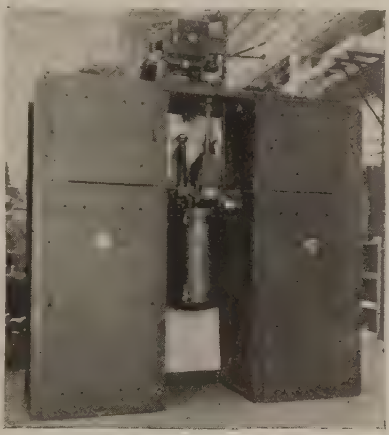
## Portable Air Compressor

A new size of portable air compressor has been placed on the market by the Ingersoll-Rand Company, 11 Broadway, New York. This makes the seventh size in the company's line of its portable air compressors. This new size, 4¾-in. bore by 4-in. stroke, has a piston displacement of 82 cu.ft. per minute. It is intended primarily for use by contractors, public utilities, cities, towns, etc., requiring a unit of slightly larger capacity than the 4¼-in. x 4-in. machine.

The new compressor, like the other I-R portables, is equipped with a four-cylinder, tractor-type Waukesha motor. It is available on broad-faced steel wheels, on steel wheels with rubber tires, on I-R trailer mounting, on Ford or Chevrolet truck, or without running gear for mounting on skids, railway cars, etc. This unit embodies all the Ingersoll-Rand features which are found on the other six sizes.

## Steel Structures for Circuit Breakers

A circuit breaker mounted in a fabricated steel structure designed to replace the concrete has been developed by the Westinghouse Electric & Manufacturing Company. The circuit breaker is built complete at the factory. The company states that time and expense of installation are materially reduced by using the steel structure because the building of forms, the pouring of the concrete and the cleaning up for installation of apparatus are eliminated. The time of preparing for service is materially reduced because of the unit construction of the apparatus, which also is shipped as a unit. It is only necessary to put the breaker in place, bolt it down, remove the blocking, check the adjustments, connect it to the control circuits and the bus, put in the oil and it is ready for service.



*Circuit breaker mounted in a fabricated steel structure designed to replace a concrete cell*

The steel structure, the company claims, is better suited for this service in that the operation of the breaker imposes shocks on the supports. Steel, by its elastic characteristics, absorbs the shocks easily with no damage to itself. Although the structure shown exactly replaces a concrete structure, it is possible to reduce the space occupied by taking advantage of the greater strength of the steel. The steel frame is lighter than the concrete structure, which results in an indirect saving in that the floors and main building can be lightened because of the decreased load carried. In the structure shown the circuit breaker only is supported. The use of steel can be extended to support the disconnecting switches and further to support the bus, with corresponding savings.

## Portable Instruments

A new line of portable alternating and direct-current instruments has been placed on the market by the Westinghouse Electric & Manufacturing Company. The alternating-current instruments are designated as the type PY5. They are of the direct-reading type and are applicable for general testing and laboratory work where high accuracy is required. The voltmeters and single-phase wattmeters are of the electrodynamometer type. The ammeters are of the moving iron type using vanes of non-residual metal. All instruments are shielded and are damped by an improved design of air damper. The ammeters have a double range which can be changed while the meter is in use by a series-parallel switch mounted in the case. They may be used on circuits up to 500 cycles and also on direct current with but slight reduction in accuracy.

The direct-current instruments are known as the type PX2 and are particularly suitable for automobile, battery, radio and miscellaneous testing. They are of the permanent magnet moving-coil type and operate on the D'Arsonval principle. This line of instruments includes millivoltmeters, double-range voltmeters, milliammeters, ammeters, radio frequency ammeters and galvanometers.

RENEWABLE CARTRIDGE FUSE.—A redesigned line of renewable cartridge fuses has been placed on the market by the Star Fuse Company, 235 Canal Street, New York. The fuses are said to be simple in construction and from the smallest to the largest size can be assembled without the use of tools. The renewable element is inclosed in a fiber tube. The company also claims that by reason of this construction a pressure, which is created in the refill, chokes the arc formed when a fuse blows on a short circuit.

CRANE PANELS.—The revision of its line of crane protective panels bearing the designation CR-7409 is announced by the General Electric Company. Such panels provide overload and undervoltage protection for all the motors of a crane and are designed to be used with an emergency switch for use by the operator in an emergency. They may be used with either drum switches or magnetic control panels. The principal change in the revised line is a regrouping of the units involved, resulting in a decided reduction in total size. Another change is the substitution of instantaneous overload relays instead of dashpot overload relays. Otherwise the equipment is practically the same as before, except that up-to-date material is used in all cases.

# Electrical Patents

*Announced by U. S. Patent Office*

*1,669,112. Supervisory Control System; F. H. Winter, Schenectady, N. Y. App. filed Sept. 15, 1924.

(Issued May 15, 1928)

1,670,218. Means for Preventing Current Leakage in Electric Cables; H. R. Searing, New York, and E. Williams, Jackson Heights, N. Y. App. filed March 11, 1927. Insulation of high tension cables.

1,670,227. Oil-Immersed Electric Switch; W. Anderson, Herburn-on-Tyne, England. App. filed Nov. 22, 1926.

1,670,237. Electrically Heating the Ends of Rock Drills and the Like; B. D. Bushell, Springs, S. E. T. Ewing, Johannesburg, and E. H. D. Brunner, Springs, Transvaal, South Africa. App. filed Aug. 7, 1926.

1,670,259. Electrical Conduit Fitting; J. J. Herlbauer, New York, N. Y. App. filed Sept. 28, 1926.

(Issued May 22, 1928)

1,670,292. Tungsten Filament and Method of Making It; F. Blau, F. Koref and K. Moers, Charlottenburg, Germany. App. filed Nov. 29, 1924.

1,670,334. .Terminal for Bushing Insulators; A. O. Austin, Barberton, Ohio. App. filed July 29, 1922.

1,670,419. Blasting Gun; W. S. Mayer, Philadelphia, Pa. App. filed March 6, 1924. With means for furnishing an electric current.

1,670,429. Pin for Insulators; J. P. Arndt, South Milwaukee, Wis. App. filed Dec. 31, 1920. Which may be arranged in different positions on the cross arm and can be used on cross arms of different sizes.

1,670,437. Electrically-Heated Steam Boiler; C. W. Campbell, Denver, Colo. App. filed April 8, 1926.

1,670,439. Motor Controller; F. F. Dorsey, Rochester, N. Y. App. filed April 30, 1924. As used with a power-driven typewriter.

1,670,506. Electric Water Heater; A. Johnson, Oakland, Calif. App. filed April 6, 1927. Wherein a relatively small quantity of the total storage capacity may be maintained highly heated for use when desired, or by the operation of a valve the entire capacity of the heater may be maintained at a high temperature.

1,670,581. Continuous-Current Variable-Speed Machine; F. Kesselring, Furth, Germany. App. filed April 6, 1927.

1,670,585. Container for Granular Depolarizers and Process of Making the Same; G. A. Lyon, Miami, Fla., R. W. Erwin, Flushing and G. W. Heise, Bayside, N. Y. App. filed Jan. 5, 1923.

1,670,590. Dry Cell; J. J. McCann, Kearny, N. J. and C. G. Birdsall, Elmhurst, N. Y. App. filed Aug. 26, 1924.

1,670,604. Dry-Cell Lining; V. Yngve, South Orange, N. J. and W. E. Vail, New York, N. Y. App. filed April 6, 1925.

1,670,634. Battery Connection; G. J. Ocker, Troxelville, Pa. App. filed June 24, 1925. For the terminal posts of a storage battery.

1,670,640. Conductivity Cell; I. B. Smith, Ambler, Pa. App. filed May 20, 1925. For measuring the resistivity or conductivity of materials whose resistance change with temperature as an electrolyte.

1,670,649. Circuit Breaker; L. L. Brown, Spokane, Wash. App. filed July 12, 1927. Of the foot operated type, designed for use as a portable switch mechanism in an electric lamp circuit.

1,670,662. Hoistable Combined Disconnecting Switch and Fuse for Outdoor Transformers and Transmission Lines; E. Johnson, Partille, Sweden. App. filed Jan. 14, 1924.

1,670,682. Signaling Device; C. A. B. Halvorson, Jr., Lynn, and R. B. Hussey, Swampscott, Mass. App. filed March 14, 1923. Adapted for signaling to or from aeroplanes.

1,670,697. Electrical Apparatus; E. D. Treanor, Pittsfield, Mass. App. filed April 6, 1926. Safety appliance for encased electrical apparatus such as transformers filled with an inert gas under heavy pressure. Safety appliance responsive to variations in the gas pressure.

1,670,699, 1,670,700. Electric Welding; J. M. Weed, Scotia, N. Y. Apps. filed April 28, 1925, and July 29, 1927.

1,670,716. Heat Deflector for Incandescent Lamps and Similar Devices; J. F. Donovan, Cleveland, Ohio. App. filed Nov. 12, 1923.

1,670,746. Thermostatically-Controlled Mechanism; O. C. Schroeder, Chicago, Ill. App. filed Nov. 19, 1924. As embodied in an oil burner structure.

1,670,759. Electrical Device; J. Berg, Chicago, Ill. App. filed April 21, 1923. Extension cord on reel take up.

1,670,767. Electric Water Heater; A. A. Grassi and R. de O. Cézar, Buenos Aires, Argentina. App. filed Aug. 30, 1926.

1,670,792. Method of and Apparatus for Checking the Connections of Watt-Hour Meters to the Instrument Transformers and to the Line; W. C. Woodson, Jr., Brooklyn, N. Y. App. filed Sept. 1, 1927.

1,670,793. Program Device; J. W. Yates, Cincinnati, Ohio. App. filed Dec. 21, 1921. For ringing a bell at desired intervals.

1,670,819. Fuel Igniter; W. L. Morris and W. K. Booth, Chicago, Ill. App. filed Sept. 11, 1922.

1,670,824. Motor-Power Reverse Gear; R. S. Roth, Fond Du Lac, Wis. App. filed July 21, 1925. For locomotives.

1,670,846. Zoned Resistor for Electric Furnaces; F. T. Cope, Salem, Ohio. App. filed Feb. 24, 1925.

1,670,856. Control Panel; G. W. Hyser, Minneapolis, Minn. App. filed June 18, 1927. For theater lighting.

1,670,897. Brake-Magnet Adjustment; R. Mercier, Paris, France. App. filed July 22, 1925.

1,670,922. Electric Switch; C. E. Anderson, Stratford, Conn. App. filed May 18, 1921. Multiple switches, lever type, asembled to independently control a group of circuits.

1,670,985. Electric Protection of Transformers; G. L. Porter, Benton, England. App. filed April 13, 1925. Using "split conductor protection."

1,670,998. Singer; H. C. Vollmer and G. H. Repke, Flint, Mich. App. filed May 23, 1927. Electric hair singer.

1,671,016. Storage-Battery Terminal; F. G. Dewey, Anderson, Ind. App. filed Dec. 13, 1924.

1,671,026. Electric Furnace; C. H. Gage, Washington, D. C. App. filed Feb. 12, 1926. Continuous feed type.

1,671,033. Gas and Electric Drive for Vehicles; C. I. Kimura, Chicago, Ill. App. filed Dec. 22, 1925.

1,671,046, 1,671,047. Hydro-Electric Installation; A. Pfau, Milwaukee, Wis. Apps. filed Sept. 6, 1921, and April 1, 1922. Where the hydraulic machine is operative under or against a widely varying head.

1,671,068. Electrical System; E. I. Deutsch, Milwaukee, Wis. App. filed April 20, 1918. An electrical generator in which the voltage is kept constant and in which a constant maximum speed is obtained by substantially limiting the speed so that it cannot exceed a given value.

1,671,076. Induction-Motor-Control System; F. Jeffrey, Milwaukee, Wis. App. filed May 29, 1920. Where the control is exercised through a rotary converter and a direct current machine interconnected with the induction motor.

1,671,077. System of Distribution; J. J. Kane, Milwaukee, Wis. App. filed July 24, 1915. Device for regulating generators connected to supply variable loads, especially where there is a tendency for a generator to operate at widely different speeds.

(Issued May 29, 1928)

1,671,145. Electric Regulation; J. L. Creveling, Tucson, Ariz. App. filed April 3, 1917. For generator used in railway car lighting.

1,671,173. Process and Device for the Protection of Metallic Parts Against Corrosion; F. von Wurstemberger, Zurich, Switzerland. App. filed April 30, 1924.

1,671,196. Electric Switch; W. J. Larson, West Hartford, Conn. App. filed Jan. 25, 1927. Push and pull type, adapted to be applied to a panel for testing electric apparatus, such as relays, meters and other instruments.

1,671,218. Motor Controller; W. O. Baer, Milwaukee, Wis. App. filed March 5, 1925. For synchronous motors.

1,671,226. Lamp Socket; L. Caruso, Irvington, N. J. App. filed Oct. 2, 1925. Combined lamp socket and supporting bracket suitable for holding miniature lamps.

1,671,229, 1,671,230. Composition Material Adapted to the Plastic Art; C. F. Chosa, Milwaukee, Wis. Apps. filed June 18, 1923.

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*Issued May 8, 1928.

# New Trade Literature

SWITCHING AND PROTECTIVE EQUIPMENT.—The Hi-Voltage Equipment Company, Cleveland, has issued bulletin No. 15 covering a complete line of 132,000-volt switching and protective equipment. This bulletin contains illustrations showing various installations, and different types of the equipment. Drawings and operating data also are included.

CONTROL APPARATUS. — "Keeping Pace in the Newspaper Plant" is the title of a catalog issued by the Cutler-Hammer Manufacturing Company, Milwaukee. The catalog contains descriptions of the function and the operation of the press control, press drives, newspaper conveyors, etc., developed by the company. It also gives the advantages of each particular style of apparatus and shows how large and small plants alike are using the equipment to best advantage. Many illustrations showing actual installations are included.

ELECTRIC EQUIPMENT FOR GRAIN ELEVATORS, ETC.—The General Electric Company, Schenectady, N. Y., is distributing the following bulletins: GEA-767A, covering the new totally inclosed fan-cooled grain elevator motors, GEA-882, covering direct-current, induction and synchronous motors and control particularly adopted to plate-glass manufacture; GEA-883 covering equipment for bottle-glass plants; GEA-955, describing electric equipment for cotton gins and GEA-241A describing oil well pumping equipment.

ELECTRIC WATER HEATERS.—Reports of electric water heating tests on low wattage heaters conducted by the Russell Sage Laboratory of the Rensselaer Polytechnic Institute, Troy, N. Y., has been issued by the Hynes & Cox Electric Corporation, Albany, N. Y. It contains information and data with performance charts of the "Red Crown Duostat" electric water heater on which the tests were made.

INSTRUMENTS AND LIGHTING ARRESTERS.—Bulletin GEA-402A issued by the General Electric Company, Schenectady, N. Y., covers its direct-current miniature portable instruments and bulletin GEA-93B covers the pellet-type oxide film lightning arresters.

GROUND RESISTANCE TESTER. — "Measurement of the Resistance to Earth of Ground Connections" is the title of technical bulletin No. 1185, issued by James G. Biddle, 1211 Arch Street, Philadelphia, covering the "Megger" ground resistance tester. The bulletin includes a description of the new direct-reading "Megger" ground resistance tester, comparison of various methods of test and data on the characteristics of earth.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Hamburg, Germany (No. 31,668), of flash-light batteries.

Purchase and agency are desired in La Guaira, Venezuela (No. 31,652), for automobile storage batteries.

An agency is desired in Wellington, New Zealand (No. 31,676), for household electrical appliances.

An agency is desired in Merida, Mexico (No. 31,655), for household refrigerators.

Purchase and agency are desired in Johannesburg, South Africa (No. 31,670), for household refrigerators.

Purchase is desired in Newcastle, England (No. 31,569), of traffic signals and devices.

An agency is desired in Edmonton, Canada (No. 31,673), for turbo-generator sets and mercury arc rectifiers.

An agency is desired in Leipzig, Germany (No. 31,672), for domestic washing machines.

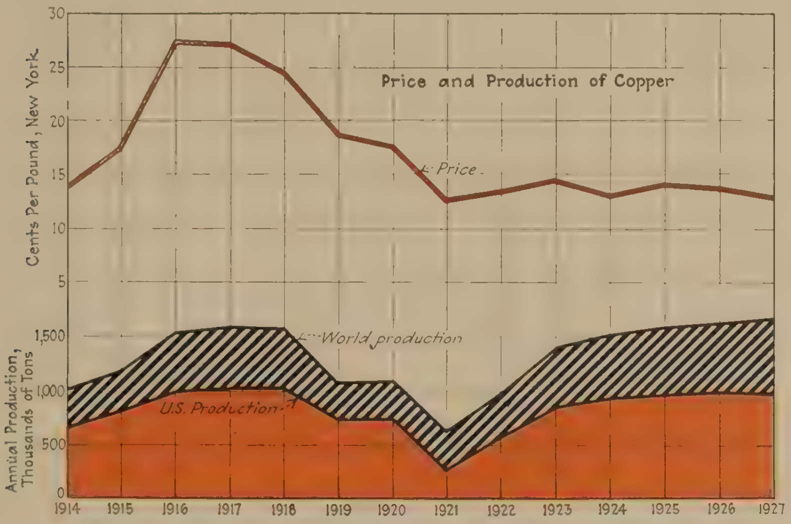
An agency is desired in Toronto, Canada (No. 31,671), for enameled magnet wire.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## Copper Consumption Reflects Electrical Progress

NEARLY 200,000 tons of copper were consumed in electrical manufacturing during 1927. Telephones and telegraphs used another 93,000 tons. Light and power lines for transmission and distribution, together with trolley wire, called for 108,000 tons. Electrical applications of one sort or another therefore account for almost half—that is, for 397,800 tons—of the 834,500 tons consumed in this country last year. Of the electrical copper, roughly three-fourths went into power equipment and circuits, the remaining quarter into facilities for communication.



*United States produced nearly 60 per cent of world's copper*

These statements are based on the estimates published in the 1927 Year Book of the American Bureau of Metal Statistics. If we add the 4,500 tons allocated to radio receiving sets, 750 tons to steam railways electrified, with perhaps a small fraction of the 46,100 tons used in buildings, plus roughly 11,000 tons used in electrical exports, it seems clear that fully half of the consumption of the metal goes into electrical applications.

The major electrical uses for the years 1920 to 1927 are given in the accompanying table. The annual consumption for electrical manufacturing as well as that for telephones and telegraphs has trended upward, the latter more than the former.

The greatest change is in the item of light and power lines. This shows a fourfold increase from 1920 to 1926, followed by a recession in 1927. The extensive building of transmission lines and interconnections in recent years is well known. The taking on of nearly 11,000,000 new customers called for vast extensions of primary and secondary lines, with corresponding quantities of inside wiring. These movements are reflected in the statistics of copper consumption.

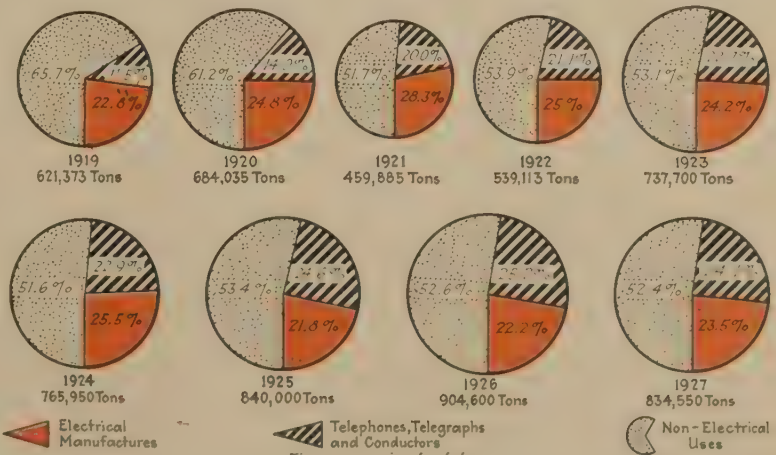
Meanwhile the ratio between electrical and other uses has been remarkably constant for seven years, the former never deviating far from 47 per cent of the total. Evidently electrical manufacturing and construction run parallel with other copper-using activities; totals rise and fall, but the ratio remains steady.

Because of storage, of the natural time lag between production and consumption and of the use of considerable quantities of scrap, consumption figures are not comparable, year by year, with those of production. Thus, after the war accumulation and the descent from war prices, production in the United States fell from 635,248 tons in 1920 to less than half as much, 238,420 tons, in 1921. The decrease in consumption was far less drastic. During recent years production in the United States has approximated 60 per cent of the world's output. The yearly average of prices as shown by the New York market has varied only moderately since 1921.

ESTIMATED CONSUMPTION OF COPPER IN THE UNITED STATES*
(In tons of 2,000 lb.)

| Year | Electrical Manufactures | Telephones and Telegraphs | Light and Power Lines | Trolley Wire |
|---|---|---|---|---|
| 1920 | 170,000 | 61,000 | 29,500 | 5,400 |
| 1921 | 130,000 | 54,000 | 33,000 | 5,200 |
| 1922 | 134,500 | 60,000 | 48,750 | 4,600 |
| 1923 | 178,500 | 75,000 | 85,850 | 6,250 |
| 1924 | 195,500 | 80,000 | 90,000 | 5,100 |
| 1925 | 183,500 | 90,000 | 110,000 | 6,650 |
| 1926 | 201,000 | 104,000 | 117,000 | 7,000 |
| 1927 | 196,500 | 93,000 | 103,000 | 5,300 |

*Year Book, American Bureau of Metal Statistics



*Figures are in short tons*

Allocation of Copper Consumption in the United States

*Half the copper is used for electrical purposes*

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.

# Production in Middle Atlantic States Continues High

PRODUCTIVE operations of the manufacturing plants in the Middle Atlantic States continued on a high plane during May, according to basic data received on electrical energy consumption by about 400 large manufacturing plants operating in the section. Ever since last November the operations of the manufacturing plants in this section have been above those for the same month in the year previous, the peak of activities being reached in February, during which month the rate of operations was about 12.5 per cent above February, 1927. In May the rate of operations was about 1.6 per cent above April and 4.6 per cent above May last year.

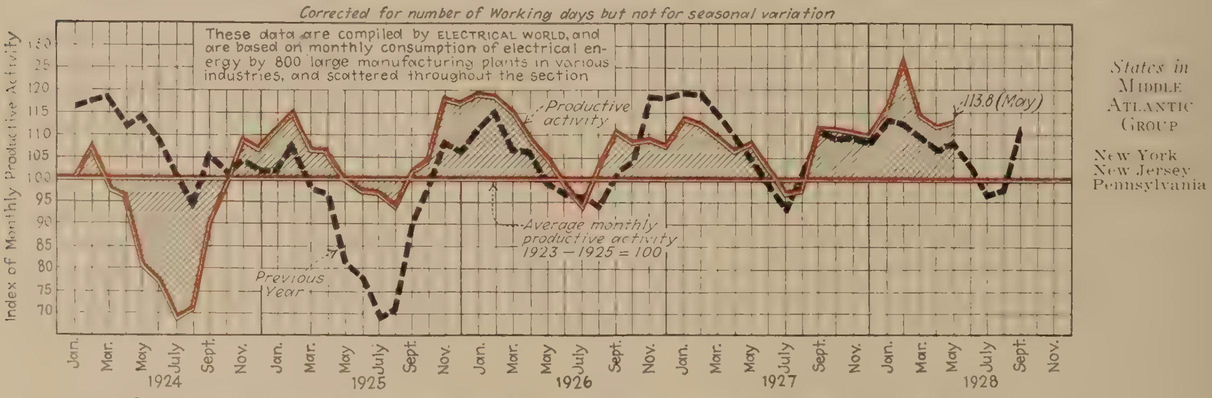
During May seven of the section's primary industries—automobiles, chemicals and allied products, food and kindred products, leather and its products, ferrous and non-ferrous metal-working plants, rolling mills and steel plants, and textiles—witnessed productive activities materially over those reported for May, 1927. On the other hand, three industrial groups—lumber and its products, paper and pulp, and the stone, clay and glass group—reported rates of operations under those of last year.

*Indexes of Productive Activity in the Middle Atlantic States*

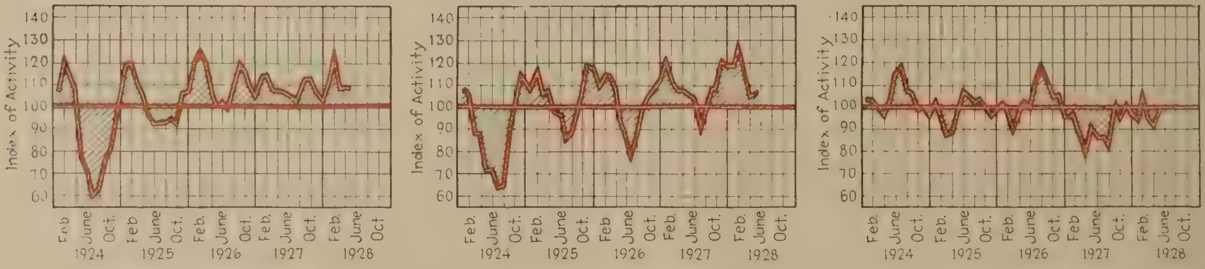
All Figures Adjusted for Number of Working Days

| | May, 1928 | April, 1928 | May, 1927 | Average First Five Months 1928 | Average First Five Months 1927 |
|---|---|---|---|---|---|
| All industries | 113.8 | 112.0 | 108.8 | 116.5 | 110.1 |
| Automobile | 169.6 | 171.2 | 121.6 | 167.0 | 103.9 |
| Chemical and allied products | 135.6 | 133.4 | 109.3 | 131.9 | 103.6 |
| Food and kindred products | 100.8 | 92.4 | 90.4 | 96.9 | ..... |
| Leather and its products | 110.0 | 120.9 | 105.8 | 117.9 | 116.7 |
| Lumber and its products | 104.8 | 104.5 | 159.5 | 106.4 | ..... |
| Metals group | 109.8 | 109.1 | 106.6 | 112.5 | 109.9 |
| Rolling mills and steel plants | 111.6 | 108.4 | 106.6 | 113.8 | 109.9 |
| Metal fabricating plants (ferrous and non-ferrous) | 108.0 | 109.9 | ..... | 111.3 | ..... |
| Paper and pulp | 123.8 | 112.5 | 129.5 | 116.1 | 126.9 |
| Stone, clay and glass | 112.6 | 124.3 | 120.4 | 115.1 | ..... |
| Textiles | 106.7 | 104.0 | 105.3 | 114.9 | 110.8 |

ELECTRICAL WORLD *Barometer of Industrial Activity in the Middle Atlantic States*



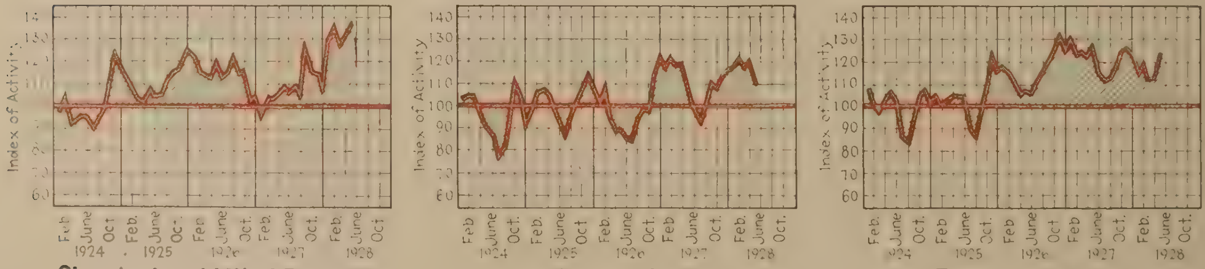
GENERAL INDUSTRIAL ACTIVITY IN THE MIDDLE ATLANTIC STATES



Metal Industries

Textile Industry

Food Industry



Chemical and Allied Products

Leather Industry

Paper and Pulp

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES
OF THE MIDDLE ATLANTIC STATES

# Electrical World

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*Editor*

Volume 91 *New York, Saturday, June 23, 1928* Number 25

## *Dramatizing a Convention*

WITH a program dramatized and animated throughout the Pacific Coast Electrical Association staged at Pasadena, Calif., last week one of the most successful conventions in its twelve years of existence. Routine matters had been handled during the year, leaving the time of the convention for consideration of new subjects with little time wasted on rehashing of old problems.

Innovations were many. Recognizing that men are becoming more and more "eye-minded," most of the subjects presented were animated by the use of pictures, slides, graphs, charts, apparatus, playlets and pantomime. Dramatization aided in brightening many topics usually found dry, and long sessions were interspersed with music. President-elect Arkwright of the parent body, who had traveled across the United States to attend the convention, spoke most enthusiastically of the whole program arrangement and said that as a result of what he had seen he would make a change in his preliminary plans for the national convention of 1929 and would adopt many of the features of the California assemblage. President W. L. Frost of the Pacific Coast Electrical Association and those who assisted him in arranging the program are to be complimented upon the outstanding success scored at Pasadena.

* * * *

## *—— and Into the Fire*

THE annual release of thousands of youngsters from their preparatory years of college life and their assimilation by industry and the world of reality is again at hand. The traditional college man is as rare an individual as the typical business man, for, like all "types," accepted characterizations approach calumny. The recent graduate is eager, ambitious, energetic, overconfident and, in general, exceedingly impatient of delayed recognition of his unproved talents. Such qualities are not those at which one may justly scoff. The somewhat gleeful initiation of the newcomer by the employer into the much overrated school of hard knocks is a doubtfully judicious appreciation of the high, if immature, qualities of youth.

Electric light and power companies have evolved several methods for the training and development of young engineers, but any plan which fails to keep the youngster's time fully employed—which fails to allow an outlet of activity for his energy and desire to do—is an exceedingly poor one. Idle hours and no assigned duties are destructive in the extreme, especially to men fresh from recent intensive mental activities. Responsibility cannot be thrown on untried shoulders, older employees cannot be sidetracked for youth; but a training plan without full-time use of the employee's services and without a job for him at the termination of the development period is unforgivable if he has proved himself.

As for the young man, W. E. Mitchell, vice-president of the Georgia Power Company, whose avowed hobby is that of making human beings out of engineers, recently said: "Broaden your field; lift your eyes; prepare for opportunities; eat up all the responsibilities in sight."

* * * *

## *Hoover Becomes the Republican Standard Bearer*

HERBERT HOOVER was nominated by the Republicans last week at Kansas City as their candidate for President of the United States. That this honor came to Mr. Hoover because he is an engineer is unlikely, he is more than that and his reputation is predicated on his humanitarian as much as on his engineering accomplishments. Nevertheless, it is not too much to claim that it was his training as an engineer which gave him analytical ability and enabled him to handle the weighty matters of feeding Europe and organizing relief expeditions in the Mississippi Valley and elsewhere as engineering problems. His nomination, therefore, is a tribute to engineering training, because any one who has ever heard Mr. Hoover knows that, like Calvin Coolidge, he possesses neither personal magnetism nor the gift of oratory. But —and his management of the Department of Commerce proves it—Mr. Hoover knows how to co-ordinate economics and science with the business of the country as well as with the business of government to the advantage of both.

Moreover, and without any show of partisanship, the business of the country and the aspirations of its citizens will be peculiarly safeguarded by a man with Mr. Hoover's passion for aggressive effort under private initiative. He has on numerous occasions delivered himself on this subject. "Our economic system," he said, "has grown up out of the magnificent effort of individuals. We have grown in efficiency in our individual businesses and in our individual concerns beyond that of any other country in the world." Speaking of government operation, he has declared: "Some faint odors of socialism are still about our country. Some groups would have the federal government undertake the operation of public utilities; some groups would have these operations undertaken by the individual states. The Republican party holds to the protection of public interest by regulation of private enterprise in public utilities—it does not believe in the deadening hand of operation by government bureaucracy."

Such is the man whom the Republican party presents to the people as its standard bearer. To the engineering fraternity, and especially to the electric light and power industry, Herbert Hoover is no stranger. They know his ability, and he is conversant with their accomplishments. Mutual admiration and respect exist, and did the decision rest with the engineers of the country, Mr. Hoover would be elected by acclamation. No greater tribute could be paid to any man.

* * * *

## *Beauty Versus Utility*

ON THREE widely separated river sites offering enticing possibilities for the generation of hydro-electric power the old question of whether esthetic or economic considerations should come first is once more to the fore. These sites are the Great Falls of the Potomac, the Cumberland Falls in Kentucky and the Royal Gorge of the Arkansas River in Colorado.

In the first case a well-backed company stands ready to develop the site as part of a comprehensive scheme designed to furnish Washington, and perhaps Baltimore, with additional energy; in the second case very powerful utility interests already own the site and await only permission from the Federal Power Commission to put to use the power now "running to waste"; in the third case the leading utility company of Colorado has applications before the state and federal commissions for authority to do likewise. Congress has taken a hand in the Potomac situation and forbidden the national power board to do anything without its approval. Vigorous opposition is also waged by those interested in park development around the capital, as well as by companies antagonistic to the plans of the applicant. Opposition from scenery preservationists has prevented action on the Cumberland project, and the same thing is true so far as to the Royal Gorge, though an early decision from the state body is expected.

It is gratifying that there seems no present disposition on the part of any of the light and power companies concerned to try to ride roughshod over the protesters. On the contrary, a disposition to let the latter's arguments carry their full weight and receive unhurried and meticulous consideration by the authorities in control, and then to abide uncomplainingly by the decision reached, seems manifest. This is as it should be. Any belittlement of views taken by sincere lovers of natural beauty would be unworthy of an industry whose loudly professed desire to serve surely includes among its objects man's higher needs where these are affected as well as his material welfare.

The controversy in each of the three cases has two aspects, just as have had the similar disputes over Niagara Falls and other water-power sites in the past. There is first the argument over whether what the electric companies desire to do would really injure the scenery. There is second the argument already stated over how far an esthetic pleasure which can be enjoyed only by a comparatively few who live near or have the chance to visit the site in question should outweigh a practical benefit to many. Every case that comes up must, of course, be settled on its individual merits. No two are just alike. And when landscape experts, engineers, economists, poets and plain citizens dispute and wrangle, not only with those of opposing views but among their respective selves, any editorial attempt to deliver judgment from the cathedral in a specific case might be as presumptuous as ill advised. Perhaps, none the less, a few general principles may be commended for the consideration of litigants and judges both. We should phrase them somewhat as follows:

First, no natural beauty should ever be harmed or even altered in aspect against general protest in the state immediately concerned. Second, even where the opposition is weak, no hydro-electric exploitation of such sites should take place without convincing proof of its economic necessity and of the public benefit resulting therefrom. Third, when the total horsepower involved is small, and the saving consequently insignificant, the stream had better be left alone to dash among its stones and over its declivities as nature taught it. Are waterfalls, after all, mere waste products of elemental forces? "The beautiful," says Victor Hugo, "is as useful as the useful—in fact, more so."

* * * *

## *Exports Depend on More than Goods*

HOWARD A. LEWIS, whose article on the electrical market in Brazil appears elsewhere in this issue, strikes a keynote as to the development of our export markets when he insists that America must send ideas and sympathy, as well as dollars and enthusiasm, management and engineering skill, to help build and develop the market in which we share. Back of the development of every export market must lie a plan, and the fundamentals of that plan should embody a development of the country involved. This plan should include not only goods and money but ideas and people who will settle there and add their lives and work to the wealth of the nation. Other European nations, and Germany in particular, have followed this plan and have thus entrenched themselves solidly in some countries. The opportunity awaits the American manufacturer in continents like South America and Africa where unexploited markets yet exist.

* * * *

## *Good Work Accomplished by the Bay State Commission*

LAST week the Massachusetts Department of Public Utilities issued a decision of no little importance and value in regard to residence rates on the Boston Edison system. In a comprehensive order the board established the principle of the company's area-energy rate as sound, extended it to cover the entire residential service supplied by this utility (excluding hotels and apartments where bills are not rendered by the company to individual tenants), and determined that at present a zone system of rates presents too many difficulties to be justified in the metropolitan and suburban area served by this leading central-station property of New England. The effect of this finding will undoubtedly be to stabilize the rate situation in the Bay State and so to improve the relations between the operating companies and the commission. These relations have been a bit strained of late in view of the pending issues between the Worcester company, the Cambridge company and the board, and it is very gratifying to record such an approval of a form of rate which President Edgar of the Edison company has well characterized as a solution of the residence-rate problem.

The commission modified the terms of the company's so-called "B" rate to an extent which cuts the company's income a million dollars a year, but this is not expected to interfere with either the dividends or the depreciation charges on this property. The limitations hitherto restricting this rate are withdrawn and the entire residential group of customers will now enjoy the benefits of the inducement-rate principle. The result will, of course, be to encourage the more liberal use of electricity for all home purposes, and it is to be expected that in due course there will be a substantial increase in the total revenue per residential customer along with a much larger use of service per dollar expended. That is, the company should be able to increase its income from this class of business in the not distant future as these customers take advantage of the opportunities to receive more for their money than ever before.

Under these conditions the prospects of future peace in regard to domestic rates on this system appear exceedingly bright, and as the practice and experience of the Boston Edison company are very closely studied by other New England utilities, the lessons of this decision are not likely to be overlooked in other quarters. Among the collateral comments of the commission in this finding it is a pleasure to note that the board sets its face against the general practice of a regulative body's undertaking to establish the entire rate structure of a company except under unusual circumstances, recognizing that this is a matter which falls largely within the field of management. We are not sure that some of our friends among the allocation experts will concede that the difficulties of establishing a zone system are as great as the commission implies, but, be that as it may, it is reasonable to expect that the continuance of uniform residential service rates throughout the many hundreds of square miles served by the Boston company will be very acceptable to the public and not unwelcome to the company. Both the commission and the company are to be congratulated upon this decision.

* * * *

## *Radio Trade Show Raises a Question*

CENTRAL-STATION men who visited the Radio Trade Show in Chicago last week carried away some definite impressions. First was the size of the outpouring—there were 205 exhibitors and 21,000 registrations—dealers, wholesalers and manufacturers and their men. Second were the three current trends in radio so conspicuous in the show—the growing popularity and pre-eminence of the dynamic type of reproducer, the rapid drift toward the combination of radio and the phonograph in a single cabinet, and the growing importance of furniture to the radio merchant. Each of these trends has a distinct significance to the power-company sales department.

The coming of the dynamic "speaker" is just one more evidence that the art of radio is young and that we may expect fundamental development to continue and bring with it both hazard and opportunity to the retailer. But the alliance between radio and the phonograph housed in expensive furniture that is the finest expression of the cabinetmaker's art is fast changing the whole merchandising aspect of the line. Radio in the past has been an electrical device. It is now taking on the aspect of a musical instrument that is to be sold as such. This transformation will undoubtedly bring a large measure of prosperity to the dealer, but it will call for a higher type of merchandising.

The power company is certainly interested now more than ever in the sale of radio goods. For by the marriage of radio and the phonograph the phonograph also becomes electrical in its amplification as well as its motive power. But fine furniture will be a moving influence in radio sales. Is the power company ready and competent to do a good job in marketing this *de luxe* line? This question deserves the very serious consideration of the industry.

* * * *

## *Some Impressions of the N.E.M.A. Convention*

ANY organization faces a test of its confidence and stability at the end of its initial administration when the man who has had the helm from the beginning steps back and turns over the ship to another steersman. So it was last week with the National Electrical Manufacturers' Association, gathered at Hot Springs, Va., for its second annual convention. It was a year ago that the apparatus, supply and radio manufacturers met together for the first time as one organization. A policies division and an appliance division have since been added, and these five divisions now comprise forty-five sections, each concerned with its own product problems. The association as a whole has naturally been finding itself and groping its way forward toward full industry consciousness and industry purpose. Under the strong leadership of Gerard Swope, it has gained strength and prospered. The year's record is a good one. And it is particularly fortunate that Mr. Swope is to be succeeded in the presidency by another strong man. H. B. Crouse, who heads the incoming administration, is one of the elder statesmen of the electrical manufacturing industry and one from whom much may be expected.

The wisdom of combining the various associations of electrical manufacturers into one industry group is clearly demonstrating itself, particularly in the fields of apparatus and supplies, where much progress has been made both in standards and in policy. It is to be hoped that the small separate groups of appliance manufacturers—the cleaner, clothes washer, ironer and refrigerator associations—may some day join the range, heating, appliance and fan sections in the N.E.M.A. and gain the benefits of unity. Some solution also should be found of the problem presented by the divided leadership in the radio industry, with its rival organizations; but whether or not it is to be found in the N.E.M.A. is, of course, a matter for the radio industry itself to decide.

The record of the year shows that much productive work has been done. Tariff rulings, labor legislation, insurance, codes and ordinances all offer common problems which call for co-operative action on the part of the entire electrical family. In the solution of these problems the association has already won a prominent place in industry councils. Moreover, among the manufacturers friendly personal contacts have worked for forbearance, trust and co-ordination, and there was a spirit of harmony in this meeting that has been sometimes wanting in the past.

President Crouse takes over a going concern that is already contributing substantially to the promotion of industry statistics, standards and improved trade practices and policies. The better feeling that today exists among these many competing manufacturers has grown largely out of the N.E.M.A. and provides a groundwork from which further good fruit should come in the year ahead.

# *Norway Leads in Hydro-Electric Development*

*Skjaeggedalsfoss, Hardanger*

*Vemork power plant, Rjukan*

THE great water-power resources of Norway were early appreciated by the engineers of that country and utilization has been consistently undertaken.

There are 35 falls of more than 50,000 hp. The consumption of electrical energy exceeds 3,000 kw.-hr. per capita per year.

*Vettisfoss, Sogn*

# Dielectric Data on "Pyrex"

### Tests of material over wide range of frequency and temperature establish a standard of comparison for dielectrics exhibiting ionization and hysteresis lag

By C. L. Dawes and P. H. Humphries
*Harvard University, Cambridge, Mass.*

In connection with dielectric investigations at the Harvard Engineering School it became necessary to know the dielectric properties of slabs of glass over wide ranges of power frequencies and temperature. Preliminary investigations with ordinary plate glass demonstrated that the losses in this type of glass vary so much with temperature that its use for this purpose is undesirable. About this time data published in the Electrical World[1] showed that the power factor and capacitance of "Pyrex" remained much more nearly constant with change of temperature than with commercial glasses. Hence a piece of "Pyrex" 8 in. (20.3 cm.) square was obtained from the manufacturers. This glass is designated as "Pyrex A" and is a chemical ware glass. It is not the low-power factor, low-dielectric constant "Pyrex" which is supplied for radio and other electrical purposes.

## Preparation and Method of Testing Glass

Both surfaces of the glass were accurately ground so that they were plane and parallel and the thickness was 0.556 in. (1.411 cm.). Then both surfaces were carefully silvered and a ring of radial thickness $\frac{1}{16}$ in. (1.6 mm.) and having an inside diameter of 4.69 in. (11.9 cm.) was cut through the silver. This gave a test electrode of 17.26 sq.in. (111.3 sq.cm.) area and the guard ring (Fig. 1).

The glass was tested in a high-voltage bridge,[2] the connections of which are shown in Fig. 1; $C_1$ is a high-voltage air condenser whose capacitance is of the order of 120 micro-mfd.; $R_1$ is the series resistance in this arm of the bridge; $R_3$ is a resistance which brings the shielding of the air condenser and vibration galvanometer $G$ to the same potential as the low-voltage plate of the air condenser; $C_2$ is the test specimen; the primary of the mutual inductance $M$ and $R_2$ are in series with it to form the other arm of the bridge; $R_4$ is adjusted to bring the shielding about the low-voltage electrode of $C_2$ to the same potential as this electrode. Bringing the shieldings to the same potentials as the electrodes which they shield eliminates errors due to shunted capacitances across resistances $R_1$ and $R_2$. Without these precautions errors from this cause may be large.

The curves Figs. 2 to 7 were taken at constant potential, 5,000 volts or 9 volts per mil (3.54 volts per millimeter). It was found that up to 5,000 volts and more the voltage had no effect on the power factor and capacitance.

Fig. 2 gives the curves of per cent power-factor as functions of frequency taken at various temperatures from 14 deg. C. to 71 deg. C. These curves are characteristic of good dielectrics. The power factor ordinarily does decrease in this manner with increase of frequency. Also the power factor should increase with temperature.

The watts loss per cubic centimeter as a function of frequency, taken at various temperatures, are given in Fig. 3. These curves are practically straight lines having positive slopes, but which do not go through the origin. The equation for each temperature is given by

$$P = mf + P_o$$

where $P$ is the watts per cubic centimeter, $m$ is the slope, $f$ is the frequency and $P_o$ is the power at zero frequency; that is, $P_o$ gives the intercept of each curve on the $P$ axis.

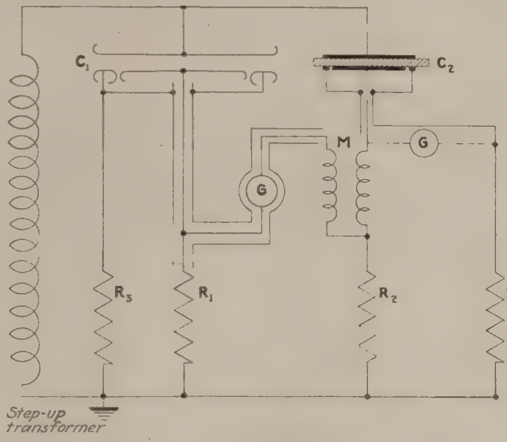

*Fig. 1—Connections of high-frequency bridge*

If the values of $P_o$ be determined and plotted as functions of temperature the curve shown in Fig. 4 is obtained. This curve is identical in shape with a curve giving the direct-current loss in a dielectric as a function of temperature, when the voltage is fixed. The authors would like to have verified this curve by direct-current measurements. Although we have extremely sensitive apparatus for making such measurements, a sample as small as this one is far beyond even its range of sensitivity. We feel, however, that this relationship is significant, and we hope to verify it further with other experiments which we are making with dielectrics. It also appears that the increase of dielectric loss over zero fre-

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[1] *"Power Losses in Commercial Glasses," by W. C. Decker,* Electrical World, *Vol. 89, page 601, March 19, 1927.*

[2] *See "Ionization Studies in Paper-Insulated Cables," by C. L. Dawes and P. L. Hoover, Transactions A.I.E.E., Vol. XIV, 1926, page 142.*

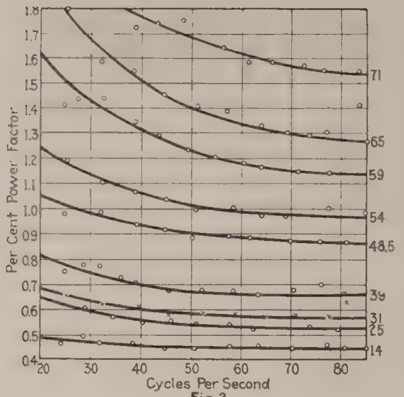


Fig. 2

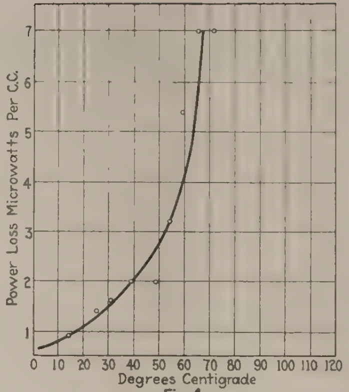


Fig. 4

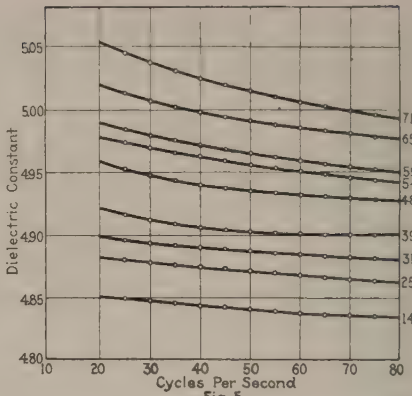


Fig. 5

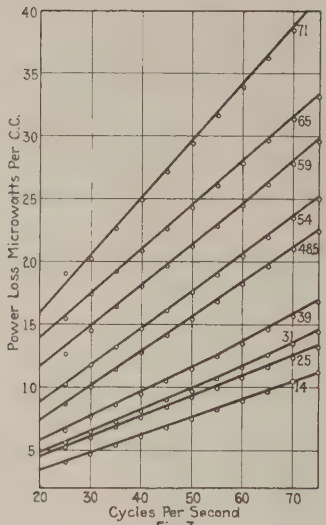


Fig. 3

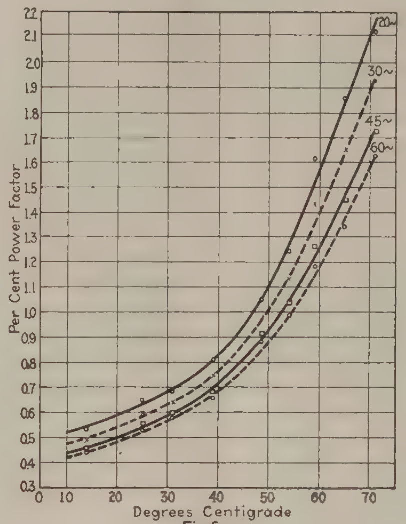


Fig. 6

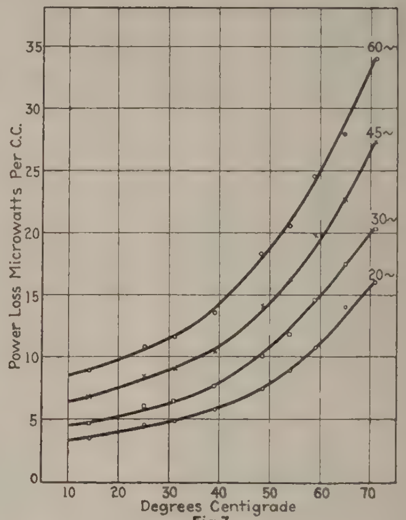


Fig. 7

Fig. 2 — Power-factor-frequency curves from 14 to 71 deg. C.

Fig. 3—Watts loss per cubic centimeter at various frequencies and temperatures.

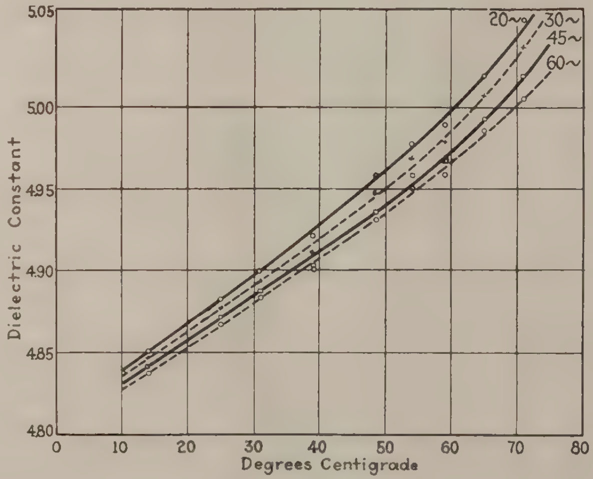
Fig. 4—Power loss against temperature at zero frequency.

Fig. 5 — Dielectric constant values against frequency for temperatures between 14 and 71 deg. C.

Fig. 6—Variations of power factor with temperature at different frequencies.

Fig. 7—Power loss against temperature at frequencies of 20 to 60 cycles.

Fig. 8—Dielectric constant values against temperature with frequencies of 20 to 60 cycles.



*Figs. 2 to 8—Results of tests at constant potential (9 volts per mil)*

quency loss is proportional to the frequency. Since "Pyrex" is admittedly an excellent dielectric, we feel that this may be one criterion of an excellent dielectric.

The curves of dielectric constant as a function of frequency, taken at various temperatures, are given in Fig. 5. These curves show that the dielectric constant decreases with increase of frequency and that the dielectric constant increases with temperature. These relationships are common with dielectrics.

Variation of power factor with temperature at frequencies of 20, 30, 45 and 60 cycles per second is shown in Fig. 6; Fig. 7 shows the variation of watts per cubic centimeter with temperature for these same four frequencies; Fig. 8 gives the variation of dielectric constant with temperature also for these same four frequencies.

The foregoing characteristics are important, both from the scientific and practical points of view. They show, over wide ranges of frequency and temperature, the characteristics of a solid dielectric in which there is no ionization and apparently no hysteresis lag. They can very well, therefore, serve as a standard of comparison for the less perfect dielectrics such as cable insulation. They show that with this type of glass the total power loss is not proportional to frequency, but that the increase of loss over that at zero frequency is proportional to frequency.

# The Right to Defense

By R. F. Pack
*Vice-President and General Manager*
*Northern States Power Company*

*R. F. Pack*

THE "revelations" and "disclosures" which have so far appeared in print as a result of the Federal Trade Commission's investigation of the electric industry boil down to the simple fact that the industry is using established methods of publicity and education for presenting its case to the public.

The methods used deviate in no essential manner from those repeatedly and successfully employed by other industries, by state and municipal agencies, by political associations and even by those who are objecting violently to such activity by the utilities. A joint committee is formed to insure united action and support. Competent counsel are employed to direct the work and able writers secured to put the facts and arguments into effective form. Naturally funds are required to carry out the program and are supplied equitably by various units of the industry.

What is illegal about any of this? The motive is self-preservation, a more united defense against bitter and mostly unjust attacks on an entire industry. There has been no secrecy concerning any portion of this defense. The industry stands back of and is ready to prove any statement of fact or argument it makes in its behalf. The fact that it has contributed something toward legitimate and valuable research generally, as well as in schools and colleges, and has invited investigation and study of its business by qualified observers, is evidence of the confidence felt in its basic soundness.

Does not the industry have the right to present its side of the case to the public, either through the press or otherwise, particularly when faced with unfair propaganda, charging unreasonably high rates and poor service, where no just ground for such charges exists, and urging municipal or government ownership and operation of the plants in face of facts which conclusively show such operation to be contrary to the best public policy, and when, further, the soundness of well-protected securities is attacked, the fairness and competency of the business organization and management questioned, without supporting evidence? Apparently not, in the opinion of their critics in Washington and elsewhere. From their viewpoint the utilities, together with all incorporated undertakings, should be muzzled and remain mute, while the interests of those who, through the supply of funds, have made much-needed enterprises possible are attacked for selfish reasons by political forces and radical organizations which evidently regard free speech as a special privilege of their own.

One is almost tempted to believe that the politician and the radical are driven to such a demand as this by lack of campaign material that will stand the test of close scrutiny. Utility commissions, for instance, are now keeping the rate levels of the utilities so low and the standards of their service so high that complaints against unreasonably high rates and inadequate service can now seldom be sustained in fact. This is a matter of record. The records further show that in practically all cases investigated the cost of producing and furnishing the service is much higher under municipal ownership and operation than under private ownership and operation. This is even true when no allowance is made for the fact that municipal plants pay no taxes, while the local, state and federal taxes paid by the privately owned utilities and by the owners of their securities amount in some cases to as much as 15 per cent on their gross earnings. When taxes of all kinds are considered, therefore, the rates should be about 15 per cent lower for municipal than for privately owned utilities. Instead, the average rate is, as a rule, higher for the former and the service poorer. Such facts are not pleasant to those who expect to find votes in bad public utility conditions. It would be better for them if the truth could be suppressed.

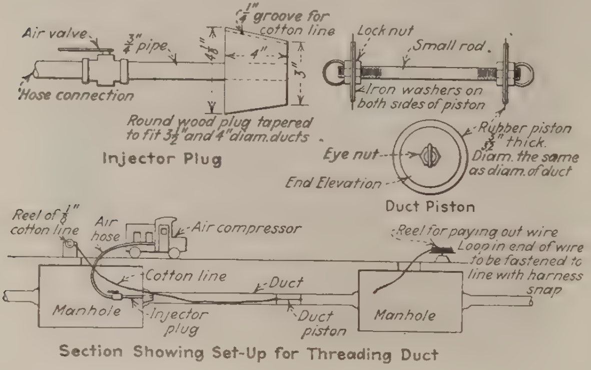
The management of the utilities believe that it is their duty to defend, by lawful means, both their business and the investors therein, and are not ashamed of the methods employed to that end. In fact, close scrutiny of both will show that those employed by the utilities will compare very favorably with those employed by their critics. No other industry has accomplished more for the benefit of the public than the public utility industry, nor will it be easy to find one with a cleaner record all around. It is difficult to see how its practices could be bad, for the form of its accounts are prescribed and audited, its rates and standard of service fixed and the security issues effectively regulated by utility commissions.

# Threading Conduit

By R. L. Dodd

*General Foreman Underground Division, Milwaukee Electric Railway & Light Company, Milwaukee, Wis.*

The problem of threading a line from one manhole or pull box to another through a conduit so that a cable may be pulled through it is one that has had many solutions in the past and will have more in the future. From the apocryphal use of ferrets and trained rats with strings tied to their necks to the very matter-of-fact and laborious employment of rod sections the solutions have spread through the range of human ingenuity. One method that has had considerable success and which is now in use on the system of the Milwaukee Electric Railway & Light Company uses compressed air.


Air valve
$\frac{3}{4}$" pipe
$\frac{1}{4}$" groove for cotton line
$4\frac{1}{8}$"
4"
3"
Hose connection
Round wood plug tapered to fit $3\frac{1}{2}$" and 4" diam. ducts
Injector Plug
Lock nut
Small rod
Iron washers on both sides of piston
Rubber piston $\frac{3}{32}$" thick. Diam. the same as diam. of duct
Eye nut
End Elevation
Duct Piston
Reel of $\frac{1}{8}$" cotton line
Air hose
Air compressor
Reel for paying out wire
Loop in end of wire to be fastened to line with harness snap
Cotton line
Duct
Manhole
Injector plug
Duct piston
Manhole
Section Showing Set-Up for Threading Duct

*Duct threading with compressed air and special parts used*

An air compressor, mounted on a truck, furnishes the power. The air hose is connected to the duct by means of a tapered wooden plug which has a hole bored lengthwise through it and which has a small grooved channel on its surface so that the $\frac{1}{8}$-in. cotton lead line may be drawn into the duct. The piston, or carrier, to which the end of the small line is attached consists, as is shown in the drawing, of a pair of rubber disks clamped between smaller iron washers in the ends of a short piece of iron rod. The piston with the line attached is placed in the duct, the injector plug inserted and the air is turned on. Then if all of the attending circumstances are propitious, the piston moves forward at a speed of about 10 ft. per second and drops into the next manhole in a very short time.

When the piston comes through a wire is pulled in and left for the cable crew, which follows the wiring crew a few days later. The process is repeated for each duct to be wired and the compressor moved along the line to every second manhole. Each set-up serves for ducts in two or more directions. Experience of four years with this apparatus indicates that the method is economical and fast for jobs involving two or more ducts and for crooked lines which would otherwise necessitate frequent uncoupling and recoupling of jointed rods.

This method of duct threading, one might say, has the advantages of its disadvantages. By this is meant that if the piston goes through the duct as it should one can be sure that the line is straight and that the duct is clean and in good condition. If there are any large pieces of rubble in the conduit the piston will either drive them before it or will be stopped. If the duct is broken and offset by injury after installation the piston will not pass. From these considerations it is apparent that the passage of the piston through it is almost a guarantee of the good condition of the duct. There are possibilities that the piston may run into a bad condition somewhere in the duct and become jammed. If it cannot be drawn out by the lead line it can usually be freed by rodding.

Four-inch duct runs up to 500 ft. long may be economically threaded and wired by thus substituting compressed air largely for manual labor in tight conduits, such as those of metal or fiber. Conduits of porous material or those having leaky joints permit the escape of the air and limit the distances.

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# Computing Compensator Settings for Voltage Regulators

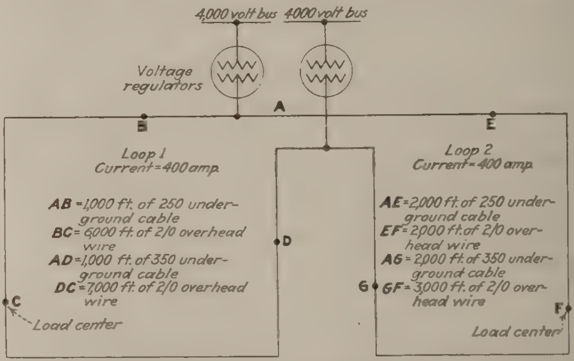
THIRD ARTICLE

By V. W. Palen

Double loop circuits.—The compensator settings for the single feed and the single loop, discussed in the previous articles, require no unusual tactics. Computations are relatively simple. In the case of the double loop things become a bit more involved. If it is assumed that the circuit shown in the accompanying illustration has been split into two individual loops and that the computations have proceeded in a manner similar to the case of the single loop, which was discussed previously, the results so far would be something like this:

*Loop 1* Resistance drop (*AC*) = 5.50 volts
Reactance drop (*AC*) = 8.90 volts
Impedance drop (*AC*) = 12.10 volts
*Loop 2* Resistance drop (*AF*) = 2.70 volts
Reactance drop (*AF*) = 3.94 volts
Impedance drop (*AF*) = 4.82 volts

A slight difficulty arises where two circuits or loops are cross-connected as in this instance, for it is evident that each regulator regulates for half of each loop. Where the impedance of one loop is greater than the impedance of the other, for which load center shall the compensator be adjusted? It has been the successful practice of one company to average the values obtained for the two loops and to set the compensator on each regulator for this average value. In this instance the settings would be:


4,000 volt bus
4000 volt bus
Voltage regulators
A
B
E
Loop 1
Current=400 amp.
Loop 2
Current=400 amp.
AB=1,000 ft. of 250 underground cable
BC=6000 ft. of 2/0 overhead wire
AD=1,000 ft. of 350 underground cable
DC=7,000 ft. of 2/0 overhead wire
D
AE=2,000 ft. of 250 underground cable
EF=2,000 ft. of 2/0 overhead wire
AG=2,000 ft. of 350 underground cable
GF=3,000 ft. of 2/0 overhead wire
G
C
F
Load center
Load center

*Double loop circuit for illustrating calculations*

$IR =$ (average of 5.50 and 2.70) $= 4.10$
$IX =$ (average of 8.90 and 3.94) $= 6.42$
$IZ =$ (average of 12.10 and 4.82) $= 8.46$

The computations for the triple loop circuit will appear in the next article of the series.

# Hydro Industry in Norway

Pioneer in legal and construction elements. Nearly 2,000,000 hp. developed for industry and public service. Details of development and basic statistics

By George Smedal, Jr.

*Transmission line from Rjukan to Oslo*

THERE is no country in the world where the development of the hydro-electric industry has been so consistent as in the little Scandinavian kingdom of Norway. According to the latest procurable figures, this nation, with a population of only 2,650,000 in 1920, a smaller population than Wisconsin or Georgia, has plants which develop 1,910,000 hp.

The beginning of water power works in Norway, the ancient quern wheels, dates back to the beginning of the nation's history. In 1530 the first water saws were built and, by royal patent, dated Aug. 15, 1616, the privilege of erecting and working such saws was confined to owners of alodial estate. This restriction is generally considered the basis for the present law relating to water courses in Norway. Originally, all water rights belonged to the ground over which the water flowed. This act was particularly definite. If the two banks of the water course happened to be under different ownership, the water rights belonged to both riparian proprietors, each of whom owned one-half, the boundary being drawn along the deepest part of the river.

In modern times most of the best water rights have been separated from the landed property and consolidated in the hands of private persons, combinations of private persons, industrial companies, or to state or local authorities.

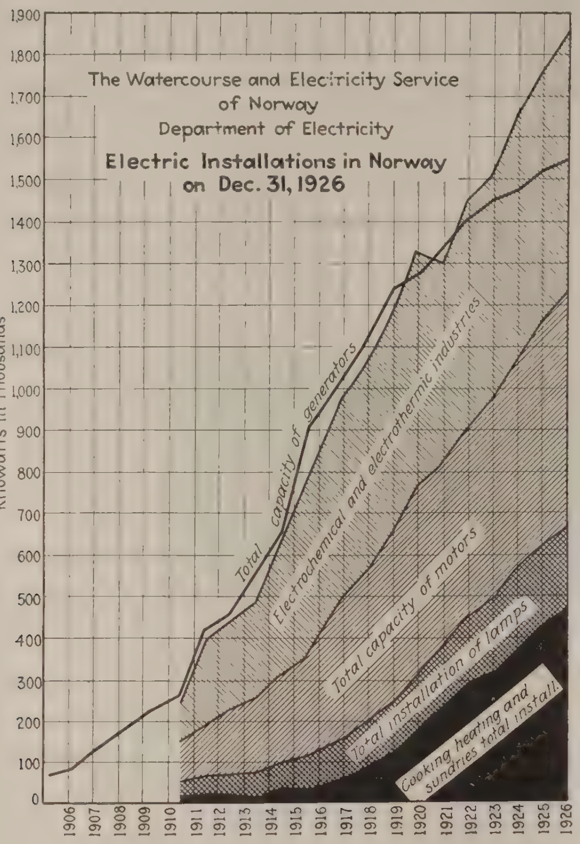
The experience and subsequent action by Norway in the control of this great resource have been the basis for similar legislation in many other countries. Especially is this true in regard to foreign ownership of power rights and sites. Until 1888 foreigners could acquire real property in Norway. In that year the act relating to Norwegian citizenship was passed. This provided that foreigners could not purchase real property or hold property in "usufruct" except by special sanction of the crown. The use of waterways in Norway is governed by the act of July 1, 1887, with subsequent supplemental measures, while the acts of Dec. 14, 1917, and May 21, 1921, apply to the regulation of water courses and the purchase of waterfalls.

The beginning of industrial exploitation of water power in Norway dates back to 1845, when textile manufacturers undertook its development, and progressed rapidly after the '70s, when the first mechanical pulp mills were established. Figures for 1880 reveal that a total of 30,000 hp. was developed. It was not until 1889, however, that the first hydro-electric works were erected in Hammerfest and Skien. At that period approximately 60,000 hp. was developed. The subsequent growth of the electrification of waterfalls is best shown by the accompanying table.

TABLE I—GROWTH AND USE OF NORWEGIAN WATER POWER

| Application | 1900 Hp. | 1907 Hp. | 1913 Hp. | 1922 Hp. | 1926 Hp. |
|---|---|---|---|---|---|
| Wood manufacturers.......... | 90,000 | 117,000 | 180,000 | 220,000 | 230,000 |
| Electricity supply............ | 8,000 | 31,000 | 125,000 | 570,000 | 690,000 |
| Electrochemical and electrometallurgical industry...... | 10,000 | 48,000 | 390,000 | 770,000 | 840,000 |
| Other industries............. | 36,000 | 42,000 | 60,000 | 140,000 | 150,000 |
| Total..................... | 144,000 | 238,000 | 755,000 | 1,700,000 | 1,910,000 |

According to 1922 government statistics the exploitable water power in Norway was estimated at 12,300,000 hp. This figure, however, is by no means final. S. Kloumann, director of the Norsk Aluminum Company, Hoyanger, Sogn, Norway, has placed the exploitable water power at between 16,000,000 and 18,000,000 hp. This is the figure he gave at the World Power Conference in London three years ago. It must also be borne in mind that there is no standard practice in estimating power resources and their distribution. Some nations state their volume of power on the basis of the estimated mean flow in the rivers, regardless of whether or not the possibilities of regulation are existent; in other cases the volumes of power returned are based upon the calculated regulated flow in the six or nine months when the rivers are at their highest level, and other figures again give the exploitable water power at the nine months' efficient, plus 40 per cent. In respect to Norwegian water power, the returns published here represent power which is disposable over the twelve months of the year in those years when conditions are least favorable and which permits economic exploitation. The 16,000,000 to 18,000,000 hp. as indicated, therefore, represents the least number of horsepower available in Norway for manufacturing industries, handicrafts, public requirements and agriculture which may be obtained from water-power resources within the kingdom.



*Electric installations in Norway as of Dec.* 31, 1926

### THE ALLOCATION OF DISTRIBUTION

When there is any question of the distribution of Norway's vast resources of water power between public requirements and those of large-scale industries, it is generally agreed that the former should enjoy the preference. How great public requirement will be in the future is a matter of conjecture which cannot now be accurately estimated. It appears, however, that these requirements have been practically met for the present. The great power projects in the north and west are favorably situated for large-scale industries. Considerable volumes of power suitable for industrial purposes exist also in the south, but they are somewhat more costly than that in the west. It may, perhaps, be of interest to set down the more important falls suited to large-scale industrial development. The water courses mentioned, according to their geographical position, are from north to south along the west coast, where harbors are free from ice all year. The accompanying list includes only such water courses as are capable of yielding, when developed, 30,000 hp. or more, and consequently do not include all resources ultimately capable of economic utilization and development.

The tabulations in Table II and Table III comprise approximately 4,200,000 hp., or about 30 per cent of the water power that is economically exploitable, and this volume may be characterized as the minimum that, in any circumstances, can be placed at the disposal of large-scale industries.

Norberg Schulz, electricity director Central Board of Norwegian Water Courses and Electricity Commission, declared that the exploitable water power in Norway is estimated at 12,500,000 turbine horsepower, or approximately 10,000,000 kw. at low flow. In this summation are not included falls of less than 10,000 turbine horsepower or falls that can be harnessed only at an exceptionally high cost. With a population of 2,700,000 Norway has, therefore, about 30,000 kw.-hr. electric energy per inhabitant per year.

The water power is spread throughout practically the whole country; the water courses are, as a rule, easy to regulate, and the extensive mountain wastes offer rich possibilities of water storage. In many Norwegian waterways there exists considerable concentration of great volumes of power, including 35 falls of more than

TABLE II—NORWAY WEST COAST WATER POWERS CAPABLE OF GIVING 30,000 HP. OR MORE

| | El. Hp. |
|---|---|
| NORTHERN NORWAY | |
| Elvegaardselven, mainly state property | 126,000 |
| Sulitjelma, private | 90,000 |
| Glaamfjord, state property, of which 80,000 developed | 140,000 |
| Rossen, mainly state property | 267,000 |
| Total | 523,000 |
| TRÖNDELAGEN AND SOUTHERN NORWAY | |
| Tunnsjöfoss, private | 120,000 |
| Fiskumfoss, private | 40,000 |
| Forra in Stjördalen, private | 48,000 |
| Aura and Mardöla, now being developed, private | 277,000 |
| Aalfoten, owned by several municipalities | 53,000 |
| Höyanger, owned by Höyangfaldene, about 27,000 hp. used by aluminium works | 80,000 |
| Jöstedalselven, private | 60,000 |
| Fortunelven, in three works, private | 130,000 |
| Töin, owned by Norsk hydro, under development | 100,000 |
| Aurlandfaldene in Sogn, private | 200,000 |
| Arnefjord and Tennesvassdragene | 60,000 |
| Matre and Haugsdal | 90,000 |
| Bjölva, 24,000 hp. developed, private | 40,000 |
| Osa in Hardanger, under development, private | 95,000 |
| Sima, Hardanger, private | 45,000 |
| Veigo, Hardanger, private | 165,000 |
| Kinservik, Hardanger, private | 116,000 |
| Tysse, 160,000 hp. developed, private | 200,000 |
| Laatefoss, Hardanger | 103,000 |
| Mauranger | 91,000 |
| Blaafaldene, 95,000 hp. in one station, by the fjord, private | 120,000 |
| Vaule | 30,000 |
| Saude in Ryfylke, about 45,000, employed mainly by electrometallurgical works at Saude, private | 130,000 |
| Förra in Ryfylke, private | 87,000 |
| Ulla in Ryfylke, state owned | 175,000 |
| Bratlandsdalen, private | 80,000 |
| Bleskestadselven, private | 75,000 |
| Lyse in Ryfylke, particularly favorable storage possibilities | 140,000 |
| Aaen-Sire, owned by the town of Stavanger | 50,000 |
| Total | 3.000,000 |

TABLE III—INTERIOR WATER COURSES OF NORWAY AVAILABLE AT A MODERATE COST OF DEVELOPMENT

| | El. Hp |
|---|---|
| Ŏvre Sira and Ŏvre Kvinna, owned partly by the state, partly by municipal authorities, partly private | 330,000 |
| Toke, state owned | 270,000 |
| Maarelven, partly state owned, partly private | 125,000 |
| Hemsila, owned by municipality of Aker | 63.000 |
| Holsvassdraget, owned by the city of Oslo | 120.000 |
| Aabjora, private | 86,000 |
| Vinsterfaldene, owned by number of municipalities | 200,000 |
| Total | 1,194,000 |

50,000 hp. Approximately 60 per cent of all the water power in the country occurs in falls that are 300 m. high or more.

### Volume of Power Developed

The accompanying chart shows from the graphic curve that the volume of power developed in Norway, Dec. 31, 1925, was 1,525,147 kw., equivalent to about 15 per cent of the aggregate water power in the country. There thus remains about 10,000,000 turbine horsepower of unharnessed power in Norway, and of this something like 4,800,000 turbine horsepower, taking into consideration only falls exceeding 10,000 turbine horsepower, is lying so near the coast that the cost of transmission to ice-free harbors will not make any material difference in the cost of the power.

The graphic curve also gives a picture of the rate at which the development of water power proceeded from 1906 to the end of 1925. The curve, in addition, shows that this work made very rapid strides, particularly from 1910, with the result that Norway has become the world's largest producer of electric energy in proportion to the size of the country and population. According to the returns available the production of electric energy in Norway Dec. 31, 1925, was:

| | Total Millions, Kw.-Hr. | Per Inhabitant, Kw.-Hr |
|---|---|---|
| Public service | 1,800 | 700 |
| Large-scale industry | 6,200 | 2,300 |
| Totals | 8,000 | 3,000 |

At the end of 1925 production was thus in the neighborhood of 3,000 kw.-hr. per head of the population. Seventy-seven and a half per cent of the total output of energy in the country was used at that time for large-scale industrial purposes. Wood manufacturers are the largest consumers of electricity in Norway, and in the expansion of this industry water power, employed both direct and converted into electric energy, has played an important rôle. Another industry using the abundant supply of cheap electric energy in large quantity is that engaged in the production of nitrate of lime, which is now consuming something like 250,000 kw. of electric energy. For the manufacture of carbide, cyanamide, aluminum, zinc, ferro-alloys and so on, there has so far been developed between 300,000 and 400,000 kw.

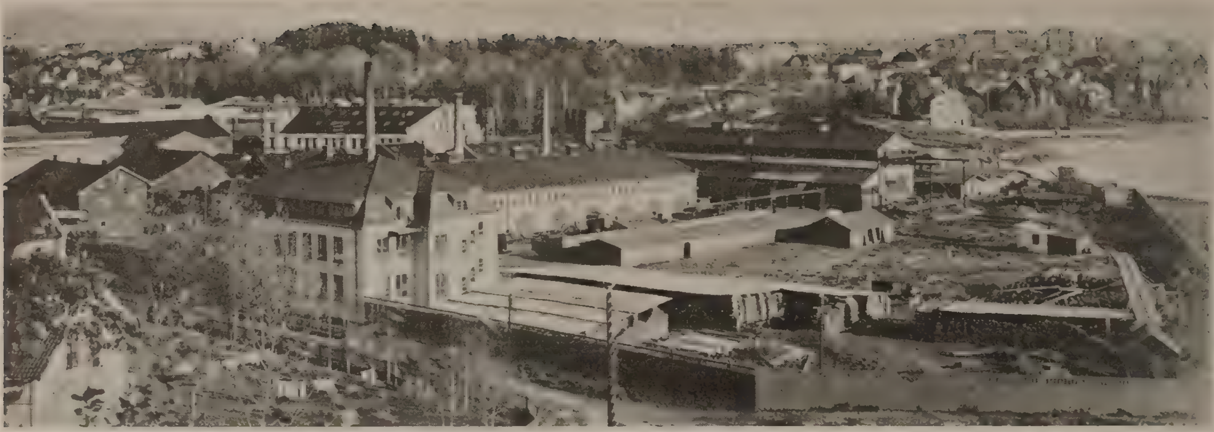
The diagram reveals that the electric supply for public service has undergone quite a rapid growth also, and bears comparison to the increase in use of energy for industrial purposes. Whereas the first electricity works constructed in Norway were for private account, and, in a majority of cases, for industrial enterprises, the public services supply has in the last ten or fifteen years become primarily a municipal business, which was at first conducted by the separate local authorities and latterly by large intermunicipal and county-municipal combines.

The extent of the areas of supply and the number of inhabitants are determined by geographical conditions. The inhabited districts of Norway occupy only 25 per cent of the total area of the country, and the population is mostly concentrated in valley districts and along the great extent of deeply indented coast, where mountain and sea form the natural limitation of the areas of supply. The administrative development of electricity supply in Norway is best illustrated by the fact that, out of the 335 electricity works in operation in 1924, there were 304 municipal and district works, eighteen intermunicipal, five county-municipal, five large private power companies and three smaller works owned by the state.

*The largest transformer in Scandinavia, 29,000 kva., 143,000/12,000 volts*

The various administrations comprise, in rural districts, supply areas with from a few hundred up to 60,000 and 70,000 inhabitants. Of large supply areas which can conveniently co-operate, there is the so-called Eastland area, representing rather more than 10 per cent of the total area of Norway and containing a population of 1,100,000, of whom 500,000 live in towns and urban districts and 600,000 in purely rural districts. In this supply area, which includes the most closely settled parts of Norway, co-operation has already been established in great measure among the power works. In order to meet the demands of the area for electric energy for years to come the government is now developing the Nore Falls, which is capable of supplying about 150,000 kw. of electric energy.

Of a total population of 2,700,000, 1,900,000, or rather more than 70 per cent, can be supplied with electric energy from power works and distributing plants. Every town in the country is supplied with energy, and of 1,800,000 rural inhabitants approximately 1,080,000, or 60 per cent, can be supplied with energy from the power mains. As the density of population is less in Norway than in most European countries, this development gives



*The pioneer electrical manufacturer of Norway, Norsk Elektrisk and Brown Boveri, near Oslo*

one some idea of the labor that has been expended in the electrification of rural districts.

The heavy expansion of public service electricity can also be deduced from the amount of capital that has been invested to this end. On Jan. 1, 1916, it was computed that 127,000,000 kroner were locked up in electricity supply for public service, for household purposes and for industrial concerns of such size that they are not supplied with energy from their own plants. On June 30, 1925, the total of 870,000,000 kroner—nearly seven times the estimate of Jan. 1, 1916—was invested in power plants and lines for the delivery of energy at the consumer's house wall. This figure does not include plants that were under construction at that date or house installations, motors and household appliances. If these values are added, a rough estimate of the capital placed in electricity supplies for public service would be something like 1,200,000,000 kroner on Jan. 1, 1927.

The preponderating part of the public service supply is due to the initiative of municipal authorities. The great capital outlays for this purpose in recent years have, therefore, involved municipal and county authorities in a material increase of their burden of debt. According to the returns of the Central Statistical Bureau June 30, 1926, the following ratio existed between the total debt of municipal boards and their liabilities on account of electricity works:

| | Total Loan Debt (1,000 Kroner) | Proportion of Debt Devoted to Electricity Works (1,000 Kroner) |
|---|---|---|
| Districts and counties...... | 733,021 | 421,820 |
| Municipal boroughs........ | 772,204 | 293,594 |
| | 1,505,225 | 725,414 |

Of present municipal loans, approximately one-half has been devoted to electricity supply. Interest on and repayment of a substantial part of this debt is covered by the income accruing from the sale of energy. Income from this source amounted to about 83,400,000 kroner in the fiscal year 1924-1925. Total outlay for working expenses, interest, repayments, etc., amounted to 90,200,000 kroner. Expenditures thus exceeded income by about 6,800,000 kroner. This is mainly due to the fact that a large number of power and distributing plants, particularly those for rural supplies, were constructed during the boom period (see chart). Many of these works are at present experiencing difficulty in meeting their heavy annual expenses, part of which have had to be covered out of taxation, and the government, also, has been forced to give assistance in the form of loans, as well as direct grants.

The working results shown by the large joint municipal and county-municipal electricity works that have been completed in the last few years, and the financial burden under which so many local governments are straining, have led to the temporary culmination of the development of large distribution works in rural districts. A contributory cause is the fact that the most densely populated rural districts and those of the best financial standing have been electrified during the last ten or fifteen years. Many of the districts still remaining will unquestionably procure cheaper electricity by constructing small local works than by joining the large intermunicipal and county-municipal combines. For this reason, a number of small plants are now under way in many districts, the intention being to supply energy to hamlets, fishing stations and similar locations.

The writer gratefully acknowledges the whole-hearted co-operation and support of J. Vidnes of the Press Bureau of the Norwegian government, Christian Raestad, consulting engineer, Oslo, and Norberg Schulz, electricity director Central Board of the Norwegian Water Courses and Electricity Commission, in connection with the preparation of this article.

# Arc-Proofing Cables

By C. H. Shaw
*Engineer Distribution and Installation Department, New York Edison Company*

THE definite trend toward the use of higher voltages on underground cable circuits has increased the importance of the arc-proof covering that is placed on the cables in the manholes, especially when new cables are installed in conduit lines that already contain older cable systems.

An extensive series of experiments was undertaken by the New York Edison Company to determine the relative protective values of different combinations of refractory materials through the exposure of specially prepared test samples to controlled electric arcs in which the energy at the arc and the distance of the test material from the arc were maintained uniform, thereby providing test data that permit direct comparisons. These experiments were recently completed by the New York Edison Company after ten months of investigation. More than 170 samples were tested, each being subjected to from ten to fifteen burns. Two to four samples were made up of each type of material and for the more important cases the samples and tests were duplicated for verification.

The standard form of fireproofing, used by the New York Edison Company for more than fifteen years, consisted of an application of Portland cement (mixture 1 : 2) upon metal lath to a total thickness of approximately ⅝ in. over the entire cable sheath. In general, this form of protection has been satisfactory and in every case cables so protected have suffered little or no injury when exposed to manhole fires or short-circuit arcs in adjacent cables. It has always been realized, however, that the preparation and application of the metal lath to the cables was both tedious and objectionable, tedious, because of the necessity of cutting the lath into narrow strips, then rolling it, winding it onto the cable and tying it in place with string from small hand-wound bobbins; objectionable, because of the frequency with which the workmen were scratched or pricked, or, if not injured, delayed in their natural activities by excess carefulness or by the handicap of thick, cumbersome gloves.

TESTS ON CABLE ARC-PROOFING MATERIALS

| Description (all ⅝-in. thick) | Average Kilowatt-Seconds | Average of 2 Lowest Kilowatt-Seconds |
|---|---|---|
| **Older Types** | | |
| Cement (1:2) on metal lath | 1,126 | 486 |
| Cement (1:2) on ½-in. hemp rope | 1,047 | 656 |
| "Asbestoment" on single ½-in. "Niagrite" | 1,060 | 517 |
| "Asbestoment" on doubled ½-in. "Niagrite" | 838 | 494 |
| **New Types** | | |
| No. 4 "Asbestoment" on No. 1047 asbestos cloth | 1,343 | 999 |
| No. 4 "Asbestoment" on ⅛-in. perforated "Niagrite" | 1,539 | 1,019 |
| No. 4 "Asbestoment"—cheesecloth, inner and outer | 1,605 | 1,133 |

An appreciation of the hazards to which the workmen were exposed in handling the metal lath, a recognition of the desirability of discovering cable arc-proofing materials having greater protective values to accompany the increase in voltages and the hope for a less expensive type of covering were the reasons for undertaking this group of tests. The results that have been secured have more than justified the undertaking. The accompanying table gives comparative protective values of some of the older types of fireproofing and for the more important combinations that have been developed as a result of these tests. A great number of experiments were performed that did not give noticeably better results than could be secured from the older forms of fireproofing, but during these tests the advantages of reducing the thickness of the binder that holds the cement to the cable to a minimum became obvious. The advantage, even though slight, that is indicated for the inner and outer cheesecloth samples, was confirmed by tests of other materials applied in the same way.

The results obtained with the new "Asbestoment" No. 4 indicate not only a highly desirable increase in the average protection values but a marked improvement in the uniformity of the material as is revealed by a comparison of the averages of the two lowest tests of each group. This new material comes ready mixed as purchased and requires only the addition of a certain amount of water to give a proper working consistency to the cement just prior to its application. The cable is prepared by painting on a coating of hot paraffin over a winding of a layer of cheesecloth that has been purchased in rolls cut 4 in. wide. The No. 4 "Asbestoment" cement is applied over this layer of cheesecloth and is progressively bound in place by an outer layer of cheesecloth of the same dimensions as the inner layer. This outer layer insures a uniformity of the cement that cannot be secured when no outer binder is used and accounts for an appreciable improvement in the arc-resisting qualities of the material. This method of applying the cement to the cable is in accordance with the standard practice of the Philadelphia and Cleveland companies for the application of their Portland cement mixtures.

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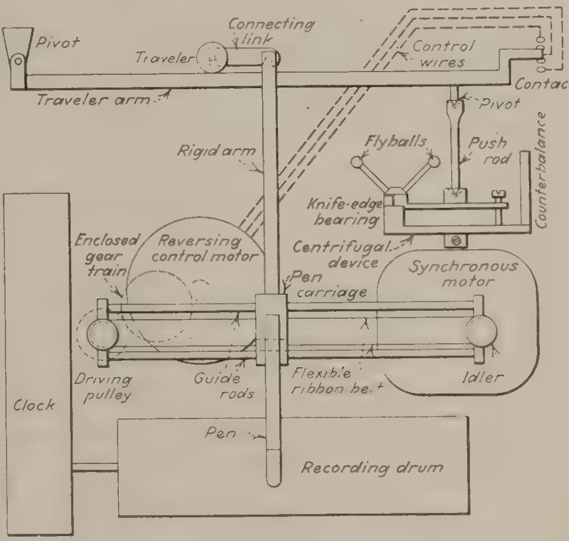
# Sensitivity—A Feature of Centrifugal Frequency Recorder

By F. S. Stickney
*Meter Engineer*
*Westinghouse Electric & Manufacturing Company*

A NEW type frequency recorder has been developed recently to meet the need for an extremely sensitive instrument for large alternating-current systems. When a mass is rotated by a synchronous motor the centrifugal force developed is proportional to the square of the frequency supplied to the motor. Application of this fundamental principle produces a recorder of great sensitivity, since large variations in operating force are produced by small variations in system frequency.

The operating principle of the new device may be explained by reference to the accompanying illustration. A self-starting synchronous motor running at relatively high speed drives a direct-connected centrifugal device which transfers centrifugal force into an axial thrust upon a vertical push rod. A traveler arm is pivoted at one end, the other end being supported by the push rod. The contacts are used to control a reversible motor, which operates a sliding pen carriage assembly along the traveler arm as the pen is moved.



*Centrifugal frequency recorder indicates instantaneous values*

As long as frequency remains constant the whole system of weights remains in equilibrium and the contacts remain open. Any increase in frequency increases the speed of the synchronous motor and throws the system out of equilibrium, thereby moving the pen carriage assembly up scale. As the assembly moves, the traveler is carried along the traveler arm, thereby increasing its moment about the pivot and tending to restore the system to equilibrium. When this is accomplished the upper contacts open and the control motor stops, leaving the recording pen in a new position further up scale, indicating an increase in frequency. When frequency falls the lower contact is closed and the cycle is reversed in a similar manner.

In operation any small change in system frequency immediately produces motion of the recording pen within a small fraction of a second. Being determined by mechanical dimensions and weights only, calibration is not subject to the errors from wave form, voltage or temperature which ordinarily appear in frequency-measuring devices.

# Boiler Feed Water Treatment in the Southwest

DATA regarding the conditioning of boiler feed water in ten representative generating stations were presented by Paul F. Hoots at the eighth annual convention of the Southwestern Geographic Division of the National Electric Light Association. The accompanying tabulation covers the major factors of treatment and operation.

*Boiler-Water Conditioning Practices Compared*

| Name of Station | Neches | Dallas | Fort Worth | Market Street | Oklahoma City | New Braunsfeld | Trinidad | Waco | Deepwater | Wichita Falls |
|---|---|---|---|---|---|---|---|---|---|---|
| Company | Gulf States Utilities | Dallas Power & Light | Fort Worth Power & Light | New Orleans Public Service | Oklahoma Gas & Electric | Coma Power | Texas Power & Light | Texas Power & Light | Houston. Lighting & Power | Texas Electric Service |
| Number boilers with internal water conditioning | 2 | 5 | 21 | 6 | 6 | 2 | 4 | 9 | 5 | 4 |
| Heating surface, sq.ft. | 15,300 | 4–17,000<br>1–18,000 | 3–20,280<br>4– 3,861<br>6– 5,891<br>8– 5,184 | 3–18,571<br>3–19,983 | 4–10,080<br>2– 9,040 | 20,198 | 21,276 | 6,000 | 4–19,884<br>1–18,348 | 5,872 |
| Drum pressure, lb. per sq.in. gage | 400 | 350 | 3–275 | 3–380<br>3–390 | 300 | 400 | 425 | 215 | 4–365<br>1–385 | 250 |
| Average rating, per cent | 250 | 4–200<br>1–250 | 3–200 | 3–225<br>3–250 | 4–160<br>2–300 | Min. rating 150 | 196 | 160 | 4–260<br>1–. . . | 182 |
| Maximum rating, per cent | 350 | 4–300<br>1–450 | 3–250 | 3–300<br>3–400 | 4–300<br>2–500 | 275 | 262 | 225 | 4–430<br>1–700 | 228 |
| Blow-down | 35,000 lb. weekly per boiler | Less than 10 in./mo./boiler | Determined by concentration | None except to clear valves | None except to clear valves | Once a week to clear valves | Approx. 5 in. per wk. boiler | Once a week to clear valves | Approx. 0.25 per cent | Negligible |
| Make-up | Evaporated | Evaporated | Evaporated | Evaporated | Evaporated | Evaporated | Evaporated | Evaporated | Evaporated | Evaporated |
| Type of evaporators | Griscom-Russell high heat level | Griscom-Russell submerged type | Griscom-Russell 3-effect high press | Griscom-Russell single effect | Griscom-Russell single effect | Wheeler single effect | Wheeler single effect | Griscom-Russell 2-effect high heat level | Griscom-Russell single effect | Griscom-Russell submerged type |
| Raw water treat. ahead of evaporat. | None | None | None | Permutit | Permutit | None | Coagulated filtered Permutit | None | None | Permutit(d |
| Make-up water, per cent | Approx. 1.5 | 2.0 | Approx. 2.0 | Approx. 5.0 (a) | 2.0 | Oct., 1927 0.88 | Approx. 2.25 | 2.75 | 1.0 | Approx. 4.0 |
| Quality of make-up | Resistance 18,000–30,000 ohms. | .......... | .......... | Resistance 10,000–30,000 ohms. | 5–10 p.p.m. toal solids | No analysis available | Resistance 9000 ohms. | .......... | Resistance Approx. 25,000 ohms. | Resistance 7,050 ohms |
| Condenser leakage | Less than 1.0 per cent | Resist. kept above 40,000 ohms. | Resist. kept above 20,000 ohms. | Resist. kept above 30,000 ohms. | Not measurable | Apparently none | Resist. 30,000 to 45,000 ohms. | Less than 0.05 per cent | Less than 0.1 per cent | Avg.-0.11 per cent<br>Max.-0.15 per cent |
| Chemicals added to boiler water | $NA_3PO_4$ | $NA_2SO_4$ | $H_2SO_4$<br>$NA_2CO_3$<br>$NA_2SO_4$ | $NA_3PO_4$<br>$NA_2CO_3$<br>$NA_2SO_4$ | $NA_2SO_4$ | $NA_2HPO_4$<br>$NAOH$<br>$NA_2SO_4$ | $NA_2SO_4$<br>$NA_2CO_3$ | $NA_2SO_4$<br>$NA_2CO_3$(c) | $NA_2SO_4$<br>$NA_2CO_3$ | $NA_2CO_3$<br>$NA_3PO_4$ |
| Quantity of chemicals added | 1–3 lb. daily | 90-lb. batches when needed | Accord. to boiler water analysis | Accord. to boiler water analysis | 75 lb. daily | Governed by water tests | 54 lb. $NA_2SO_4$<br>47 lb. $NA_2CO_3$ /Mo. | .......... | 50–100 lb. week | 0.0059 lb. $NA_2CO_3$<br>0.0012 lb. $NA_3PO_4$(e) |
| Ratio sodium sulphate to total alkalinity ($NA_2CO_3$ equivalent) | 3–1 | 3–1 | Low press. 2–1<br>High press. 3–1 | 3–1 | 3–1 | .......... | 2.5–1 (b) | Slightly above 2–1 | 3–1 | No definite ratio (f) |
| Ratio for control of scale deposits | .......... | None | Very little scale | 10–30 p.p.m. $PO_4$ | None | 30 p.p.m. $NA_2HPO_4$ | None | None | None | Total hardness boiler waters below 20 p.p.m. |
| Total alkalinities maintained | 120–170 p.p.m. | 200–400 p.p.m. | At least 150 p.p.m. | 150–300 p.p.m. | Not artificially increased | .......... | 170–250 p.p.m. | 50 p.p.m. minimum | 150–350 p.p.m. | 150–300 p.p.m. |
| Max. sodium chloride concentrations | 170 p.p.m. | .......... | 150 p.p.m. | 170 p.p.m. | Not regulated | No control needed (very low) | No attempt to regulate | Not regulated | 175 p.p.m. | Not regulated |
| Dissolved $O_2$ in feed. C.C./Liter | 0.0 | 0.0 | Less than 0.1 | 0.02–0.10 | 0.22 | 0.0 | 0.0 | About 0.0 | 0.0 | 0.07 |
| PH. value of feed | .......... | No data available | About 7.0 | 7.5 | Has not been determined | Has not been determined | 7.0 | No data available | 8.5 avg.<br>8.0 min. | Above 7.0 |
| Max. boiler water concentrations | .......... | 400 p.p.m. | 1,650 p.p.m. | 1,700 p.p.m. | 3,420 p.p.m. | .......... | .......... | 400 p.p.m. total alkalin | 1,575 p.p.m. | 1,700 p.p.m. |
| Boiler water samples tested | Daily | Daily | Daily | Twice weekly | Once weekly | Daily | Daily | Daily | Daily | Daily |

$NA_3PO_4$—Trisodium phosphate.
$NA_2HPO_4$—Disodium phosphate.
$NA_2CO_3$—Sodium carbonate (soda ash).
$NA_2SO_4$—Sodium sulphate.
$H_2SO_4$—Sulphuric acid.
$NAOH$—Sodium hydroide (caustic soda).

(a) Make-up high due to keeping lines hot n an inoperative low pressure plant, but being gradually reduced.

(b) Soon to be increased to 3–1.

(c) Sodium sulphate used is slightly acid. Soda ash is used to neutralize this acidity.

(d) Permutit softener just being installed and zeolite softened water will constitute evaporated feed.

(e) Average quantities added per 1,000 gal. feed water.

(f) Sulphates high enough without artificially increasing.

## *Simplified*
# Distribution Planning

Methods of calculating the economic characteristics of electrical distribution systems, particularly transformer spacing and sizes of line conductor

By W. R. Bullard
*Electric Bond & Share Company, New York City*

THE method of utilizing the equations, derived in the preceding articles, for the design of an actual overhead distribution system is given here. It is suggested that the steps noted in the summary be followed. The large number of equations may at first sight make the mathematics appear to be too complicated for practical use. However, since only a few of the equations need be used in any particular study of system economics and since the solution of the more complex equations is given in graphical form, the application of the equations will in most cases be comparatively simple. Furthermore, since the results, once obtained, will be applicable for a number of years in handling the growth of system load, the effort spent in making the calculations will in many cases be amply repaid by the economies that may be effected thereby.

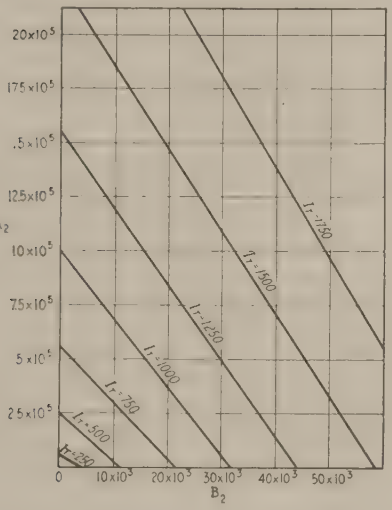
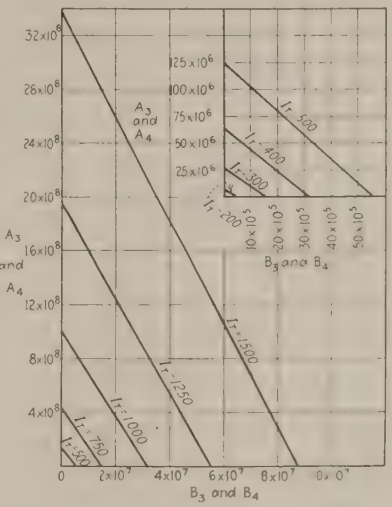


*Fig. 1 (left)—Graphical solution of equation 6 (Article III)*

The numerical values of $A_2$ and $B_2$ for a given system when referred to the ordinates and abscissas represent a point on the surface. By interpolation between the valves of $I_T$ indicated on the curves the proper value of $I_T$ can be determined. This value will represent the most economical ampere load at the transformer.

*Fig. 2 (right)—Graphical solution of equations 10 and 14 (Article III)*

If voltage drop determines the size of conductors the point, the co-ordinates of which are the numerical values of $A_3$ and $B_3$, will give the most economical transformer ampere load by interpolation between the straight lines representing different values of $I_T$. If current-carrying capacity limits size of conductors the point, the co-ordinates of which are the numerical values of $A_4$ and $B_4$, will give, by interpolation, the economical transformer ampere load.



In the sample calculations given the values for the various constants are representative of a section of an actual system now operating in a Southern city.

The section chosen for the example is a residential section, the system having a 2,300/4,000-volt primary and three-wire, single-phase, 220-110-volt secondary. Transformers are set midway between street intersections.

*Calculation of Constants.*—Following is a summary of the values used for the various constants and the methods of obtaining these values.

*C*, the cost of copper loss expressed as a fraction of a dollar per kilowatt-hour, equals 0.03215. For the derivation of this value see example given in first article of this series in the section on "Unit Energy Costs."

$C_1$, the yearly cost of each transformer installation, including cost of losses and fixed charge on investment in dollars per installation per year, independent of size of transformer, is derived by the use of equation 3 (Article II), which gives the algebraic components that enter into this constant—that is:

$$C_1 = W_1 f C + 8{,}760\, W_2 C_4 + C_5$$

where $W_1$ equals transformer copper loss in kilowatts per transformer installation, independent of transformer size (intersection of axis of losses, Fig. 1 (Article II), ELECTRICAL WORLD, March 24, page 611); $W_2$ equals transformer core loss in kilowatts per transformer installation independent of transformer size (intersection of axis of losses, Fig. 1 of the second article of this series); $C_4$ equals cost of core loss in fraction of a dollar; $C_5$ equals annual fixed charges on cost of each transformer installation. For the derivation of $C_4$ see the example given in the first article in the section on "Unit Energy Costs."

In the investment from which $C_5$ is computed there are two items: First, the fixed component of trans-

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**The last of a series of four articles. The first appeared in* ELECTRICAL WORLD, *March 10, 1928; the second and the third in the issues of March 24 and April 21, respectively.*

former purchase price, independent of size of transformer (this value is shown in Fig. 1 of Article II at intersection of the cost axis); second, the cost of installation including auxiliary apparatus, labor, etc.

The numerical value of the investment per transformer installation in the example selected is

| | |
|---|---|
| Fixed component of transformer cost (from curve).... | $56.00 |
| Installation and auxiliary apparatus .................. | 97.83 |
| | $153.83 |
| Thirty per cent for overhead expenses.................. | 46.17 |
| Total investment per transformer independent of size.. | $200.00 |

Annual fixed charge, or $C_5$, is 0.15 × $200 = $30.

Inserting the above values in equation 3 (Article II) (values for $W_1$ and $W_2$ being taken from Fig. 1 of that article), we have $C_1$ equal to 35.90.

$C_2$, the annual fixed charges on investment in line conductors in dollars per year per thousand circ.mils per 100 ft. of single conductor, is derived by using cost of copper per pound delivered at the job, which is $0.245. From this value the cost per 100 ft. per thousand circ.mils is $0.0951. The annual fixed charge, or $C_2$, is 0.15 × $0.0951, equals $0.01426.

$C_3$, the annual fixed charges on average total investment costs of primary laterals in dollars per year per 100 ft. of complete circuit, is derived as shown in the following:

| | |
|---|---|
| Additional cost of longer pole........................ | $7.00 |
| Crossarms, wire, labor, etc........................... | 22.30 |
| | $29.30 |
| Overhead construction expenses......................... | 7.33 |
| Total ........................................... | $36.63 |

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# *List of Equations*

Note: Roman numerals indicate article in which formula originally appeared, thus, *I* refers to March 10; *II*, March 24, and *III*, April 21 issues of the ELECTRICAL WORLD

### GENERAL

Yearly cost of each transformer installation: $C_1 = W_1 fC + 8760 W_2 C_4 + C_3$

*(Equation II—3)* SEE FIG. 1 ARTICLE II

### PRIMARY

Economical current density in primary feeders:

$$I_F = \sqrt{\frac{C_2}{0.0011Cf}} \quad \textit{(Equation I—1)}$$

Economical current density in primary laterals:

$$I_L = \sqrt{\frac{3C_2}{0.0011Cf}} \quad \textit{(Equation I—2)}$$

### SECONDARY

*Two-Way Straight Line Feeds:*

Maximum voltage drop per conductor in secondary mains:

$$V = \frac{0.274 I_T^2}{aD} \quad \textit{(Equation II—1)}$$

Power loss in secondary mains:

$$W = \frac{0.183 I_T^2}{1000a} \quad \textit{(Equation II—2)}$$

*For Complete Economics:*

Economical secondary copper size:

$$a = 0.01352 I_T \sqrt{\frac{nfC}{n_1 C_2}} \quad \textit{(Equation II—4)}$$

Economical ampere load of transformer:

$$I_T = \frac{6.08\sqrt{C_1 D}}{(nn_1 fCC_2)^{1/4}} \quad \textit{(Equation II—5)}$$

*If Voltage Drop Limits the Size of Conductors:*

Secondary copper size:

$$a = \frac{0.274 I_T^2}{DV} \quad \textit{(Equation II—6)}$$

Economical ampere load of transformer:

$$I_T = 1.221 \sqrt[3]{\frac{C_1 V D^2}{C_2 n_1}} \quad \textit{(Equation II—7)}$$

*If Current-Carrying Capacity Limits Size of Conductors* (these equations apply to overhead conductors only):

Secondary copper size:

$$a = \frac{I_T^{4/3} b}{1170} \quad \textit{(Equation II—8)}$$

Economical ampere load of transformer:

$$A_1 = I_T^{7/3} + B_1 I_T^{5/3}$$

*(Equation II—9)* SEE FIG. 2, ARTICLE II

where $A_1 = \dfrac{878 C_1 D}{C_2 n_1 b}$ *(Equation II—10)*

and $B_1 = \dfrac{125.2 nfC}{C_2 n_1 b^2}$ *(Equation II—11)*

### FOUR-WAY NETWORK FEEDS

Maximum voltage drop per conductor in secondary mains:

$$V = \frac{0.0685 I_T^2}{aD} \quad \textit{(Equation III—2)}$$

Power loss in secondary mains:

$$W = \frac{0.04575 I_T^2}{1000a} \quad \textit{(Equation III—1)}$$

*For Complete Economics:*

Economical secondary copper size:

$$a = 0.00676 I_T \sqrt{\frac{nfC}{n_1 C_2}} \quad \textit{(Equation III—5)}$$

Economical ampere load of transformer:

$$A_2 = I_T^2 - B_2 I_T^{1/2}$$

*(Equation III—6)* SEE FIG. 1, ARTICLE IV

where $A_2 = \dfrac{74 C_1 D}{\sqrt{nn_1 fCC_2}}$ *(Equation III—7)*

and $B_2 = \dfrac{26.15 C_3 \sqrt{LD}}{\sqrt{nn_1 fCC_2}}$ *(Equation III—8)*

*If Voltage Drop Limits the Size of Conductors:*

Secondary copper size:

$$a = \frac{0.0685 I_T^2}{DV} \quad \textit{(Equation III—9)}$$

Economical ampere load of transformer:

$$A_3 = I_T^3 - B_3 I_T^{1/2}$$

*(Equation III—10)* SEE FIG. 2, ARTICLE IV

where $A_3 = \dfrac{7.3 C_1 V D^2}{n_1 C_2}$ *(Equation III—11)*

and $B_3 = \dfrac{2.58 C_3 V L^{1/2} D^{3/2}}{n_1 C_2}$

*(Equation III—12)*

*If Current-Carrying Capacity Limits the Size of Conductors.* (These equations hold only for underground conductors):

Secondary copper size:

$$a = \frac{I_T^2 b}{160{,}000} \quad \textit{(Equation III—13)}$$

Economical ampere load of transformer:

$$A_4 = I_T^3 - B_4 I_T^{1/2}$$

*(Equation III—14)* SEE FIG. 2, ARTICLE IV

where $A_4 = \dfrac{80{,}000 C_1 D}{C_2 n_1 b}$ *(Equation III—15)*

and $B_4 = \dfrac{28{,}280 C_3 \sqrt{LD}}{C_2 n_1 b}$

*(Equation III—16)*

### TWO-WAY NETWORK FEEDS

Maximum voltage drop per conductor in secondary mains:

$$V = \frac{0.391 L^{2/3} I_T^{4/3}}{aD^{1/3}} \quad \textit{(Equation III—4)}$$

Power loss in secondary mains:

$$W = \frac{0.2905 D^{2/3} L^{2/3} I_T^{4/3}}{1000a}$$

*(Equation III—3)*

*For Complete Economics:*

Economical secondary copper size:

$$a = 0.01703 \sqrt{\frac{nfC}{n_1 C_2}}\, D^{1/3} L^{1/3} I_T^{2/3}$$

*(Equation III—17)*

Economical ampere load of transformer:

$$A_5 = I_T^{5/3} - B_5 I_T^{1/2}$$

*(Equation III—18)* SEE FIG. 3, ARTICLE IV

where $A_5 = \dfrac{44 C_1}{\sqrt{nn_1 fCC_2}} \left(\dfrac{D^{2/3}}{L^{1/3}}\right)$

*(Equation III—19)*

and $B_5 = \dfrac{15.58 C_3 L^{1/6} D^{1/6}}{\sqrt{nn_1 fCC_2}}$

*(Equation III—20)*

*If Voltage Drop Limits the Size of Conductors:*

Secondary copper size:

$$a = \frac{0.391 L^{2/3} I_T^{4/3}}{VD^{1/3}} \quad \textit{(Equation III—21)}$$

Economical ampere load of transformer:

$$A_6 = I_T^{1/3} - B_6 I_T^{1/2}$$

*(Equation III—22)* SEE FIG. 4, ARTICLE IV

where $A_6 = \dfrac{1.92 V C_1 D^{4/3}}{n_1 C_2 L^{2/3}}$

*(Equation III—23)*

and $B_6 = \dfrac{0.678 C_3 V D^{5/6}}{n_1 C_2 L^{1/6}}$

*(Equation III—24)*

*If Current-Carrying Capacity Limits the Size of Conductors.* (These equations apply only to overhead conductors):

Secondary copper size:

$$a = \frac{I_T^{4/3} b}{1170} \quad \textit{(Equation III—25)}$$

Economical ampere load of transformer:

$$A_7 = I_T^{7/3} - B_7 I_T^{1/2}$$

*(Equation III—26)* SEE FIG. 5, ARTICLE IV

where $A_7 = \dfrac{877.5 C_1 D}{C_2 n_1 b}$

*(Equation III—27)*

and $B_7 = \dfrac{310 C_3}{C_2 n_1 b} \sqrt{LD}$

*(Equation III—28)*

The annual fixed charge, or $C_3$, is 0.15 × \$36.63, equals \$5.50.

The system in question has a three-wire, single-phase, 220-110-volt secondary; therefore, $n$ and $n_1$ are 2 and 3 respectively.

*D*, the load density at yearly peak load in amperes per 100 ft. per current-carrying conductor of secondary mains, was calculated from the substation load curves of the section considered with an allowance for diversity and an allowance for load growth for seven years in the future. Its value, 8 amp. per 100 ft., is the total yearly peak load of the section, including the above allowances, divided by the total length of streets in 100-ft. units.

*L*, the length of a block in units of 100 ft., by scaling off the streets on a map of the section was found to be 3.5.

Having found all the values of the constants, we can now proceed to use the equations involved in calculating the economical transformer spacing and copper size.

*Calculations for Complete Economics.*—Since the secondary mains have a network arrangement and transformers are located midway between street intersections, equation 18 (Article III), applies, or

$$A_5 = I_T^{5/3} - B_5 I_T^{1/2}$$

The most economical transformer ampere load, $I_T$, is found from Fig. 3, providing the values of $A_5$ and $B_5$ are known. The values for $A_5$ and $B_5$ are given by equations 19 and 20 of Article III, or

$$A_5 = \frac{44\,C_1}{\sqrt{CC_2n_1nf}}\left(\frac{D^{2/3}}{L^{1/3}}\right) =$$

$$\frac{44 \times 35.9 \times (8)^{2/3}}{\sqrt{0.03215 \times 0.01426 \times 3 \times 2 \times 1{,}600}\,(3.5)^{1/3}} = 1{,}972$$

$$B_5 = \frac{15.58\,L^{1/6}D^{1/6}C_3}{\sqrt{CC_2n_1nf}} =$$

$$\frac{15.58 \times (3.5)^{1/6}(8)^{1/6} \times 5.5}{\sqrt{0.03215 \times 0.01426 \times 3 \times 2 \times 1{,}600}} = 71.2$$

The value of $I_T$, which is found from Fig. 3 by interpolation, is 115 amp. The economical cross-sectional area of secondary mains required to carry this load is given by equation 17 (Article III), or

$$a = 0.01703\,\sqrt{\frac{nfC}{C_2n_1}} \times I_T^{2/3} \times L^{1/3} \times D^{1/3}$$

$$= 0.01703\,\sqrt{\frac{2 \times 1{,}600 \times 0.03215}{0.01426 \times 3}}$$

$$\times (115)^{2/3} \times (3.5)^{1/3} \times (8)^{1/3} = 59.9 \text{ M.C.M.}$$

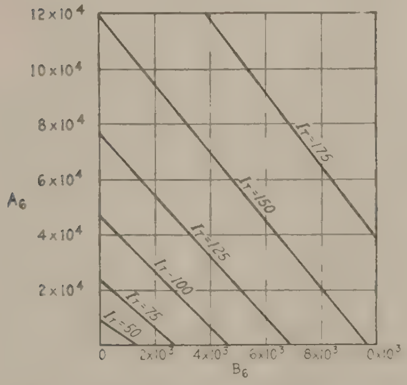
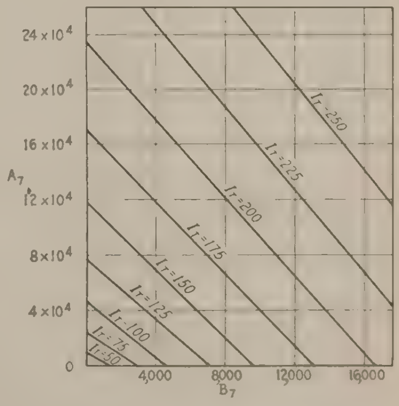


*Fig. 4 (left)—Graphical solution of equation 22 (Article III)*

The point the co-ordinates of which are the numerical values of $A_6$ and $B_6$ will give, by interpolation, the most economical transformer ampere load.

*Fig. 5 (right)—Graphical solution of equation 26 (Article III)*

The point the co-ordinates of which are the numerical values of $A_7$ and $B_7$ will give, by interpolation, the most economical transformer ampere load.



By the use of equation 4 (Article III) the maximum voltage drop in secondary mains is found to be:

$$V = \frac{0.391\,L^{2/3}I_T^{4/3}}{aD^{1/3}} = \frac{0.391(3.5)^{2/3}(115)^{4/3}}{59.9 \times (8)^{1/3}} = 4.23 \text{ volts}$$

The assumed maximum allowable voltage drop per conductor in the particular system in question is 3 volts.

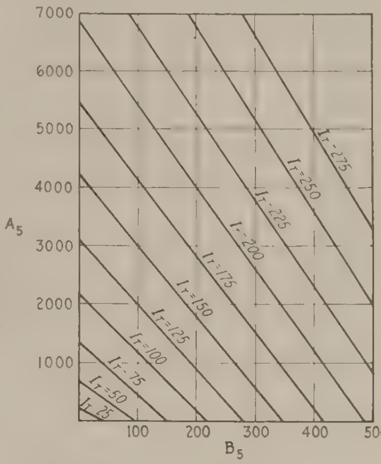


*Fig. 3—Graphical solution of equation 18 (Article III)*

The point the co-ordinates of which are the numerical values of $A_5$ and $B_5$ gives, by interpolation, the most economical transformer ampere load.

The above value is higher than this; therefore it is necessary to make a new set of calculations using equations that are limited by allowable voltage drop.

*Calculations With Voltage Drop as the Limiting Factor.*—Proceeding as in the previous case but using equation 22 (Article III), we have

$$A_6 = I_T^{7/3} - B_6 I_T^{1/2}$$

where

$$A_6 = \frac{1.92\,VC_1D^{4/3}}{n_1C_2L^{2/3}} = \frac{1.92 \times 3 \times 35.9 \times (8)^{4/3}}{3 \times 0.01426 \times (3.5)^{2/3}} = 33{,}600$$

$$B_6 = \frac{0.678\,VC_3D^{5/6}}{n_1C_2L^{1/6}} =$$

$$\frac{0.678 \times 3 \times 5.5 \times (8)^{5/6}}{3 \times 0.01426 \times (3.5)^{1/6}} = 1{,}202$$

The value of $I_T$, which is found from Fig. 4 by interpolation, is 98 amp. The cross-sectional area required to carry this load is given by equation 21 (Article III), or

$$a = \frac{0.391\,L^{2/3}I_T^{4/3}}{VD^{1/3}} = \frac{0.391 \times (3.5)^{2/3}(98)^{4/3}}{3 \times (8)^{1/3}}$$

$$= 68.3 \text{ M.C.M.}$$

The nearest practical wire size corresponding to this

## *Steps in Study of Distribution Economics*

THE various steps to be taken in applying the methods described to a study of the economics of any given distribution system are as follows:

1. Make a study of load characteristics and calculate the annual duration factor for copper loss and the cost of losses in the distribution system.

2. Make a study of the primary system in order to select the proper primary voltage and to determine the proper size of primary feeders and primary laterals.

3. Make a study of load densities of the system, calculating the prospective densities for several years in the future. Select two or three areas in the territory to be served, each area having reasonably uniform prospective load density. In each of the areas thus selected calculate the average distance between street intersections in both directions.

4. Determine upon the type of secondary system which is to be used—that is, whether three-phase, four-wire or single-phase, three-wire, etc.

5. Determine which set of formulas for economics of copper size and transformer spacing applies to each section of territory that has been selected as mentioned above—that is, whether it is to be network or straight line feed, two way or four way.

6. Calculate the economical transformer load current and secondary copper size for each section, assuming these values to be independent of voltage drop or current capacity of secondary mains.

7. From the values thus obtained determine whether the allowable voltage drop or current capacity would be exceeded.

8. If the current capacity or allowable voltage drop would be exceeded by the values obtained from the over-all economics, recalculate the values by the proper equations, depending upon whether voltage drop or current capacity is the limiting factor.

9. In a solidly interconnected alternating-current network system the copper size and transformer spacing may be limited by the ability to burn off low-voltage short circuits. The values obtained by the above procedure should be checked as to their relation to this feature and revised if necessary.

10. The values finally obtained for transformer load and copper size are average values to be used to serve the general distributed load of the system. These sizes should be adhered to in the majority of cases and the growth of load should be taken care of by setting additional transformers rather than increasing the transformer sizes, although it may be necessary to use somewhat smaller transformer sizes at the start in order to hold the voltage drop within the proper limits. If the load densities have been calculated for several years in the future, the values obtained by the described methods can usually be adhered to for a number of years without fear of varying materially from the proper economics. After a number of years, however, a new study should be made and new values adopted, for extensions and replacements of the system.

cross-sectional area is No. 2 A.W.G. The current in secondary mains nearest to the transformer is one-half of $I_T$, or 49 amp. This is considerably less than the current-carrying capacity of No. 2 wire. Therefore this size is satisfactory as far as temperature limitations are concerned, and no further detailed calculations are necessary.

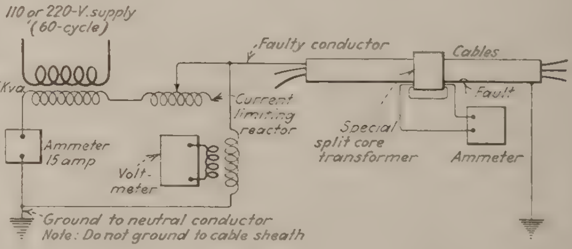
The transformer size corresponding to the above current is 220 × 98 equals 21.55 kva. The nearest practical size is 25 kva., which with an average load current of 98 amp. as indicated above, will leave a margin of safety of 14 per cent of the normal capacity of the transformer. This is sufficient, in the case under consideration, to take care of ordinary variations of loading under practical conditions, particularly since the load current indicated occurs only at the yearly load peak, and since a certain amount of overloading for short periods of time can be permitted.

Thus in the section of the system under consideration the average size of copper to use in the construction of secondary mains is No. 2 A.W.G. The average size of transformer required for a load density estimated for seven years in the future is 25 kva. For the present construction it will be desirable to use a somewhat smaller average size, say, 15 kva., gradually adding transformers of the larger size to the system and eventually standardizing upon 25-kva. transformers for serving the general distributed load of the system. Large concentrated loads will of course be served by transformers of sizes corresponding to the individual loads, plus small allowances for additional capacity for serving portions of the general system load.

In laying out and operating the system the transformer spacing will be determined by the percentage loading selected for the transformers. That is, in the case of the 25-kva. transformers the spacing must be such that the average transformer peak load will be 98 amp. Individual variations from this value will probably bring about the overloading of some transformers and the loading of others below the desired amount. However, the net result will be an over-all cost of distribution at or near the theoretical minimum value.

## Locating Underground Network Cable Faults

THE more or less delicate methods for locating faults which are used to good effect on high-voltage cables were not always so successful when they were applied to the low-voltage network cables of the Dallas (Tex.) Power & Light Company. The principal reason for the poor performance of these methods is the low conductor resistance as compared to the high fault resistance in the usual case of a fault, especially if it is under water. Recourse has been had, and successfully, to probably the simplest and oldest principle of all, but with a different type of testing equipment from that ordinarily used for such work.


110 or 220-V. supply (60-cycle)
15 Kva
Faulty conductor
Cables
Current limiting reactor
Fault
Special split core transformer
Ammeter 15 amp
Volt-meter
Ammeter
Ground to neutral conductor
Note: Do not ground to cable sheath

*Schematic diagram of test*

As shown in the accompanying illustrations the testing equipment consists of a 15-kw. transformer, a reactor and the necessary control and measuring equipment, which is mounted on a truck. One lead of the transformer is grounded, the other, at 4,000 volts, is connected to the faulted cable conductor and a current of 20 amp. applied at such intervals as desired for testing. The current is limited by the top connection to the reactor, a special form furnished by the States company. The exploring equipment consists of a special core transformer and an ammeter. On account of the relatively large diameter of the cable to be encircled by the transformer in comparison with the magnetic field surrounding the conductor, it is necessary for the transformer to be designed for very high sensitivity. To meet this requirement the Western-Electro Mechanical Company furnished a transformer with an extraordinarily large core and which weighs about 25 lb. The ammeter, which is really a very sensitive alternating-current millivoltmeter, is also of special design and is of the thermally operated type. The equipment has been in use for several years and has repeatedly demonstrated its convenience, speed and accuracy in locating various kinds of faults where other methods failed.

*Network cable fault locating apparatus*

## 188 Kw.-Hr. per Year per Cow

FIGURES compiled by the agricultural power committee of the Pacific Coast Electrical Association to show the value of one cow to the central station when the dairy is completely electrified give the following interesting results:

| Operation | Average Annual Consumption (Kw.-Hr.) |
|---|---|
| Milking | 25 |
| Pumping drinking water | 13 |
| Lighting barns, yards, etc | 5 |
| Cream separation | 1 |
| Sterilizing utensils | 100 |
| Milk cooling | 18 |
| Feed chopping | 26 |
| Total | 188 |

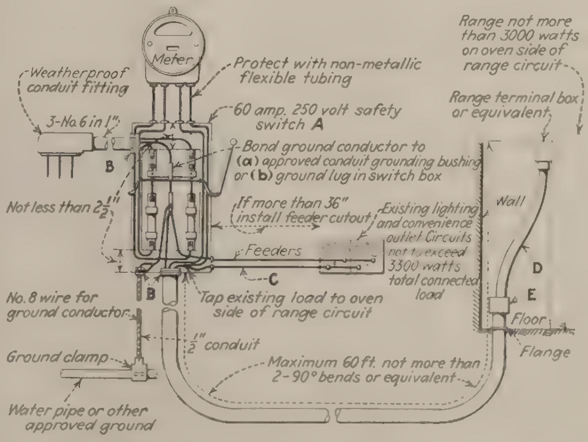
If alfalfa land is irrigated by electric pumping it was found that an additional 240 kw.-hr. per year per cow is required, assuming that the average pumping head is 40 ft. and that one acre of alfalfa is required to maintain one cow.

The report shows that all of the operations listed can be carried out to the economic advantage of the dairyman.

## New Range Wiring Standards Reduce Cost

ESTABLISHMENT of minimum range wiring specifications for installation of electric ranges in homes already wired, which will reduce wiring costs in many localities approximately 25 per cent, was one of the outstanding accomplishments of the Commercial Section of the Pacific Coast Electrical Association during the past year. With the new standards approved for a year's field trial by the California Association of Electrical Inspectors, one of the biggest obstacles in the past to the sale of electric ranges in California has been removed. If adopted by individual city inspection departments throughout the state a uniform minimum wiring standard will replace local rules of varying requirements heretofore in force.

Important features of the new standards are: Providing the lighting and convenience outlet load does not exceed 3,300 watts and the branch fuse cabinet is not more than 36 in. from the range service switch, a separate service and switch for the lighting is not required; providing there are not more than two 90-deg. bends or the equivalent in the conduit run from the service switch to the range, three No. 6 wires may be run in 1-in. conduit instead of 1¼ in., as previously required; No. 8 wire may be used for grounding the neutral of the range service instead of No. 6, as previously required, in case the range service consisted of three No. 6 wires; flexible conduit is now permitted in the run from the main service switch to the range; in practically all cases a switch at the range end of the conduit run is no longer required. Details of the new specifications are given in the accompanying schematic diagram.


Range not more than 3000 watts on oven side of range circuit
Meter
Protect with non-metallic flexible tubing
Weatherproof conduit fitting
Range terminal box or equivalent
60 amp. 250 volt safety switch A
3-No.6 in 1"
B
Bond ground conductor to (a) approved conduit grounding bushing or (b) ground lug in switch box
Not less than 2½"
If more than 36" install feeder cutout
Existing lighting and convenience outlet Circuits not to exceed 3300 watts total connected load
Wall
Feeders
C
D
E
No. 8 wire for ground conductor
B
Tap existing load to oven side of range circuit
Floor
½" conduit
Flange
Ground clamp
Maximum 60 ft. not more than 2-90° bends or equivalent
Water pipe or other approved ground

*Schematic range wiring for demands not exceeding 50 amp.*

*A*—Service switch may be installed: (*a*) Inside or outside family dwellings. (*b*) Inside each apartment or on same floor level outside each apartment, in two-family and multi-family dwellings.

*B*—Double locknuts and approved bushings on all conduits entering service switch box.

*C*—For surface work, if not over 12 in., protect with flexible tubing. If more than 12 in., install in metal conduit with approved fitting, or in metal gutter.

*D*—One-inch flexible metallic conduit not more than 36 in. Long enough to permit movement of range not less than 6 in. from wall.

*E*—Approved outlet box and cover or direct connection to end of range conduit run. Avoid unnecessary joints in range circuit conductors.

# Motion-Color

Philadelphia Electric Company provides exterior illumination of its new building to enhance civic attractiveness and demonstrate lighting possibilities

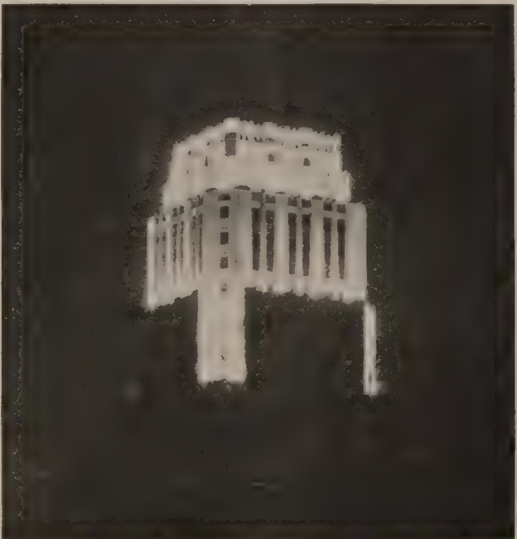
By Arthur A. Brainerd
*Assistant Illuminating Engineer*
*Philadelphia Electric Company*

IN FLOODLIGHTING its new 26-story building, the Philadelphia Electric Company decided that it should, if possible, be superior to the lighting of any similar building in the world. Leading floodlighting authorities were consulted and the following guides to designing the system were adopted:

1. The system must be flexible enough so that we could be assured of producing an effect that would be different from and more attractive than any installation installed in the vicinity within at least five years.
2. As far as possible the units should be located on the building and concealed from sight.
3. To secure the maximum value both color and motion should be used.
4. Adequate provision must be made for rapid changes in the arrangement of both color and motion media.

Very little definite information could be found on the wattage required for color illumination to produce satisfactory visibility at a distance of several miles, or on the desirable dimming speed for motion effects. Consequently experiments were conducted in which a 70x15-ft. panel having about the same reflection factor as the new building was illuminated and observations made at distances up to 1.75 miles.

These tests warranted the installation of two separate floodlighting systems—one to be normally equipped with clear lamps and connected to a theatrical dimmer and the other normally equipped with color. It was found that the clear lighting should have approximately 50 per cent of the wattage of the color lighting. Furthermore, the projectors equipped with clear lamps should be slightly nearer the building and slightly lower down than the color equipment. With the brick under consideration 8 to 9 watts per square foot produced excellent results.



*Night view from Washington Square with color and motion left to the imagination*

Referring to the illustrations it may be observed that the building is a towered structure, with a small rectangular balcony at each corner on the fifteenth floor and balconies on three sides on the eighteenth and twenty-second floors. There is also a narrow balcony on the fourth side of the twenty-second floor. Below this level the wall of the building is unbroken. The majority of people will view the building from a distance of half a mile or more.

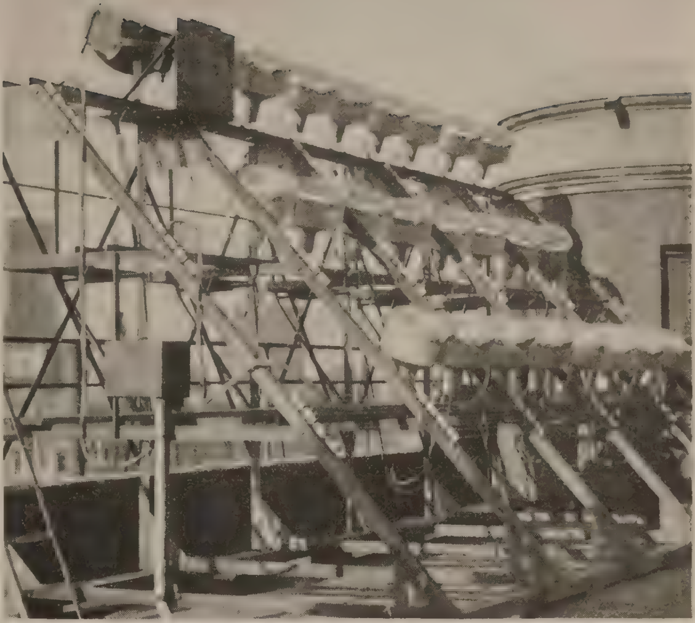
On each fifteenth floor corner are placed 30 500-watt projectors, ten connected to a dimmer circuit and the rest directly across the line. These units are placed on steel framework as far from the building as possible. The space covered is from the fifteenth to the twenty-second floor. On the eighteenth floor, on the north, east and south sides, the projectors are grouped in front of the pilasters, which are of two widths (2½ ft. and 7 ft.) and extend to the twenty-second floor. The groups consist of three projectors and nine projectors respectively for the narrow and wide pilasters. One-third of these projectors were on dimmers. On the twenty-second floor the arrangement was more irregular, but the same general rule was followed. Except where wide pillars jut out into the balcony all projectors are mounted close to the parapet

# Floodlighting

and as high as possible. The total number of projectors on this floor is 162, 62 of which are dimmers.

On the twenty-third story level there is a wide ledge which cannot be reached satisfactorily by projectors. On each of these ledges was mounted a 200-watt prismatic vapor-proof unit turned base out and equipped with a natural finish colored lamp. The units stand out as jewels and entirely relieve the harsh shadow which otherwise would exist.

The west side of the building from the eighteenth to the twenty-second floors is illuminated by two banks of projectors on the roof of the adjacent building, consisting of 48 1,000-watt projectors, sixteen of which are on dimmers. At this level there are also two 18-in. incandescent searchlights to take care of two inaccessible spaces above the twenty-second floor.



*A bank of 29 projectors*

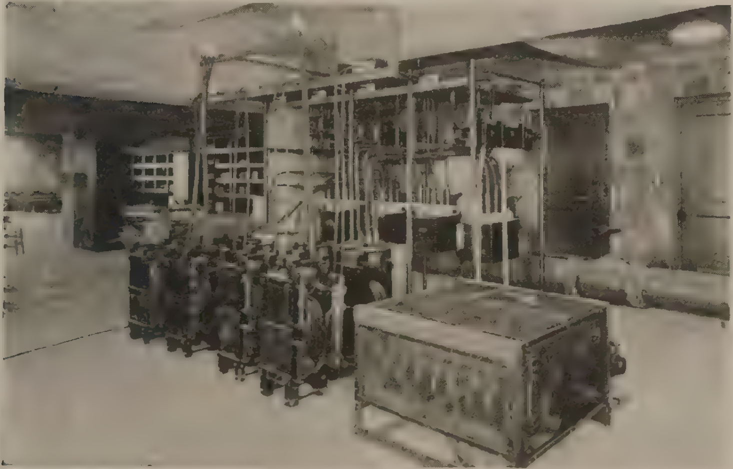
Dimming is provided by a four-element Ward-Leonard reactive dimmer of 90-kw. capacity located on the seventeenth floor. Three speed changes are provided, making possible a complete cycle of 30 seconds, one minute, or two minutes duration. Each of the four levels is provided with a pair of reactors and separate cams so that they may be dimmed simultaneously or progressively. The cams are so constructed that any desired change in sequence of dimming may be made in ten minutes. Flexibility in adjusting and changing of colors is secured by standardizing on two units, a 500-watt projector with a recess in the reflector to receive a color cap and a 1,000-watt projector which will accommodate a specially designed inner color lens. A complete change in color arrangement may be made within a very few hours. The whole arrangement constitutes in effect a big floodlighting experimental station. It is possible at any time to have a color system, a white system or a continuously changing system, and the arrangement of both color and dimming can be altered at will.

The total load on the system amounts to 262 kw., divided as follows: 419 500-watt Pittsburgh F.L.C. projectors, 48 1,000-watt

*At right — One of vapor-proof units on 23d floor balcony*

*Below, left — 90-kw. reactive dimmer controlling white lights*

*Below, right — Arrangement of projectors on eighteenth floor balcony*



Pittsburgh F.L.C. projectors, two 18-in. General Electric incandescent searchlights and fourteen 200-watt Holophane vapor-proof units. Normally the system is equipped with 219 Laco-Phillips color caps and 34 Laco-Phillips color lenses.

It is greatly to the credit of the manufacturers who co-operated with the lighting service department of the Philadelphia Electric Company that all of the material was manufactured, delivered, installed and adjusted within four weeks after the first order was given.

In the brief time that the system has been in operation it has excited widespread comment and already requests have been received to prepare plans for two large office buildings.

# Utility Attitude on Oil Burners

POWER companies are keenly interested in domestic oil burners as a means of building up the residential load, declared Charles K. Nichols of the New York Edison Company, in an address before the recent convention of the American Oil Burner Association. They are most interested, he asserted, in the particular appliance or type of appliance that will help to improve load factor and the oil burner meets this requirement very well. About one year ago the question of the domestic oil burner as an appliance which the central-station companies should encourage came up and it was found that one large company was successfully promoting the sale of this equipment. Outlining the attitude of the power companies, Mr. Nichols continued:

"Since last summer the central stations have gone into this matter a little more carefully and in two of our largest associations, the National Electric Light Association and the Association of Edison Illuminating Companies, committees have been formed to investigate this question of oil burning and to report back, if possible, this summer or this fall, whether or not this is a matter which our companies should take on. We want apparatus that is efficient. We want apparatus that is going to function over a reasonable length of time with very little servicing.

### Customer Relations a Factor

"The position of the central stations with their customers is a rather unique one. For years we have been trying to build up good customer relations. I believe that we have accomplished something along those lines, for we now find that our customers come to us and ask what apparatus they shall buy. For that reason we must be very careful to find out what apparatus there is that we can safely recommend.

"If we are handling an oil burner, if an oil burner appears on our floors for demonstration, it means that the company that has put that oil burner there, the central station that is advocating its use, tacitly guarantees that that oil burner may be used by our customers without mistake.

"In our merchandising methods there are very great differences. Some companies on one hand believe that it is advisable to select one piece of apparatus and merchandise. There are other companies which undertake to sell the idea of burning oil, advertise that, try to promote it by demonstration, have half a dozen burners on the floor, if possible, each one good, each one advertising the use of oil. There are others that will fall between those two classes, some selling them and having a manufacturer or a dealer install and service them, and merely working as an adjunct to that dealer.

### A Parallel Situation

"This is the way in which the central stations have handled a business that seems to be very analogous with the oil burner. That is the domestic refrigerator. About five years ago the domestic refrigerator came rather forcibly to our attention, and for two years we investigated them, tested them, tried them out under all possible conditions, and finally in 1925 we felt that the refrigerator was here to stay, that it was no longer a luxury, that the price was such that our customers could

## *Number and Population of Communities with More Than One Voltage*

From report of N.E.L.A. Lamp Committee (F. W. Smith, chairman)

| Lighting Voltage | Number of Communities | | | | | Population of Communities (1920 Census) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1923 | Per Cent | 1928 | Per Cent | Change | 1923 | Per Cent | 1928 | Per Cent | Change |
| 110 volts only | 6,976 | 47.7 | 3,751 | 19.9 | —27.8 | 21,224,500 | 33.6 | 9,211,100 | 14.8 | —18.8 |
| 115 volts only | 5,226 | 35.6 | 12,879 | 68.2 | +32.6 | 24,302,900 | 38.5 | 36,748,100 | 58.8 | +20.3 |
| 120 volts only | 1,197 | 8.2 | 2,088 | 11.1 | + 2.9 | 7,147,300 | 11.3 | 12,980,600 | 20.8 | + 9.5 |
| Total, one standard voltage only | 13,399 | 91.5 | 18,718 | 99.2 | + 7.7 | 52,674,700 | 83.4 | 58,939,800 | 94.4 | +11.0 |
| More than one standard voltage, one station | 435 | 3.0 | 62 | 0.3 | — 2.7 | 1,407,600 | 2.2 | 1,075,900 | 1.7 | — 0.5 |
| More than one standard voltage, more than one station | 102 | 0.7 | 33 | 0.2 | — 0.5 | 6,934,000 | 11.0 | 2,323,200 | 3.7 | — 7.3 |
| Total, standard voltage(s) only | 13,936 | 95.2 | 18,813 | 99.7 | + 4.5 | 61,016,300 | 96.6 | 62,338,900 | 99.8 | + 3.2 |
| 112 volts only | 118 | 0.8 | 9 | ..... | — 0.8 | 333,500 | 0.5 | 28,200 | 0.1 | — 0.4 |
| 125 volts only | 88 | 0.6 | 13 | 0.1 | — 0.5 | 189,100 | 0.3 | 19,800 | 0.1 | — 0.2 |
| Other voltage below 130 volts | 162 | 1.1 | 9 | ..... | — 1.1 | 667,100 | 1.1 | 5,100 | ..... | — 1.1 |
| 200 volts or higher | 260 | 1.8 | 20 | 0.2 | — 1.6 | 252,500 | 0.4 | 15,600 | ..... | — 0.4 |
| Standard and odd voltages, one station | 59 | 0.4 | 1 | ..... | — 0.4 | 337,000 | 0.6 | 800 | ..... | — 0.6 |
| Standard and odd voltages, more than one station | 16 | 0.1 | 3 | ..... | — 0.1 | 316,000 | 0.5 | 75,800 | ..... | — 0.5 |
| Grand total | 14,639 | 100.0 | 18,868 | 100.0 | ....... | 63,111,500 | 100.0 | 62,484,200 | 100.0 | ....... |

afford to buy them in large quantities, so we advocated the use of electric refrigeration very strongly, some selling one particular refrigerator, others selling the idea of mechanical refrigeration for domestic use.

"Since that time perhaps conservatively half a million electric refrigerators have been purchased and put on the power companies' lines. We still have our committees that are promoting the use of the refrigerator, and I see no reason if the oil burner is to our minds a successful piece of apparatus, as the refrigerator now is, why we cannot handle this in practically the same way.

"I believe that if we find the oil burner is a satisfactory piece of apparatus, as we believe it has been shown within the past year, the advantages of co-operation between the central stations and the oil burner companies will become more and more apparent."

## Electric Annealing of Brass Shows Good Economies

RECENT experience in electric brass annealing shows advances in economy by the use of selective load control, according to a paper by R. M. Keeney before the Bridgeport meeting of the American Electrochemical Society. A representative Connecticut plant installed a 350-kw. furnace in 1924 with "on and off" control and annealed yellow brass tubing in small sizes and thin gages with a power consumption of 110 kw.-hr. per ton (2,000 lb.), or 18.2 lb. per kilowatt-hour. The inside muffle dimensions were 16 ft. by 4 ft. by 18 in. Annealing was done at a muffle temperature of 1,200 deg. F., and the outfit has been in service for nearly four years, running ten hours per day without a coil burnout or any furnace maintenance expense. The first furnace has been followed by two more 350-kw. units.

The first furnace has coils in the bottom, two sides and top of the muffle, with two control groups, each covering one-half the length of the muffle. Its production[*] was increased to 20 lb. per kilowatt-hour, or 100 kw.-hr. per ton, by the development of a selective[†] load control. The increased efficiency appears due to the more rapid absorption of heat by the mass of tubing in the furnace, because convection currents are established. This is contrary to the general opinion that all heating in an electric resistance furnace is by radiant heat and suggests that possibly mechanical circulation of a furnace atmosphere may prove beneficial in increasing the speed of annealing. The two later furnaces have four control groups each, two being in the bottom and two in the sides and arch. These additional control groups were installed because it was found that the bottom coils should be on most of the time and should be arranged for independent operation. In these two later furnaces, equipped with load control, the production is 24 lb. per kilowatt-hour, or a consumption of 83 kw.-hr. per ton.

The installation was made entirely on an economic basis, Mr. Keeney states, a large saving in pickling cost and labor having been demonstrated by experiments prior to the purchase of the first furnace. The pickling time has been reduced to about 25 per cent of the previous requirements, because there is much less oxidation of the tubing, which has cut the labor cost in two and materially reduced the acid consumption. This electric furnace installation anneals brass tubing at a cost for annealing and pickling of $2 to $2.50 per ton less than the former wood-fired muffles and results in a yearly return on about 50 per cent of the furnace investment.

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[*] *Production about 18,000 lb. per ten-hour day.*—EDITOR.

[†] *The "selective load control" keeps down demand charges and raises the efficiency of the furnace by fluxing the heat around the interior. Zones of heating are operated alternately under control of a timing device for a predetermined period (six minutes in this case), the input being shifted from one to the other as long as heat is required in both zones. When one zone reaches a cut-off point, i.e., a predetermined temperature, the furnace immediately goes off the time cycle and operates in the usual way.*—EDITOR.

## Planting the Electrical Idea in Fertile Soil

STUDENTS in the mechanical engineering shops at Stanford University receive their training in as modernly equipped a foundry and shop as may be found anywhere. Electric melting and heat-treating equipment installed during the past year gives the student the advantage of the best equipment and latest foundry and shop practice and he goes forth to his chosen field with a knowledge of electrical methods which better enables him to cope with such present-day industrial problems as he may encounter.

In the foundry is to be found a 100-kw. Electromelt steel furnace with a capacity of 125 lb. per hour and a Young Brothers shelf-type core-baking oven with Bristol automatic control Heat-treating equipment consists of a 30-kw. Hagan box-type heat-treating furnace with Wilson-Maculen temperature control, a 10-kw. General Electric box-type heat-treating furnace with Leeds & Northrup recording control, a Rockwell-Sentry laboratory model heat-treating furnace with carborundum heating elements and dilatometer control and a Leeds & Northrup Hump heat-treating furnace

*Electric melting and heat-treating equipment used at Stanford University in teaching modern foundry and shop practice*

# Markets in Brazil

### Some observations by Howard A. Lewis, an American manufacturer, recently returned from a study of South American conditions

BRAZIL presents a most appealing market for American electrical products, according to Howard A. Lewis, vice-president in charge of the development of export markets for the Kelvinator Corporation of Detroit. Mr. Lewis has just returned from an extended trip to South America and brings with him some interesting observations on conditions there. He sees Brazil, from the electrical standpoint, as standing where America did twenty years ago, with this difference, that she is starting on her era of intensive electrical development with all the advantage of modern American practice at her hand.

#### DOMESTIC APPLIANCE FIELD LARGE

"The cities of Rio de Janeiro and São Paulo, the two chief centers of population in Brazil, have been electrified for years," said Mr. Lewis. He continued:

"The Pearson Engineering Company developed hydro power for both cities. With the growth of these cities there came a shortage of electricity. Recently additional hydro powers have been completed, and there is now a surplus. Nearly every home in Rio is wired. The population went from candles to electricity. The use of domestic appliances has not yet gone very far. The same condition applies in São Paulo. Rio is one of the most dramatically lighted cities in the world, miles of electrically lighted boulevards following the shore line and curve after curve of light with straight strings of illumination climbing the mountainsides. In Rio electricity has been used to beautify, in São Paulo electricity has been used for power. These two cities are now controlled by the Canadian General Finance Corporation. A progressive program is under way which will make for the greater use of electricity in the homes and in industry. A program of trade co-operation headed up by the Rio company has been inaugurated and the best of American and English association practices are being followed.

#### RATE STRUCTURES BEING STUDIED

"Rates for lighting in Rio have been 800 reis or (at 12 cents the milreis) 9.6 cents American a kilowatt. The power rate starts at 500 reis or 6 cents American a kilowatt. A scientific study is now being made of the Rio rate structure, and a new domestic rate, probably with a sliding scale of charges, is soon to be set up. It is estimated that there are more than 120,000 domestic meters in Rio. In São Paulo the domestic rate is 720 reis of 8.64 cents American a kilowatt, and the power rate 200 reis or 2.4 cents American a kilowatt. The estimates give 80,000 domestic meters in São Paulo.

"There are many smaller hydro plants in Brazil. In the State of São Paulo alone it is estimated that there are more than 300 communities, large and small, served with electricity. The most important electrical development in Brazil; in fact, the most important single industrial development in the country, has been the advent of the Electric Bond & Share Company of New York. This group has already taken over Bahia, Victoria, Nictheroy and the Riberao Preto district in São Paulo. It is understood that it has options on many other desirable properties. Already it represents the largest American interest in Brazil. The program includes the building of new hydro-electric plants, the rehabilitation of existing plants, high-tension transmission and a progressive commercial development campaign. It is able to draw on the best of American experience for engineering, operation and commercial development. The existing organization is a fast-moving, modern crowd, already on a par with the best of the central-station organizations in the States. Adequate power at fair rates, with the skill to sell the idea of electricity as a labor-saving tool for industry, for the home and for agriculture, will be this organization's contribution to the growth of this empire of the south.

"There are three large electrical trading organizations in Brazil, the General Electric S. A. of Brazil, the German A.G.E. and Siemens. The Brazilian G.E. operates through seven branches, with the head office at Rio. This company manufactures lamps, and besides selling G.E. products it does some independent trading with other manufacturers. The American Westinghouse is represented by a Brazilian organization, Byington & Company. The Byington interests also control and operate light and power properties. Besides these large electrical organizations there are many smaller trading houses, handling American, English, German, Danish, French and Italian lines. For electrical apparatus and fabricated products Brazil draws from all the world.

"As for credit terms, you run the gamut in Brazil, from cash against documents in New York to consigned stocks, and anywhere in between. Local interest rates are high and much organized propaganda has been set up as to terms that must be given in order to do business. Before the financial crash of 1920-21 the American commission houses did business on a 120-day sight basis, and these terms were, up to that time, more or less standard. Today the merchandise, the salesmanship involved and the standing of the respective firms are the controlling credit factors.

#### BRAZIL OFFERS OPPORTUNITIES

"Brazil is now entering the period of centralized and unified power station operation and control, plus the era of diversified electric applications, both commercially and domestically. What the States was electrically twenty years ago is now being repeated here. With a present population of 37,000,000 and room for 100,000,000 people, Brazil offers large opportunities for American enterprise. It should be understood by our electrical exporters, however, that this market will not be won by men who go down there and gang together with the American and English colonies. There is entirely too much of that, too much drinking and loafing by men who fail to study the national viewpoint and to become a part of the life of the country. These men are apt to fail and come back to the States to tell how hard it is to sell in South America. It is in this that the Europeon has been surpassing the American. The Latin nations of Europe have been exporting to Brazil not only dollars and goods but ideas, ideals and people who settle there and add their lives and work to the wealth of the nation. The British have sent goods and money. The Germans have sent goods, money and people. America must send ideas and sympathy, as well as dollars, plus enthusiasm, management and engineering skill, to help them build and develop the market in which we hope to share. We must forget many of our home traditions and absorb the traditions of Brazil, that we may effectively help them create a greater electrical market. No man can go there with the mere idea of exploitation and hope to succeed."

# Letters from Our Readers

## *Dr. Stratton Misinterpreted on Maine Power Exportation*

*To the Editor of the* ELECTRICAL WORLD:

I am very much surprised to learn of the interpretation that, according to a news item printed in your issue for June 2 (page 1163), has been placed upon my remarks at Bangor. In the first place, there was nothing whatever in my written paper concerning the Maine law as to exportation of electric power. In emphasizing the assistance that scientific and technical graduates of New England educational institutions could give in developing the industries of the State of Maine, I did remark that by keeping in touch with modern chemical and metallurgical developments they might be able to find uses for electrical current near the point of generation, where current is the principal factor in the process.

The question as to whether the law is best for the interests of the State of Maine is an economic one involving many factors, and about which I did not express an opinion.

S. W. STRATTON,
President Massachusetts Institute of Technology.
Cambridge, Mass.

## *Securing Accurate Results with Calculating Table*

*To the Editor of the* ELECTRICAL WORLD:

In transmission networks the ratio of reactance to resistance is frequently so large that satisfactory results can be obtained on the calculating table by using only the value of reactance. In underground systems the ratio of reactance to resistance is smaller and much larger errors enter into the results by the neglect of the resistance. Since the voltages consumed in a network by the reactance and resistance are in quadrature it is not permissible to combine the reactance and resistance into an equivalent impedance for use in setting up the calculating table.

The following method properly allows for the quadrature relation and yields a true value for the short-circuit currents. Three steps only are involved in the solution, viz.:

1. Set up the calculating table with resistance values only and determine the current. Let it be $I_r$.
2. Again set up the calculating table with reactance values only and determine the current, $I_x$.
3. Substitute these values into the formula

$$I_{sc} = \left\{ \left[ \frac{\frac{1}{I_r}}{\frac{1}{I_r^2} + \frac{1}{I_x^2}} \right]^2 + \left[ \frac{\frac{1}{I_x}}{\frac{1}{I_r^2} + \frac{1}{I_x^2}} \right]^2 \right\}^{1/2}$$

The formula is arrived at directly, thus, $I_r = \frac{E}{R}$ and $I_x = -j\frac{E}{X}$ and also, $I = \frac{E}{Z} = \frac{ER}{R^2 + X^2} - j\frac{EX}{R^2 + X^2}$.

The "in phase" component is $\frac{ER}{R^2 + X^2}$ and the "quadrature" component is $\frac{EX}{R^2 + X^2}$

When the readings are taken on the calculating table they are $\frac{E}{R}$ and $\frac{E}{X}$ so, to establish the equalities $\frac{EK}{R} = \frac{ER}{R^2 + X^2}$ and $\frac{EK^1}{X} = \frac{EX}{R^2 + X^2}$ it is apparent that $K = \frac{R^2}{R^2 + X^2}$ and $K^1 = \frac{X^2}{R^2 + X^2}$.

So $I_{sc} = \sqrt{\left( I_r \frac{R^2}{R^2 + X^2} \right)^2 + \left( \frac{E}{X} \frac{X^2}{R^2 + X^2} \right)^2}$

$$= \sqrt{\left[ I_r \frac{\frac{E^2}{I_r^2}}{\left(\frac{E}{I_r}\right)^2 + \left(\frac{E}{I_x}\right)^2} \right]^2 + \left[ I_x \cdot \frac{\frac{E^2}{I_r^2}}{\left(\frac{E}{I_r}\right)^2 + \left(\frac{E}{I_x}\right)^2} \right]^2},$$

$$= \sqrt{\left[ \frac{\frac{1}{I_r}}{\frac{1}{I_r^2} + \frac{1}{I_x^2}} \right]^2 + \left[ \frac{\frac{1}{I_x}}{\frac{1}{I_r^2} + \frac{1}{I_x^2}} \right]^2}$$

The formula is simpler to use than may appear. Let the setting on resistance alone yield $I_r$ as 1,000 and the setting on $X$ alone yield 250 units—any units. Then in the same units,

$$I_{sc} = \left[ \left( \frac{10^{-3}}{10^{-6} + 16 \times 10^{-6}} \right)^2 + \left( \frac{4 \times 10^{-3}}{10^{-6} + 16 \times 10^{-6}} \right)^2 \right]^{1/2}$$
$$= \left[ \frac{10^{-6}}{(17)^2 \times 10^{-12}} + \frac{16 \times 10^{-6}}{(17)^2 + 10^{-12}} \right]^{1/2}$$
$$= \left( \frac{17 \times 10^{-6}}{(17)^2 \times 10^{-12}} \right)^{1/2} = \left( \frac{10^6}{17} \right)^{1/2} = 243 \text{ units}$$

In the analytic solution of a network the treatment can deal separately with the resistances and reactances, i.e., consider the network first as containing only resistance and then as containing only reactance, and the results be combined as indicated. This affords a check method for solutions derived in the regular way.

L. S. FOLTZ,
Head Electrical Engineering Department.
Michigan State College,
East Lansing, Mich.

## *Service Testing of Meter Transformers*

*To the Editor of the* ELECTRICAL WORLD:

Referring to the article on "Service Testing of Meter Transformers" in the April 28, 1928, issue of the ELECTRICAL WORLD, I would like to call your readers' attention to the fact that this article was written before the Southern Power Company had changed its name to the Duke Power Company, hence the confusion in names.

The cost of testing was small at the time. I have checked it again this spring and it runs even less. Including time loss and overhead expenses the cost would be around \$6 or \$7. The cost of changing and testing was estimated on a basis of traveling considerable distances and should not average over \$10 or \$12. However, estimated costs differ, so they can be depended upon only when local conditions are known.

The accuracies given are high, but were obtained over several years by different men; a number of checks were made on standard transformers and their curves. Errors of potential transformers tend to balance those of current transformers and the trouble with the bad types of transformers, connections, cables, etc., were eradicated in first tests. This method has located troubles with much greater ease and rapidity than the usual method. Later tests on the meters do not show materially different results.

We would like to hear from any one who has developed methods of field testing current transformers of less than 300-amp. capacity.

BEDFORD J. BROWN,
Superintendent Meter Department.
Duke Power Company,
Charlotte, N. C.

# Digest of Electrical Literature

## *Hydro-Electric Development and Steam Equipment*

*The Development of the Gatineau River.*—The program under which the development of the Gatineau River has proceeded and the three separate projects which have been undertaken in order to complete the comprehensive scheme have been outlined. The design and operating factors involved in the three generating stations installed for the utilization of this power have been fully covered, with particular reference to the paper mill constructed as a part of the scheme and constituting an essential feature of the development. The present installed capacity amounts to 436,000 hp. The Gatineau Company has contracted to supply the Hydro-Electric Power Commission of Ontario with 260,000 hp. of 25-cycle power for its Niagara system for a period of 30 years and 100,000 hp. of 60-cycle power for its eastern Ontario district. The 25-cycle power will be supplied at 220 kv. and that for the 60-cycle system at 110 kv.—*Electrical News (Canada)*, May 15, 1928.

*The Combustion of Coal.*—F. H. Rosencrants.—A review of the past development, the present position and the trend of progress in the use of solid fuel, with particular reference to pulverized fuel and stoker firing. It is stated that the rapidity with which the process of combustion of pulverized coal may be carried out depends upon several factors, namely, the coal should be reduced to infinite fineness: the coal and air should be preheated to the ignition temperature of the coal; the coal and air should be brought together in correct proportions and as a perfect mixture at the furnace entrance. The author adds that under these conditions combustion would be instantaneous, but that as it is neither practical nor economical to reduce coal to infinite fineness and as the ignition temperature of coal is in no case much more than 900 deg. F. little is to be gained by preheating the air beyond the more practical limit of 400 to 600 deg. F., and that in the absence of infinite or atomic fineness it is impossible to realize the intimacy of association of coal and oxygen specified as the ideal. The various factors involved have been considered, including a comparison of the advantages of the storage system and the unit pulverizer.—*Electrical Review (England)*, May 18, 1928.

## *Transmission, Substations and Distribution*

*Toronto Terminal for 220-Kv. Gatineau Power.*—The new 220,000-volt step-down transformer station of the Hydro-Electric Power Commission of Ontario possesses a number of unusual features. The high-voltage lines from the Ottawa River development terminate on the 220-kv. bus at this station and may be disconnected from it by means of oil circuit breakers. Provision is made for isolating each circuit breaker by means of disconnecting switches, so that repairs may be made without interrupting service. The breakers are of unusual size and are said to be the largest in physical size and rupturing capacity yet manufactured. Complete interruption is accomplished in one-half second. The high voltage terminal of the main transformers is connected to the bus and transformation is made in the windings of the transformers to 110,000 volts and 13,200 volts. Each transformer is rated at 15,000 kv. and has three windings insulated from each other. Direct interconnection with another system is effected through 110,000-volt windings and bus construction. Synchronous condensers are employed to regulate the voltage over the 230-mile line supplying this station. — *Electrical News (Canada)*, May 1, 1928.

*Cable-Laying Improvements.*—E. S. Byng.—The efficient use of labor-saving, mechanical appliances in cable-laying practices is considered in this article, one of a series on similar topics, with particular reference to British practice. The devices include compressed-air-operated tools, trench-digging machines, back fillers, tampers, concrete mixers, thrust borers, installation appliances, motor winches and pumps. It is stated that the whole economical use of any mechanical appliance depends in large measure upon the factors of cost of manual labor in relation to machine cost for a similar operation; amount of work to be done; suitability of locality for machine operations, and selection of suitable type of machine, bearing in mind capital cost and maintenance charge and also facilities for obtaining spare parts.—*World Power*, May, 1928.

*Excitation Systems and Their Influence on Short Circuits and Maximum Power.*—R. E. Doherty.—A new regulator, unique in its operating characteristics, has been developed which makes it possible to maintain stable operation under the conditions of dynamic stability, thus increasing the maximum power by taking advantage of the heretofore unexploited range of operation of synchronous machines. Comparative test results are given for different types of regulators. The new regulator indicated an extraordinary gain, giving an increase in maximum power from a steady state value from 110 kw. to a maximum of 415 kw. on a system comprising a synchronous generator supplying power directly to a synchronous motor. The excitation system as controlled by the new regulator provides a component of excitation voltage which is at all instants equal to the drop in the field circuit during the necessary small oscillations under dynamic stability. With zero effective field resistance, the maximum power corresponds to the condition of constant flux linkages, the power under that condition being greatly increased above the constant field current value.—*Journal of the American Institute of Electrical Engineers*, May, 1928.

## *Units, Measurements and Instruments*

*A Thermal Method of Standardizing Dielectric Power Loss Measuring Equipment.*—J. H. Scott, H. W. Bousman and R. R. Benedict.—The need for reference standards in dielectric power loss measurements at high voltage and commercial power frequencies have been reviewed and a thermal method for measuring dielectric power loss in cables utilizing the sheath temperature rise associated with the flow of heat due to the power loss within the sheath has been offered. Sources of error are discussed briefly and results are given in comparison with the measurements of dielectric power loss by the reflecting astatic, electrodynamometer wattmeter, using an air capacitor for phase-angle compensation. Certain possible errors in dynamometer measurements are noted, with particular reference to the effect of humidity on power loss in the air capacitor.—*Journal of American Institute of Electrical Engineers*, May, 1928.

*Sodium-Peroxide Bomb Calorimeter.*—A bomb calorimeter in which the use of oxygen for combustion purposes has been replaced by that of solid sodium-peroxide mixed with the fuel to be tested is described. It is stated that the oxygen bomb calorimeter remains the standard instrument, but that it is inconvenient for routine work and expensive. There are a number of advantages claimed for the device described in this discussion, namely, the ease with which the equipment may be dismantled and sulphur determinations made: the water equivalent of the calorimeter is determined by a test with pure benzoic acid, the calorific value of which is well known; the difference between the theoretical calorific value and the value observed to give the loss of heat by radiation and in other ways, and volatile liquid fuels may be readily tested in this device.—*Engineering (England)*, May 18, 1928.

*The Microscopic Examination of Some Electrical Insulating Materials.*—Arthur B. Everest.—The first test to be applied to an insulating material must obviously be directed toward ascertaining its electrical properties. Underlying the properties of any material are its composition and structure, and it is in determining these as well as in the study of defective material that microscopic examination has proved of value to the electrical engineer in connection with his study of insulating materials. The author has undertaken a considerable microscopic examination of various materials, including insulating papers, varnished cloths and vulcanized fiber and has analyzed the influence of certain characteristics as indicated in the tests upon their value as insulating media.—*Engineering (England)*, May 18, 1928.

## *Illumination*

*Intensity of Light and Speed of Vision Studied with Special Reference to Industrial Situations—Part II.*—C. E. Ferree and G. Rand.—This study is a continuation of the program outlined in an earlier paper and the investigation has been extended to include conditions of work as sampled from industrial situations supplementing the earlier determinations. In the first series of experiments described in the present discussion the effect of intensity of light was investigated for light objects on dark backgrounds and a comparison made with the effect for dark objects on light backgrounds. In the second series of experiments a color difference was introduced of a kind frequently found in industrial situations. In the third experiment the effect of intensity of light on the speed of reading a steel vernier rule was determined. Other points included are: Study of the cause of the difference in results obtained for dark objects on light backgrounds and vice versa; the measurement of the size of the pupil under certain conditions; the individual differences in speed of discriminating white and black objects on gray backgrounds, and several similar physiological determinations.—*Transactions of the Illuminating Engineering Society*, May, 1928.

## *Electrophysics, Electrochemistry and Batteries*

*Adsorption Phenomena in Primary Cells.*—E. O. Jegge.—The adsorption phenomena are stated by the author to constitute important factors in the dry cell. In this discussion the characteristics of various chemical constituents are considered and the resulting effect upon the life of the cell outlined.—*Report of American Electrochemical Society*, April, 1928.

*The Development of the Process and Equipment for the Manufacture of Chemically Pure Acid by Electrical Distillation.*—C. M. Hoff.—The demand for a better method for the manufacture of chemically pure hydrochloric acid led to the present investigation. Efforts were directed toward developing a continuous process, first employing fuel heating and later electrical energy for distillation. Paramount difficulty was the obtaining of materials of construction that would meet all the requirements. The result of this work was a continuous process that utilized electrical energy in place of fuel, reduced greatly the operating costs and breakage, advanced the quality of the product and improved the working conditions. This process and apparatus are also adapted, it is said, to the manufacture of chemically pure nitric acid, although introducing additional problems in the selection of materials of construction.—*Report of American Electrochemical Society*, April, 1928.

*Behavior of Plating Baths and Anodes During Electrodeposition of Chromium.* — Richard Schneidewind and Stephen F. Urban.—In this study of the behavior of chromic acid plating baths during electrolysis special emphasis has been placed on the relationship between anodes and the solution composition. If all plating conditions are kept constant, trivalent chromium in the bath approaches an equilibrium concentration, a condition of steady state. The magnitude of this concentration is a function of the following conditions: Anode current density; the nature of the anode material; temperature of the bath, and the sulphate concentration of the bath. Where iron anodes were used they dissolved at a constant rate during electrolysis. Lead is less soluble at low temperatures, but proved even more soluble at high temperatures than iron. Dissolved iron and trivalent chromium greatly contract the range of current densities at which good plate is produced.—*Report of American Electrochemical Society*, April, 1928.

*Electrochemical Production of Graphitic Oxide.*—Bruce K. Brown and Oliver W. Storey.—Graphitic carbon may be oxidized to a deflagrating oxide of carbon having the properties of graphitic oxide when used as an anode in a neutral or an acid electrolytic bath containing oxidizing anion. The authors conclude as a result of their investigation that dilute nitric acid with or without the addition of an oxidizing salt is the preferred electrolyte for producing electrochemical graphitic oxide. A low current density and a low temperature electrolyte are conditions required to fix the greatest amount of oxygen. Best current efficiencies and the highest percentage of fixed oxygen are obtained by using impregnated anodes. The available oxygen in graphitic oxide may be determined by the ferrous sulphate method, the available oxygen being somewhat lower than the total oxygen obtained by combustion.—*Report of American Electrochemical Society*, April, 1928.

## *Traction*

*Chicago Terminal Electrification of the Illinois Central Railroad.*—R. F. Schuchardt and W. M. Vandersluis.—The general problem of railroad electrification has been considered with particular reference to the installation on the system of the Illinois Central in Chicago. The local conditions involved in the design and construction work of this carrier, the analysis prepared in connection with desirable sources of power supply, and the fundamentals of the contract entered into by the railroad and the power utility, are outlined by the authors. The rolling stock and method of energy distribution as well the substations and their equipment are noted, and operating experiences to date are given. It is stated that the high-speed circuit breaker is the major item of importance in the equipment and that this device has done all that was expected of it. Both in correct selectiveness and in effective current interruption its behavior is said to have been excellent. Power requirements under varying load conditions and classifications of traffic are given.—*Report of American Institute of Electrical Engineers*, May, 1928.

## *Miscellaneous*

*Strength of Interlocking-Rib Tile Walls.*—A. H. Stang, D. E. Parsons and A. B. McDaniel.—A number of walls were examined in the course of this investigation regarding the strength of interlocking rib tile masonry. Four walls were stressed in compression, three under transverse loading and one was subjected to a transverse load before being tested in compression. Lime, cement-lime and no mortars were used in the horizontal joints. Spaces between the terminal ribs of the tiles in the walls were grouted. The strength of the walls both under vertical and transverse loads was affected by the workmanship and the mortar beds. The wall with cement-lime mortar beds sustained a maximum transverse load about 2½ times that taken by the wall with lime mortar beds and higher than any other wall tested so far at the Bureau of Standards. A specially designed tile was used. The compressive strength of the other cement lime mortar bedded walls was about 2½ times that of the other wall with lime mortar bed.—*No. 366 Technologic Papers of the Bureau of Standards.*

*Brittleness Tests for Rubber and Gutta-Percha Compounds.*—By G. T. Kohman and R. L. Peek, Jr.—An insulated material compounded of rubber, gutta percha or of similar substances becomes brittle at a temperature characteristic of the material below which it may not be used if subject to mechanical stress. The authors have devised an apparatus for determining the temperature by giving the sample a sharp bend through a fixed angle. The highest temperature at which fracture occurs in this test has been found to be nearly independent of the bending angle and the sample's dimensions provided the rate of bending is maintained at a nearly constant rate. A modified form of this equipment is also described, by means of which the brittle temperature may be determined when the material is under high hydrostatic pressure. The constancy of the brittle temperature when determined under different conditions suggests that it marks a change in the structure of the material. — *Reprint B-287, Bell Telephone Laboratories, Inc.*

# Book Reviews

## *Die Messwandler*

By I. Goldstein. Berlin: Julius Springer, 166 pages, 130 illustrations. 1928.

The growing importance of measuring apparatus and protective relays in modern high-voltage plants and networks has increased the interest in the necessary current and potential transformers, yet the present book is the first one dealing with this subject to appear in European literature in almost twenty years. Volumes on transformers in general, while in themselves of rather infrequent appearance, find it beyond their scope to consider measuring transformers with more than a mere mention. Designers and operating engineers will therefore welcome this highly practical book, covering all phases of the subject in a concise manner. Mathematical treatment is subordinated to vector analysis and other graphical representations. The fact that the author is a member of a large German concern, and that only the products of this concern are used to illustrate the book, does not seem to lessen the general appeal of the publication. However, it does not seem logical to devote five-sixths of the book to current transformers and only one-sixth to potential transformers.

## *The Story of Public Utilities*

By Edward Hungerford. New York: G. P. Putnam's Sons. 384 pages, 81 illustrations.

The purpose of this book is well expressed in the foreword by Mrs. Henry G. Danforth, president Board of Education, Rochester, N. Y., who says: "'The Story of Public Utilities' aims to give in as simple a way as possible a picture of the origin, the development, the general organization and the practical workings of the utilities which serve our cities and our country. It is written in the belief that the increasing importance of public utilities in home, industrial and civic life justifies the inclusion of such a study as a part of the supplementary work in the social studies and the science classes of our public school system.

"The publication of the work is in no sense a commercial venture. For this reason the copyright has been vested in the Children's Memorial Scholarship Fund, Inc., and royalties accruing from the sale of the book will be devoted to the purposes of the fund. It enables pupils to continue in school who would otherwise be obliged to withdraw from financial necessity."

The book fulfills its purpose very ably. The author, a well-known writer on travel and transportation, has treated his subject in an interesting manner, uncommon to most literature on the subject. While the book is devoted chiefly to the historical development, two chapters treat briefly the service organization, policy, financing and regulation of utilities.

The criticism made of some books on public utilities can hardly be justified in this case because the book is confined to facts and does not include discussions of argumentative subjects. No comparisons of government, municipal and private ownership or operation are made. The book has received the indorsement of the Rochester (N. Y.) Board of Education.

## *Electric Traction on Italian Railways*

(La Trazione elettrica sulle ferrovie Italiane.) Published by the Minister of Railways and Communication in connection with the Volta Centenary in 1927. Board covers, illustrated, 194 pages and two large maps.

In a country like Italy, where coal is expensive but water powers are abundant, it is not surprising that a great deal of attention should have been paid to railway electrification. Up to Sept. 1, 1927, there had been built and put into operation by the Italian government heavy electric traction lines comprising 1,149.8 km. (718.5 miles) of route and 2,399 km. (1,499 miles) of track, and there was in course of equipment 257 km. (161 miles) of route and 744 km. (465 miles) of track.

These figures, with a great deal of other good information, are contained in a book recently issued by the Minister of Railways and Communication of the Italian government. It is divided into five sections as follows: General statistics and discussion; detailed information of the electrical equipment and distribution system of each of the lines of the State railway system; data on the sources of electric power supply; detailed information of the electric locomotives; brief information in regard to 33 interurban electric railways that do not form a part of the State railway system.

The book is very well illustrated, among the prints being two large maps. One shows all of the interurban and trunk electric railway lines in Italy. The other is on a larger scale and shows the electrified lines in the Milan-Genoa-Leghorn district, with their transmission lines.

## Book Notes

ELEMENTS OF MACHINE DESIGN. By Prof. J. D. Hoffman, Purdue University, Lafayette, Ind., and Prof. L. A. Scipio, Robert College, Constantinople, Turkey. Boston, Mass.: Ginn & Company. Engineering Series, 327 pages.

Treats of the fundamental mechanics of machine construction, covering materials and forces involved in design. Mechanical driving equipment is comprehensively discussed, with practical problems set forth with unusual clarity. Nine chapters are devoted to shafting, keys, couplings, flywheels and pulleys, belt and rope drives, friction gearing, spur, bevel and screw gearing, bearings, flat plates, pipes, cylinders, joints and fastenings. Design applications are analyzed in the remaining seven chapters, featuring press, jib crane, punch, shear, overhead traveling crane, the Scotch marine boiler and the kinematics of machines.

WISSENSCHAFTLICHE ABHANDLUNGEN DER PHYSIKALISCH TECHNISCHER REICHSANSTALT. Band XI, Heft 2. Berlin: Julius Springer. 108 pages.

The latest group of papers, continuing this well-known series, again touches on many fields: Properties of materials, especially cobalt and nickel alloys; the photometry of diffusely transmitting glassware; new methods for sundry types of measurement, to mention only a few. The longest contribution reports the results of another attempt to unravel the acoustical complexities of speech sounds.

THE "ELECTRICIAN" ANNUAL TABLES OF ELECTRICITY UNDERTAKINGS 1928. By *The Electrician*. London: Ernest Benn, Ltd. 200 pages. Price, 10 shillings, net.

This book comprises data on 800 British and 1,300 colonial and foreign electrical undertakings. Details of generating plants, which were omitted during the war, have been restored and additional data included. Among the information covered are: Voltages and frequencies used; generator plant rating and system load; output; and energy rates.

STORAGE BATTERIES SIMPLIFIED. By Victor W. Page. New York: Norman W. Henley Publishing Company. 258 pages, illustrated. Price, $2.

This book is a non-technical treatise discussing the development of the modern storage battery, outlining the basic operation of the leading types. Also the methods of construction, charging, maintenance and repair. Practical applications of commercial batteries are shown and described. Includes special instructions for care and repair of automobile batteries and glossary of terms, also storage batteries for radio.

## Books Received

*Elektrische Vollbahnlokomotiven.* By Dr. Karl Sachs. Berlin: Julius Springer. 461 pages, illustrated. Price, 84 marks.

*Hochfrequenzmesstechnik.* By Dr. Ing. August Hund. Berlin: Julius Springer. 525 pages, illustrated. Price, 39 marks.

*Intermediate Electricity and Magnetism.* By R. A. Houston. New York and London: Longmans, Green & Company, Ltd. 170 pages, illustrated. Price, $1.75.

*The Story of Electricity.* By Hermann Goodman. New York: Medical Life Press. 62 pages, illustrated. Price, $1.50.

*Scientific Purchasing.* By Edward T. Gushee and L. F. Boffey. New York: McGraw-Hill Book Company. 195 pages. Price, $3.

*Electric Heating.* By Edgar A. Wilcox. New York: McGraw-Hill Book Company. 569 pages, illustrated. Price, $5.

*Storage Batteries.* By Morton Arendt. New York: D. Van Nostrand Company, Inc. 281 pages, illustrated. Price, $4.50.

*Die Physikalischen Grundlagen der elektrischen Festigkeitslehre.* By N. Semenoff and A. Walther. Berlin: Julius Springer. 166 pages, illustrated. Price, 16½ marks.

*Die Selbsttaig Signalanlage Der Berliner Hoch- Und Undergrundbahn.* By Alfred Bothe. Berlin: Julius Springer. 164 pages, illustrated. Price, 32 marks.

# News of the Industry

## Republican Platform and the Utilities

### Satisfaction Expressed at Indorsation of State Regulation and Reiterated Opposition to Government Ownership—Rate Feature of Muscle Shoals Bill

By Paul Wooton
Washington Correspondent of the Electrical World

NO REPRESENTATIVE of the public utilities appeared before the resolutions committee of the Republican National Convention at Kansas City last week, and it is understood that the reference to public utilities in the platform came from within the committee. The text of the utilities plank follows:

> Republican congresses and administrations have steadily strengthened the Interstate Commerce Commission. The protection of the public from exactions or burdens in rates for service by reason of monopoly control, and the protection of the smaller organizations from suppression in their own field, has been a fundamental idea in all regulatory enactments. While recognizing that at times federal regulations might be more effective than state in controlling intrastate utilities, the party favors and has sustained state regulation, believing that such responsibility in the end will create a force of state public opinion which will be more effective in preventing discrimination and injustices.

In another plank, headed "Home Rule," the platform says:

> There is a real need in the country today to revitalize fundamental principles; there is a real need of restoring the individual and local sense of responsibility and self-reliance; there is a real need for the people once more to grasp the fundamental fact that under our system of government they are expected to solve many problems themselves through their municipal and state governments, and to combat the tendency that is all too common to turn to the federal government as the easiest and least burdensome method of lightening their own responsibilities.

Representatives of the utilities industry are pleased with the declaration as to the advisability of state regulation, but some will take issue with the statement that federal regulation might be more effective.

It is believed that all the utilities wanted to see in the platform was a declaration against the government in business. In that they were not disappointed. At several points in the platform positive commitments are made against such a policy. In the agricultural plank, for instance, the party pledge specifies that its aid will not go to the point of putting the government into business, and in the merchant marine plank the outright statement is made that "the Republican party does not believe in government ownership or operation."

The Republican platform is silent on Muscle Shoals, Boulder Dam and federal water-power policy in general.

That feature of the Muscle Shoals bill requiring that the charge for electricity to the ultimate consumer must not exceed an amount fixed by the Federal Power Commission as reasonable, just and fair is believed to have been one of the major reasons for the President's pocket veto. The question of the constitutionality of federal regulation of electric rates was raised in Congress, and some members argued that there need be no fear of an invasion of the rights of the states as the courts certainly would find that portion of the bill unconstitutional.

The President has very decided views as to the propriety of passing legislation thought to be in conflict with the constitution. While the government operation features of the bill doubtless were highly objectionable to him, it is conceivable that he might have made concessions in that regard because of the unusual situation surrounding the properties of the government at Muscle Shoals. The President also had taken a decided position against getting the government in deeper at Muscle Shoals, and the inclusion of the Cove Creek dam in the bill doubtless had an important bearing on his action.

Had the bill become a law it is doubtful that the power companies in the South would have been willing to take any of the power because of the conditions attached to its use. It also is thought more than possible that the state commissions themselves, rather than surrender jurisdiction over an indeterminate amount of power, might decline to sanction contracts between the utilities and the federal government.

### Power Commission Criticised

Some spokesmen of the power industry are much concerned over the action of the Federal Power Commission in ruling that no application for a license or an amendment to a license will be considered by the commission itself until the amounts of preliminary expenditures approved by the commission's staff for inclusion in the capital cost of the project shall have been accepted by the applicant. It is asserted that had such a regulation been put into effect with the enactment of the water-power law few important licenses would have been issued. The last annual report of the Federal Power Commission shows a long list of license cases in which the pre-license costs have not been determined. Had the new policy been in effect when these licenses were considered, they could not have been issued up to the present time. Bureaucratic supervision and legislative attacks are declared to have about reached the point where the development of water-power resources has been effectually checked.

## Norris on Warpath

### *Nebraskan Assails "Power Trust" in Unmeasured Terms, Likening It to "Old Man of the Sea" and Comparing Its Menace to That of Slavery*

IN THE July issue of a radical publication called *Plain Talk* Senator George W. Norris of Nebraska makes a violent assault upon the light and power industry—the "power trust," as he terms it—declaring it to be "riding Uncle Sam like the mythical Old Man of the Sea rode Sindbad the Sailor" and demanding government competition as "the one sure method by which its strangulation grip can be broken." "Abraham Lincoln once declared that this nation could not survive half slave and half free," the Senator says. "We settled that problem by abolishing chattel slavery. In my opinion, an analogous situation exists today—and one equally dangerous to the republican institutions of our country. If the United States government cannot control the power trust, it follows as night follows day that the power trust will control the United States government." Much more follows to the same effect.

Mr. Norris scouts the tax argument. He thinks "the government could vastly undersell private companies and yet get profit ten times as great as the lost taxes," and that if the sources of power controlled by five dominant interests—which he enumerates as the General Electric, Doherty, Morgan, Ryan and Insull interests—can be "regained by the public" and potential water-power resources fully developed, electricity will be "as freely used in the average home as running water." The Ontario Hydro system and the Tacoma (Wash.) municipal plant are invoked to support his contentions.

Senator Norris also came out immediately after the Republican National Convention with a savage attack on its platform, criticising among many other things its silence on the various matters affecting the utilities that have recently figured prominently in political news. He said: "The platform is silent as to Boulder Dam, Muscle Shoals and the 'lame duck' constitutional amendment. It says nothing about the water-power trust. In fact, it is 100 per cent perfect as judged from the power trust viewpoint."

# Investigation Records Personal Opinions

## Director of Missouri Committee Admits Activities That Did Not Commend Themselves to His Private Judgment—Oklahoma Committee Has Its Turn

MORE or less exploitable matter was brought to light when the Federal Trade Commission's investigation into the public utility companies was resumed on Wednesday of this week. Correspondence between J. B. Sheridan of St. Louis, director of the Missouri Committee on Public Utility Information, who took the stand, and John W. Colton of New York, former editor of *Aera*, a magazine published by the American Electric Railway Association, taken presumably from Mr. Sheridan's files, showed that the writers were personally by no means in complete harmony with all utility activities as they conceived them. Mr. Colton, for instance, had denounced "the lying, trimming, faking and downright evasion of trust or violation of trust that mark the progress toward enormous wealth of some of the so-called big men in the industry," and Mr. Sheridan had congratulated him on his protest against an alleged plan of utility companies and organizations to "brand all advocates of government ownership as reds and bolshevists." Mr. Sheridan had also expressed an academic opinion that "the man who invented private ownership was a mortal enemy of the human race."

In his testimony about his committee's work Mr. Sheridan said, according to Associated Press reports, that his organization had sought to prevent Carl D. Thompson, head of the Public Ownership League, from filling a speaking contract on a Chautauqua circuit in 1924 and that a special committee appointed to prevent him from making the speeches discussed the question of whether to "annihilate or modify" him and the latter course was decided upon. Letters also were introduced into the record to show that pressure was brought to bear on Keith Vawter, of the Redpath-Vawter Chautauqua, and that in some places Thompson was prevented from giving his lecture.

Mr. Sheridan testified that his committee expends an average of $15,700 annually. Four pamphlets on the utility industry have been furnished the heads of schools, he testified. He admitted that $50 had been paid Prof. A. S. Langsdorf of Washington University for writing a description of the pamphlets, of which 15,000 of each had been issued. The employment last year of E. J. McCausland, dean of engineering at the University of Missouri, to make speeches at $75 each and expenses at three Missouri state teachers' colleges was also put in evidence. Mr. Sheridan said he had taken an active part in promoting utility advertising in the newspapers as a means to good will.

Mr. Sheridan is reported to have frankly admitted that he used methods not in line with his own convictions.

On Thursday of last week, June 14, Fred R. Jenkins of Chicago, chairman of the educational committee of the National Electric Light Association, told of the action of a joint committee composed of representatives of his association, the American Gas Association and the American Electric Railway Association in discussing textbooks with publishers with the result that some chapters of a volume by Howard Copeland Hill of a Chicago high school which referred to public utilities were revised.

H. J. Gonden, publisher of the *Public Service Magazine* of Chicago, testified that a survey costing $105,000 was carried out under the auspices of the magazine to obtain complete information regarding ventures and experiments into public ownership of utilities. An account of the survey was published in abbreviated form and more than one thousand copies of the set of 24 volumes were distributed. Half the money for this, Mr. Gonden said, was put up by the magazine and the other half raised by subscriptions of $1,200 each taken by various utility companies and committees on information and utility publicity. Earlier in his testimony the witness had stated that the 300 shares of the preferred stock of the publishing corporation was owned by officials of public utility company or representatives of the companies.

On Friday various activities of the Oklahoma Public Utility Information Bureau in schools and colleges, on the lecture platform, in the circulation of news releases and in connection with legislation were outlined by Edward F. McKay, manager of that bureau. Mr. McKay defended the procedure of his bureau in everything that had been done, explaining that it was its prime purpose to acquaint the people of the state with public utility work. He said that he had been responsible for the establishment in the University of Oklahoma of a course in public utility and business administration. While he did not believe the news letter sent out by his committee affected editorial opinion to any great extent, he did think it was proper for the utility interests to influence public opinion in favor of private ownership if the facts presented warranted such influence. It was the effort of his organization, he said, to present the facts.

The witness denied any knowledge of money alleged to have been used as a bribe in the Oklahoma Senate. He said that the matter of a survey of textbooks in the Oklahoma schools had been called to his attention but that nothing in that direction had been done. "I think it would be a perfectly proper thing to do," he added. He testified that thousands of speeches on utilities had been made in Oklahoma during the past few years to hundreds of thousands of persons. His organization had spent from $20,000 to $30,000 a year during recent years in carrying on its work.

Commissioner McCulloch announces that public hearings will not be held between July 6 and Sept. 1, although the field work and office activities connected with the investigation will go on. The commission's fourth interim report has been issued. It is accompanied by eleven volumes of stenographic transcripts of evidence from May 15 to June 14 inclusive.

# New Generating Plant Is in Prospect for New York

When the stockholders of the Consolidated Gas Company of New York City meet on July 16 to vote on the proposed absorption of the Brooklyn Edison Company they will, according to President George B. Cortelyou, who makes this announcement in a letter to stockholders, be asked to authorize plans now being completed for the erection of a generating plant to supply service to all the boroughs of the city. This plant will, if the plans are carried out, be built on the Brooklyn side of Buttermilk Channel, opposite Governor's Island, in the harbor, and on a site already owned by the Brooklyn Edison Company.

# A. H. Harris Explains Sale of Mohawk Valley Company

Alleged mystery in the sale last week of New York Central Railroad holdings in the Mohawk Valley Company and New York State Railways to the E. L. Phillips power interests, involving a transfer of nearly $42,000,000, was scouted this week at Rochester by Albert H. Harris, chairman of the executive committee of the railroad. Current rumors had it that the sale was prompted by anticipation of difficulties with the Interstate Commerce Commission should the New York Central purchase power from one of its own companies to electrify its main line from Buffalo to Harmon, by the possibility that the Mohawk Valley Company's outlet for power had been cut off at the east by the Mohawk & Hudson Company, at the west by Niagara Falls power developments and at the south by the Phillips interests, and by reports that the railroad would use proceeds of the sale to retire indebtedness of the Lake Shore Railroad.

None of these alleged facts, according to Mr. Harris, was the foundation for the sale. The holders, he said, were motivated chiefly by the offer of a fair price and the fact that the New York Central is concerned first with railroad operation. "The railroad received various offers during the last five years for its holdings in the Mohawk Valley properties because of their strategic importance, but up to the last few months had given no serious thought to selling," Mr. Harris said. "No one can tell when electrification is coming since the drawback to extensive electrification has been the initial cost. The Rochester company would not be able to supply all the power needed for such a project."

## Purchases and Mergers

*Brooklyn Edison Stockholders Approve Merger with Consolidated Gas—Small Utility Companies Change Hands—Municipal Plant Sales Referred to Voters*

STOCKHOLDERS of the Brooklyn Edison Company on June 15 signified their approval of the coming merger of the company with the Consolidated Gas Company (see ELECTRICAL WORLD for May 19, page 1033) by depositing more stock with the National City Bank of New York than was necessary to carry out the first part of the plan. Stockholders of the Consolidated Gas Company will vote on the proposal July 16.

Permission from the Public Service Commission of New York to the Syracuse Lighting Company to acquire all of the outstanding capital stock of the Seneca River Power Company and to merge that company with the Syracuse company has been granted. The Seneca River company has operated in Baldwinsville and the territory surrounding that village, which is near Syracuse.

A. A. Lowe of New York, holder of a large tract in the Adirondacks, has a 30-day option on the municipal light and power plant at Old Forge, in that section, and it is expected that he will take up the option.

The Connecticut Public Utilities Commission has approved the plan of the Connecticut Power Company to take over the Union Light & Power Company of Unionville, Conn.

Purchase by the Duke Power Company of five small utilities in North Carolina—the Caldwell Power Company of Lenoir, the Bradley Electric Company of Lenoir, the County Service Company of Lenoir, the Catawba Valley Light & Power Company of Morganton and the Burke Utilities Company of Morganton—is announced. It is said that about $1,500,000 was involved, although no generating plant forms part of the properties. Decision whether to sell to the Duke Power Company the lighting system of Huntersville, N. C., will be made by the voters on June 30.

The Mississippi Power Company has taken over the electric light system of Flora, Miss.

After three years of agitation, during which two municipal elections were held to determine whether the citizens of Charleston, Miss., wanted to dispose of their light and water plants, both defeating the proposed sale, their disposal has been settled and the Mississippi Power & Light Company will take them over for $125,000, after another election which is regarded as a mere formality shall have been held.

The City Council of Pavo, Ga., has passed an ordinance authorizing the sale of the electric light and water plant to the Georgia Power & Light Company for the sum of $30,000. Final consummation of the sale is deferred until July 1, within which time registered voters of the town may protest the sale. If 20 per cent of the registered voters do so, the matter will be disposed of by a vote of the townspeople.

An offer of $800,000 for the municipal light and water plant of Lafayette, La., by the Gulf States Utilities Company is reported. This is the second proposal made. One from the Gulf Public Service Company is to be submitted to taxpayers at a special election set for July 6.

An application to buy the electric light and power plant at Iberia, Mo., to be operated by a new company to be known as the Citizens' Electric Company, has been filed by promoters of the Citizens' Public Service Company, recently organized in Missouri.

The Lexington (Ky.) Utilities Company is reported negotiating for purchase of the Georgetown (Ky.) Water, Gas & Electric Company.

The Kentucky Utilities Company, Louisville, an Insull property, announces that through purchase on June 1 of the Kentucky holdings of the General Power & Light Company of New York it has come into possession of transmission and distribution lines in the towns of Calhoun, Corydon, Rumsey, Poole, Slaughters and Sebree, Ky. Power for this district will be supplied by the company from its generating plants at Earlington and Graham, Ky., as soon as a 15-mile stretch of 33,000-volt line can be constructed.

An offer of $44,000 has been made by the Missouri Edison Company for the power plant and waterworks system of La Grange, Mo.

In orders recently approved by the Indiana Public Service Commission the Southeastern Indiana Power Company of Indianapolis, of which Charles T. Dehore of Ohio is head, was declared a public utility and authorized to buy the Evans Electric Company for $8,288, the Suburban Light & Power Company for $30,215 and the Eastern Light & Power Company for $14,733. These properties are in Marion, Johnson, Shelby and Fayette Counties and adjacent territories. The Southeastern company has applied for permission to issue $1,200,000 in securities, in three groups of $600,000, $400,000 and $200,000, to purchase the Indianapolis & Connersville Light & Power Company, the Milroy Light & Power Company, Battle Ground Light & Power Company, Evans Electric Company and the Indianapolis & Southwestern Railroad Company.

Arrangements by which the Interstate Public Service Company will purchase the property of the Elizabethtown (Ind.) Light & Power Company have been made by stockholders.

The Greencastle (Ind.) Gas & Electric Company has been purchased by the Midland Utilities Company from J. Gordon Martin of LaPorte and associates.

An election has been called by the Town Council of Aurelia, Iowa, to vote on selling to the Iowa Public Service Company the city's electric plant and equipment and the transmission line to Cherokee.

The California-Oregon Power Company, whose operating field extends to within 40 miles of Lakeview, in southeast Oregon, has advised the council of that city that negotiations are under way for the purchase outright of the properties which now belong to the People's California Hydro-Electric Corporation in Lake County or entering a contract whereby the California-Oregon will complete the 40-mile extension and furnish energy wholesale to the other concern.

## No Consolidation of Boston Edison and N. E. Power

Regarding current rumors that a consolidation of the New England Power Association and the Edison Electric Illuminating Company of Boston is contemplated, President F. D. Comerford of the former said this week that no foundation exists for these reports. "What is expected," he said, "is a consummation of arrangements now in progress for a general interchange of power between the two companies in order that the power facilities of each may be available to the other. This should result in operating economies and benefit the public served by both."

As announced under "News About Men of the Industry," Charles L. Edgar, president of the Boston Edison company, has just been elected chairman of the board of directors of the New England Power Association—to which fact the rumors alluded to probably owed their persistence.

## Arkwright at Pasadena

*President-Elect of Parent Body Addresses Pacific Coast Division on Service and Citizenship—Worth-While Speeches Conclude Sessions*

THURSDAY and Friday sessions of the Pasadena convention of the Pacific Coast Electrical Association last week maintained the interest aroused by the earlier sessions and reported June 16 on page 1306. "The Rising Tide of Taxation" and "Putting a Soul Into the Corporation" were the subjects of addresses on Thursday morning. A. C. Joy maintained that advertising should not be defensive, explanatory or historical, because the people are not greatly interested in these aspects of the business, but rather in the comfort, convenience and service that electricity will bring to them and the price which they must pay.

At the public policy meeting in the evening P. S. Arkwright, president-elect of the N.E.L.A., took as his subject "A Citizen Wherever We Serve" and showed how through carrying service to prospective customers instead of waiting for them to make the first move, and through industrial development programs and good citizenship on the part of the corporation and its employees in the community, the industry can merit public confidence and support and fortify itself against public attack. R. H. Ballard, the chairman of the meetings, said that the electrical industry is under national attack because of its power in the fields of engineering and finance and that it must make itself so sound commercially that it will not be vulnerable to attack nor fear the invasion of government in its realm.

On Friday morning Clyde Chamblin, president of the Association of Electragists International, said that contractors and dealers are looking to the central-station companies to lead the way in establishing a sales policy so sound that it will rally the support of the entire industry. If central stations would take half the money they now spend to create good public relations outside the industry and spend it within the industry to create better trade relations, far more would be accomplished than under present policies, he declared. C. T. Hutchinson of the California Electrical Bureau reported substantial progress for the "Red Seal" movement in California.

The closing session was devoted to the affairs of the national association.

with President-Elect Arkwright presiding. C. E. Greenwood, national commercial director, asked the sympathetic support of the geographic divisions and at the same time pledged national support to regional activities. He described the plan of the sales conference group to start an industry load-building program based on a marketing survey to be made by one of the largest business development agencies in the country. Research—the study of the consumer's psychology and reaction to the uses of electricity—and the formulation of a selling plan with common-sense appeal would, with good team work, accomplish what other industries have done. A. Jackson Marshall, national secretary, told of the national organization set-up and how the association functions through its committees.

## "Z" Canyon Project Gets Preliminary Permit

*Federal Power Commission Also Gives Final License to Savannah River 120,000-Hp. Development — Applications Pending for a Number of Streams*

A PRELIMINARY permit was issued by the Federal Power Commission on June 14 to Hugh L. Cooper for his project in "Z" Canyon on the Clark Fork of the Columbia River in Washington. About 200,000 hp. of primary power will be made available by this development. The power is to be used for commercial and public utility purposes.

The commission also has issued a final license to the Savannah River Power Company covering its development on the Savannah River above Augusta, Ga. It is planned to install 120,000 hp. at that point.

A license has been issued to the Bedford Pulp & Paper Company covering a 1,300-hp. project on the James River below Balcony Falls, Va.

Another important interconnection between two large systems is made possible by a license just issued for a 77-mile transmission line which will connect the Prospect No. 2 plant of the Pacific Gas & Electric Company with the Copco No. 2 plant of the California-Oregon Power Company. This is the second connection between these two systems.

The Alabama Power Company has requested the termination of its license covering proposed plants No. 1, No. 2 and No. 3 on the Tallapoosa River. It is understood that the decision to abandon these plants above the Cherokee Bluffs development, which it had been authorized to construct, was influenced by the increasing obstacles in the path of water-power development. The state tax on water power was an important feature. The accounting regulations of the Federal Power Commission constituted another barrier. These and other difficulties are not encountered to the same extent in the development of power by steam. For that reason the Alabama company is turning more and more to the use of steam.

The commission has approved termination of the preliminary permit issued June 16, 1926, to Ray K. Holland of Ann Arbor, Mich. The permit covered a project on Fox River in Illinois. The permittee reached the conclusion after his investigation that it would be impossible to develop water power at a cost which would allow it to compete with steam power in that vicinity.

The commission has taken formal action approving the assignment and conveyance of the rights of the Hydraulic Race Company for the diversion of 275 sec.-ft. from the New York Barge Canal to the Niagara Falls Power Company.

The Virginia-Carolina Power Company of Richmond, Va., has applied for a preliminary permit covering a project on the Roanoke River, near Boydton, Va. It is planned to construct a dam 35 ft. high, creating a reservoir with a surface area of 3,500 acres, and to install 50,000 hp.

Charles H. Lee and Romaine W. Myers, of San Francisco and Oakland, Calif., respectively, have applied for a preliminary permit covering the construction of three plants in Josephine County, Ore., on Rogue River. These plants are designated as Nos. 3, 4 and 5, applications for plants Nos. 1 and 2 having already been received. The power is to be used for public utility purposes.

The Kentucky Utilities Company of Louisville has applied for a license covering a proposed project on Kentucky River in Mercer, Woodford, Franklin and Owen Counties, Ky. It is intended to construct power houses at United States dams and locks 4, 5, 6 and 3 and to utilize the head available at such dams. These developments are to be connected by transmission lines with the existing system of the applicant and that of the Kentucky Hydro-Electric Company. The water to be taken is estimated at 11,280 sec.-ft.

S. B. Collins of Denver, Colo., has applied for a preliminary permit to cover a project on Clear Creek in Hinsdale and Mineral Counties, Colo. The development is to divert water by tunnel from the creek to a power house with 400 hp. installed capacity. The power is to be used for mills and domestic purposes.

## Gardiner Wins Nomination for Governor of Maine

William Tudor Gardiner, candidate for the Republican nomination as Governor of Maine and a believer in the exportation of hydro-electric power beyond the state boundaries, provided that there shall be "proper protection to the state," received a decisive majority over the combined votes of three opponents in primaries held this week. Mr. Gardiner has advocated a referendum on the state water-power question. Governor Brewster, who has opposed any change in the law, sought the nomination for Senator and was badly defeated by the incumbent, Senator Hale.

## Power Commission Licenses Are Halted

### New Order Aims to Prevent Further Accumulation of Unaudited Accounts—Insufficient Personnel the Cause Given for Radical Move

AN ORDER which is expected to halt action on water-power licenses for an indefinite period was adopted by the Federal Power Commission at a recent meeting. In the past, the commission was told, the staff has had difficulty in procuring satisfactory statements of capital accounts in accord with its accounting regulations and procedure. A considerable portion of the difficulty has been associated with expenditures prior to the issuance of the license. Apparently the new order will limit the commission's work to the issuance of the preliminary permits and the granting of transmission-line and other minor licenses.

The full text of the commission's order is as follows:

ORDER No. 27.—In pursuance of the findings of the Federal Power Commission made at its meeting of May 28, 1928, namely: "That the work of the commission relating to auditing of the accounts of its licensees and to the valuation of properties which were constructed at the time license was issued is seriously in arrears and must remain so until a more adequate personnel is available for the performance of this work, and that under such circumstances it is desirable to limit as far as practicable any further accumulation of unsettled cases affecting questions of accounting and of valuation," and by authority of subsections (a), (f), (g) and (h) of Section 4 of the federal water-power act:

It is hereby ordered that from and after the date hereof no application for license, or for amendment of license which adds to the property subject thereto, shall, except in case of emergency or in cases coming within the scope of Subsection (i) of Section 10 of the federal water-power act, be presented to the commission for its approval unless and until agreement has been reached with the applicant with respect to the valuation under Section 23 of said act, in cases where the provisions of said section are applicable, of the property or properties affected by such application for license or for amendment of license, or, if such section is not applicable, with respect to the amount which, under the provisions of said act and of the rules and regulations of the commission, may, as of some definite date, properly be included in the fixed-capital accounts of the project or projects covered by such application for license or for amendment of license; and

It is further ordered that all preliminary permits hereafter issued shall contain a requirement that the permittee shall, with its application for license, submit under oath a statement in triplicate showing the items and amounts and the total amount claimed by the applicant as the actual legitimate cost of and the actual legitimate investment in said project as applied for as of the date of such application or as of a date not more than thirty days prior thereto. Such statement shall include all items and amounts properly chargeable in whole or in part to the fixed-capital accounts of said project under the provisions of said act and of the regulations of the commission established thereunder, whether consisting of expenditures actually made, of charges accrued, or of liabilities or obligations incurred up to and including the date of such statement; and each of such items and amounts shall be supported by satisfactory evidence and shall show the nature of the service performed or of the property acquired or to be acquired, or of the charge or proposed charge, and whether such items or amounts have been actually paid or actually accrued or represent liabilities or obligations under contract, agreement or otherwise applicable to the period prior to the date of such statement.

## Georgia Electrical Men Argue About Merchandising

The Georgia Electrical Association held its annual meeting at Savannah, Ga., on June 15 and 16, with central-station, manufacturing, contracting, jobbing and dealer interests represented in its registration, approximating sixty. President Charles Ludwig of Dublin was in charge of the convention. The principal addresses were made by Gordon Groover, vice-president Citizens' and Southern National Bank, Savannah; R. A. Clark, General Electric Supply Corporation, Atlanta; J. E. Mellett, J. M. Clayton Company, Atlanta, and Marshall Adams, merchandising division of the Westinghouse Electric & Manufacturing Company, Atlanta.

The meeting was somewhat enlivened by the remarks of S. M. Byck, contractor of Savannah, in the discussion of Mr. Mellett's paper, "The Contractors' Viewpoint," when he asserted that the central-station companies should be compelled to refrain from their merchandising and wiring activities, which were taking away the livelihood of the contractors. Central-station merchandising practices were defended by power-company representatives, who held that the central station had been forced into merchandising for the sake of service to its customers and to provide a market for its product and that the power companies had no desire to handle wiring work when reliable contractor facilities were available.

A noonday shore dinner, an afternoon golf tournament and an evening banquet were the entertainment features of the meeting. Deep-sea fishing on the day following the convention was enjoyed by many of the delegates.

The following officers were elected for the coming fiscal year: President, W. W. Barr, Georgia Power Company, Dublin; vice-president, T. W. Moore, General Electric Company, Atlanta; secretary-treasurer, J. J. McDonough, Mutual Light & Water Company, Brunswick.

## Broad Program Furthered

*Industry Sales Conference, Through Its Sales Plan Committee, Undertakes a Study of the Market and the Development of an Industry Selling Plan*

IN FURTHERING its work of developing a selling program for all branches of the industry, the Electrical Industry Sales Conference, through its sales plan committee, has engaged marketing counsel to undertake immediately a research into all consumer and industry factors governing the market for adequate wiring in the home. Out of the facts obtained will be built a co-operative selling plan for early presentation to the industry. The sales plan committee selected as such counsel the J. Walter Thompson Company of New York, Chicago, Boston, Cincinnati and San Francisco. J. E. Davidson (chairman), G. E. Cullinan (vice-chairman), W. E. Sprackling, L. W. Davis, J. E. North and J. L. Ray compose the sales plan committee, which is also to function as the working contact committee through the study and development of the selling plan.

The problem of increasing the effectiveness of the house-wiring contractor is being considered as the subject of a special program for industry action and is not within the scope of the work assigned to the agency, although, of course, the house-wiring contractor will be one of the elements to be considered in the development of the main selling plan. The scope of the work for which the agency is engaged is thus stated:

1. Approaching the problem with the attitude of fundamental analysis, the necessary investigation is to be made which will provide a clear understanding of the market to be influenced, geographically and psychologically, with regard to this problem, as a basis of definite knowledge on which to proceed. This investigation will refer to the present objectives of the conference, as distinguished from a broader investigation of the whole marketing situation of the industry.

2. Interpret the findings of this investigation in the light of broad merchandising experience and with an outside viewpoint.

3. Prepare a comprehensive all-industry selling program founded on the conclusions reached and composed of two parts, viz.: (a) A complete and self-contained localized selling plan, suited to successful promotion and operation in any community. This would be designed as a local co-operative plan, with participation by the electric utility, jobber, contractor, dealer and manufacturer's local representatives. (b) A national phase to give a national background of advertising and publicity and to provide the bond for tying the local programs into a national movement.

It is expected that the program will be built around a new and effective approach that will grip public imagination.

4. Develop an effective plan for presenting the main selling program to the electrical industry in a way to secure the necessary financial support and participation throughout the country. The industry's existing national and local facilities would, of course, be counted on to perform their proper functions.

Funds for the preliminary investigation and development of plan have been made available by the national associations. The conference is handling the business arrangements through the board of directors of the Society for Electrical Development, and members of the staff are assisting the sales plan committee and the agency in their work.

## Saluda River Dam Rapidly Getting Under Way

THE great dam to be erected on the Saluda River in South Carolina by the Lexington Water Power Company, work on which is approaching "full blast," is expected almost to transform the industrial situation in that state. It has already changed the aspect of the country up and down the Saluda River for 30 miles. One thousand farmers will have to vacate their homes. Already thousands of acres of land have been cleared of timber, and a thousand men employed by the Arundel Corporation of Baltimore, the contractor, are at work under the engineering supervision of Murray & Flood.

The dam will be 8,000 ft. in length and 208 ft. high. The lake will be 32 miles long by 14 wide. When the elevation of the lake is sufficiently high, 200,000 hp. will be available in a 60-ft. draw-down. The General Gas & Electric Company of New York has the financial responsibility for the plant.

# Briefer News

New Officers for Vermont Electrical Association.—At the annual meeting of the Vermont Electrical Association, held this month, the following officers were elected: President, A. W. Peterson, St. Albans; first vice-president, W. H. Lawson, Rutland; second vice-president, L. A. Bill, St. Johnsbury; secretary-treasurer, L. E. Merrow, Montpelier.

Power for Idaho Mines.—Opening of the new electrolytic smelter of the Sullivan Mining Company at Kellogg, Idaho, about July 1 will require from 10,000 hp. to 12,000 hp. from the lines of the Washington Water Power Company of Spokane. This plant will be doubled in size in the future, according to announced plans. The smelter is owned jointly by the Bunker Hill and the Hecla mining interests.

Electrical Progress at Syracuse.—Plans for the development of a five-year program for the removal of poles and light, power and telephone cables in the congested district of Syracuse were formulated at a recent meeting at the City Hall. Removal of poles and wire has already been started in several streets by the Syracuse Lighting Company, and the New York State Railways has agreed to place some of its high-tension cables underground. The New York Central Railroad will be electrified through Syracuse, according to information received there.

Last Water Mill on Roanoke to Go.—The last water mill operating on the Roanoke River will pass with the construction of the dam and electric power house for which the Virginia-Carolina Power Company awaits a permit. This is Boyd's Mill, in Mecklenburg County, constructed in 1837 and in continuous operation ever since. During the war between the states it was operated day and night to supply flour and meal to the Confederate forces. With its wing dam and its 1,500-ft. canal, dug by slave labor, it has been considered one of the state's picturesque and historic spots.

Low-Dam Development Near Gouverneur, N. Y., Is Being Pushed.—Two hundred men are pushing work on the Eel Weir power dam a mile downstream from the outlet of Black Lake, near Gouverneur, N. Y. The plant will be in operation by October if expectations are realized. It is being erected by the St. Lawrence Valley Power Corporation and will be interconnected with the lines of the St. Lawrence County Utilities and the power distributed throughout the northern counties where the company already operates lines. The dam will be of the Ambursen type, 14 ft. high, and will have a crest length of 750 ft. The power house, which will be 117 ft. long, will be built in the bed of the river as an extension of the dam proper. The installed capacity will be 3,300 hp. in three General Electric units. A transmission line will be constructed from the power house directly to the company's power house in Ogdensburg.

Western Society of Engineers Has New Home.—The annual dinner of the Western Society of Engineers in Chicago on June 13 celebrated the removal of the society into its new and larger quarters in the recently completed Engineering Building at 205 Wacker Drive. Nearly a thousand engineers were present at the dinner and listened to a program in which all of the national engineering societies were represented. The incoming president of the society, John A. Garcia, and the other new officers were introduced to the assemblage after the retiring president, Rufus W. Putnam, had reviewed the year past.

Law Aimed at Further Hydro-Electric Plants on Four Rivers Is Proposed in Oregon.—An initiative measure which has for its purpose the establishment of fish reservations on four of Oregon's most important water-power resources will be placed in circulation for signatures soon, according to the Oregon Game Protective Association. The rivers affected will be the Rogue, Deschutes, McKenzie and North Umpqua. If adopted by the voters of the state, this measure may close the four streams in question to further hydro-electric development. It is the object to submit the proposed law to the voters next November.

St. Louis Company Answers Attack on Its New Rates.—The Union Electric Light & Power Company of St. Louis has filed with the Missouri Public Service Commission its reply to the petition of that city for an audit to determine whether there can be a further reduction in its rate schedule. The company's answer is that any reduction in residential rates now would mean that other rates would have to be increased. In reply to the city's contention that the company should not be permitted to set up an annual depreciation charge in excess of $950,000 it is stated that the company has adhered strictly to the rate of depreciation fixed by the state commission.

Southwestern Light & Power Company Finishes Second Loop.—The Southwestern Light & Power Company has finished the second loop of its system in Oklahoma with the completion of the 6,600-volt line from Manitou Junction to Frederick, according to E. R. Ernsberger, president and general manager. The company is now closing the last gap in its third loop, extending from Duncan to Addington. A new line just completed replaces one from Walters to Temple. The line from Waurika to a pump station near Ryan has been completed. Material will be ordered next week for several lines surveys of which are now being made. They are Sayre to Erick, Granite to Willow and Brinkman, and Arapaho to Thomas.

Newcastle, Ind., to Be Tied Into Central Indiana Loop.—The Interstate Public Service Company has started to build a 66,000-volt single-circuit transmission line north and west of Newcastle, Ind. This line, which will be 16 miles long, will be connected with the loop of the Central Indiana Power Company at the Henry County line, thus being able to get energy from Kokomo, Lafayette and Dresser. The cost of the line is put at approximately $84,000, and an addition to the New Castle substation will cost $40,000. Yellow-pine treated poles 45 ft. high with 300-ft. spacing will be used.

Teachers' College, Columbia University, to Have Course on Electricity in the Household.—A three weeks' summer course on electricity and household electrical equipment will be held at Teachers' College, Columbia University, New York City, with the co-operation of the women's committee of the National Electric Light Association and under the direction of Dr. C. J. Lynde, head of the department of physics and household engineering of the college, from July 30 to Aug. 17. Dr. Lynde will lecture daily, with demonstrations on electricity, and nearly two hours each day will be spent in the laboratory testing household electrical equipment.

Municipal Plant Advocated for Paducah, Ky.—An effort to put the city of Paducah, Ky., back into the light and power business is being made by the municipal government, which is now of the commission type. It is planning to submit to the voters in the fall a proposed bond issue for $1,000,000 with this end in view. The old power company in Paducah was purchased by the Kentucky Utilities Company in December, 1925, at which time the property was badly run down. Since that time the Kentucky Utilities has spent $615,474 on electrical equipment within the city, having virtually rebuilt the entire system. Electric rates in Paducah are today 15 per cent less than in 1914 and 29 per cent less than in 1921. Agitators for a public plant, however, think the rates should be still lower. The company is making liberal use of the advertising columns of the local newspapers in defense of its service.

Great Western Power Breaks Ground for New San Francisco Plant.—The Great Western Power Company of California has broken ground for its new 35,000-kw. steam generating plant on San Francisco Bay. The plant, which will cost $3,500,000 and will take a year in building, is to be the first unit of a development which will ultimately have a generating capacity of 140,000 kw. Its location is in the southern part of the city, close to its most rapidly developing industrial section. The plant is needed primarily for standby and emergency service. The first unit will increase the steam generating capacity of Great Western to 66,400 kw. and the total hydro and steam capacity to 249,400 kw.

**Electrical Extension for Bradford, England.**—The Corporation of Bradford, England, has determined to install a new 30,000-kw. steam-electric plant at a cost of $1,650,000. Steam pressure of 1,100 lb. will be employed.

**Progress on Great Northern Electrification.**—The new Great Northern Railroad track substation at Cashmere, Wash., one of three being installed between Wenatchee and the Cascade Tunnel to aid the electrification, is progressing rapidly. Similar stations will be built at New Leavenworth and Winton, and at Wenatchee, Cascade Tunnel, Scenic and Skykomish stations are now in operation. They will be used for stepping down the transmission voltage of 44,000 to the trolley voltage. When the line has been electrified the Puget Sound Power & Light Company will furnish electricity at Wenatchee, Skykomish and Tumwater. A 13,200-volt, single-phase, 25-cycle primary signal circuit is also being installed. It is expected that the transmission lines and substations will be completed by Sept. 15.

**Potomac Electric Power Company to Erect Office Building in Downtown Washington.**—As the government's project for the beautification of the Mall requires the purchase of the property at present occupied by the executive offices of the Washington Railway & Electric Company and the Potomac Electric Power Company, these companies have acquired a tract in the downtown business section for a new office and sales building of the best type. Moving will involve a considerable task, officers of the company point out, because most of the feeder conduits from the Benning power plant run into the present office building. No decision has been reached regarding the disposal of the substation that adjoins the present building, but it is expected that this will be moved to some other location rather than the site purchased for the new building.

**Utilities' Donation to Johns Hopkins School of Engineering Explained.**—Dr. John B. Whitehead, dean of the Johns Hopkins School of Engineering, has issued a statement explaining the character of the fellowship of $7,500 given the university by the Utilities Research Commission of Illinois and concerning which Baltimore newspapers have made some mystery. The Illinois donor is the creation of railroad and utility companies in which the Insull interests predominate, Dr. Whitehead explained, adding: "The conditions are perfectly clear. The university has entered into an agreement to prosecute an experimental research into the problem of the insulation of high-voltage cables. This is one of the most pressing problems now confronting the engineering profession. The work is to be done under my supervision, and I am receiving no compensation. No textbooks or other material in which the comparative merits of public and private ownership of public utilities are discussed are used in connection with this work. The work is entirely in scientific research as

**Fifteen Ohio Companies File Rural Service Plans.** — The joint committee on rural lines policy which was set up last March at a conference of farm organization representatives and power companies of Ohio has been making a collection of the rates, schedules and rural electrification plans of Ohio power companies. Already the following companies have filed their plans with the committee: Pennsylvania-Ohio Power & Light, Ohio Power, Ohio Utilities, Ohio Edison, Wooster Electric, Southern Ohio Public Service, Cleveland Southwestern Railway & Light, Western Ohio Railway, Lake Shore Power, Toledo Edison, Columbus, Dalaware & Marion Electric, Dayton Power & Light, Southern Ohio Electric, Suburban Power and Ohio Public Service.

## *Coming Meetings*

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]

American Institute of Electrical Engineers—Cosmopolitan Hotel, Denver, June 25-29; Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

Society for the Promotion of Engineering Education—University of North Carolina, Chapel Hill, N. C., June 26-29. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Empire State Gas and Electric Association—Commercial Section, Hotel Utica, Utica, N. Y., June 28 and 29. C. H. B. Chapin, Grand Central Terminal, New York.

Michigan Section, N.E.L.A.—Mackinac Island, July 5-7. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Public Utilities Advertising Association —Detroit, July 8-12. T. P. Pfeiffer, Byllesby Engineering & Management Corp., Chicago.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

National Electric Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

National Electrical Manufacturers' Association — Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

**Power Company Sues New York City for Diversion of Its Water Supply.** — An injunction suit and a claim for $750,000 against the city of New York for the alleged diversion of the waters of the Schoharie River have been filed in the Supreme Court of the state by the New York Power & Light Corporation, into which the Adirondack Power & Light Corporation was merged last fall. The power company alleges that the city, by various structures, especially the Gilboa Dam and the Shandaken Tunnel, has diverted the Schoharie from its natural channel and deprived the plaintiff of its right to use its waters. The city asserts its right to the river under legislation authorizing it to condemn lands necessary for its water supply.

**Chippewa Falls Hydro Plant Completed Ahead of Schedule.**—The Chippewa Falls hydro-electric development of the Northern States Power Company went on the line on June 15. Completion of this project, which has been described in previous issues of the Electrical World, was scheduled originally for Sept. 1, but in January of this year it was deemed advisable to advance the completion date to July 1 owing to an increased demand for service. Exceptional construction progress made possible because of good weather conditions permitted this date to be anticipated by two weeks. The new hydro-electric station will provide an additional 27,000 hp. for the Northern States Power Company's Wisconsin division. It will operate synchronously with the 42,000-hp. station at Wissota.

**Artificial Lightning at 1,500,000 Volts to Be Produced at Stanford University.**—Artificial flashes of lightning at a potential of 1,500,000 volts, produced by an impulse generator of the type first developed by F. W. Peek of the General Electric Company several years ago, will soon be available in the Harris J. Ryan high-voltage laboratory of Stanford University in California. The generator, which is an arrangement of capacitor and resistor units, will be the first high-voltage unit to employ cable-type capacitors in place of the glass-plate type formerly used in these generators. It will be connected to the 2,000,000-volt, 60-cycle testing set put into operation in the Stanford laboratory about a year ago. The impulse voltage produced by the generator will be used in studies of high-tension transmission systems and the lightning protection problems with which they are faced. The new impulse generator was designed and manufactured by the General Electric Company at its Pittsfield plant and is at present undergoing tests at the company's high-voltage laboratory there.

## Zone Rates Undesirable in Complex Territory

In the decision of the Massachusetts Department of Public Utilities establishing a general area-energy rate on the Boston Edison system (ELECTRICAL WORLD, June 16, 1928, page 1305) for residential service, the commission declared itself opposed to the establishment of zone rates under present conditions in that territory and approved the application of the company's promotional rate "B," modified as to terms, to the entire area reached by the company's lines. The Boston company serves about 41 cities and towns ranging in size from the metropolitan center to country villages and farming sections about 30 miles distant. There has lately been more or less talk about the desirability of zone rates, but the company has pursued the policy of uniform rates for residential service all over the 700 square miles of territory which make up its terrain. Discussing this matter, the board said:

We have considered whether a system of zone rates would be more equitable than treating the entire area as one district and whether it could be made effective at this time. In view of the large territory the company serves and the differences in the density of the population in the various communities, a superficial view is likely to lead one to the thought that there ought to be a differential in the price. In the consideration of the zones to be established and the differential to be applied practical difficulties are immediately encountered. The profit derived from a community is not easily, if at all, ascertainable, for the reason that the cost of supplying such a community cannot definitely be ascertained. If the customers in a city were all supplied from substations used to supply them alone, it would be possible to approximate the cost of serving the consumers in that city. This is not so, but even if it were, it would require a very long and expensive study of the cost of that part of the distribution system devoted to the distribution of electricity in each community. The company has developed its business on the basis of charging the same rate to the various customers of the same class without regard to the community in which the customer's premises are located. The distribution system of the company has been developed without regard to city and town lines, treating the area served largely as if it were one city. The rates applicable to the more densely settled portions of the territory could not be lowered without making a substantial increase in the rates in the less densely settled portions. Owing to the manifest difficulties involved in fixing satisfactory zone rates, we think it undesirable at this time to attempt to establish them.

Elsewhere in the finding the commission expressed its belief that it ought not, except in unusual circumstances, to undertake to establish the entire rate structure of any company, as the matter falls largely in the field of management. It found that no material discrimination exists today against any class of customers in the company's rate schedule. Commenting upon the decision, President C. L. Edgar of the Edison company said:

The decision is a sound one. It has adopted the form of rate which we believe is the solution of the residence-rate problem, a form in which the normal lighting requirements are measured by the floor area in the residence and energy used in excess of this small portion is charged for at very much reduced rates. The decision cuts our income a million dollars a year, but nevertheless this will in no way interfere with our dividends or with our depreciation charges. In short, the commission has adopted a sound basis of rate making and one with which we are in entire sympathy. It is a great satisfaction to us and will be a distinct benefit to our small residence customers. It does not, of course, apply to commercial customers.

## Recent Court Decisions

POWER OF COMMISSION TO AMEND ITS RECORDS.—The Supreme Court of Ohio, in Helle vs. Public Utilities Commission, reversed an order of the commission which amended its own records by the insertion of an order *nunc pro tunc* (now for then). The court affirmed the right of the commission to make a *nunc pro tunc* order, but pointed out that such orders had only the province of correcting negligent or accidental omission in the case of an order actually rendered but not recorded and that such an order could not be made to correct a mistake in judgment, as had in the case under review been attempted (161 N.E. 282.)*

OHIO COURT APPROVES THE RULING OUT OF "GOING-CONCERN" VALUE AS AN ITEM IN RATE BASE.—A decision of the Ohio Supreme Court in a suit by the Portsmouth Gas Company against the Public Utilities Commission upheld the latter in a refusal to allow a specific "going-concern" value on the company's property. James W. Huffman, a commission member, says the decision has established a precedent to be followed in at least two important rate cases now before the commission affecting the Ohio Bell Telephone Company and the Logan Gas Company. In the Ohio Bell case the company claims a "going-concern" value of more than $14,000,000. The Portsmouth Gas case will probably be appealed to the United States Supreme Court by the company.

WHERE ADEQUATE SWITCHES ARE PROVIDED NEGLIGENCE CANNOT BE PREDICATED ON ABSENCE OF A PARTICULAR KIND.—Because the Circuit Court of Appeals at Baltimore held it to be proved by testimony that an electric signal maintainer on a railroad killed by electric shock while at work could have avoided the accident in any one of three different ways by using properly the switching apparatus maintained by the company, it refused, in Kreger vs. Baltimore & Ohio Railroad Company, to award damages. The claim of the plaintiff was that the company had been negligent in not providing air-break disconnecting switches rather than fuse cut-outs. The victim's neglect, or his unwarranted ignorance concerning the character of the installation, precluded the claim, which, according to the court, would have been valid had he opened the cut-outs and been injured in so doing. (25 Fed. [2d] 728.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

## Commission Rulings

"ROOM RATE" AND DEMAND CHARGE.—The municipal corporation of Aledo, Ill., complained to the Illinois Commerce Commission against the rates of the Illinois Northern Utilities Company. The commission overruled the complaint and defended the "room rate" of the company, saying that such a basis of electric rates permits of the recognition of the demand feature in a rate schedule without having the effect of penalizing the consumer for the installation of extra or additional sockets and outlets, thereby encouraging the increased use of energy. The room basis, the commission observed, differentiates between the small and the large domestic consumers and permits the small householder to earn as good a rate as the large householder, a condition not easily attained under other forms of rate. It is, on the whole, favorable to the consumer, fair to the utility and just and reasonable in application. The fact that the rates of an electric company are not the same in all of the different communities served by it over transmission lines does not, the decision went on, necessarily indicate discrimination between localities. It cannot be inferred that an optional rate established in one part of the total territory served should be annulled from the mere fact that the rate is not available to the other communities served by the company.

RULES LAID DOWN TO GOVERN COMPETITION.—Adjudicating complaints made by the Public Service Company of Colorado against the city of Loveland, which owns and operates a municipal plant, the Colorado Public Utilities Commission enunciated the following principles: (1) No certificate is necessary for the construction of an electrical extension into contiguous territory not already served by another public utility of like character. (2) The failure to ask for a certificate until after an extension is constructed cannot give the utility any greater right thereto than if it had asked before, in view of the premium that would otherwise be put on the violation of the law. (3) A complaint of inadequate service by an existing utility will not be entertained for the first time in a hearing on a complaint against unauthorized competing service. (4) A utility may not single out isolated unserved inhabitants of a territory through which existing competitive service is offered as constituting together unserved territory. (5) A private utility serving four customers in a territory and offering to build other extensions on reasonable terms subject to the authority of the commission is engaged in "service" within a "territory" to the exclusion of competition from a municipal utility without a certificate. The commission held that the case did not turn upon the question whether the extension could be made by the municipal plant without using any more wire or without using a great deal more than would be required by the public utility company if it gave service to the consumers in question, but upon the question whether the territory in which the customers in question are was "theretofore served" by the private company. A public utility company complaining against an unauthorized invasion of its territory by a municipal plant is not required to show any damage or interference with it.

# News About Men of the Industry

### *A. W. Thompson New Vice-President of N.E.L.A.*

Arthur W. Thompson, who was elected a vice-president of the National Electric Light Association at the recent convention in Atlantic City, has been prominently connected with public utility activities for a number of years and at the present time is president of the United Gas Improvement Company as well as chairman of the board of the Philadelphia Electric Company, acquired early this year by U.G.I. interests. His training as an educator, engineer and railroad executive eminently qualified him for service in a highly industrialized territory, and when he became president of the Philadelphia Company and its affiliated corporations in 1919 he took an active part in all developments undertaken in the Pittsburgh district.

*A. W. Thompson*

Mr. Thompson was born at Erie, Pa., in 1875 and was educated at Allegheny College, Meadville, Pa. Before completing his college course he started his railroad experience and continued to engage in that phase of public utility work until he removed to Pittsburgh. He was identified with the Baltimore & Ohio Railroad for eighteen years and during the war he was made federal manager of several large Eastern railroads. It was due to Mr. Thompson's persistent efforts that the great Colfax power plant of the Duquesne Light Company was erected to anticipate the electric power needs of the Pittsburgh district and to provide abundant cheap electric power. In addition to his affiliation with the National Electric Light Association, Mr. Thompson is a member of the American Electric Railway Association, the American Society of Civil Engineers and of other technical societies.

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**W. R. Smith** and **P. H. Adams**, assistant chief engineer and electrical engineer respectively of the Public Service Production Company, Newark, N. J., were among those awarded the honorary degree of electrical engineer by Clemson Agricultural and Mechanical College of South Carolina. The degrees were conferred on June 4, 1928, in connection with the dedication of the Riggs Memorial Engineering Building. Mr. Smith and Mr. Adams were both graduated from Clemson in 1906.

**Nicholas F. Brady**, president of the New York Edison Company, arrived in New York June 19 aboard the White Star liner *Majestic* after a short sojourn abroad.

**Maxwell Sauer** has resigned as chief engineer of the William Hamilton Company, Ltd., Peterboro, Ont., and has joined the Winnipeg Hydro-Electric System as designing engineer. Before affiliating himself with the William Hamilton Company, about two years ago, Mr. Sauer was designing engineer of the hydraulic department, Ontario Hydro-Electric Power Commission.

**William H. Onken, Jr.**, editor of the Electrical World, sailed for Europe June 22 aboard the White Star liner *Majestic* to attend as a representative of the American Institute of Electrical Engineers the dedication of the Louvain Library and Engineers' Memorial in Belgium, to be held July 4. From July 5 to July 10 Mr. Onken will be in Paris, where, as a representative of the National Electric Light Association, he will attend the convention of Union Internationale des Producteurs et Distributeurs D'Energie Electrique. Later he will visit Italy and Germany, investigating superpower and hydro-electric developments in those countries. After leaving the Continent Mr. Onken will visit Great Britain to investigate superpower developments there and to study the extent to which American capital has been used in public utility developments in that country and throughout Europe.

**George C. Daniels** was appointed mechanical engineer of the Commonwealth Power Corporation of Michigan to succeed H. F. Eddy, resigned. Mr. Daniels entered the employ of the Central Illinois Light Company, one of the Hodenpyl Hardy companies, in 1910 as engineer, where he remained for four years engaging in engineering, operating and construction in connection with steam power plants. After serving as superintendent of power plants for the Central Light Company and mechanical engineer of the Central Illinois Light Company he was appointed mechanical engineer for the Hodenpyl Hardy Company, in which position he was responsible for the design, construction and operation of the steam plants of the Central Illinois Light Company, the Ohio Edison Company, the Southern Indiana Gas & Electric Company and the Illinois Power Company. He has been connected with the mechanical engineering department of the Commonwealth Power Corporation of Michigan since 1925.

### *W. A. Brackenridge Resigns*

William Algernon Brackenridge, senior vice-president and a director of the Southern California Edison Company, has resigned. In the course of his engineering career Mr. Brackenridge has been identified with some of the most important water-power developments in the United States and since 1909 he has been an officer and director of the Los Angeles utility. In that year he was named vice-president and general manager of the company, which position he held until his election to the presidency in 1918. He served in that capacity until 1920 and at the time of his resignation was occupying the position of senior vice-president.

*W. A. Brackenridge*

Following the completion of his technical education in 1877 he was engaged in an engineering capacity on the rapid transit system in New York City and later he spent some time abroad in an investigation of engineering works in England, France, Germany and Switzerland. Upon his return he was engaged by the Railroad Commission of Connecticut to make plans and surveys. After serving on the board of consulting engineers then making plans for the development of water power at Niagara Falls by the Niagara Falls Power Company, he was appointed engineer in charge of all construction for that company. In 1904 he was appointed by the Governor of New York to the advisory board of consulting engineers in charge of the construction of the Barge Canal connecting the Hudson River with the Great Lakes. During these engagements he conducted a private practice as consulting engineer, specializing on water-power development. Mr. Brackenridge will continue to serve the Southern California Edison Company in an advisory capacity.

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**J. P. Van de Voort**, assistant general counsel of the American Gas & Electric Company, has been elected vice-president. Mr. Van de Voort is a graduate of the University of Alabama and practiced law in Tuscaloosa until 1917, when he joined the legal staff of the American Gas & Electric Company, specializing in mortgages and contracts for the interchange of power between subsidiary and other companies.

## *Edgar Heads New England Power Association Board*

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, has been elected chairman of the board of directors of the New England Power Association, succeeding F. L. Carlisle, resigned. In announcing this change Tuesday, F. D. Comerford, president of the association, stated that Mr. Edgar has been a director of the New England Power organization for several years, and said further: "He has been an acknowledged leader in the electrical industry for many years and no one is more familiar with the problems with which the industry is concerned. His knowledge of these problems and long experience in directing the Boston Edison will be of great value to the association."

H. R. Bowie has been appointed auditor of the Pennsylvania-Ohio Power & Light Company and Pennsylvania Power Company and auditor and secretary of associated companies of the Penn-Ohio System to succeed F. E. Wilkin, who resigned to join the staff of Stevens & Wood, Inc. Mr. Bowie has been assistant auditor of the Penn-Ohio System for the last nine years.

D. J. Kennelly, who for the past six years has been superintendent of electrical construction for the Southern California Edison Company, has been transferred to the newly created position of superintendent of transmission substation operation. Mr. Kennelly joined the Southern California Edison Company in 1913 and has held successively the positions of job foreman, electrical inspector, construction department and superintendent of electrical construction.

H. F. Eddy, mechanical engineer of the Commonwealth Power Corporation of Michigan, has resigned to enter the research department of the Foster-Wheeler Corporation of New York. Mr. Eddy's identification with the Commonwealth Power Corporation and affiliated companies dates back to 1910, when the present Consumers Power Company was known as the Commonwealth Power Company. At first his work was of a general engineering nature, but later he specialized in mechanical engineering, assisting J. B. Foote in the design of the Flint, Grand Rapids, Kalamazoo and Battle Creek stations. For a period of years he was with the production and transmission department of the Consumers Power Company with duties of an operating and construction nature. When the Grand Rapids heating plant and the Saginaw River steam plant were built he became associated with the engineering force, remaining with that division until his resignation.

## *J. F. Owens Becomes Vice-President of N.E.L.A.*

J. F. Owens, who was elected a vice-president of the National Electric Light Association at the recent convention in Atlantic City, as announced in the June 9 issue of the Electrical World, has been vice-president and general manager of the Oklahoma Gas & Electric Company for the past ten years. His renown, however, is not bounded by the State of Oklahoma, for today he is recognized nationally as one of the most beloved and capable of the executives of the light and power industry. Congenial and sympathetic by nature, he promptly established organization morale through his personal interest in the company's employees, and on this foundation he built an enviable record in the way of public relations. Outside of the electrical world Mr. Owens has an unusually wide acquaintance among representative business men of Oklahoma, having been called upon to serve in every civic campaign of importance.

*J. F. Owens*

Mr. Owens was born in Aurora, Ill., and was educated at the Kansas State University. Before becoming vice-president and general manager of the Oklahoma Gas & Electric Company in 1918 he had been identified with utility properties at Baldwin, Kan., and at Wagoner and Muskogee, Okla. He is a past-president of the Oklahoma Utilities Association, past-president of the Southwestern Division of the National Electric Light Association and during the past year served as chairman of the Public Relations National Section.

E. Lovette West, president of the W. S. Barstow Management Association, Inc., and for many years prominently identified with public utility interests in the East, has been elected a director of the General Gas & Electric Corporation, New York, to succeed Joseph B. Taylor.

Ernest E. Blair has been appointed purchasing agent of the Central Maine Power Company, succeeding the late Blaine Owen. Mr. Blair has been in the employ of the company since 1912 and has been acting purchasing agent since July, 1927. His headquarters will be at Augusta, Me.

V. P. Griffin, combustion engineer in the power stations department of the Duquesne Light Company since 1923, has been appointed mechanical operating engineer, supervising the operation of power station mechanical equipment.

## Obituary

Albert Stetson, patent attorney, who was prominently identified with the Edison interests in England, France and this country, died June 7 at his home in Brooklyn, N. Y. While attending Tufts College Mr. Stetson became associated with Professor Dolbear, one of the early workers in telephony, and this connection was continued following graduation, taking him abroad for an extended period for scientific study. He affiliated himself with the Edison interests in Europe and spent much time in Paris and London in their employ in the early '80s. Largely as the result of this work he subsequently became a confidential expert in electrical and metallurgical matters for Grosvenor P. Lowery, of Lowery, Stone & Auerbach of New York, who was one of the counsel for the Edison interests up to the time of his death.

William T. Holmes, vice-president of the Monitor Controller Company, Baltimore, Md., died at his residence in that city June 9. Mr. Holmes was born in Philadelphia 51 years ago and had been associated with the Monitor Controller Company interests for about 25 years. For the last ten years he was vice-president of the company. Mr. Holmes was well known as a control engineer. He participated especially in the development and application of current limit control and time limit control systems which were organized by the Monitor Controller Company. His mind was particularly apt and keen in the analysis of control problems in the field—in shops and plants where electric motor control had to be applied in particular ways to accomplish specific results.

Joseph K. Choate, consulting engineer of New York, died June 19 in San Francisco of pneumonia after an illness of three days. Mr. Choate conducted an active consulting practice and since 1913 had been engaged in the management of public utility properties, particularly those of the J. G. White Management Corporation, of which he was a vice-president and director when he resigned early this year. Early in his career he did some engineering work for the New York City Department of Public Works and later engaged in railroad engineering. During his connection with the White organization he served as vice-president and director of the Augusta-Aiken Railway & Electric Corporation, director of the Georgia-Carolina Power Company and vice-president and director of the Helena Light & Railway Company.

# Financial and Statistical News

## *Power Stocks Recover Refunding Operations Heavy*

POWER and light stocks have shown their stability during the past week by a tendency to withstand the general selling movement after the liquidation of two weeks ago. With the beginning of the heavy selling which took place early in June, utility prices receded with the rest, but the downward trend seems to have halted much sooner than in most other groups. During the current week stocks such as American Gas & Electric, Pacific Gas & Electric, Detroit Edison, Middle West Utilities, Columbia Gas & Electric, etc., actually showed marginal gains, while the general market average was moving downward.

Refunding operations continue to require the great bulk of capital being currently secured by power and light companies. For the first five months of the year to date, out of some $734,000,000 raised for all purposes through public sales, refunding operations required 78 per cent. This indicates a slackening off in new building and construction programs.

## Westinghouse Electric Elects New Director

At the annual meeting of stockholders of the Westinghouse Electric & Manufacturing Company held in the company's East Pittsburgh headquarters June 13 the election of four directors to serve for the term ending 1932 and a modification of the by-laws were the chief items of business transacted. Charles A. Terry, a vice-president of the company, was elected to the directorship left vacant by the death of Gen. Guy E. Tripp. The three others upon whom action was taken were re-elected. They were Joseph W. Marsh of the General Cable Company, H. H. Westinghouse of the Westinghouse Air Brake Company and Albert H. Wiggin of the Chase National Bank.

The stockholders ratified a change in the by-laws by which the fiscal year of the company now conforms with the calendar year. Instead of the fiscal year ending March 31 as formerly, it will now end Dec. 31, and the annual meeting of stockholders will be held in the future the second Wednesday in April.

## Electric Investors Issues New Preferred Stock

Electric Investors, Inc., offered an additional issue of $6 preferred stock (no par value), totaling 49,000 shares, the price being 103 a share and accrued dividend, to yield over 5.80 per cent. The proceeds from the sale of this preferred stock provided funds for the retirement on June 1, 1928, of all $7 preferred stock then outstanding, for the acquisition of additional interests in electric light and power companies, and for other corporate purposes.

## April Revenue $153,400,000

### Income and Energy Output Six Per Cent Greater Than in April, 1927—Hydro Generation Breaks Record

WITH a revenue of $153,400,000, operating expenses of $63,200,000 and an energy output of 6,419,112,000 kw.-hr., operations of the electric light and power industry in the United States during April showed an increase of 6.0 per cent in income and virtually the same in production compared with the corresponding month last year, while the cost of operation rose less than 2.5 per cent, according to monthly reports received by the ELECTRICAL WORLD, together with energy statistics compiled by the U. S. Geological Survey.

In each respect the figure is the highest for any April in the history of the industry, although in accordance with the usual seasonal swing both the output and the revenue were smaller than during the winter months, the decrease in the latter amounting to 2.5 per cent compared with March. The rise over the corresponding month of 1927 is somewhat less than in the first three months of the year, particularly March, but this difference is partly offset by the fact that the extra day in February increased the energy consumption by more than 3 per cent, and this excess was necessarily reflected in the bills paid during the following month.

Nevertheless, April operations were close to the estimated normal based on growth in recent years. The average daily revenue was $5,110,000; the normal would have been $5,300,000; the energy averaged 214,000,000 kw.-hr.; the normal was computed to be 215,000,000 kw.-hr. daily.

Output from water power, nearly 2,822,000,000 kw.-hr., was not only the largest ever reported but also constituted the largest fraction of the total output ever reached, 44 per cent. Hydro energy, indeed, made up 80 per cent of the increase over the total output of April, 1927. The balance came from fuel-burning plants. Although the out-

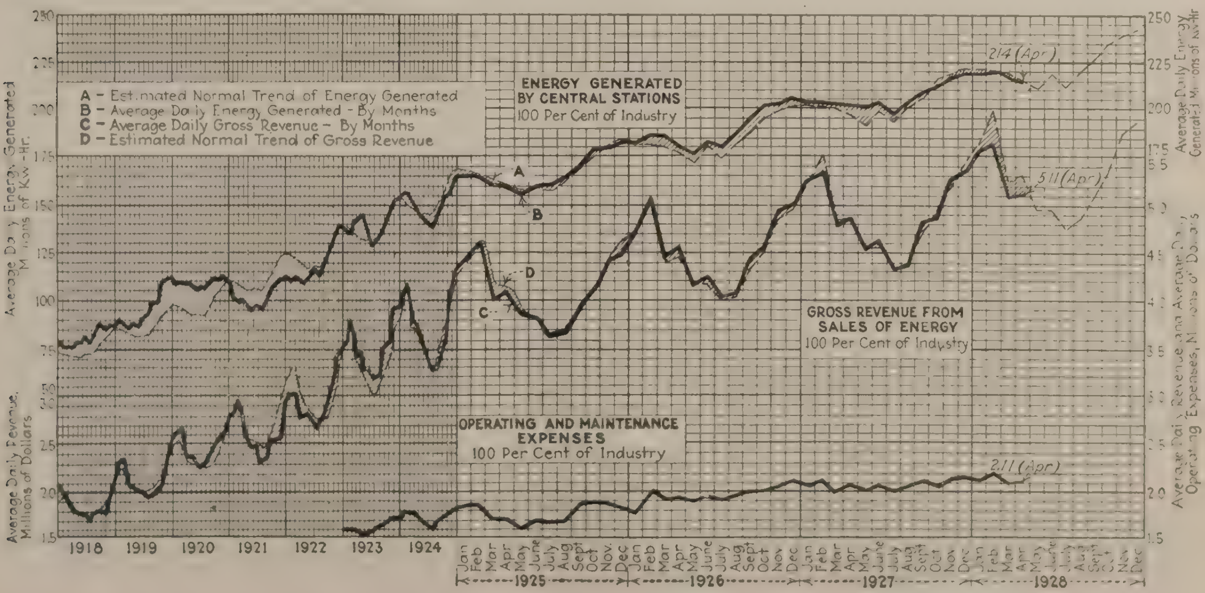


*Table I—Generation and Distribution of Central-Station Energy in the United States*

(100 Per Cent of the Industry)

| Month | Kw.-Hr. Generated Monthly * | | | Estimated Distribution of Energy Generated | | | | | | | | | | Energy Purchased by Public Utilities for Resale, Kw.-Hr. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total Energy Consumption by Central-Station Customers, Kw.-Hr. | | Energy Consumed for Lighting, Kw.-Hr. | | Energy Consumed for Power, Kw.-Hr. | | Energy Sold to Electric Railways, Kw.-Hr. | | Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr. | | | |
| | 1928 †Thousands | 1927 Thousands | Per Cent Inc. | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands |
| Jan.. | 6,767,866 | 6,303,199 | + 7.4 | 5,582,866 | 5,188,199 | 1,493,000 | 1,395,000 | 3,514,866 | 3,170,199 | 575,000 | 534,000 | 1,185,000 | 1,115,000 | 1,230,000 | 1,090,000 |
| Feb | 6,402,837 | 5,706,468 | +12 2 | 5,272,837 | 4,696,468 | 1,395,000 | 1,210,000 | 3,367,837 | 2,928,468 | 510,000 | 477,000 | 1,130,000 | 1,010,000 | 1,211,000 | 1,017,000 |
| March | 6,755,346 | 6,314,272 | + 6 9 | 5,560,346 | 5,194,272 | 1,400,000 | 1,305,000 | 3,630,000 | 3,304,272 | 530,000 | 503,000 | 1,195,000 | 1,120,000 | 1,254,000 | 1,084,000 |
| April.. | 6,419,112 | 6,049,656 | + 6.1 | 5,284,112 | 4,979,656 | 1,323,000 | 1,235,000 | 3,461,112 | 3,194,656 | 500,000 | 472,000 | 1,135,000 | 1,070,000 | 1,137,000 | 1,087,000 |

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.
†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.

put of the latter exceeded that of a year ago, there was a decrease of nearly 160,000 tons in the consumption of coal and a slight decrease in fuel oil, far from counterbalanced by the somewhat greater use of natural gas.

Regional changes in revenue, as indicated by the reports, are as shown in the following table:

REGIONAL CHANGES IN REVENUE

| Region | Per Cent Change From April, 1927 | From March, 1928 |
|---|---|---|
| New England | +4.7 | —5.2 |
| Atlantic | +6.8 | —2.6 |
| North Central | +6.2 | —3.1 |
| South Central | +5.1 | —2.9 |
| Western | +12.0 | —0.4 |

Changes in energy output followed the same general trend; the increase on the Atlantic seaboard was greatest in the southern portion, and a high rate in the West South Central states balanced a lack of increase in the East South Central, while both Mountain and Pacific states in the Western group reported 11 per cent increase over April, 1927.

# General Gas & Electric Corporation Cuts Cost and Simplifies Set-Up

WITH a 4.3 per cent reduction in operating costs for 1927, the General Gas & Electric system was able to show a gain of 8.2 per cent in net operating revenue from an increase of less than 2 per cent in gross revenue. This is one of the few systems which has shown an actual reduction in costs for the year. The corporation itself showed a 25 per cent increase for the year both in gross revenue and in net income. This substantial growth, presumably, is what warranted the inauguration of dividends on the B stock at the rate of $1.50 per share.

The increase in revenue accruing to the parent company resulted in earnings of $5.90 per share on class A common stock. This compares with earnings on A and B stock of $3.43 in 1926 and $1.69 in 1925. Dividends on A stock commenced in October, 1925. Class A stock is currently quoted at around 41 and Class B at around 50.

The reduction in operating costs and maintenance improved the operating ratio of the group very materially, from 58 in 1926 to 54.8 last year. Property investment amounted to $5.85 per dollar of gross revenue, which makes an attractive showing among similar systems.

## ELIMINATES COMPETITIVE SITUATION

In July, 1927, all securities of the North Carolina Public Service Company and the South Carolina Gas & Electric Company, owned by the corporation, and all property owned by the Broad River Power Company in North Carolina and that portion of its property in South Carolina located north and west of Union, S. C., was sold to the Duke Power Company, thereby eliminating a competitive situation which would have been very costly for both interests if continued. Benefits to the General Gas & Electric Corporation of this transaction are steadily accruing, but will not be fully apparent in its earnings until July 31, 1928.

*Table II—Central-Station Financial Operations for Four Months in the United States*

(100 Per Cent of the Industry)

| Month | Total Gross Revenue from Sale of Energy† | | | Estimated Distribution of Gross Revenue | | | | | | | | Total Operating and Maintenance Expenses‡ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lighting Customers | | Power Customers | | Electric Railways | | Other Public Utilities | | | |
| | 1928 Thousands | 1927 Thousands | Per Cent Inc. | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands | 1928 Thousands | 1927 Thousands |
| Jan. | 171,700 | 161,100 | +6.6 | 99,500 | 93,600 | 53,900 | 50,200 | 6,600 | 6,600 | 11,700 | 10,700 | 66,700 | 64,800 |
| Feb. | 162,700 | 151,100 | +7.7 | 94,200 | 88,800 | 51,700 | 47,000 | 5,600 | 5,400 | 11,200 | 9,900 | 64,200 | 61,200 |
| Mar. | 157,350 | 145,200 | +8.3 | 90,200 | 85,000 | 50,700 | 45,400 | 5,150 | 5,000 | 11,300 | 9,800 | 64,700 | 62,700 |
| April. | 153,400 | 144,800 | +6.0 | 85,400 | 81,900 | 51,700 | 48,200 | 5,200 | 5,000 | 11,100 | 9,700 | 63,200 | 61,750 |

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

*Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

| Month | Energy Generated | | | | | | Fuel Consumption | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hydro-Plants | | | Fuel Power Plants | | | Coal | | | Oil | | | Gas | | |
| | 1928 Thousands of Kw.-Hr. | 1927 Thousands of Kw.-Hr. | Per Cent Increase | 1928 Thousands of Kw.-Hr. | 1927 Thousands of Kw.-Hr. | Per Cent Increase | 1928 Short Tons | 1927 Short Tons | Per Cent Increase | 1928 Barrels | 1927 Barrels | Per Cent Increase | 1928 Thousands of Cubic Feet | 1927 Thousands of Cubic Foet | Per Cent Increase |
| January | 2,609,283 | 2,331,140 | +11.9 | 4,158,583 | 3,972,059 | + 4.7 | 3,321,568 | 3,365,461 | —1.3 | 560,871 | 786,062 | —28.6 | 4,955,262 | 3,900,868 | +27.0 |
| February | 2,462,450 | 2,172,740 | +13.3 | 3,940,387 | 3,533,728 | +11.5 | 3,122,160 | 2,958,797 | +5.6 | 521,526 | 646,558 | —19.4 | 4,896,497 | 3,859,791 | +26.8 |
| March | 2,727,970 | 2,551,792 | + 6.9 | 4,027,376 | 3,762,480 | + 7.2 | 3,115,814 | 3,090,984 | +0.8 | 594,613 | 612,657 | — 2.9 | 5,600,146 | 4,312,322 | +29.7 |
| April | 2,821,758 | 2,526,938 | +11.6 | 3,597,354 | 9,522,718 | + 2.2 | 2,782,356 | 2,942,421 | —5.4 | 506,593 | 524,148 | — 3.3 | 5,319,945 | 4,482,900 | +18.7 |

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

Further simplification of the corporate structure of the system was accomplished through the acquisition by the Metropolitan Edison Company of the property of the Metropolitan Power Company and the redemption of the latter's 6 per cent gold bonds. The latter step is part of a general refinancing program in which it is planned to retire all Metropolitan Edison's underlying issues and to replace them with bonds bearing a lower interest rate; also to have the Metropolitan Edison Company acquire the property and franchises of the Pennsylvania Edison Company, its principal subsidiary. This plan has been consummated during 1928.

The corporation closed the year with no bonded or floating debt. Notes payable on the consolidated balance sheet are those of subsidiary companies, which are paid off from time to time through funds obtained from the sale of securities and which represent temporary obligations pending the sale of such securities.

Expansion during the year included the installation of a 30,000-kw. unit at the Johnson City generating station of the Binghamton Light, Heat & Power Company and the completion of an interconnection of its lines with those of the Elmira Railway, Light & Water Company. The Florida Public Service Company constructed a new steam-electric generating station near Avon Park, which is interconnected with the Benson Springs station, placed in operation in 1926.

The General Gas & Electric system as at Dec. 31, 1927, served 224,208 customers. Electric sales for 1927 were 731,347,110 kw. and gas sales totaled 1,028,110,000 cu.ft. Of the operating income of subsidiaries for 1927, 85 per cent was derived from the sale of electricity, 9 per cent from gas and miscellaneous services and 6 per cent from bus and street railways. The physical properties include electric generating stations with total installed capacity of 337,398 kw-hr., approximately one-eighth hydro-electric and seven-eighths steam; also 2,207 miles of transmission lines and 3,592 miles of distribution lines. The gas properties have a 24-hour generating capacity of 9,335,000 cu.ft. and 312 miles of mains.

## Savings Banks Association Advocates Private Operation

At a meeting of the mutual savings bankers of the country held last week at Swampscott, Mass., the passing of legislation in the State of New York making it possible for savings banks to invest approximately $500,000,000 in public utility securities was lauded. The committee on public utilities submitted a report which strongly upheld the principle of private ownership. The report said: "We believe that regulation is infinitely better than public ownership, and such regulation, in our opinion, should include issuance of securities, both bonds and stocks, methods of accounting, and rates to be charged for the service rendered."

The committee on uniform policies and laws submitted a report showing the four classes of property which comprise the bulk of savings banks investment are public funds, railroad bonds, public utility bonds and real estate mortgages. Some recent figures indicate that in 1922 the banks had 24 per cent of their

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday June 19 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com., new - no par | 58¼ | 57 | 85 |
| Ala. Pwr., $7 cum pf.—no par | m115 | 114 | 115½ |
| Allis Chalmers Mfg., 6% com. | 116½ | 115⅛ | 129¾ |
| Aluminum Co. of Amer., com. | 155 | 120 | 197¾ |
| Aluminum Co. of Amer., 6% pf | m108½ | 105⅛ | 110¼ |
| Amer. & Foreign Pwr., 7% pf. no par | 106 | 105½ | 110 |
| Amer. & Foreign Pwr., com. no par | 32½ | 22⅞ | 38⅞ |
| Amer. Bosch Magneto, com.—no par | 31 | 15⅞ | 41 |
| Amer. Brown Boveri Elec † | 15½ | 10¾ | 26¼ |
| Amer. Brown Boveri Elec., pf. $7 | 58⅞ | 40⅝ | 65⅞ |
| Amer. Gas & Elec., 6% pf.—no par | m106 | 105 | 108¾ |
| Amer. Gas & Elec., com. †—no par | 155 | 117½ | 184 |
| Amer. Lt. & Trac., 6% pf. | 118 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 222½ | 170 | 249 |
| Amer. Pwr. & Lt., 5% pf. | 81 | 81 | 87 |
| Amer. Pwr. & Lt., com. †—no par | 75¾ | 62½ | 95 |
| Amer. Pub. Serv., 7% pf. | a103 | 97⅛ | 104 |
| Amer. Pub. Serv., com. † | m 60 | 70 | 75 |
| Amer. Pub. Utilities, 7% ptc. pf. | a 93¾ | 95 | 97⅛ |
| Amer. Pub. Utilities, 7% pr. pf. | a101½ | 95¼ | 103 |
| Amer. Pub. Utilities, com. | m 50 | ... | ... |
| Amer. States Sec., A | a 10⅛ | 4 | 13⅞ |
| Amer. States Sec., B | a 13⅛ | 4⅞ | 17⅞ |
| Amer. Superpwr., 6% 1st pf. | l100⅛ | .... | .... |
| Amer. Super pwr., Class A†—no par | 36 | 35½ | 56 |
| Amer. Super pwr., Class B† no par | 38 | 36½ | 56⅞ |
| Amer. Wtr. Wks. & Elec., 6% pf — ex div | m 99 | 101 | 106 |
| Amer. W. W. & E., com. new —no par | 55 | 52 | 70¾ |
| Anaconda Copper cap $3 | 65 | 53¾ | 74⅞ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr. & Lt. 7% pf. | 107 | 108 | 109½ |
| Assoc. Gas & Elec., $3.50—50 | 50 | .... | .... |
| Assoc. Gas & Elec., pf. $6 no par | 92 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par. | 48 | 47 | 52⅞ |
| BABCOCK & WILCOX, 7% com. | 125 | 117½ | 128 |
| Binghamton L., H. & P., $6 pf. | 105 | 102 | 109¼ |
| Birmingham Elec., pf. -$6 no par | 107 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf. | m107 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—50 | m165 | 135 | 170 |
| Blaw Knox com † | i107¼ | 91 | 108 |
| Brazilian Trac., Lt. & Pwr., com., new | f 54 | . | |
| Broad River Pwr., 7% pf. | 104 | 105 | 108⅞ |
| Brooklyn Edison, 8% com. | 237 | 206⅞ | 268¼ |
| Buffalo, Niagara & East. Pwr., $1 60 pf. 25 | l26⅞ | . . . | . |
| Buffalo, Niagara & East. Pwr. com $1 20—no par | i 38⅞ | ..... | .... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | 99 | 98 | 101 |
| Carolina Pwr. & Lt., pf.—$7—no par ex div | l108 | 109 | 111 |
| Central & S. W. Util., $7 pf. no par | a100 | 99⅛ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf — no par | a106 | 103½ | 112 |
| Central Ark. Ry. & Lt., 7% pf. | 106 | 105 | 107⅛ |
| Central Ill. Pub. Serv., $6 pf. | a 99 | 97⅞ | 101⅛ |
| Central Ind. Pwr., 7% pf. | a 99½ | 94 | 101 |
| Central Maine Power, 6% pf. | 97 | 96 | 98⅛ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf. | 107 | 104½ | 114 |
| Central States Elec., 7% pf. | 117 | 104¾ | 121⅛ |
| Cincinnati Gas & Elec., 5% com. | g 99½ | 97⅞ | 100½ |
| Cities Service, $6 pf.—no par | i 101⅞ | 94⅛ | 103½ |
| Cities Service, pf. B —no par | i 9½ | 8⅛ | 9⅛ |
| Cities Service, pf. BB no par | i 95 | 88⅛ | 97 |
| Cities Service, com.—20 | i 71⅞ | 54 | 71⅞ |
| Cities Service, Bks. Shrs.—10 | i 33⅞ | 26¼ | 35¼ |
| Cities Service Pwr. & Lt., 7% pf. | m107 | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf. | 100¾ | 95½ | 102 |
| Cleveland Elec. Illg., 6% pf. | 111 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 425 | 350 | 425 |
| Columbia Gas & Elec., 6% pf. | 106 | 106 | 110½ |
| Columbia G. & E. com. $5—no par | 103⅛ | 107½ | 118⅞ |
| Columbus Elec. & Pwr., $2 com.—no par | m 79 | 66 | 79⅛ |
| Columbus Elec. & Pwr., 7% | 110 | .. | .... |
| Columbus Ry., Pwr. & Lt., 7% | 107 | 107 | 111 |
| Columbus Ry., Pwr. & Lt., 7% pf. B | 105 | 105 | 111 |
| Columbus Ry., P. & Lt. com. no par | 125 | 120 | 125 |
| Commonwealth Edison, 8% com. | a181 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 101⅞ | 101 | 104⅛ |
| Commonw'th Pwr., $2, com.—no par | 71 | 62½ | 87⅛ |
| Conn. Lt. & Pwr., 8% pf. | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 118 | 121 |
| Cons. Gas of N. Y., pf. | 102 | 100¾ | 105 |
| Cons. Gas of N. Y., com. $5—no par. | 142¼ | 119⅞ | 170¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf. | e114¾ | 110 | 114⅛ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf. | e101 | 100⅛ | 105¼ |
| Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3 00—no par. | e 81 | 67½ | 93 |
| Consolidated Pwr. & Lt., 7% pf. | 105 | 106 | 109 |
| Consumers Pwr., 6% pf. | 104¼ | 105½ | 106½ |
| Consumers Pwr., 6.6% pf. | 104½ | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 106 | 106½ | 108½ |
| Conti. G. & E. com. $4.40—no par. | m240 | 240 | 265 |
| Crocker Wheeler, com.† | 63 | 23 | 70 |
| Crocker Wheeler, 7% pf. | 96 | ... | ... |
| DALLAS PWR. & LT., 7% pf. | 110½ | 110 | 111⅛ |
| Dayton Pwr. & Lt., 6% pf. | 107 | 108⅛ | 110⅛ |
| Derby Gas & Elec., 7% pf. | 101 | 96 | 100½ |
| Detroit Edison, 8% com. | 206 | 166⅛ | 209⅞ |
| Dubilier Condenser, com.—no par. | 3¼ | 2⅛ | 5⅛ |
| Duke Pwr., cap | 130 | 130 | 148½ |
| Duquesne Lt., 5% pf. | 101½ | 101 | 105¼ |
| EASTERN NEW YORK UTIL., $7 pf. | m110 | 111 | 112½ |
| Eastern States Pwr. B | 20½ | 11¼ | 26⅞ |
| Eastern States Pwr., pf. | m100 | 98 | 100⅛ |
| East Tex. Elec., 7% pf. | 108 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d275 | 252 | 305 |
| El Paso Elec. 7% pf. | m112 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l110 | 108⅞ | 111⅞ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l100½ | 76 | 127½ |
| Electric Household Util † | a 23½ | 13¼ | 27 |
| Elec. Investors, 6% pf.—no par | 102 | 101 | 104 |
| Elec. Investors, com.†—no par | 63 | 40⅛ | 78¼ |
| Elec. Pwr. & Lt., ctfs. pf. | 108 | 106½ | 110½ |
| Elec. Pwr. & Lt., ctfs., com.—no par | 34½ | 28⅛ | 45½ |
| Elec. Ry. Securities, com. —no par | 6⅞ | | |
| Elec. St. Battery com. $5 25—no par | 73¾ | 69 | 84¾ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 105 | 105 | 108 |
| Empire Pwr., ptc.† | 36 | 27⅛ | 39⅛ |
| Engr. Pub. Serv. $7, pf.—no par | 110¾ | 107 | 110¾ |
| Engr. Pub. Serv., com.—no par | 37 | 33 | 46¼ |
| Eureka Vacuum Cleaner, com. $4—no par | 63 | 62½ | 79 |
| FAIRBANKS MORSE, 7% pf. | m109¾ | 104 | 114⅞ |
| F.-M., com.—$3—no par—ex.div. | 38 | 32⅛ | 54 |
| Federal Lt. & Trac., com. $1.40 | 53 | 42 | 56⅞ |
| Federal Lt. & Trac., $6 pf. —no par | 104 | 98 | 109⅞ |
| Florida Pwr. & Lt., 7% pf. | m105 | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf. | i113½ | 113 | 114½ |
| GALVESTON-HOUSTON ELEC., 6% pf. | 80 | 75 | 85 |
| Galveston-Houston Elec., com. | 31¼ | 31¼ | 42½ |
| General Cable, Cl. A | 63¾ | 56 | 84 |
| Gen. Elec. $3 com.—no par | 145 | 124 | 174½ |
| Gen. Elec., special—6% | 11⅞ | 11¼ | 11½ |
| Gen. Gas & Elec. (Del.) com. A $1.50—no par—ex. div. | 43⅞ | 35¼ | 50¾ |
| Gen. G. & E. (Del.) pf. A $8 —no par | 135 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7 —no par | 118 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 | 114 | 104 | 117 |
| Gen. Pub. Serv., $7 pf. | 98 | ... | .. |
| Gen. Pub. Serv., com., no par | 22¾ | 16⅞ | 29 |
| General Public Utilities, $7 pf. | m101 | 98 | 103 |
| Ga. Lt., Pwr. & Rys., com. | m 58 | 55 | 65 |
| Gt. Western Pwr., 7% pf. | b104 | .... | ... |
| IDAHO PWR., 7% pf. | 108½ | 109 | 111¼ |
| Ill. No. Utilities, 6% pf. | m 99 | 96 | 100 |
| Ill. Pwr. & Lt., 7% pf. | 106¼ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf. | m104 | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf. | 101 | 100 | 105 |
| Ingersoll Rand com. | 91 | 90 | 98 |
| Int. Combus. Engr., com. $2 no par | 55 | 45¼ | 72⅞ |
| Int. Combustion Engr., 7% pf. | m105 | 103 | 109 |
| Int. Util., Class A $3.50 no par | m 48¾ | 44⅛ | 52 |
| Int. Utilities, Class B—no par | 14⅞ | 6⅞ | 19½ |
| Interstate Pwr., pf. —$7 —no par | 101 | 99 | 105 |
| Interstate Pub. Serv., 7% pf. | 106 | 103 | 108 |
| Iowa Ry. & Lt., 7% pf. | 101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 104 | 105 | 107 |
| Johns-Manville com. † —no par | 102 | 96½ | 134 |

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington; kCleveland. lBid price Wednesday, June 20. mBid price Saturday, June 16. nLatest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday June 19 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY POWER & LIGHT pf. $7 | m108¼ | 109 | 114 |
| Kansas Gas & Elec. 7% pf. | l109 | 107 | 110 |
| Kelvinator Corp. | 14½ | 11⅛ | 22⅞ |
| Kentucky Hydro-Elec., 7% pf. | m103 | 100 | 105 |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 105 | 100 | 105 |
| LACLEDE GAS LT., 10% com. | m200 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | n 65 | 19¾ | 65 |
| Long Island Ltg., 7% pf. | 110½ | 103¾ | 112½ |
| Long Island Ltg., 6% pf. | m106 | 107 | 109 |
| Long Island Ltg., com.†—no par | m250 | 170 | 250 |
| Los Angeles Gas & Elec., 6% pf. | 111 | 105 | 112 |
| Louisville Gas & Elec., cl. A. $1.75 | 34½ | 28 | 41 |
| MAN. ELEC. SUPPLY, cap. $5—no par | 55 | 50 | 66⅞ |
| Maytag Co., com. 50—no par | 19 | 18⅛ | 22 |
| Memphis P. & L., pf.—$7—no par | 110 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 108 | 103 | 109½ |
| Metropolitan Ed., pf.—$7—no par | 109 | 109 | 111½ |
| Metropolitan Ed., com. $5—no par | 105 | 125 | 185 |
| Middle West Utilities, 6% pf. | a 97¼ | 93½ | 100¼ |
| Middle West Util., 6% pr. lien | a101½ | 99 | 108 |
| Middle West Util., com. $7—no par | a145 | 123¼ | 169 |
| Midland Utilities, pr. ln. 7% pf. | a105½ | 104 | 107 |
| Midland Utilities, 7% pf. A | a 90¼ | 89½ | 92¾ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 100 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | l108½ | 110 | 111½ |
| Miss. River Pwr., 6% pf. | m111 | 94 | 112½ |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | 109½ | 107¼ | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | m105 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 39¼ | 29¼ | 53 |
| Montana Pwr., 5% com. ex. div. | m162¼ | 102½ | 175 |
| Montreal Pwr., 7½% com. | f100½ | .... | .... |
| Mountain States Pwr., 7% pf. | m103 | 97 | 105 |
| Mountain States Pwr., com.† | 18½ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 109 | 98 | 110¼ |
| National Carbon, 8% pf. | a137 | 136½ | 139¾ |
| National Elec. Pwr., A† | a 32½ | 27¼ | 42 |
| National Pwr. & Lt., pf.—7% | 107¼ | 107¾ | 111 |
| National Pwr. & Lt., com.†—no par | 33¾ | 21¼ | 36¼ |
| National Pub. Serv., 7% pf. | 102 | 99 | 104 |
| National Pub. Serv., 7% ptc., pf. | n114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 28½ | 22 | 29⅞ |
| National Pub. Serv., B com.—no par | 29¼ | 22 | 29¼ |
| Nebraska Pwr., 7% pf. | l108½ | 110 | 111½ |
| Nevada-Calif. Elec., com. | m 50 | 33¼ | 50 |
| New Brunswick Pwr., 4% pf. | 62 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 110 | 98½ | 110½ |
| New Eng. Pub. Serv., pf. $7 | 98 | 95 | 108 |
| New Orleans Pub. Serv. 7% pf. | 107½ | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 102 | 91 | 104 |
| N. Y. Central Elec., 7% pf. | 105 | 101 | 107 |
| New York Power & Light 7% pf. | 114 | | |
| NiagaraFalls Pwr., 7% pf.—25 | m 27½ | 27½ | 29½ |
| No. Amer., 6% pf.—50 | 54½ | 53½ | 55⅝ |
| No. Amer., com.—10 | 68 | 58⅛ | 78½ |
| No. Amer. Edison, $6 pf.—no par | m101⅞ | 100⅜ | 105⅜ |
| Northeastern Pwr., com. | 26½ | 19¾ | 31 |
| No. N. Y. Utilities, 7% pf. | 108 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 25¾ | 18 | 32 |
| Northern Ohio Pwr. & Lt., 6% pf. | 100 | 90 | 100 |
| No. Ont. Lt. & Pr. 6% pf. | m 98 | 94 | 100 |
| No. States Pwr. (Del.), 7% pf. | 109½ | 108½ | 110¼ |
| No. States Pwr. (Del.), 8% com. | 133½ | 123 | 152 |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par | m 94 | 89 | 100½ |
| Ohio Brass, 6% pf. | m105 | 106 | 111 |
| Ohio Pwr., 6% pf. | 108 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | 104 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 111 | 107 | 112 |
| Ohio River Edison, 7% pf. | 109 | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 109 | 106 | 115½ |
| PACIFIC Gas & ELEC., 6% pf. | 26¼ | 26¼ | 30 |
| Pacific Gas & Elec., 8% new com. | 46½ | 43½ | 53¼ |
| Pacific Pwr. & Lt., 7% pf. | l109½ | 106 | 110 |
| Packard Electric | k 66 | 47 | 68½ |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 80 | 79⅛ | 82 |
| Penn-Ohio Edison, 6% pf. no par | 97½ | 93½ | 101 |
| Penn-Ohio Edison, 7% pf. | 107 | 105 | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 105 | 99 | 112 |
| Penn Pwr. & Lt.—$7—no par ex.div. | l108½ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new ex.div. | e 79 | 63 | 90 |
| Phila. Co., 5% pf.—50 | m 48 | 45½ | 48¼ |
| Phila. Co., 6% pf.—50 | 53 | 52 | 57 |
| Phila. Co., com.—50 | m161 | 145 | 174¾ |
| Phila. Elec., 8% com.—25 | c 63 | 55½ | 74¾ |
| Portland Elec. Pwr., 7% pf. | 104 | 100 | 106 |
| Portland Elec. Pwr., 6% pf. | 94 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 43 | .... | .... |
| Potomac Elec. Power, 6% pf. | j111½ | .... | .... |
| Pwr. Sec., pf.—no par | 60 | 50 | 68 |
| Pwr. Sec., com.—no par | m 14½ | 11⅛ | 14½ |
| Public Serv. of Colorado, 7% pf. | 107 | ... | .. |
| Pub. Serv. of N. J., 6% pf. | 110¼ | 103⅜ | 115 |
| Pub. Serv. of N. J., 7% pf. | 127 | 118 | 129½ |
| Pub. Serv. of N. J., $2 com.—no par | 53¾ | 41½ | 66⅞ |
| Pub. Serv. of No. Ill., 6% pf. | a119 | 110 | 119 |
| P. S. of No. Ill., com. $8—no par | a185½ | 159½ | 190½ |
| Pub. Serv. of No. Ill., $8 com. | a181 | 139⅜ | 190 |
| Pub. Serv. of Okla., 7% pr. ln. | 109 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 107½ | 107¼ | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | m110 | 105 | 110 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | 101½ | 92 | 105¼ |
| Puget Sound Pwr. & Lt., com. | 80 | 34⅛ | 87 |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 56 | 54½ | 60 |
| Radio Corp. of Amer., com.—no par | 161½ | 85½ | 224 |
| Rochester Gas & Elec. 6% pf. D | 105½ | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B | 107 | 105 | 108 |
| Rochester Gas & Elec., 6% pf. C | 104 | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf. | 117 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | m 75 | 70 | 75 |
| Servel, Inc. | 14¾ | 4½ | 17½ |
| Sierra Pacific Elec., 2% com. | 38 | 29 | 40½ |
| Sioux City Gas & Elec., 7% pf. | 104 | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l107½ | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 88 | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 49⅛ | 40⅛ | 61 |
| So. Calif. Edison, 8% pf. | 49 | 38½ | 53 |
| So. Calif. Edison, 7% pf. | 28½ | 28¼ | 30 |
| So. Calif. Edison, 6% pf. | 26¼ | 25½ | 27⅞ |
| So. Calif. Edison, 8% com. | 45¾ | 43½ | 53½ |
| Southern Cities Utilities, 7% pf. | 83 | 75 | 92 |
| Southwestern Lt. & Pwr., A $3 | 70 | 60 | 80 |
| Southwestern Lt. & Pwr., B | 50 | ... | |
| Southwestern Lt. & Pwr., $6 pf. | 90 | 88 | 96⅛ |
| Southwestern Pwr. & Lt., 7% pf. | m111 | 103 | 115 |
| Standard Gas & Elec., 8% pf., ex. rts. | 69½ | 65 | 71½ |
| Standard Gas & Elec., 7% pr. pf. | 113¼ | 108 | 115 |
| Standard G. & E., com. $3.50 | 63¼ | 57¼ | 74¾ |
| Standard Power & Light, com. | m 53½ | 29¼ | 58¼ |
| Standard Pwr. & Lt., 7% pf. | 105 | 103¼ | 107¼ |
| Staten Island Edison, pf.—$6—no par | 98 | 99 | 103½ |
| Superheater, $6 com.—no par | 150 | 149⅛ | 178 |
| Syracuse Lighting, 7% pf. | 110 | 103 | 112½ |
| Syracuse Lighting, 8% pf. | m120 | 114 | 121 |
| TAMPA ELEC., com. $2 | 64 | 62 | 71 |
| Tenn. Elec. Pwr., 6% pf. | 101 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 109 | 107 | 110 |
| Tex. Pwr. & Lt., 7% pf. | l113 | 113¼ | 115 |
| Tide Water Pwr., 8% pf. | 103 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 118 | 112⅛ | 134 |
| Toledo Edison, 7% pf. | 109 | 108 | 111 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | m145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 95 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c132 | 114½ | 149⅞ |
| United Lt. & Pwr., pf.—$4—no par | a 57 | 53 | 58 |
| United Lt. & Pwr., pf.—$6.50—no par | 101 | 95 | 101½ |
| United L. & P., com. A .48—no par | 21½ | 13¾ | 26⅜ |
| United L. & P., com. B .48—no par | a 27½ | 20 | 31 |
| Utah Pwr. & Lt., 7% pf.—ex. div. | l108 | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 104 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | m200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 100 | 98 | 104 |
| Utilities Pwr. & Lt., com. A $2 | 36 | 28½ | 45⅞ |
| Utilities Pwr. & Lt., com. B $1—no par | 28 | 18½ | 32⅞ |
| VERMONT HYDRO-ELEC., 7% pf. | 99 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | 108¼ | 107¼ | 114½ |
| Virginia Public Service 7% pf. | 104 | 103½ | 103½ |
| WAGNER ELEC., 7% pf. | n106½ | 96⅛ | 107 |
| Wagner Elec., com.—no par | b 78 | 37 | 120 |
| Washington Ry. & Elec., 7% com. | j450 | .... | .... |
| Washington Ry. & Elec., 5% pf. | j100 | .... | .... |
| Washington Wtr. Pwr., 8% com. | 225 | 175 | 235 |
| West Penn Elec., 7% pf. | 109 | 108 | 115 |
| West Penn Elec., Cl. A $7 | 106 | 105 | 112 |
| West Penn Pwr., 7% pf. | 116 | 114⅞ | 117 |
| West Penn Pwr., 6% pf. | m110 | 108 | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf. | 104 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 99 | 100 | 106 |
| Western States Gas & Elec., com. | 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 91¼ | 88⅛ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | 33⅜ | 30⅛ | 36⅜ |
| Weston Elec. Instrument, com.—no par | 22 | 12½ | 28½ |
| Wheeling Elec., 6% pf. | 106 | 95 | 109 |
| Worthington Pump, 7% pf. A | m 49 | 46¼ | 58¼ |
| Worthington Pump, 6% B | 44½ | 41 | 51 |
| Worthington Pump, com. | 29 | 28 | 37⅞ |
| YALE & TOWNE com. $5—25 | 70 | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 20. *m*Bid price Saturday, June 16. *n*Latest quotations available. †Dividend rate variable.

assets in public funds and only 16.6 per cent in 1927. The investment in railroad bonds decreased from 21 per cent to 15.7 per cent. Public utility investment increased from 7.1 per cent to 12.3 per cent and real estate mortgages increased from 32.9 per cent to 42.1 per cent.

## Chicago Utility to Issue Additional Common Stock

At a meeting to be held Aug. 2, the stockholders of the Public Service Corporation of Northern Illinois will vote on increasing the authorized no-par common stock from 200,000 to 300,000 shares. The additional stock will be offered to common and preferred stock holders at $100 a share to the extent of one share for each five shares held. Proceeds are to be used to reimburse the company's treasury for additions to property already made and to provide funds for projected additions and betterments to the company's property.

TWO HOLDING COMPANIES PAY INITIAL DIVIDENDS ON PREFERRED.—Directors of the American Power & Light Company have declared an initial quarterly dividend of 62½ cents a share on the $5 preferred stock, series A. This issue of preferred stock is entitled to cumulative dividends at the rate of $2.50 a share for the balance of the year 1928, $3 a share during 1929, $3.50 a share during 1930, $4 a share during 1931 and thereafter at the rate of $5 per share annually. This stock was issued to holders of Montana Power Company common stock in the ratio of two preferred shares for each Montana Power common share held. The directors of the American Superpower Corporation have declared an initial quarterly dividend of $1.50 per share on the new $6 cumulative preferred stock (no par value), payable July 2 to holders of record June 15. This stock was recently distributed to the common stock holders in the form of a 20 per cent stock distribution.

PUGET SOUND UTILITY PAYS INITIAL PREFERRED DIVIDEND.—The directors of the Puget Sound Power & Light Company have declared an initial dividend of $1.05 per share on the new $5 cumulative prior preference stock (no par value), payable July 16 to holders of record June 15. The directors also declared the regular quarterly dividend on the $6 preferred.

# Business News and Market Conditions

## Middle Atlantic Shows Increased Construction

*Volume for the United States in 1928 Is 25 per Cent Greater Than for the Same Period of 1927*

DURING the five weeks of May, 1928, engineering construction volume reached a total of $357,059,000. On the basis of average weekly lettings the construction industry showed the same activity as in May, 1927, and was about 5.6 per cent lower than in April of this year, according to the *Engineering News-Record.* The value of contracts awarded this year to date is 25 per cent ahead of last year.

The Middle Atlantic states lead in the percentage increase over the first five months of 1927. This year contracts exceeded those of a year ago in that section by 66 per cent. The South showed a substantial increase of 31 per cent; New England, 18; Middle West, 14, and west of the Mississippi, 2 per cent above a year ago. The far West showed the only decline. Contracts were 12 per cent lower than last year for that section.

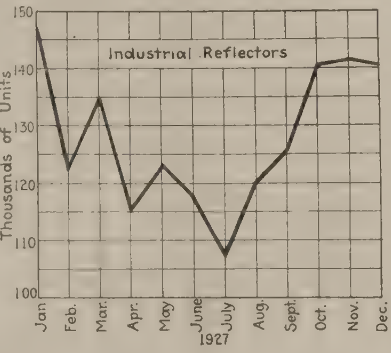
All classes of construction showed larger five-month totals in 1928 except sewers, excavations, federal government and private unclassified work. The outstanding increases in awards were made in streets and roads (62 per cent) and in private commercial buildings (33 per cent). This year is 26 per cent ahead of last for all private construction and public awards are 23 per cent greater than in 1927.

Commercial buildings constitute the largest class of construction as measured by value of contracts; the section in which the greatest expenditures for all construction are made is the Middle Atlantic. Average monthly awards for private commercial buildings in this section in 1928 has been $71,461,000, while the average month for all 1927 was $44,380,000. There is, however, no indication or suggestion of overconstruction in the increasing rapidity with which these large commercial buildings, both residential and commercial, are being built. Rents have been practically unchanged in New York City within the last three years, and there was a continual increase in rents since 1915. Average rents for the whole country have been declining since the high point reached in December, 1924.

Compared with average weekly contract awards in April, 1928, May showed an increase only in New England. Two exceptionally large waterworks contracts in Massachusetts contributed to the total. Very small decreases were shown in the Middle West and west of the Mississippi. The construction volume index number for May was 299. In April it was 312.

Classes of construction for which contract values exceeded the weekly rate a month ago were water-works, bridges, excavations, industrial buildings and federal government work. Two conspicuous bridge awards were the Lake Champlain bridge from Crown Point, N. Y., to Chimney Rock, Vt., and a railroad bridge over Newark Bay. The contract value for the former was $920,177 and the total value of the latter structure will be $7,500,000.

## N.E.M.A. Statistics



*Sales of industrial reflectors in numbers of units*

(Other statistics collected by the National Electrical Manufacturers' Association appeared in previous issues.)

## Markets for Equipment in Western Europe

Exports of electrical machinery from the United States to the whole of Europe were valued at $1,826,900 in 1926 and at $3,047,800 in 1927. Exports to western Europe amounted to $1,501,700 in 1926 and to $2,383,100 in 1927. During the year 1926 the United States exported $84,226,000 worth of electrical apparatus, of which $10,341,440, or 12.26 per cent, went to European countries. A survey of the exports of electrical machinery and apparatus during the four years 1923 to 1926 reveals the fact that an average of 16 per cent of the total found its way to European markets, but our exports of such material to Europe have dropped consistently since those countries have recovered from the loss of trade following the World War. The fact that our total exports of electrical equipment are increasing each year, while exports to Europe are slowly falling off, may be attributed in some degree at least to the fact that a greater effort is being made to develop other markets, such as Latin America, where competition is less keen.

Generally speaking, France, Spain and the United Kingdom are our best European markets for industrial electrical appliances. Rather a large proportion of our exports of accessories and parts for motors go to Belgium and Italy, and even Norway imports a good deal of this equipment, while of our shipments of small motors a large percentage finds its way to Germany. The Netherlands, Sweden, Switzerland, Italy and Belgium also import small motors to a considerable extent. Trade with Russia is steadily improving, exports of industrial electrical appliances to that country for 1925 and 1926 showing a marked gain over the two preceding years.

A survey of the world markets for electrical goods in 1923 shows that Great Britain, the United States and Germany together supplied 80.6 per cent of the world requirements of

*Value of Contracts Let in the United States and Canada During May, 1928*

Thousands of dollars (000 omitted)

| | New England | Middle Atlantic | South | Middle West | West of Mississippi | Far West | United States | Jan. 1 to date, U. S. | Canada |
|---|---|---|---|---|---|---|---|---|---|
| Waterworks | $8,964 | $1,342 | $239 | $510 | $859 | $1,691 | $13,605 | *$24,519* | $23 |
| Sewers | 119 | 1,218 | 384 | 6,183 | 1,077 | 1,350 | 10,331 | *38,837* | 497 |
| Bridge | 805 | 10,573 | 1,884 | 4,053 | 2,340 | 984 | 20,639 | *58,560* | 375 |
| Excavations, drainage, etc | 70 | 353 | 324 | 664 | 122 | ...... | 2,133 | *7,353* | ...... |
| Streets and roads | 3,655 | 22,974 | 8,539 | 28,351 | 12,997 | 6,903 | 83,419 | *265,279* | 1,833 |
| Industrial buildings | 7,057 | 6,349 | 2,690 | 5,254 | 5,246 | 1,173 | 27,769 | *124,693* | 2,200 |
| Commercial buildings | 15,259 | 78,337 | 5,625 | 42,574 | 19,195 | 12,669 | 173,659 | [illegible] | 6 704 |
| Federal government | 271 | 935 | 493 | 129 | 1,781 | 437 | 4,046 | *19,371* | ...... |
| Unclassified | 703 | 12,815 | 267 | 4,819 | 4,699 | 1,155 | 15,458 | *120,444* | 1,697 |
| May, 1928 | 36,903 | 134,896 | 20,445 | 89,537 | 48,916 | 26,362 | 357,059 | ....... | 13,329 |
| April, 1928 | 17,018 | 114,380 | 24,780 | 73,765 | 41,813 | 30,972 | 302,728 | ....... | ...... |
| May, 1927 | 19,268 | 77,056 | 7,352 | 82,547 | 63,239 | 35,818 | 285,280 | ....... | ...... |
| Year to date, 1928 | *102,471* | *552,507* | *109,729* | *338,891* | *211,169* | *135,815* | ....... | *1,450,582* | *64,051* |
| Year to date, 1927 | 86,538 | 332,644 | 83,740 | 297,910 | 207,920 | 153,799 | 1,162,551 | ....... | 37,592 |

electrical machinery alone and 78.4 per cent of the requirements of electrical machinery and apparatus combined, the smaller percentage in the latter instance being due to the enormous lamp trade carried on by the Netherlands and the French trade in insulators and cables. The countries entering definitely into the field of international competition are Great Britain, the United States, Germany, Switzerland and Sweden.

The following table gives a comparison of the values of the exports of electrical machinery and apparatus from the five principal industrial countries during the years 1913, 1923 and 1924.

Details of power supply and industrial conditions are given for the fourteen countries comprising western Europe in trade information bulletin No. 547, issued by the electrical equipment division of the Bureau of Foreign and Domestic Commerce, Washington, D. C. In this bulletin reference is made to data published in the ELECTRICAL WORLD that industry in the United States is already electrified to the extent of 65 per cent. In Great Britain, Belgium, Czechoslovakia, Hungary and other countries the degree of electrification is much less. In Germany industry is electrified to the extent of 70 per cent.

VALUE OF EXPORTS OF ELECTRICAL MACHINERY AND APPARATUS FROM LEADING COUNTRIES

| Exported from | 1923 | 1923 | 1924 |
|---|---|---|---|
| United States.. | $28,200,000 | $75,600,000 | $81,000,000 |
| Germany...... | 77,000,000 | 69,300,000 | 69,300,000 |
| Great Britain... | 37,300,000 | 68,800,000 | 75,100,000 |
| France........ | 10,620,000 | 17,250,000 | 22,200,000 |
| Switzerland.... | 6,050,000 | 9,610,000 | 10,240,000 |
| Total...... | $159,170,000 | 240,560,000 | 257,840,000 |

# Market Conditions

SALES of power equipment show an advance in New England. An outstanding order for motors amounted to $11,000. Buying of scheduled material and general supplies is steady. Refrigerating machinery sales are quite active. The volume of sales has been reduced in the Eastern district, but the prospects for increased industrial business are good. Important new plants planned include a power plant for a typewriter manufacturer in New England, at a cost of $300,000; an oil refining plant on Staten Island, to cost $10,000,000; another oil refining plant in Baltimore, at a cost of $1,000,000; additions to a wire plant in New Jersey, amounting to $100,000, and plant extensions by a shock absorber manufacturer in northern New York, amounting to $100,000. Wire and cable sales show a noticeable improvement and transformer orders have increased and are expected to continue at that rate for several weeks.

In the Southeast a large condenser order placed by a Carolina power company amounted to $325,000. An oil circuit breaker order in immediate prospect will amount to $100,000. Industrial plant business is steady. An improved tone is reported in the St. Louis district with an increased demand for motors. Sales continue to improve in the Middle West. Orders placed by a central-station company for boilers, etc., amounted to more than $1,500,000. On the Pacific Coast apparatus sales, despite a 10 per cent increase in pumping motor business, are running somewhat less than those of last year. Distribution transformer business, however, is greater. Orders for equipment for the Northern Life Building in Seattle are placed at a cost of $200,000.

## *Metal Demand Active—Prices Stable*

Non-ferrous metal prices are substantially stable with the exception of tin and silver, which are slightly lower. The demand in general has been good.

NEW YORK METAL MARKET PRICES

| | June 13, 1928 Cents per Pound | June. 20, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic..... | 14.525 | 14.525 |
| Lead, Am. S. & R. price | 6.30 | 6.30 |
| Antimony.............. | 9.75 | 9½ |
| Nickel, ingot........... | 35 | 35 |
| Zinc spots.............. | 6.50 | 6.50 |
| Tin, Straits............ | 48 | 47 |
| Aluminum, 99 per cent... | 24.30 | 24.30 |

Base copper wire price June 20, 1928, 16⅝ cents.

Though many of the copper producers are unwilling sellers, especially for early delivery, no attempt has been made to advance prices over the quotations of last week.

## *Improved Tone Noted in St. Louis District*

Manufacturers report a much-improved tone in business in the St. Louis district. Orders for stock sizes of motors have almost doubled over those of the previous week. One order for motors ranging from 15 hp. to 35 hp. and amounting to $5,000 was placed and a local manufacturing concern purchased $3,000 worth. No large contracts have been closed, but several are being figured. There have been a number of good-sized shipments of transmission line material and a large volume of building materials is being sold. Construction projects are as follows:

The Citizens Electric Company, Hot Springs National Park, Ark., will make extensions in its power plant to cost $90,000. The Page Milk Company, Merrill, Wis., plans a plant a Coffeyville, Kan., to cost $200,000. The Gulf States Utilities Company, Beaumont, Tex., plans extensions in transmission lines, near New Iberia, La. The South Coast Company, Chicago, plans a sugar refining plant at Oaklawn, La., to cost $500,000. The Hillyard Chemical Company, St. Joseph, Mo., plans a plant to cost $100,000. The Gulf, Colorado & Santa Fe Railway, Fort Worth, Tex., plans locomotive repair shops at Saginaw, Tex., to cost $150,000.

The Texas Utilities Company, Plainview, Tex., plans rebuilding of transmission line from Plainview to Lockney, Tex., and extensions to South Plains to cost $90,000. The San Antonio Portland Cement Company, San Antonio, Tex., plans an addition to its power plant in the Lakeview district. The West Texas Utilities Company, Abilene, Tex., plans a 12,000-volt transmission line in Crockett County; and also will extend lines to the Rosser-Pendleton oil field.

## *Sales Volume Reduced in Eastern District*

Actual commitments show a tendency to slacken in the Eastern district. The decline in activity is evidenced both with central station and industrial business. The latter looks favorable for an immediate revival, despite the usual seasonal decrease which is anticipated at this time of the year. A typewriter manufacturer in New England will build a power plant to cost $300,000; an oil refining company has authorized a plant on Staten Island to cost more than $10,000,000, while another company in this same line will build a plant at Baltimore to cost approximately $1,000,000. A wire company in New Jersey has approved an addition to its factory to cost $100,000, while a shock absorber manufacturer in northern New York will build an extension to cost a like sum. Control equipment sales are rather spotty. Cement mills and baking plants, two active outlets in recent weeks, have curtailed their inquiries, although it is believed to be only temporary.

Business in wire and cables shows noticeable improvement. Switching apparatus is operating under a reduced call, especially high-voltage, outdoor type apparatus, and no immediate renewal of demand is anticipated in that line until near the end of the summer season. Fractional-horsepower motor business has been extremely active in recent weeks and, while a temporary lull is evidenced, good sales are anticipated. Orders for transformers show an advance that is expected to last for several weeks. Sales of electric refrigerators are very strong. Construction activities are as follows:

The Northern Westchester Lighting Company, Ossining, N. Y., is building a substation at Ossining, N. Y., to cost $85,000. The Gulf Refining Company, New York, plans a refinery on Staten Island to cost $10,000,000. The Columbia Metal Box Company, New York, will build an addition to cost $100,000. The New York Edison Company, New York, plans a substation on West 56th Street. The Underwood-Elliott Fisher Company, New York, plans a power plant at Hartford, Conn., to cost $300,000.

The duPont Cellophane Company, Buffalo, plans additions to its paper goods mill to cost $200,000. Beach Haven, N. J., plans an addition to its municipal power plant to cost $50,000. The Public Service Electric & Gas Company, Newark, N. J., has purchased 200 acres of land on Staten Island Sound, vicinity of Sewaren, N. J., for a new power plant at a later date. The H. F. Runkel Bakery, Elizabeth, N. J., plans a baking plant to cost $350,000 (this project was incorrectly attributed to the Ward Baking Company in these columns last week). The American Copper Products Company, Elizabeth, N. J., will build an addition to its wire-manufacturing plant to cost $100,000. The Radio Tube Company, Newark, N. J., will build an addition to cost $70,000. Harrisburg, Pa., will make extensions in its lighting system with the installation of 600-cp. units. The Youngstown Sheet & Tube Company, Youngstown, Ohio, will install a coal-washing plant at Nemacolin, Pa., to cost $600,000. The Asiatic Petroleum Company, New York, has acquired property at Baltimore, Md., for a proposed refining unit, to cost $1,000,000.

## *Sales Continue to Improve in Middle West*

Business in most sections of the Middle West continues to show improvement and indications point to a continuation of this condition during the coming months. Reports from manufacturers of agricultural implements indicate an increase in the demand for farm machinery. Industrial activity is increasing and the steel and railroad industries continue to show improvement. Important orders placed by utility companies include three boilers complete with appurtenances valued at $1,000,000, labor and material to build foundations for a coal reclaiming structure valued at $60,000, a heating and ventilating system valued at $40,000, labor and material for erecting flues, uptakes, air ducts and appurtenances valued at $115,000, one 300-kw. electric mule complete with appurtenances and "Mazda" lamps valued at $90,000. Construction projects are as follows:

The Commonwealth Edison Company, Chicago, plans an addition to substation on Lake Street. The Illinois Steel Company, Joliet, Ill., is planning expansions to cost $200,000. The Delco-Remy Corporation, Anderson, Ind., plans an addition to its starting and lighting equipment plant to cost $100,000. The Electric Shovel Coal Corporation, Clinton, Ind., plans an electric mining plant and tipple at Winslow, Ind., to cost about $100,000. The Marshalltown Trowel Company, Marshalltown, Iowa, plans an addition to cost $120,000.

The Municipal Utilities Company, Des Moines, Iowa, plans a power plant at Missouri Valley, Iowa, to cost $225,000. The Briggs Manufacturing Company, Detroit, plans an addition to its automobile body plant, to cost $500,000. The Michigan Public Service Company, Ludington, Mich., has acquired the Antrim Light & Power Company, Mancelona, Mich. The Fisher Body Corporation, Pontiac, Mich., plans an addition to cost $1,000,000. The Ohio Electric Power Company, Sidney, Ohio, plans an automatic power substation at its Mill Road plant, Ravenna, Ohio, to cost $50,000. The Minnesota Power & Light Company, Duluth, Minn., will make extensions in transmission lines near Duluth, Minn.

The Nebraska Power Company, Omaha, Neb., plans extensions in transmission lines near Omaha, Neb., to cost $350,000. The Otter Tail Power Company, Fergus Falls, Minn., plans extensions in transmission lines near Montpelier, N. D. The Central West Public Service Company, Omaha, Neb., will build a transmission line from Edmore to Lakota, N. D. The Northern States Power Company, Eau Clair, Wis., plans extensions in transmission lines at Summer, Wis. The Wisconsin Power & Light Company, Madison, Wis., will build a 66,000-volt transmission line in the Iron River district, Mich., and the Wisconsin Lake territory, about 70 miles to cost $250,000. Lake Forest, Ill., Marquette, Mich. and Coleraine and Mankato, Minn., plan ornamental lighting systems.

## *Apparatus Sales to Date Below Last Year on Pacific Coast*

Apparatus and machinery sales on the Pacific Coast, despite a 10 per cent increase in pumping motor business, are running somewhat less than those of last year. The exception is distribution transformers. One manufacturer reports transformer orders aggregating 400 units during the past week with an upward trend. Orders for equipment for the Alameda Estuary tube have amounted to $34,000. An electrical contract for the Capwell department store in Oakland has been let at a cost of $165,000 to the Nepage-McKenny Company. Power company purchases have included $4,500 worth of hardware and also a carload of bolts and screws, two carloads of poles and four 1,667-kva. transformers for the Modesto irrigation district. Interesting industrial orders include a dynamometer equipment for $6,000 for testing gas engines, two motion-picture motor-generator sets at $2,500 each, a 125-hp. synchronous motor valued at $2,700 for a cement plant and three 200-kva. transformers amounting to $3,500 for a steel plant. Street-lighting projects and orders are many and total $62,000.

An average week of motor and apparatus sales involving about 80 machines, from 30 hp. down, for irrigation, orchards, cold storage plants and lumber mill replacements, was reported in the Puget Sound district. An order for equipment for the Northern Life Building in Seattle amounted to $200,000. The city of Seattle has authorized the reconstruction of the Cedar Falls transmission line No. 1 by increasing the size of the conductors and installing new wire at a cost of approximately $100,000. Proposed industrial projects are as follows:

A cold storage plant at Wenatchee, Wash., to cost $60,000. A milk evaporating plant at Sunnyside, Wash., to cost $50,000. A cold storage plant at Clarkston, Wash., to cost $80,000. A large addition to the Fidalgo Pulp and Paper mill at Anacortes, Wash. A 22,000-volt line extension from Reedsport to Coosbay, costing $40,000. The superintendent of the U. S. Indian School at Phoenix, Ariz., is asking bids until July 10 for seven motors. The Los Angeles Compress & Warehouse Company, Los Angeles, plans an addition to cost $500,000. The Modesto irrigation district, Modesto, Calif., will receive bids until July 2 for high-voltage power transformers, 1,667 kva., outdoor type (Specifications No. E-11).

The Pacific Gas & Electric Company, San Francisco, has approved a fund of $278,000 for a substation at San Jose, Calif. The Great Western Power Company, San Francisco, will build a steam power plant at South San Francisco to cost $3,000,000. The West Stanislaus irrigation district, Westley, Calif., is asking bids until July 14 for seventeen electric-operated pumping units, six outdoor switching stations, and eighteen transformers. The Pacific Lighting Corporation, San Francisco, will make extensions in systems at Beaumont, Hemet and San Jacinto, Calif., to cost $50,000. The Astoria Box & Paper Company, Astoria, Ore., plans a pulp mill to cost $400,000. Ellensburg, Wash., will soon take bids for extensions to the municipal power plant, for which a fund of $35,000 has been approved. The Seattle Pulp & Paper Mills, Inc., Seattle, Wash., plans a mill to cost $1,000,000, including a power plant.

## *Power Equipment Sales Advanced in New England*

Motor sales and control equipment orders have increased in New England. An outstanding order for a number of motors, amounting to about $11,000, was received, as well as an order for twelve motors for a complete installation for a paper mill. One manufacturer reports a number of interesting group orders for small motors. No let-down in the buying of scheduled materials and general supplies by central-station companies is apparent. Orders for small switches, watt-hour meters and power control equipment were numerous. A line material order totaling four carloads was reported. Refrigerating machinery sales are quite active. The demand for electric heating furnaces is continuing, with encouraging prospects of little abatement this season as compared with other years. Construction projects are as follows:

The Ames Shovel & Plow Company, North Easton, Mass., will build a new plant. The People's Hydro-Electric Vermont Corporation plans a development on the Green River to cost $163,000. The Farrell Foundry & Machine Company, Waterbury, Conn., will build an addition to cost $100,000. Boston, Mass., will expend $125,000 for a traffic control system. The Bureau of Supplies and Accounts, Washington, D. C., will receive bids until July 3 for electric pumps and spare parts for Boston navy yard and other yards (Schedule 9261). The American Writing Paper Company, Holyoke, Mass., will make extensions in its mill to cost $500,000. The Public Electric Light Company, St. Albans, Vt., plans extensions in its plants to cost $40,000.

## *Large Condenser Order Placed in Southeast*

The outstanding order placed in the Southeast was by a Carolina power company for condensers for two 60,000-kw. turbines, amounting to $325,000. An oil circuit breaker order approximating $100,000 is in immediate prospect in another section of the territory. A power company in Mississippi ordered power transformers amounting to $30,000, while copper wire orders of a Georgia company totaled in excess of $15,000. Other central-station orders included $3,500 worth of distribution transformers, $2,200 worth of bushings and insulators, $2,400 in small switching equipment and $1,500 in creosoted pine poles.

Engineering contracts have been let on a paper mill to be constructed in Alabama and wiring materials amounting to $40,000 will be used. An order was placed for motors, switchboards and lighting transformers amounting to $40,000 for textile mill units being moved from the East to Alabama. Another textile plant in the same state placed an order for a 1,500-kw. turbine. Electric welders were ordered by two small iron works in Georgia. A town in Georgia let a contract for 113 additional "whiteway" standards. Another municipality ordered one carload of creosoted pine poles, while a third purchased wiring materials amounting to $500 for use in its fire alarm system. An order for $2,500 worth of wiring materials for a hotel job in south Georgia was placed by a contractor. Construction projects are as follows:

The Gulf Utilities Company, New Port Richey, Fla., has acquired the Cedar Keys Light & Power Company, Cedar Keys, Fla. The Florida Public Service Company, Orlando, Fla., is arranging for the purchase of the municipal power plant at Mount Dora, Fla. The Mississippi Power & Light Company, Jackson, Miss., is arranging a fund of $350,000 for 110,000-volt transmission line. The Duke Power Company, Charlotte, N. C., has acquired utilities in Lenoir and Morganton, N. C. The Capital Granite Company, Oxford, N. C., will build an electric-operated stone-crushing plant at Blairs, S. C., to cost $100,000. Mobile, Ala., plans an ornamental lighting system to cost $200,000.

# Activities of the Trade

## Brown Boveri Plans Sale of Part of Holdings

A special meeting of holders of founders' stock has been called by the American Brown Boveri Electric Corporation for June 25 at the office of the corporation, 420 Lexington Avenue, New York, for the purpose of voting and taking action on the sale of the entire stockholdings in the Moloney Electric Company, St. Louis. In a letter to its stockholders the company states that the sale is for cash and is recommended by the board of directors in view of present conditions in the industry and as the corporation may itself now engage in transformer manufacture at space already available for that purpose at its Camden, N. J., plant, thus avoiding duplication. The Moloney holdings will be sold to Stifel, Nicolaus & Company of St. Louis. There also will be submitted at the same meeting of holders of founders' stock the proposed sale of its shipbuilding business at Camden, a matter which the management has had under consideration for some time, believing the best interests of the corporation indicate that its activities be concentrated upon its electrical business alone. The sale will include that part of the plant known as the "North Yard" and parts of the "South Yard" particularly involved in shipbuilding. The consideration proposed is cash under circumstances that will insure the retirement of the present bond issue and a cash balance in addition. If approved by the stockholders the sale will be made as soon as the proposed purchaser can complete his financing.

W. M. Flook, chairman of the board of directors of the company, in commenting on the proposed sale to a representative of the Electrical World, said that it will put the company in a stronger and better position than ever before. If the sale of these two holdings is approved by the holders of founders' stock the subsidiaries of the Brown Boveri corporation will consist of the Condit Electric Manufacturing Corporation of Boston and the Scintilla Magneto Company of Sidney, N. Y.

## Robbins & Myers Company Reorganizes

Robbins & Myers, Inc., Springfield, Ohio, successor to the Robbins & Myers Company, manufacturer of electric motors, generators and fans, announces the purchase of all of the assets of the Robbins & Myers Company, including the Robbins & Myers Company of Canada, Ltd., from W. J. Myers, receiver. The new company states that it is in a position better to serve its customers than ever before, with ample working capital amounting to over $2,000,000 in quick assets and less than $50,000 of accounts payable. The capital structure of the new company will consist of 100,920 shares of $25 par value 6 per cent preferred stock and 151,380 shares of no-par common authorized.

The officers of Robbins & Myers, Inc., are W. S. Quinlan, president; C. A. Stirling, vice-president and general sales manager; O. C. Burmeister, secretary; H. I. Smeltzer, treasurer, and W. M. Mumma, fan sales manager. All of the above have been connected with the old Robbins & Myers Company and no change in personnel is contemplated. It is understood that Wilbur J. Myers will become permanently identified with the new company as one of the principal executives as soon as he is relieved of his duties as receiver.

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The Wheeler Insulated Wire Company, Bridgeport, Conn., manufacturer of lamp cords and fixture wires, announces the appointment of the Burg Electric Sales Company, 32 Union Square, New York City, with a branch office at 1321 Arch Street, Philadelphia, as selling agent in the territories covered.

The Combustion Engineering Corporation, International Building, 200 Madison Avenue, New York City, announces the appointment of James Cleary as general sales manager. Since associating himself with the company in 1921, Mr. Cleary has been district manager of the Philadelphia and Detroit offices and for the past two years has been assistant general sales manager.

The Edwin L. Wiegand Company, 422 First Avenue, Pittsburgh, manufacturer of electrical heating units, announces that George Bray & Company, Leeds, England, have purchased the rights to the "Chromalox" line of heating units for Great Britain and other European countries. George Bray & Company are manufacturers of ceramic products, especially refractories for gas burners and electric heating units of the open coil type, and will manufacture the "Chromalox" products in their own plant at Leeds.

The James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis, manufacturer of overhead and underground utility equipment, announces a price reduction on solderless service connectors and guy wire clips. The company also announces the manufacturing of the Kearney "Hi-tension," four-in-one expansion anchors made in four sizes.

The Hoover Company, North Canton, Ohio, manufacturer of vacuum cleaners, announces that it has placed on the market a new model 972, heavy-duty electric cleaner which is said to have a very large dirt-removing capacity. The company also announces that it is now equipping Hoover models 700, 543 and 972 with a new cord-strain-relief plug made of bakelite,

The Welsbach Street Lighting Company of America, the Welsbach Electric Street Lighting Company and the Pennsylvania Globe Company announce the removal of their general offices to 261 North Broad Street, Philadelphia, Pa.

The Mogadore Insulator Company, Mogadore, Ohio, manufacturer of electrical porcelain, announces the removal into its new factory at Akron, Ohio, and a change of its name to the Akron Porcelain Company. There has been no change in the personnel or status of the company.

# New Equipment Available

## Three-Element Watt-Hour Meter

The type OB three-element watt-hour meter has been placed on the market by the Westinghouse Electric & Manufacturing Company. This meter is designed primarily for use on three-phase, four-wire circuits where a high degree of accuracy in measurement is desired. In construction the meter consists essentially of three single-phase elements placed one above the other, having all three disks mounted on a common shaft. The torques of all three elements are totalized and the energy measured on one register. The elements each have adjustable power-factor loops and are fully compensated for variations in temperature. The entire meter element is a unit assembly and can be removed from the case without affecting the calibration. The meters are made for either house type or switchboard mounting.

## Dynamic Balancing Machine

An improved model of the Olsen-Lundgren centrifugal dynamic balancing machine has been placed on the market by the Tinius Olsen Testing Machine Company, Philadelphia. The supports for the rotor to be balanced are of the ball-bearing roller type and are provided with a ball-bearing support so that each bearing may oscillate freely to obtain correct alignment in supporting the rotor. A new type of coupling also has been developed, incorporating a ball-bearing universal joint instead of the former driving pins. This arrangement has the advantage that any ordinary misalignment between the spindle and the piece tested does not interfere with the accuracy of the reading.

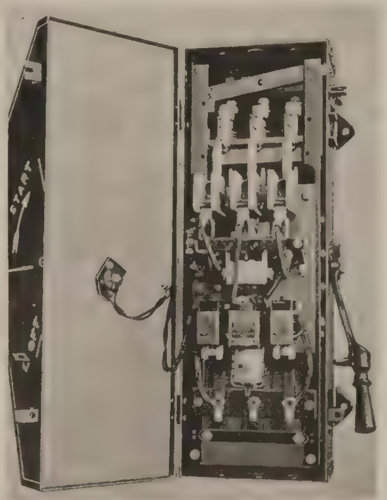
The rotor being tested can be quickly disengaged from the adapter and the time required to mount the part to be balanced is also reduced to a few seconds. The supports for the rollers can be readily adjusted to various lengths. Each one is provided with a quick-locking mechanism to facilitate taking the reading of unbalance at either bearing, so that the one support will be entirely free from the other in taking the readings.

To transfer the amount of unbalance and angle as shown by the machine so that corrections may be made at any two points along the length of the rotor, an entirely new transfer instrument has been developed. The correct reading of the amount of unbalance in ounce-inches, and the angular plane of unbalance required at selected points of correction from readings taken at the bearing support are readily obtained through simple adjustment. Where work is of a production character the settings are simplified further.

The improved dynamic balancing machine is available in any desired size suitable for balancing very small rotors of ½ lb. in weight up to the largest size turbine rotors. It is made to suit different lengths and classes of work and any special graduation other than ounce-inches can also be furnished on the dial and instrument. The wiring of the machine is entirely self-contained, and is piped so that no additional outside wiring is required.

## Combined Resistance and Transformer Starter

The "Resisto-Transformer" starter, which is said to combine the features of both the primary resistance starter and the auto-transformer for reducing the starting current taken from the line, has been developed by the Allen-Bradley Company, Milwaukee. The transformer is connected to the line through graphite compression resistors, the resistance of which is gradually reduced until the motor starts. The transformer, which up to this point has been connected in open delta, is disconnected at the common point, leaving the motor connected to the line through the graphite compression resistors and the impedance of the transformer. The next step connects the motor through the running switch to the line and the final step disconnects the transformer altogether from the line. The manufacturer states that the second current inrush is limited to a value which can do no harm to the line voltage because the motor is not disconnected when switched to line voltage. The company claims that it is possible with this new starter to install squirrel-cage motors on power lines which otherwise could not handle them without costly additions in line and transformer capacity to prevent voltage fluctuations.



*Motor starter combining the primary resistance and auto-transformer principles*

## Control for Automatic Arc Welding

An improvement in the control equipment used with its automatic arc welding heads, by means of which the feed of the electrode wire is stopped a short time before shutting off the welding current at the end of the weld, has been developed by the General Electric Company. This is said to clear the electrode from the weld and to fill in the crater which is inevitably left at the end of the weld when the arc is cut off short. According to the manufacturer, it is always desirable to have the electrode clear of the weld when removing the work from the clamping fixture, to prevent the end of the wire from dragging. This is of particular importance with large sizes of wire. Many users of arc welding also want to eliminate the undesirable crater, as they find its presence is objectionable, especially on circular welds of small diameters where one end of the weld is lapped over on the other end.

The General Electric control panel for its automatic arc welding heads is controlled by a push-button station. Mounted on the panel are a line contactor of suitable size for the welding current, an arc voltage regulating relay, a relay for controlling the travel motor and a time delay relay for clearing the electrode from the weld. The rheostats for controlling the arc voltage and the speed of the electrode motor are mounted on the outside of the sheet metal inclosing case. A small meter panel is used for indicating the arc voltage and welding current.

Plating Tank Rheostat.—An improved type of plating tank rheostat, known as the "Optimus," has been developed by the Hanson-Van Winkle-Munning Company, Matawan, N. J. These rheostats are said to afford absolute regulation and control of plating baths. It enables the electroplater to adjust the total resistance of a plating tank circuit so as to regulate the current density in the plating bath itself.

Railway Signal Choke Coils.—A new choke coil, recommended for use with all high-voltage lightning arresters when used for the protection of transformers on railway signal high-voltage power lines, is announced by the General Electric Company. This choke coil is designed for location between the arresters and the apparatus to be protected, so that an incoming surge will first meet the arrester and then the choke coil. As the current requirements in such service are unusually small, it was found possible to utilize galvanized iron wire as the conductor in the coil without sacrificing efficiency.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued May 29, 1928)

1,671,236. Toy Railroad-Track Switch; A. H. Gill, West Haven, Conn. App. filed March 16, 1927.

1,671,245. Alternating-Current Rectifier; F. Kraus, Rodenkirchen, near Cologne, Germany. App. filed April 15, 1926. Using a tuned spring set in synchronous vibration by an alternating current magnet.

1,671,247. Current Rectifier; L. Levy, Paris, France. App. filed Oct. 28, 1925. For wireless telegraphy and telephony and other analogous uses.

1,671,262. Submarine Sound Reception; R. L. Williams, Newton, Mass. App. filed April 2, 1925.

1,671,269. Electric Switch; C. W. Bassett, Maplewood, N. J. App. filed Oct. 31, 1923. Rapid make and break.

1,671,294. Switch; L. Kellner, Chicago, Ill: App. filed April 27, 1925. Snap switch for lighting circuits.

1,671,300. Electrical Heating Apparatus; A. S. Macdonald, Great Neck, N. Y. App. filed May 17, 1923. Treating small objects such as steel balls for bearings.

1,671,335. Storage-Battery Separator and Process of Producing the Same; T. A. Willard, Cleveland Heights, Ohio. App. filed May 28, 1921.

1,671,337. Soaking Pit; T. F. Baily, Alliance, Ohio. App. filed March 5, 1925. A soaking pit or furnace adapted to receive ingots or other articles to be heated in spaced upright position, the heating elements being located above the upper ends of the ingots whereby the heat is radiated downward.

1,671,344. Soldering Implement; C. M. Chapman, Terryville, Conn. App. filed March 25, 1926.

1,671,378. Electric Heater; F. D. Pitt, Kansas City, Mo. App. filed June 7, 1926. Bowl radiating type.

1,671,379. Rotary Switch; R. K. Winning, Milwaukee, Wis. App. filed July 16, 1924.

1,671,394. Electric Heater; E. E. Anderson, Kansas City, Mo. App. filed March 2, 1925. Bowl type.

1,671,401. Extruded Depolarizing Bobbin; A. J. Briggs, Syracuse, N. Y. App. filed Mar. 31, 1922. For electric cells.

1,671,407. Connecter for Use in Charging Batteries; A. O. Codney, Cleveland, Ohio. App. filed Dec. 18, 1925.

1,671,417. Welding Rod; R. Franks, Elmhurst, N. Y. App. filed Jan. 21, 1926.

1,671,451. Electric Vacuum Furnace; M. D. Sarbey, Cleveland, Ohio. App. filed Dec. 1, 1925.

1,671,461. Electric Vacuum Furnace; G. D. Bagley, Great Neck, N. Y. App. filed April 28, 1927.

1,671,463. Water-Wheel Regulator; C. A. Boddie, Pittsburgh, Pa. App. filed Nov. 26, 1924.

1,671,469. Electric Resistance; G. Egly, Berlin-Treptow, Germany. App. filed March 31, 1925. Terminal connection for resistor rods.

1,671,471. Circuit Interrupter; C. LeG. Fortescue, Pittsburgh, Pa. App. filed Jan. 3, 1920. Quick-acting.

1,671,473. Electrical Instrument; M. Jacobson, Camden, N. J. App. filed July 9, 1924. With increased sensitivity.

1,671,488. Induction Motor; R. Rüdenberg, Charlottenburg, near Berlin, Germany. App. filed May 11, 1917. With increased starting torque while retaining good constant-speed characteristics and low starting current.

1,671,514. Control System; R. C. Deale and N. Marcalus, Plainfield, N. J. App. filed July 16, 1924. For operating machine tools.

1,671,533. Brush Holder for Electric Motors; J. Lindall, Boston, Mass. App. filed Jan. 21, 1927.

1,671,538. Pothead or Electric Distributing Box; E. W. McIntyre, Cleveland, Ohio. App. filed March 11, 1927.

1,671,550. Safety-Latch Split Electrical Plug; E. H. Semmens, Seattle, Wash. App. filed April 30, 1927.

1,671,566. Dry Battery; A. T. Baldwin, Montclair, N. J. App. filed May 31, 1923.

1,671,568. Heating and Cooling Device for Buildings; A. H. Barker, Westminster, London, England. App. filed Nov. 23, 1926.

1,671,584. Electric Heating System; W. W. Hicks, San Francisco, Calif. App. filed May 10, 1926.

1,671,591, 1,671,592. Electric Heater; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. Apps. filed March 10, 1924, and Dec. 17, 1925.

1,671,593. Temperature-Control System; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. App. filed March 5, 1927.

1,671,615. Electric Switch; H. A. Spahr, Milwaukee, Wis. App. filed Nov. 24, 1926. For elevator use; actuated by a cam.

1,671,622. Box and Method of Manufacture Thereof; W. A. Wilcox, Seattle, Wash. App. filed Sept. 8, 1925.

1,671,640. Electrical Attachment Device; W. F. Hendry, Ossining, N. Y. App. filed Jan. 7, 1924.

1,671,641. Controlling Electric Machines; H. S. Holmes, New York, N. Y. App. filed March 21, 1925. For electric resistance welding.

1,671,659. Means for Protecting Aerial Cables; T. Varney, Sewickley, Pa. App. filed Feb. 25, 1927.

1,671,742. Electric Kiln; T. C. Prouty and W. O. Prouty, Hermosa Beach, Calif. App. filed June 27, 1927.

1,671,767. Support for Outlet Boxes and the Like; J. Kozelka, Cleveland, Ohio. App. filed Jan. 2, 1926.

1,671,794. Resistor and Support Therefor; D. L. Summey, Waterbury, Conn. App. filed June 5, 1926.

1,671,799. Brake-Controlled Circuit Closer; G. J. Warndorf, Cincinnati, Ohio. App. filed Feb. 18, 1926.

1,671,805. Projector Lamp; P. R. Bassett, Brooklyn, N. Y. App. filed Nov. 25, 1922.

1,671,824. Electric Switchboard and Template Structure; J. W. Hooley, Larchmont, N. Y. App. filed Sept. 27, 1927.

1,671,837. Electric Switch; A. H. Nero, New Britain, Conn. App. filed Jan. 30, 1922. For controlling lighting systems.

1,671,839. Inductional Water Heater; F. C. Owen, Fayetteville, N. C. App. filed Oct. 28, 1926.

1,671,842. Battery-Charging Clip or Connecter; G. Schurimann, Seattle, Wash. App. filed Sept. 22, 1926.

1,671,860. Electric Switch; O. Hammerstrom, Bridgeport, Conn. App. filed Nov. 4, 1924. Snap switch mechanism as in a socket.

1,671,905. Electrical Terminal; E. D. McKenna, New York, N. Y. App. filed Oct. 3, 1924.

(Issued June 5, 1928)

1,671,963. Induction Regulator; D. L. Alexander, Chevy Chase, Md. App. filed Oct. 2, 1926.

1,671,965. Electric Switch; G. R. Brown, Croydon, near Sydney, New South Wales, Australia. App. filed Aug. 31, 1926. Pull cord.

1,671,970. Liquid Rectifier; G. W. Carpenter, Palo Alto, Calif. App. filed June 7, 1921.

1,671,979. Wire Splice; W. E. Cook, New York, N. Y. App. filed Nov. 27, 1925. For use during the manufacture of insulated conductor wires.

1,671,985. Thermostatic Switch Control; J. C. Goosmann, Peoria, Ill. App. filed March 3, 1921.

1,671,993. Fuel-Oil Preheating Device; J. T. McTarnahan, Boston, Mass. App. filed Aug. 21, 1922.

1,672,005. Electrical Apparatus; A. J. Sorensen, Wilkinsburg, Pa. App. filed June 25, 1927. Railway signal equipment.

1,672,049. Alternating-Current Relay; M. L. Almquist, Brooklyn, N. Y. App. filed March 29, 1926.

1,672,059. Insulator; W. S. Cook, Parkersburg, W. Va. App. filed Oct. 9, 1923. Pin type insulators.

1,672,067. Grounding Receptacle and Plug; P. F. Labre, Spalding, Mich. App. filed May 12, 1927.

1,672,085. Signal; G. A. Primrose, Oakland, Calif. App. filed March 27, 1922.

1,672,112. Means for Facilitating Starting of Automatic Generating Plants; A. F. Brotz, Kohler, Wis. App. filed Dec. 30, 1921.

1,672,201. Terminal Connecter for Electrical Supply Cables; A. Champion, Flint, Mich. App. filed May 18, 1921.

1,672,219. Switch Receptacle; H. Hubbell, Bridgeport, Conn. App. filed Dec. 30, 1925. For use in wall outlet box.

1,672,221. Electric Hammer; J. Karcevsk, Chicago, Ill. App. filed April 25, 1927.

1,672,261. Fuse; G. Kahn, Chicago, Ill. App. filed Oct. 1, 1927. Renewable plug fuse.

1,672,263. Sectional Switch Box; E. H. Kruse, Fort Wayne, Ind. App. filed March 22, 1923.

1,672,285. Gaseous Conduction Lamp; F. Schaefer, Kalamazoo, Mich. App. filed Aug. 27, 1927.

# New Trade Literature

LAMPHOLDERS.—The General Electric Company, merchandise department, Bridgeport, Conn., is distributing a pamphlet covering a line of new threaded catch "Textolite" lampholders.

BUS SUPPORTS.—The Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago, has issued bulletin No. 31-BA, describing a new line of low-voltage bus supports for voltages from 200 to 4,500.

SWITCHES AND WIRING DEVICES.—The Hart & Hegeman Manufacturing Company, Hartford, Conn., has issued catalog T describing its complete line of "H & H" fine switches and wiring devices. Many illustrations showing the various types of the equipment are included.

STARTERS AND SWITCH. — Bulletins Nos. 111, 112 and 113 issued by the Clark Controller Company, Cleveland, describe respectively the Clark "Three C" primary resistor starters, the Clark "Three C" across-line-type reversing starters and the Clark "Three C" starting switch with disconnect feature. The bulletins contain dimension diagrams and ratings.

CONDUIT FITTINGS. — The Adapti Company, 2996 East 72d Street, Cleveland, has issued catalog No. 107-A, a supplement to catalog No. 107, describing and illustrating the company's new line of Adaptilets, also fixture elbows, plug and base receptacles and self-aligning fixture joints for use with Adapti-lets, Adaptiboxes and all regular standard fittings.

ELECTRIC FANS. — Robbins & Myers, Inc., Springfield, Ohio, is distributing bulletins No. 1386 and No. 1387 describing and illustrating its alternating and direct-current circuit ceiling fans built with lighting units. These fans are especially suited for hotels, office buildings, churches, theaters, restaurants, stores and homes.

DEMAND REGISTER.—Bulletin No. 75 issued by the Sangamo Electric Company, Springfield, Ill., describes and illustrates the Sangamo type HB maximum demand register. The bulletin contains instructions for installing and operating the register, as well as other information in regard to it.

SWITCHBOARD DEVICES.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-924, GEA-938 and GEA-942 covering respectively its bus supports for indoor service, accessories for switchboards and miscellaneous air break switches, plugs and receptacles.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Berlin, Germany (No. 31,534), for motor-driven household electrical appliances, and another (No. 31,537) for household electrical appliances and motor-driven devices.

An agency is desired in Leipzig, Germany (No. 31,530), for electric refrigerators, and another (No. 31,535) for all-metal electric washing machines.

Purchase is desired in Bradford, England (No. 31,527), of electric traffic control devices.

An agency is desired in Dresden, Germany (No. 31,529), for electric washing machines.

An agency is desired in Warsaw, Poland (No. 31,565), for wiring supplies and fixtures.

Purchase is desired in Auga Prieta, Mexico (No. 31,556), of X-ray and electromedical equipment.

An electric power station is being planned to be built at Bohult, about 2 miles from the present junction of the tributary and the main river, and will have a capacity of 100,000 hp. Additional information is avaliable under reference Sweden No. 276,297.

A company is being organized in Oswiecim (Teschen, Silesia) for the utilization of water power on the Sola River. The company's intention is to build a hydro-electric plant which will furnish the current for operating a normal-gage electric railway to be constructed between Oswiecim and Zywiec.

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## *The Washington Investigation and the Information Bureaus*

AS THE time draws near when the Federal Trade Commission will conclude its investigation of the various state public utility information bureaus, one cannot but be impressed with the sorry spectacle made in their testimony by these masters of publicity. This has been due primarily to the *ex parte* nature of the hearings and to the manner in which the examinations have been conducted, but the ego and love of exaggeration of the press agent also form part of the story. Unfortunately, the public utility industry is judged by the statements of the most incompetent of these men and the public reaction is anything but good. Distorted though the newspaper accounts may be, they are what reach the public, which in the presentation made can only conclude that it has been imposed on and made the dupe of insincere statements put forth for that end.

Of course, if the complete story of the industry could be told by the men who have been part and parcel of it, a different impression might be created; but we doubt very much whether a chance will be given to the industry to vindicate itself before the Federal Trade Commission. It has already been damned and cast into outer darkness by the scandalmongers, and the public relations work of years has been undone. Does this mean that the utility companies should cease all publicity work? Quite the contrary. The public utilities of the country should double and quadruple their efforts to command public understanding and respect, but information bureaus must hereafter be under stricter executive guidance and direction. That has been made all too plain by developments in Washington.

* * * *

## *Bond Issues Are Withheld from Falling Market*

THE remarkable paucity of public utility bond issues now being offered is due, not to a lack of demand for new capital, but to a well-considered policy on the part of the investment banking fraternity. There is much senior financing to be done, but the present weakness in the bond market apparently demands the policy of postponement which has been adopted.

This time last year the volume of bond debenture financing was unusually large. New financing of this type on the part of power and light companies during April and May alone exceeded $200,000,000. Early in the summer the bond market began to display a downward tendency, but the volume of new issues was not reduced until a rather serious congestion occurred throughout the investment market as a whole. It was some time before shelves were cleared. The bankers and those sponsoring new issues are carefully guarding against a repetition of this situation. There is much refunding still to be done, and this will effect marked economies. It is apparently the consensus of opinion in banking circles, however, that refunding economies may easily be wiped out if too many issues are thrown on the market indiscriminately at a time such as the present.

* * * *

## *Mergers Predicated on Banking and on Service*

BANKERS peering into the future profess to see in the offing business changes as momentous and as far-reaching as any of those already experienced in recent years. Throughout the convention of the American Institute of Banking in Philadelphia last week that note was dominant. Naturally, there was also a feeling of apprehension, for bankers are as a rule conservative; but conservatism did not becloud the picture of the tremendous industrial evolution which every one, including the bankers, knows is taking place in this country. Continued mergers of banking institutions are looked for; but here the bankers, although in step with the general trend of industry, are face to face with the problem confronting executives of utility companies—a dearth of skilled men.

Holding companies in the public utility field are admonished to adopt a plan of "merciless publicity" and a complete willingness to co-operate with public authorities as a safeguard against trouble and public disfavor. For adequate funds with which to carry on their operations holding companies will probably resort to debentures more than ever, and if these are readily absorbed, the electric light and power industry ought to continue unhampered its onward march. Of course, if money were all that were needed to conduct the public utility business—and money is most important—and if mergers could always be relied on to work out as planned or expected, the outlook would be roseate.

But there are other problems just as perplexing as finance. In union there is strength, but very little if it is a union of brass and lead. New holding companies and new investment companies are springing into being very rapidly of late, and unless wisdom and knowledge are displayed in combining or buying into properties, the combinations are bound to come to grips. Mere combination offers no royal road to fame and riches. Weak properties may be kept alive by transfusion with some strong property, but if the property is hopelessly anemic, it is a burden to the strong property and combination will not save it. Bankers are too prone to believe that mere manipulation of shares suffices to effect solidarity.

It will, if the combination is a logical one; but only a seasoned operator of public utilities can tell that. The market of the electric public utility industry is exceedingly bright, but its development must be intrusted to skilled utility men who will not easily be led astray during periods of cheap money. The object of all combinations should be better, or more economic and reliable, service, in keeping with the wants and needs of the community. Operators must never lose sight of that.

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## *Becoming "System-Minded"*

IT IS essential that the rising generation of electrical engineers regard their daily problems with a broader outlook than in the past. They must become "system-minded"—as they have become "automobile-minded" and are fast becoming "air-minded."

The past generation had to do with small systems, usually comprising one generating plant and a few radial feeders. They were isolated by distance and were developed along individual ideas—often widely divergent. The head of each department was a law unto himself. He had mastered his own duties but usually knew very little else outside his immediate sphere.

The present large systems and the intricate combinations resulting from interconnections of larger systems have introduced many problems which cannot be successfully solved by the old methods. Planning for many years into the future is an absolute necessity if economy and successful operation are to accompany expansion. Each new development in any part of the system, no matter how small, should be made with an eye to its relation with and its influence upon the system as a whole. It should be an efficient link in the chain, not only fulfilling its own immediate purpose but assisting adjacent members to reach the highest state of efficiency.

The men who are in charge of the work, whether planning, installing or operating, must get themselves in the habit of seeing beyond the local problem. They must think and work in terms of the system. They must become "system-minded."

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## *Evidence of Progress by Industry Sales Conference*

THERE is good news in the announcement that the Industry Sales Conference has retained a prominent advertising agency to assist in the development of the sales program for which electrical men are waiting. That they are waiting expectantly cannot be questioned. It was clearly evidenced at the recent conventions of the manufacturers, the jobbers and the power companies. The contractor-dealers are pinning great hopes upon the conference. For the four branches of the industry have appointed the men considered best for the job and asked them to find together the way to bring about the adequate wiring and equipment of the millions of homes now connected where further sale of electric service is largely blocked by inadequate facilities for the use of appliances. A fund has been provided, principally by the power companies and the manufacturers, to finance the preparatory work.

The conference has wisely sought expert advice. After all, this is not primarily an electrical problem. It is a problem of how to sell in the popular market. Why do the American people spend so small an amount for electrical equipment compared with other modern luxuries and conveniences? That is the question. It will be worth a good deal to have some unprejudiced outsider study this and find the answer, for any large market development by the electrical industry in the homes will have to be achieved through increasing the popularity of electrical appliances in direct competition with the other good things of life. We will have to change the present public attitude toward these relative appeals.

It may be expected that by fall whatever research is necessary will have been completed and that a plan and program will be ready for the consideration of the industry. The conference believes that this program must embrace three things—the sale of adequate wiring on a large scale, the education of the small contractor to better business standards, and a greater pressure of popular advertising by the electrical industry. It is a large order. It will require generous appropriations by the national associations and by companies. But nothing less will be effective.

* * * *

## *Too Many Variables Exist in Transmission Problems*

CONTINUITY of service by high-voltage transmission lines is a problem of unceasing interest and importance. The economic rewards of first-class service are matched by its effect on public relations. Notable progress is being made in the study of the phenomena underlying transmission practice, and the pioneer work of the manufacturers' laboratories is being supplemented by increased efforts to co-ordinate field observations and deduce from these the relative value of various protective methods. The number of variable factors affecting conclusions, however, is still too great to satisfy critical engineering judgment.

An interesting discussion of flashover problems has recently been published by the overhead systems committee of the Engineering Section, New England Division, N.E.L.A., based on a series of tests made last year on the 66-kv. circuits of the Turners Falls Power & Electric Company. Analysis of motion-pictures taken at the time led some engineers to accept three conclusions: (1) Devices on the line ends of insulator strings give about 10 per cent additional protection; (2) devices on both ends of insulator strings give about 54 per cent increased protection; (3) electric control devices are required when short circuits materially exceed 240 amperes, because of damage to insulators. Other engineers differed widely in their interpretations of the test data.

Actually, such tests on lines in the field are highly useful, even if generally acceptable conclusions are as yet unattained. We see these variables face to face when we seek to interpret such data. It is very important to accumulate a large number of observations upon the behavior of insulators and power arcs following up flashovers under a wide range of conditions on operating systems. We need more light upon many things—on the effect of arcing horns, grading rings, inter-disk gaps and distribution of voltage stresses; on the number of test "shots" and field flashovers reasonably necessary to permit detailed conclusions on a single line, on a system and between systems; on the relative effect of circuit breakers and power arc breaks on surge formation; on the amount of energy justifying particular interpretations; on the influence of wind conditions, the value of shorter disk spacing, the types of connections between units of strings, and so on.

The art of transmission has reached a stage where it justifies liberal outlays of time and money for assembly and analysis of facts bearing upon local flashovers and interruptions. Free interchange of data among those competent to discuss such problems is also essential.

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## *Benefits Available if Efforts Are Expended*

POSSIBILITIES for increased sales and improvement of a system load factor through the sale of electrical energy for industrial heating are enormous. But this class of load will not knock on the door for admittance. Competition is keen. The manufacturers of natural gas and fuel oil are competitors. The industrial man must be convinced of the advantages of electricity for industrial heating. The selling can be done by the manufacturers of heating equipment and by the utilities. Each must do its share, as the most effective work can be accomplished only through co-operation.

The industrial heating committee of the N.E.L.A. has prepared considerable data on methods of surveying the utility's territory for the adaptation of electric heat to specific applications and on the results that have been accomplished. A five-reel motion picture entitled "Electric Heat in Industry" has been prepared for the use of utilities. When shown before prospective customers it is a most convincing salesman. From time to time the committee sponsors schools for the training of industrial electric heating engineers.

It remains for the utilities to take advantage of these opportunities to increase their business. No group should be more interested than they.

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## *Transmitting Power Through Insulation*

AN INTERESTING case of apparent paradox in present-day electrical engineering is the series capacitor, which has recently been applied for the first time to transmission-line practice. A group of three of these capacitors has been placed in series with a 20-mile, 33-kv. line running between Amsterdam and Ballston Spa., N. Y., and the entire 7,500 kva. which passes over the line is transmitted through their dielectric.

This may seem a startling thing, since the profession has been engaged for years in the development of better solid and liquid dielectrics to withstand the increasing voltages used in transmission and the better to protect transformers and other apparatus from high potential disturbances resulting from lightning and switching operations. To be sure, any one who is familiar with radio knows that the high-frequency impulses travel through the dielectric of the condensers. But when it comes to commercial power, measured in thousands of kilowatts, it seems a pure figment of the imagination.

Operating data taken over a period of four months on the New York Power & Light Corporation's system give strong evidence that there is no paradox involved in transmitting power through insulation. The three series capacitors have been in continuous service during that period, transmitting regularly, day after day, as much as 5,000 kva. from the bus of the Amsterdam steam station into the system at Ballston and beyond to Spier Falls.

The importance of the capacitor lies in its ability to neutralize line reactance at all loads. The 20-mile line in which the group of capacitors is connected operates without reactance drop, achieving the voltage characteristics of direct-current transmission. And long-distance direct-current transmission has been the dream of engineers since the time of Edison's Pearl Street station, when one mile was the limit of distribution. Is it too much to expect that this new development may mean transmission of far greater blocks of power than at present; that greater distances may be covered than are now economically possible, and that thousands of miles of rural line may soon reach loads which are so light that their present-day development is impracticable?

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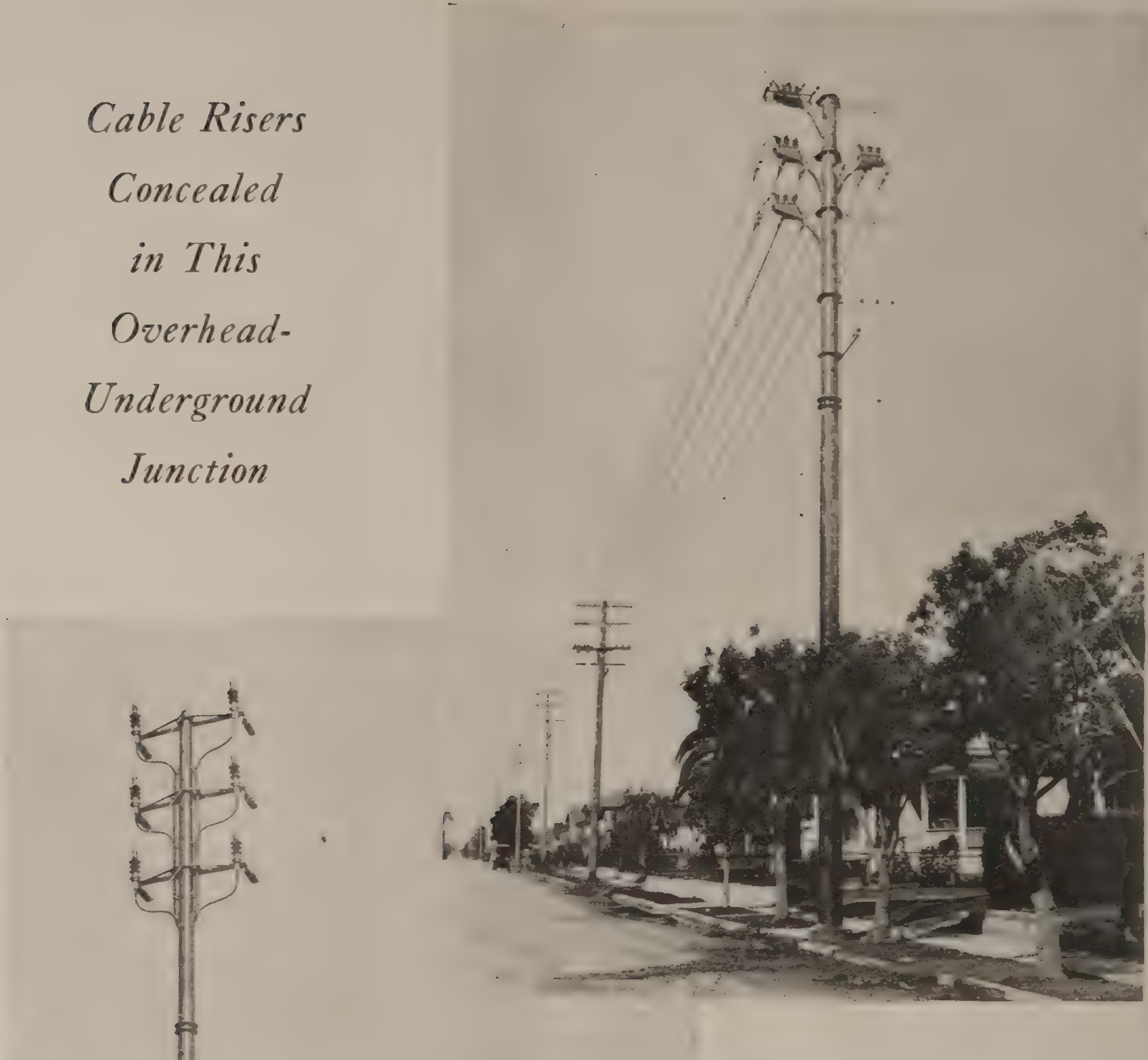
## *A New Hope Found in the Fixture Show*

A NEW spirit in the fixture industry was evidenced last week at the annual trade show of the Artistic Lighting Equipment Association, held in Chicago, in the appearance of a new modern expression of art in fixture design. It manifested itself conspicuously in one or two exhibits. It cropped out in many other places. There seemed to be a groping for a new approach to the old problem of providing a base for the incandescent lamp that will combine efficient illumination and a contribution to the interior decoration of the home. It took the form of modernistic expressions in both metal and glass and achieved not only interest but beauty.

The fixture industry has long languished for the want of new thought. Manufacturers continued to follow the old path of tradition, designing lighting equipment after the pattern of the candelabra and the chandelier, despite the fact that the candle has long since been laid aside in so far as general illumination is concerned and that we have instead a new source of light, intense and of large volume. Year after year the new fixtures for household use have brought but superficial changes in the old themes, and what wonder that the public has refused to become interested in the idea of buying new fixtures as it buys new furniture. "Modern" fixtures have established no vogue, have made no appeal to the popular fancy. And so little progress has been made with the electrical man's refixturing idea.

In this exhibition the Artistic Lighting Equipment Association has begun to demonstrate the meaning of the word "artistic" as applicable to home lighting, and its members have shown the compatibility of art and practical illumination. For the tendency in this modern expression is clearly toward the use of glass and parchment for shading and directing the light and eliminating exposed lamps. The lingering impression, however, is the hope that the fixture designer is really at last pushing forth into the open water of creative art. No one can doubt that the industry would profit greatly from such an excursion. For if vogue in fixtures can be established so that modern fixtures look new and have a mode appeal, the public will buy them and discard the obsolete just as it modernizes its other choice possessions.

# *Cable Risers Concealed in This Overhead-Underground Junction*



CONFRONTED with the problem of joining underground cables with overhead circuits in a residential section of Los Angeles, the Bureau of Power and Light was particularly anxious to avoid aggravating the public's objection to overhead lines, which would result from a nest of exposed cable risers. By using tubular poles in which the cables are concealed except where they emerge at the top it was successful in removing the objections to underground-overhead junctions at least. Some of the features of construction are presented on page 1383.

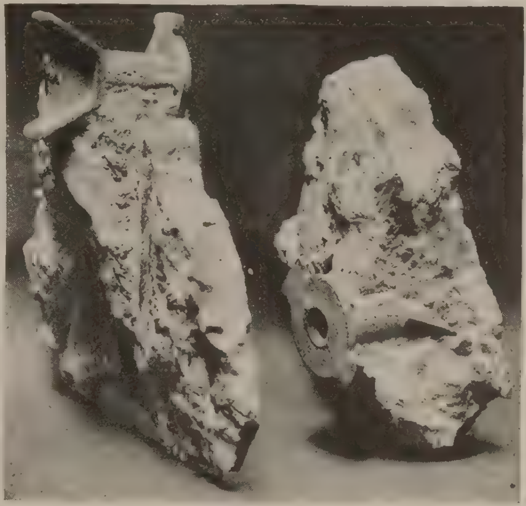
# Concrete Bus-Structure Tests

Characteristic failures of monolithic, thin-wall bus structures and supporting equipment developed in laboratory tests. Tension and compression strength values established

By Willard A. Kates

*Engineer Day & Zimmermann Engineering & Construction Company*

THE concrete cell-type bus structures which are widely used in substations and medium-capacity power plants are formed of relatively thin walls and horizontal slabs cast monolithic. Because of the thin cross-sections involved, predetermination of the mechanical strength is difficult. A "sloppy," well-puddled concrete mix is essential to assure filling the thin sections, particularly around the reinforcing steel. Even with the most thorough puddling a uniform distribution of concrete aggregates is questionable. Calculations of reinforced concrete slabs are based on definite positions for the reinforcing bars. In thin slabs a small absolute variation from the assumed position results in a large percentage change in strength. In addition, the mechanical loading due to short-circuit forces is impressed on the horizontal slabs over the restricted areas of bus support bases and the vertical compartment walls opposite these bus supports are weakened by the openings provided to permit installation and maintenance of the latter.

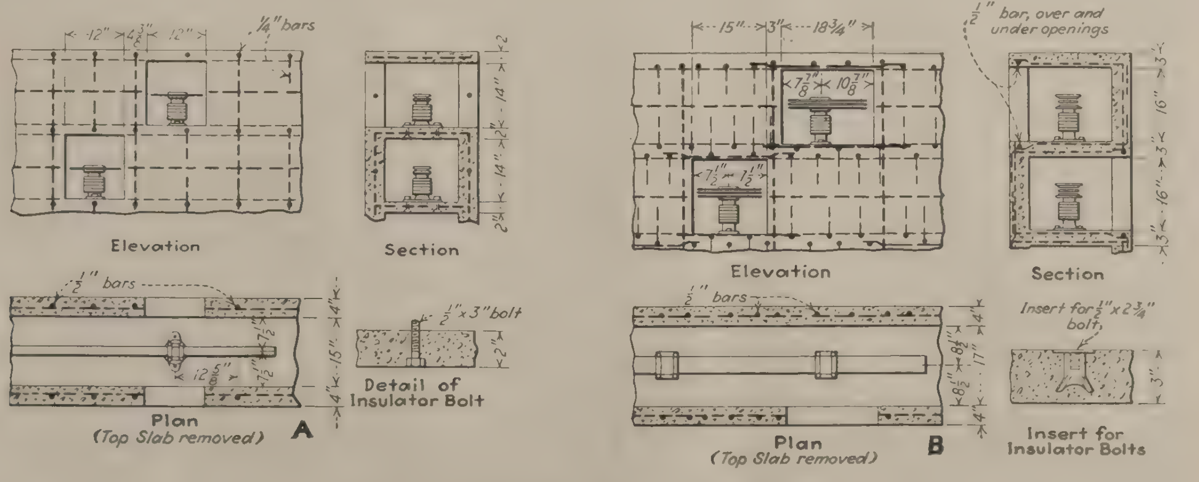


*Characteristic failures of bus structures*

Conical failures for tension (left) and compression (right) are typical of these tests.

To determine the composite results of these factors and compare two designs of cell structures typical sections were constructed and subjected to mechanical loading tests. Six sections of each type of structure were cast of 1 : 1½ : 3 concrete under conditions duplicating those obtained on a construction job. The reinforcing steel was placed and the concrete poured by field construction men, as a part of a construction job. It may be noted from the illustrations that the two types of structures differed in a number of respects.

It was anticipated that tests of these typical sections



*Sections of two types of bus structures tested*

The type A sections were constructed with 2-in. horizontal slabs, whereas the type B structures were constructed with 3-in. slabs. The differences in reinforcing steel sizes and locations are shown. The bus supports of the type A structures were held by bolts extending through the horizontal slabs with heads flush with the underside of the slab. In the type B sections the bus supports were held by means of bolts screwed into concrete inserts set in the slab. The 3-in. type B slabs permitted the use of these inserts without providing a complete metallic path through the slabs. The type A compartments were equipped with bus supports having cast iron bases, while the type B compartments had malleable iron bases. The bus supports of the type A structure were set on 4-ft. 10-in. centers, whereas those in the type B structure were on 2-ft. 9⅜-in. centers (max.)

*(a) Type A section in tension tests. (b) Type B section under compression stress*

would indicate the performance of entire structures, since the latter would consist of a succession of the test sections cast monolithic and since each section would support an identical arrangement of bus supports. It was also thought that the strength of the bottom slab of the top compartment would be typical of the two slabs below, since this slab is supported by vertical walls in the same manner as are the two lower slabs.

The application of impact to the bus support was considered as a method of test, but was abandoned in favor of slowly applied loading. While the force applied during short circuits is of the nature of an impact, the duplication of such impact was beyond the possibility of the investigation. Furthermore, progressive impact application to destruction would have produced a fatigue type of failure which would not be as informative for design purposes as failure due to slowly applied loading.

As indicated in the illustrations, the sections were supported on wooden blocks on the head of a 50,000-lb. Olsen machine. A transverse steel bar was clamped on the bus support in place of the busbars and was yoked by two steel rods to a similar bar on the movable testing head. The position of the test specimen, whether erect or inverted, was determined by the type of test desired, i.e., whether compression or tension.

The results of tension tests are summarized in Table I.

*Table I—Tension Loading Tests of Concrete Bus Compartments*

| Test Section Number | Type | Age, Days | Breaking Load, Pounds | Approximate Size of Spalled Area, Inches | Radius in Inches from Bolt or Insert Center to Edge of Spalled Area Max. | Min. | Remarks |
|---|---|---|---|---|---|---|---|
| 1 | A | 54 | 5,950 | 12 x 17 | 7 | 3 | Breaking load preceded by load of 5,130 lb., which broke bus support base. Base replaced with steel plate and failure loading applied. |
| 3 | A | 54 | 6,560 | 14 x 16 | 7 | 3 | Breaking load preceded by load of 5,660 lb., which broke bus support base. Base replaced with steel plate and failure loading applied. |
| 7 | A | 57 | 5,550 | 13 x 15 | 8 | 5 | ........ |
| 8 | A | 56 | 5,230 | 11 x 15 | 7 | 4 | ........ |
| Average | .. | .. | 5,823 | ......... | ... | .. | ........ |
| 6 | B | 49 | 12,245 | 18 x 21 | 13 | 5 | Breaking load preceded by loads of 4,570 lb., and 5,060 lb. which broke bus support porcelain. Bus support replaced by yoke and failure loading applied. |
| 4 | B | 49 | 12,535 | 18½ x 13 | 8 | 3 | Breaking load preceded by load of 8,715 lb., which deformed cross bar applying load. Bar replaced and failure loading applied. |
| 10 | B | 48 | 11,700 | 17 x 19 | 9½ | 4½ | Compartment had spalled area on under side of horizontal slab and under bus support location. Apparently did not affect strength of specimen. |
| 11 | B | 48 | 10,670 | 15½ x 16 | 8½ | 6 | ........ |
| Average | .. | .. | 11,788 | ......... | ... | .. | ........ |

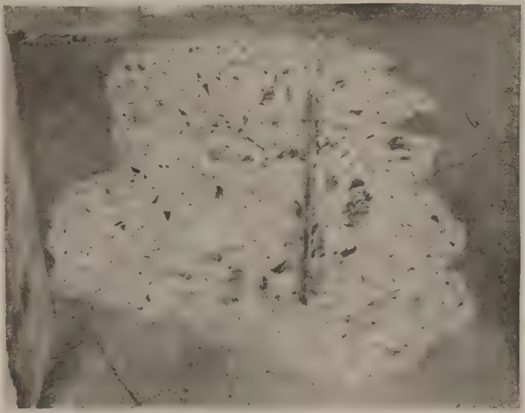
*Table II—Compression Loading Tests of Concrete Bus Compartments*

| Test Section Number | Type | Age, Days | Breaking Load, Pounds | Approximate Size of Spalled Area, Inches | Radius in Inches from Bolt or Insert Center to Edge of Spalled Area Max. | Min. | Remarks |
|---|---|---|---|---|---|---|---|
| 2 | A | 55 | 14,015 | 13 x 17 | 10 | 3 | Breaking load was preceded by loads of 10,095 lb. and 11,095 lb., which resulted in bus support failures. Bus supports replaced by steel plate of same contour as bus support base and failure loading applied. Slight cracking radially. |
| 9 | A | 56 | 11,610 | 15 x 18½ | 10 | 8½ | Radial cracking in slab and side walls. |
| Average | .. | .. | 12,813 | ......... | ... | .. | ........ |
| 5 | B | 50 | 23,550 | 16½ x 19 | 10 | 6 | Breaking load was preceded by a load of 21,415 lb., which resulted in deformation of cross bar applying load. Bar replaced and failure loading applied. |
| 12 | B | 51 | 19,420 | 17 x 21 | 12 | 9 | ........ |
| Average | .. | .. | 21,485 | ......... | ... | .. | ........ |

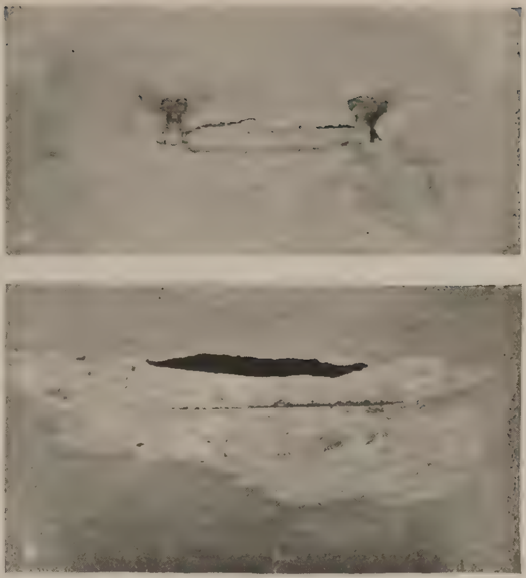
The tests of type A sections were featured by the failure of the cast-iron bases of the bus supports. It was not possible to develop the strength of the bolts as set in the slab by pulling the bus support and a heavy steel plate was therefore substituted to permit failure loading of the concrete. Typical shear and spalling and the pulling out of the bolts are shown in the accompanying illustration.

The bus supports of the type B specimens were also insufficient to pull out the inserts, but their failure occurred in the porcelain. They were replaced with a steel plate for continuance of tests. Failures of the concrete section then occurred by fracture over a conical surface.

Compression test results are summarized in Table II. Here also the cast-iron bases of the type A bus supports proved inadequate to distribute the load properly from porcelain to concrete. The deformation of the latter resulted in the breaking of two cast bases, and further tests were made by applying the load to the concrete on a steel plate having the same shape and area as the casting. Under such compression loading the type A specimens developed a failure accompanied by radial cracks in the horizontal slab. One test section developed cracking of the side walls, being the only specimen to do so in either tension or compression tests.



*Typical tension failure*
Note cavities in bolt positions

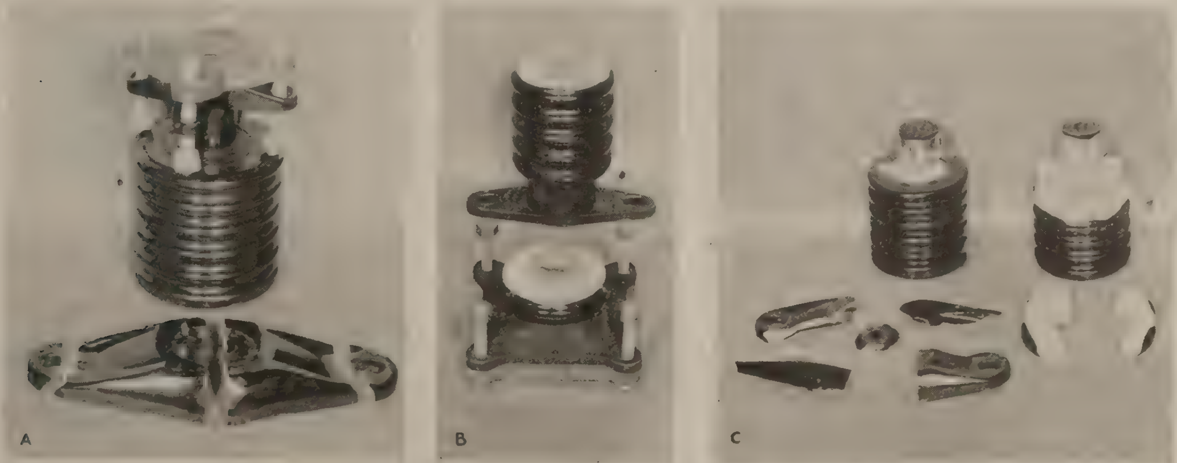


*Typical compression failure*
Conical failure is characteristic—(a) shows failure from above, (b) from below.

The type B bus supports withstood compression loading to failure of the type B test specimens, the only distress shown being a deformation of the base to conform to the contour of the bending of the concrete slab. Such deformation is of benefit rather than harm, for it results in the applied load being distributed over the area of the base. Failure of the concrete occurred by fracture over a truncated conical surface tapering out from the edge of the bus support base.

Comparison and review of these tests show the following prominent features:

1. All concrete was of good quality and there was much shear through the coarser aggregate. There was no relation apparent between the area of the spalled section and the ultimate strength of the test section. The amount of spalling was probably limited in many cases by the reinforcing steel and the vertical walls of the specimen.



*Iron bus support failures*
(a) Base casting failure in tension type A support. (b) Insulator failed in tension type B support. (c) Compression destruction of type A support.

2. The type B structure, having 3-in. horizontal slabs and using bolt inserts, is approximately twice as strong as the type A structure, which is of 2-in. horizontal slab section, using bolts set in concrete.

3. The type A design was of better balance than the type B. Any interphase short circuit causes tension on the supports of one phase. The limit of any design is therefore the tensile strength of either the bus support or its attachment to the concrete. The failure load of the type A bus support in tension is of the same order of magnitude as the failure load of its attachment to the concrete.

A much heavier bus support of more than twice the strength of the type B could be used in the type B bus structure with resultant better balance of design for the structure as a unit.

4. Failure in either type of structure due to mechanical loading of the bus supports would probably not result in failure of the side walls of the structure. Spalling and cracking of the concrete were, in all instances save one, confined to the horizontal slabs.

5. As a corollary, the cast-iron bus support bases were much inferior to the design of malleable iron, both in tension and compression loading. This fact was further checked by placing a support with cast-iron base on the smooth bed of the testing machine and loading it in compression.

In three such trials the bases broke at 17,250, 14,900 and 14,400 lb. Similar test of a type B support with malleable base produced no distress under loading of 50,000 lb.

## Modern Elevators

PRESENT tendencies in elevator design are directed toward higher intensity of service, higher quality of service, improved safety or better economy, although most improvements involve several of the desired qualities.

*Higher intensity of service* has been secured by:

New control systems using multi-voltage operation.

Joint operation of two elevators in up and down service.

Car position indicator exposing floor numbers successively.

*Higher quality of service* has been secured by:

Gearless instead of geared machines.

Automatic scheduling device to signal operators starting from terminals.

Automatic spacing device to minimize stops per car.

*Improved safety* has been secured by:

Tied-down compensator frames, which eliminate slack formation in cables under emergency stopping conditions.

Institution of slow-speed, zone, automatically controlled at terminal landings.

Improved safety gates, eliminating shearing hazards.

*Better economy in manufacture* has been secured by:

Main-motor-micro for speed control during self-leveling period, eliminating large quantities of auxiliary apparatus.

Micro-selector in machine room, eliminating leveling switch on car and cams at each floor.

Improved door hangers, minimizing friction and clearances.

# Computing Compensator Settings for Automatic Voltage Regulators

FOURTH ARTICLE

By V. W. Palen

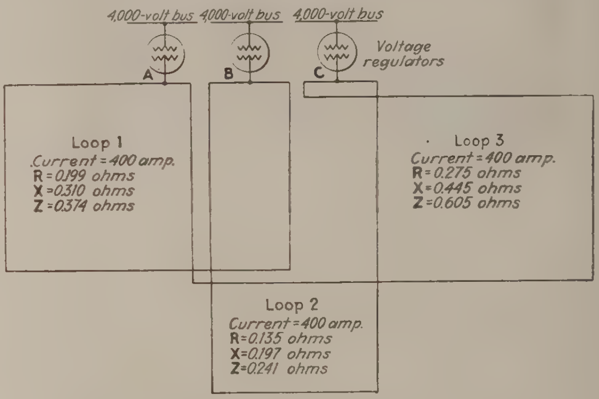
TRIPLE LOOP CIRCUITS.—The procedure outlined in previous articles for single-feed, single-loop and double-loop circuits has been tested in everyday practice and found satisfactory. For a triple loop a similar procedure may be followed. As with the other loop circuits the calculations would net a set of values thus:

*Loop 1*
Resistance drop = 3.98 volts
Reactance drop = 6.2 volts
Impedance drop = 7.48 volts

*Loop 2*
Resistance drop = 2.70 volts
Reactance drop = 3.94 volts
Impedance drop = 4.82 volts

*Loop 3*
Resistance drop = 5.50 volts
Reactance drop = 8.90 volts
Impedance drop = 12.10 volts

An examination of the accompanying illustration will disclose that *A* compensator and regulator regulate the voltage on half of loops 1 and 3. Therefore, the settings on the compensator on *A* regulator will be set for the average voltage drops for loops 1 and 3 thus:



*Triple circuit assumed for illustrative calculations*

$IR$ = (average of 3.98 and 5.50) = 4.74 volts
$IX$ = (average of 6.2 and 8.90) = 7.55 volts
$IZ$ = (average of 7.48 and 12.10) = 9.79 volts

Also, *B* regulators regulate half of loops 1 and 2. Therefore, the settings on the compensators on *B* regulators will be set for the average voltage drops for loops 1 and 2 thus:

$IR$ = (average of 3.98 and 2.70) = 3.34 volts
$IX$ = (average of 6.2 and 3.94) = 5.07 volts
$IZ$ = (average of 7.48 and 4.82) = 6.15 volts

Finally, *C* regulators regulate half of loops 2 and 3. Therefore, the settings on the compensators on *C* regulators will be set for the average voltage drops for loops 2 and 3 thus:

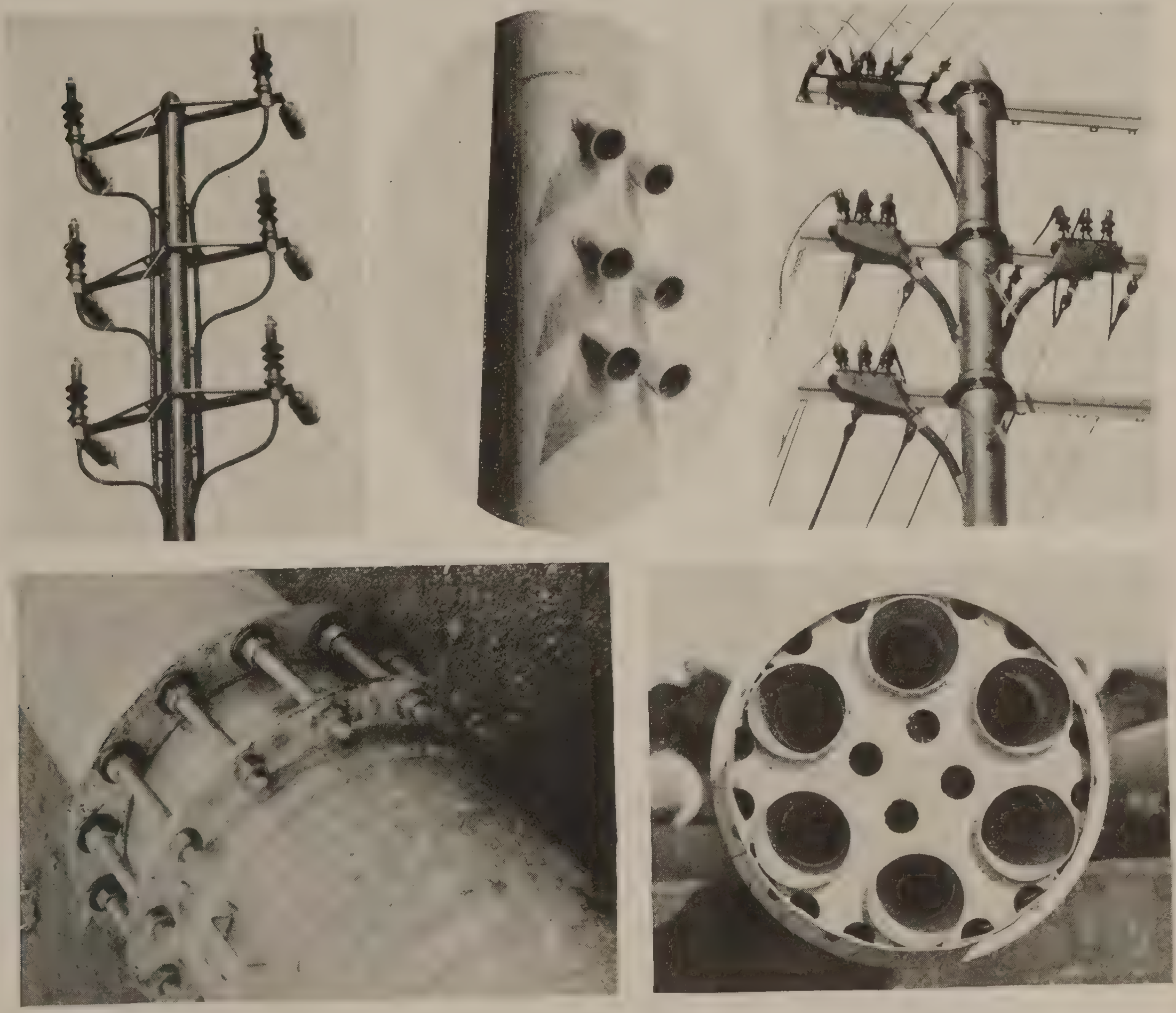
$IR$ = (average of 2.70 and 5.50) = 4.10 volts
$IX$ = (average of 3.94 and 8.90) = 6.42 volts
$IZ$ = (average of 4.82 and 12.10) = 8.46 volts

The various types of compensators and setting methods will be covered in the next and final article of this series.

# Tubular-Steel Poles for Cable Risers

By C. H. Jenkins
*Underground Engineer*
*Bureau of Power and Light, Los Angeles, Calif.*

Wood poles for cable terminal risers to overhead lines have been the source of considerable trouble and expense, due to the pole igniting when a ground occurs on a circuit at this point. Latticed steel poles with cable pipes placed inside the structure frequently have been used. They provide ample strength and are free from fire hazard, but can easily be climbed by unauthorized persons. Furthermore, the exposed conduits are rather unsightly in appearance.



*Details of tubular pole construction for overhead-underground junctions*

The pothead-to-line-conductor construction for two 33,000-volt circuits and for four feeders from a single pole is illustrated in the upper views, as are the details of the pole base through which cables are conveyed to conduit lines. The method of joining pole sections is also illustrated, as is the arrangement of cable conduits within the pole with steel diaphragm support.

Rapid increase in the number and size of distribution circuits has made it necessary to substitute some pole material which will not burn, yet will provide suitable strength and present a satisfactory appearance on the street. Believing that a tubular steel pole with cable pipes installed within the pole would best meet the requirements for strength, durability and appearance, the Bureau of Power and Light of the city of Los Angeles has purchased several taper-tube poles made by the Taper Tube Pole Company of San Francisco and erected them at cable terminals adjacent to a new class "A" distribution substation.

This station will have an ultimate capacity of 31 primary feeders, twenty street-lighting circuits and twelve 33-kv. incoming and "peddler" lines. Three-conductor, 500,000-circ.mil, 5-kv. cable is used for primary feeders, four-conductor, No. 6, 5-kv. cable for street lighting circuits, three-conductor, 400,000-circ.mil, 33-kv. cable for conduit runs and 500,000-circ.mil, single-conductor cable for cable-pole risers for the high-tension lines. The three single-conductor, 33-kv. cables are placed in one 6-in. conduit riser to reduce sheath current and voltage.

The tubular steel poles are made of No. 10 gage sheet-steel rolled into taper tubular form and butt-welded. A No. 10 gage sheet-steel diaphragm is welded to the tube near each end of all sections to hold the cable pipes rigidly in position and stiffen the pole against crushing strains. At one end of each section the cable pipes are provided with loose couplings for alignment. The poles are made in sections which are swedged together in socket formation and held rigidly by ¾-in. bolts between the flanges. The method of taking out the six 3½-in. cable pipes with 4-ft. radius bend for connecting to the conduit line at the pole base is shown.

An angle bar bent in "U" form is welded to the pole for crossarm support. Three classes of crossarm are provided, as follows: No. 1, designed for dead-ending six conductors, each with 1,800-lb. pull and of sufficient strength to resist twisting or buckling with two wires broken on each side of the pole. The arms are placed on 4-ft. centers and support flat-type potheads with cable outlet at an angle of 45 deg. A pole with three such crossarms and four circuits in place is shown. No. 2 crossarm is designed for supporting eight conductors in both buck and line arm positions. No. 3 arm is for dead-ending two 33-kv. conductors each with 1,500-lb. pull and is of sufficient strength to resist twisting or buckling with one wire broken. One pothead terminating one single-conductor, 33-kv. cable is attached to each end of each arm by means of a bracket. These arms are placed on 6-ft. centers.

| Pole No. | No. of Sections | Outside Butt Dia., In. | Outside Top Dia., In. | Length | Cable Pipes Inside Dia., In. | Cable Pipes No. | Crossarms No. 1 | Crossarms No. 2 | Crossarms No. 3 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 19¾ | 12 | 82 ft. 3 in. | 3½ | 6 | 3 | 6 | 3 |
| 2 | 3 | 17½ | 12 | 61 ft. 3 in. | 3½ | 6 | 3 | 2 | .. |
| 3 | 3 | 18½ | 12 | 70 ft. 3 in. | 3½ | 6 | 3 | 1 | 3 |
| 4 | 3 | 18¾ | 12 | 72 ft. 3 in. | 6 | 2 | .. | 1 | 3 |
| 5 | 4 | 20 | 12 | 84 ft. 3 in. | 6 | 2 | .. | 6 | 3 |
| 6 | 2 | 16¾ | 12 | 54 ft. 3 in. | 3½ | 6 | 3 | .. | .. |

All poles are set 8 ft. deep in a concrete base 1 ft. greater in diameter than the pole and 6 in. deeper. The poles are assembled in the yard, hauled by truck to location and erected with a gin pole of the ordinary type. A short gin pole is temporarily attached to the pole top to assist in drawing riser cables from the nearest manhole through the cable pipes to pothead position. The poles are head-guyed in the usual manner.

Double hot process galvanizing is applied to all poles at the factory and after erection they are painted with one coat of red lead and one coat of green pole paint to harmonize with tree foliage. A spun copper acorn is attached to the pole top to exclude moisture and provide ornamentation.

Specifications for several types of poles are given in the accompanying table.

## Restoring Service from Flooded Generators

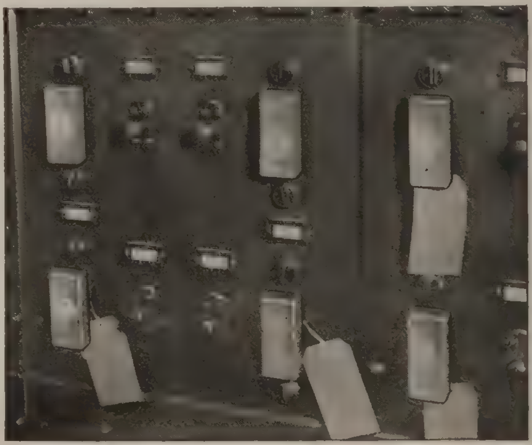
By William Wallet
*Electrical Department, Vermont Marble Company, Proctor, Vt.*

The Proctor hydro-electric station of this company presented the chief problem in service restoration when flooded last fall. The plant contains one 1,600-kw. and three 750-kw. vertical units generating at 280 volts and operating under a head of 120 ft. Following the subsidence of the flood it was found that the generating units and switchboard were almost covered with waste marble, sand and gravel. Twenty-five men worked more than three days to clear the first floor, after which a space in the cellar was cleared sufficiently to permit the installation of a large hot-air furnace built with three pipe outlets and a motor-driven fan to speed up air circulation.

Each generating unit was taken apart and the parts cleaned from sand and grit, after which it was reassembled and a temporary housing built over it to hold the heat, hot air then being circulated from the furnace piping through the under side of the machine and thence through the windings. The machine was then started, but not built up to generate. After running it 24 hours it was shut down, the temporary wooden housing set to one side and the machine blown out with compressed air at about 80 lb. pressure. The temporary house was again placed over the machine and the generator leads short-circuited at the switchboard, starting the machine and circulating full-load current. This, with the heat from the furnace, built up a temperature on the windings of about 200 deg. F., which was held for three days. A "megger" test showed 35 megohms between windings and frame, and after removing the short circuit the units were put on the line. The first machine went on the line twelve days after the flood hit the plant.

## Signal Device Promotes Safety on Circuits

An insulated detachable cover to prevent premature operation of control switches has recently been installed at the generating plant of the Salem (Mass.) Electric Lighting Company. It consists of a bakelite box with rubber extensions and slotted design which enables the device to be slipped over the switch control button, as illustrated, and hung in place as desired. Covers used to protect lines whose disconnecting switches are open or whose conductors have been grounded are painted red and those used to remind the operator that a particular switch is to be opened only after removal of the cover are painted gray. Suitable printed and symbolic designations are carried on the covers as desired. These signal devices have been patented by Allen J. Ryno, chief operator of the Salem company, and are manufactured by the States Company, Hartford, Conn.



*Device hung over control switch buttons warns against operation*

# *Effect of* Sudden Loss of Load

Voltage and frequency conditions following the sudden dropping of load on 20,000-kva. hydraulic-driven generator. Voltage may reach values detrimental to machine insulation

By C. B. HAWKINS*, S. MURRAY JONES† and O. E. CHARLTON†

TO DETERMINE the increase in voltage and speed when full load is suddenly dropped from a generator and to obtain data on the operation of an overvoltage overfrequency relay, tests were recently made by the Alabama Power Company at its Mitchell Dam plant, on the Coosa River. The overvoltage overfrequency relay used was designed to open the main field circuit and the low-tension breaker when the speed and voltage had increased to some predetermined value.

In all the tests, shown in Figs. 2 to 18 and Table I, the generator was made to carry full load at some predetermined power factor and then the load was dropped by opening either the high-tension or the low-tension breaker, depending upon the particular test being made. A six-element oscillograph recorded the increase in voltage and speed resulting from the sudden decrease in load, as well as other information pertinent to the object in view. A number of tests were made before the overvoltage overfrequency relay was put in service, giving some idea of the maximum voltage to be expected under the worst conditions (Figs. 2 to 12). The relay was then connected and the tests repeated (Figs. 13 to 18). By comparing the results of the two series of tests the effects of the relay were clearly shown.

After analyzing the results of these tests the following conclusions were formed:

1. When a generator suddenly drops its load, there is an accompanying rise in voltage, which at times may attain values sufficiently high to affect the insulation of the connected apparatus.
2. The present voltage regulator reduces the overvoltage somewhat, but is not able to prevent the voltage from rising to excessive values.
3. The power factor of the load has little effect on the total increase in voltage, but it does affect the rate of increase. When the load of low power factor is dropped from the generator, the rise in voltage will be more rapid than an equal load of higher power factor.
4. When power transformers are connected to the generator, the magnetizing current constitutes a load on the machine and tends to hold the voltage down, though this effect is not very pronounced.
5. The overvoltage overfrequency relay used did not function sufficiently fast to prevent the voltage from rising to values that might prove destructive to insulation. It was found that certain refinements in setting the relay were possible, but were unknown at the time of these tests. These refinements would probably have made the relay more definite in operation. Further tests are to be made some time in the future to clear up these points.

To obtain a complete record of the principal factors contributing to the above conclusions, tests were made under the following conditions: (*a*) Voltage regulator in service, (*b*) voltage regulator out of service, (*c*) load dropped by tripping the low-tension breaker, (*d*) load dropped by tripping the high-tension breaker and (*e*) power factor of load changed. After analyzing the results obtained from these tests, an overvoltage overfrequency relay was connected to the generator and the tests were repeated. The relay used was not a standard product, but an experimental piece of apparatus consisting of a combination of a frequency relay and an overvoltage relay. The contacts of these relays were in series, so both had to be closed before the auxiliary relay could open the generator field circuit. In the test shown in Fig. 17 the relay was operated by the overfrequency element only, whereas that shown in Fig. 18 was operated by the overvoltage element only. The relays were set to operate on 25 per cent overvoltage and 8 per cent overspeed.

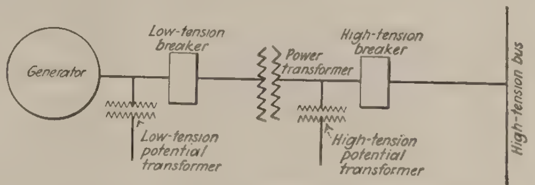


*Fig. 1—Schematic arrangement of equipment for overvoltage overfrequency tests*

The generator used in these tests is rated at 6,600 volts, 17,500 kw., at 87.5 per cent power factor (20,000 kva.) and 100 r.p.m., and was made by the General Electric Company with direct-connected exciter. This generator is driven by a 24,000-hp. Allis-Chalmers turbine designed for 100 r.p.m. at a head of 70 ft. and is controlled by an Allis-Chalmers governor operated at 180 lb. oil pressure. A standard Tirrill voltage regulator was used. The schematic diagram of test connections is shown in Fig. 1. The test results are described in detail as follows:

*Effect of the Magnetizing Current of Power Trans-*

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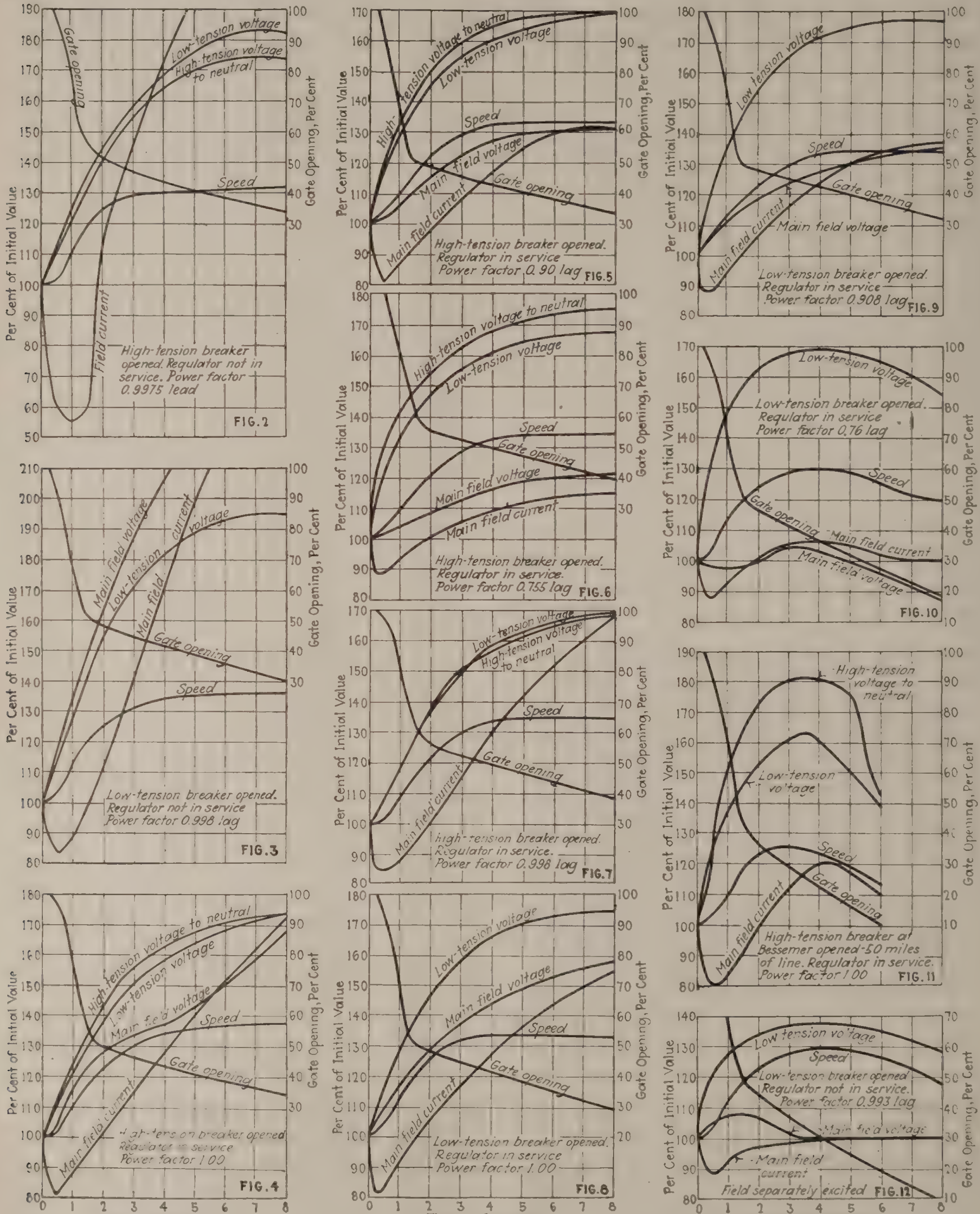
**Alabama Power Company.*
*†Southeastern Engineering Company.*

*formers.*—The maximum voltage obtained when the load is suddenly dropped from the generator depends somewhat on which oil switch operates. If the high-tension switch interrupts the load, the power transformers are left connected to the machine and the magnetizing current of these transformers becomes a load on the generator. The generator field current increases very rapidly as the impressed voltage increases. The reac-



*Figs. 2 to 12—Tests on generator under various conditions without overvoltage overfrequency relay in service*

TABLE I—INITIAL VALUES FOR OVERVOLTAGE OVERFREQUENCY TESTS

| Figure Nos. | Load on Generator, Kw. | Power Factor, Per Cent | Low-Tension Voltage | High-Tension Voltage | Main Field Voltage | Current in Main Field, Amp. | Speed, R.p.m. |
|---|---|---|---|---|---|---|---|
| Fig. 2 | 17,640 | 99.75 lead | 6,660 | 64,500 | 111 | 330 | 100 |
| Fig. 3 | 17,700 | 99.8 lag | 6,150 | ..... | 120 | 335 | 100 |
| Fig. 4 | 17,700 | 100 | 6,234 | 64,500 | 121 | 337.5 | 100 |
| Fig. 5 | 17,460 | 90 lag | 6,480 | 65,000 | 161 | 455 | 100 |
| Fig. 6 | 17,460 | 75.5 lag | 6,750 | 66,000 | 121 | 580 | 100 |
| Fig. 7 | 17,700 | 99.8 lag | 6,270 | ..... | 126 | 360 | 100 |
| Fig. 8 | 17,650 | 100 | 6,150 | ..... | 120 | 335 | 100 |
| Fig. 9 | 17,460 | 90.8 lag | 6,420 | ..... | 160 | 445 | 100 |
| Fig. 10 | 17,460 | 76 lag | 6,630 | ..... | 205 | 580 | 100 |
| Fig. 11 | 17,460 | 100 | 6,210 | 64,000 | 122 | 337.5 | 100 |
| Fig. 12 | 17,650 | 99.3 lag | 6,216 | ..... | 127 | 360 | 100 |
| Fig. 13 | 17,460 | 99.8 lag | 6,420 | ..... | ... | 352.5 | 100 |
| Fig. 14 | 17,220 | 76.5 lag | 6,870 | ..... | ... | 600 | 100 |
| Fig. 15 | 17,460 | 100 | 6,420 | 66,000 | ... | 342.5 | 100 |
| Fig. 16 | 17,300 | 75.5 lag | 6,840 | 66,300 | ... | 600 | 100 |
| Fig. 17 | 17,500 | 100 | 6,420 | ..... | ... | 250 | 100 |
| Fig. 18 | 17,350 | 100 | 6,390 | ..... | ... | 350 | 100 |

TABLE II—EFFECT OF MAGNETIZING CURRENT OF POWER TRANSFORMERS

| | Transformers With Fig. 2 | Transformers Without Fig. 3 |
|---|---|---|
| Load dropped, kw. | 17,640 | 17,700 |
| Power factor, per cent | 99.75 lead | 99.8 lag |
| Increase in low-tension voltage, per cent | 183 | 195 |
| Maximum low-tension voltage | 12,200 | 12,000 |

tion of the lagging current flowing through the generator armature tends to decrease the generator field flux somewhat and consequently to prevent the terminal voltage from rising as high as when the machine is operating at a higher lagging or a leading power factor.

The voltage rise expressed in per cent of the initial voltage, with and without the power transformers connected to the generator, is shown respectively in Figs. 2 and 3. The maximum voltage increase in each test is given in Table II. The increase in voltage as expressed in per cent of the initial value is greater when the power transformers are not connected to the generator. The reason the maximum voltages are about the same is that in the test shown in Fig. 2 the initial voltage was higher than that of the Fig. 3 test.

*Effect of Voltage Regulator.*—By comparing the curves shown in Figs. 2 and 4 and also Figs. 3 and 8 it becomes apparent that the voltage regulator does reduce the overvoltage to some extent, the per cent voltage rise with the regulator in service being less than when it is disconnected, but the curves show that the regulator alone is incapable of holding the voltage down to reasonable limits. In Fig. 3, which shows a condition in which the regulator was out of service and the current and voltage of the generator field increased approximately 150 per cent over the initial values, it would seem that the low-tension alternating-current voltage should have increased in proportion. The reason it did not is, of course, due to the generator field becoming saturated. The maximum values reached are shown in Table III. In each case, whether the high-tension or the low-tension breaker was tripped, the voltage increase in per cent of initial value was greater when the regulator was not in service. As before, the initial voltages were somewhat different, so the maximum voltages reached cannot be compared on an equal basis.

*Effect of Load Power Factor on Voltage Increase.*—Loads with low lagging power factor require stronger field excitation on the generator than high power factor loads. If the circuit is opened when the generator is carrying load at low lagging power factor, the rate of increase of the voltage will be greater than if an equal load of higher power factor were dropped. The effect of different power factors can be seen by comparing the curves for the tests shown in Figs. 4, 5 and 6, where the high-tension breaker was tripped, or in Figs. 8, 9 and 10, where the low-tension breaker interrupted the load. These data are compared in Table IV, which clearly indicates that the maximum value of the voltage increase is not affected very much by the power factor, but that the rate at which the voltage rises becomes greater as the power factor decreases.

*Effect of a Transmission Line Connected to Generator.*—The test shown in Fig. 11 was made by dropping the load from the generator under test at the Bessemer substation, leaving about 50 miles of transmission line connected to the machine. The curves show a very rapid increase in voltage and also a large maximum value. The voltage was prevented from reaching higher values because of the lightning arresters at Mitchell Dam discharging to ground. It should be noted that in this test the maximum speed was only 25 per cent above normal and this would tend to hold the voltage down, as the voltage varies approximately as the square of the speed. The high voltage reached in this test is partly produced by the charging current of the line, which is about 90 deg. ahead of the voltage, flowing through the reactance of the power transformers. This leading current at a low power factor gives a voltage rise through the transformer instead of the customary voltage drop which results from a lagging current.

*Separate Excitation.*—One test was made with the generator separately excited and without voltage regulation in service, the results being given in Fig. 12. It is obvious that under this condition the voltage increase is negligible, attaining a maximum of 138 per cent of the initial value. It is interesting to note in this connection that the voltage is approximately proportional to the speed of the generator, whereas with the direct-connected exciter the rise in voltage becomes approximately proportional to the square of the speed.

*Transients in the Generator Field Current.*—In all of the tests described above the generator field current was included on the oscillogram and from these records the

TABLE III—EFFECT OF VOLTAGE REGULATORS ON MAXIMUM VOLTAGES REACHED

| | High-Tension Breaker Tripped | | Low-Tension Breaker Tripped | |
|---|---|---|---|---|
| | Without Regulator Fig. 2 | With Regulator Fig. 4 | Without Regulator Fig. 3 | With Regulator Fig. 8 |
| Load dropped, kw. | 17,640 | 17,700 | 17,700 | 17,650 |
| Power factor, per cent | 99.75 lead | 100 | 99.8 lag | 100 |
| Increase in low-tension voltage, per cent | 183 | 173 | 195 | 175 |
| Increase in high-tension voltage, per cent | 174 | 174 | ..... | ..... |
| Maximum low-tension voltage | 12,200 | 10,800 | 12,000 | 10,770 |
| Maximum high-tension voltage | 194,000 | 194,500 | ..... | ..... |

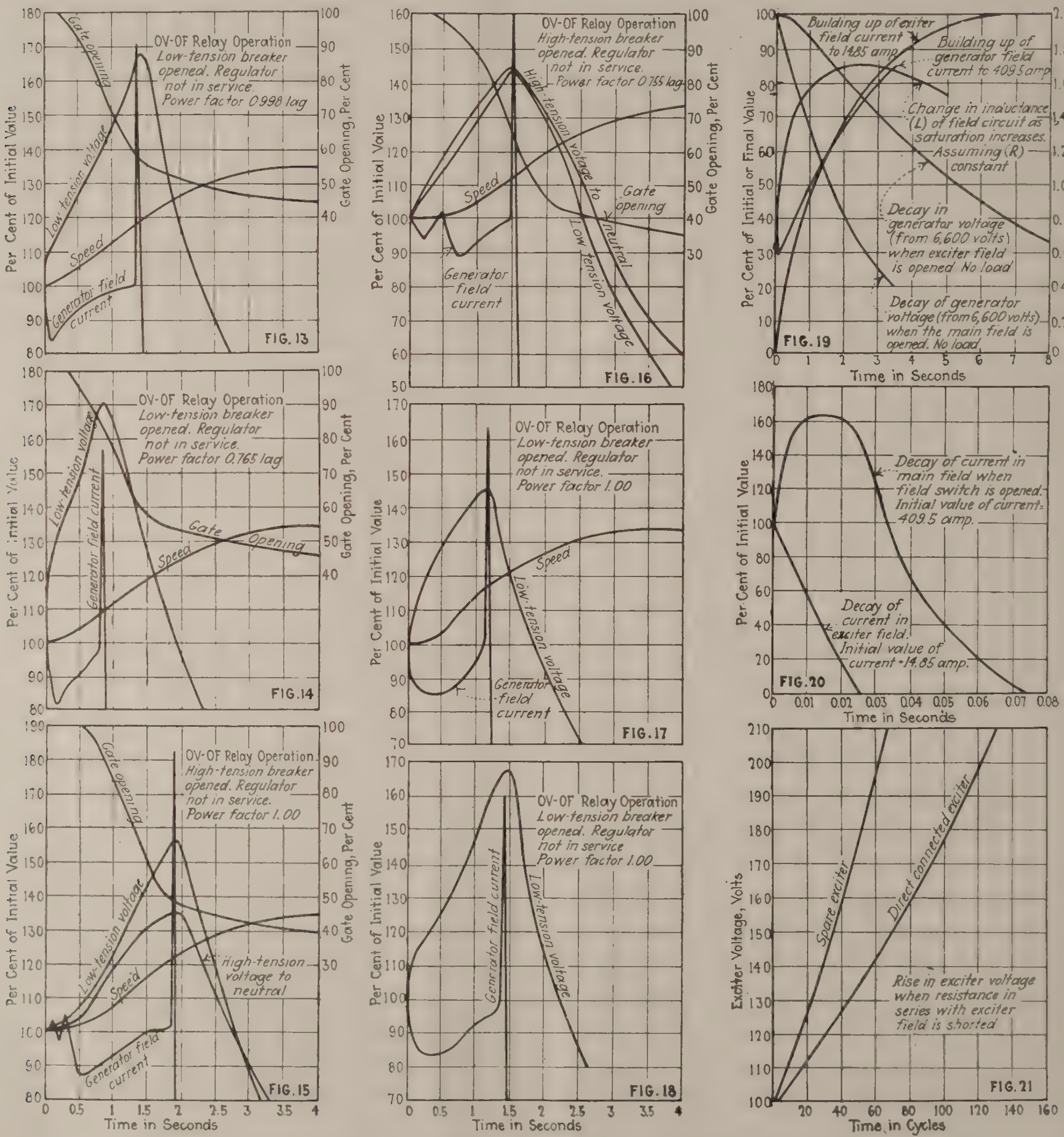
TABLE IV—EFFECT OF POWER FACTOR ON VOLTAGE INCREASE

| | High-Tension Breaker Tripped | | | Low-Tension Breaker Tripped | | |
|---|---|---|---|---|---|---|
| | Fig 4 | Fig. 5 | Fig. 6 | Fig. 8 | Fig. 9 | Fig. 10 |
| Load dropped, kw. | 17,000 | 17,460 | 17,460 | 17,650 | 17,460 | 17,460 |
| Power factor, per cent | 100 | 90* | 75.5* | 100 | 90.8* | 76* |
| Increase in low-tension voltage, per cent | 173 | 170 | 168 | 175 | 177 | 169 |
| Increase in high-tension voltage, per cent | 174 | 170 | 175 | ..... | ..... | ..... |
| Maximum low-tension voltage | 10,800 | 11,000 | 11,350 | 10,770 | 11,350 | 11,200 |
| Maximum high-tension voltage | 194,500 | 191,500 | 200,000 | ..... | ..... | ..... |
| Increase of voltage at end of one second, per cent: | | | | | | |
| Low-tension | 120 | 128 | 133 | 130 | 136 | 148.5 |
| High-tension | 123.5 | 133 | 142 | ..... | ..... | ..... |

*Lag

curves of the field current against time were plotted, these being included on Figs. 2 to 12 inclusive. A transient in the generator field must of necessity follow a sudden decrease in the generator load. The reason is as follows: In the steady state condition there is a certain air gap flux in the machine corresponding to a given load and a necessary amount of ampere turns or magnetomotive force in the field to force the flux through the magnetic path and to overcome the armature reaction due to the load current in the armature. The current in the armature suddenly decreases to zero when the load is dropped and consequently the armature reaction disappears. If we assume that the flux in the air gap cannot change suddenly (and such an assumption is not greatly in error), it becomes evident that the field magnetomotive force must decrease by an amount equal to the armature reaction expressed in ampere-turns. The only way for this to take place is for the current in the generator field to decrease. After a short interval of time the air gap flux begins to change and a new state of equilibrium is established.

*Operation of the Governor in Closing the Turbine Gates.*—In order to determine the rapidity with which the governor closed the gates a resistance unit with a sliding contact was connected mechanically to the piston rod that operates the gates. By impressing a voltage on this resistance it was possible to record on the oscillograph film the position of the piston at any time after



*Figs. 13 to 21—Tests on generator under various conditions with overvoltage. overfrequency relay in service* the load had been dropped. Curves of the gate opening plotted against time will be found in Figs. 2 to 16 inclusive. From these curves it is easy to explain why in some of the tests the speed of the generator reached a maximum and then remained constant, whereas in other tests (Figs. 10, 11 and 12) the speed reached a maximum, then began to decrease. In these three tests the gates were closed more rapidly than in the other, consequently the overspeed of the turbine diminished. In Fig. 11 a condition is shown in which the governor was operated partly by hand, which accounts for its rapid closing. The tests showed that the oil pressure in the governor has a marked effect on the speed of operation.

TABLE V—OPERATION OF OVERVOLTAGE OVERFREQUENCY RELAY

|  | Low-Tension Breaker Tripped |  | High-Tension Breaker Tripped |  |
|---|---|---|---|---|
|  | Fig. 13 | Fig. 14 | Fig. 15 | Fig. 16 |
| Load dropped, kw | 17,460 | 17,220 | 17,460 | 17,300 |
| Power factor, per cent | 100 | 76.5* | 100 | 75.5* |
| Increase in low-tension voltage, per cent | 167 | 171 | 155 | 144 |
| Increase in high-tension voltage, per cent | ..... | ..... | 135 | 144 |
| Operation of relay, per cent overspeed | 117 | 108 | 120 | 112 |
| Operation of relay, per cent overvoltage | 161 | 165 | 135 | 143 |
| Time for relay to operate, cycles | 79.5 | 47 | 111.5 | 88 |

*Lag.

The results of the previous tests show that very high voltages will be encountered when a machine suddenly loses its load. An overvoltage overfrequency relay was installed and connected in such a way that it would open the generator field switch and main generator breaker when the speed had increased 8 per cent and the voltage 25 per cent of the normal value, the relay operating at 108 r.p.m. and 8,250 volts.

*Effect of the Overvoltage Overfrequency Relay Operation.*—The operation of this relay is shown in Figs. 13 to 16 inclusive. From these test curves it is apparent that the relay did not function with sufficient speed to prevent the voltage from reaching high values. This time lag may be due to incorrect setting of the relay or to sluggishness in the relay mechanism, or both, as mentioned in the first part of this article. Since tests were made with only one setting of the relay, there are not sufficient data available to locate the trouble definitely. The voltage drops very quickly, however, as soon as the relay operates and there is only a lag of three cycles between relay closing and switch opening.

*Time of Relay Operation.*—In the above tests it was impossible to determine the sequence of operation of the overvoltage and overfrequency elements of the relay; therefore in order to get definite information on the time required for each element to operate and the actual percentage increase above normal value at which they operate, tests were made in which only one element at a time was used. The results are shown in Figs. 17 and 18, with the maximum values given in Table VI. It would seem from these tests that the overvoltage element is responsible for the delayed action of the relay.

*Decay of Generator Voltage When the Main Field Is Opened and When the Exciter Field Is Opened.*—The decay of generator voltage, plotted against time, when the main generator field is opened and when the exciter field is opened is shown in Fig. 19. In both cases the generator was running with no load and an initial terminal voltage of 6,600 volts.

*Time Constant of the Exciter Field.*—The building up and decay of the current in the exciter field are shown in Figs. 19 and 20, and from these curves the time constant was calculated. It takes about six seconds for the current to build up from zero to its final value, but when the circuit is opened, the current decreases much more quickly, because of the discharge resistance that is connected across the field when the switch opens. Since the current in the field is changing during the process of building up and dying down, the inductance of the windings will also change. A curve was plotted (Fig. 19) to show the relation of the ratio $L/R$ to time as the current builds up in the field. If the resistance ($R$) of the field is assumed to remain constant, the curve shows how the inductance ($L$) changes with time.

*Building Up and Decay of Current in the Generator Field.*—With the generator stationary, a voltage was impressed on its field by closing the field switch and an oscillogram of the building up of the current was taken. Likewise the switch was opened and an oscillogram was made of the decay of the current. The curves shown in Figs. 19 and 20 were plotted from these oscillograms. It will be noticed that when the field switch is closed the current suddenly increased to about 40 per cent of its final value and then fell off slightly before building up along an exponential curve as it should. Similarly, upon opening the field switch the current suddenly increased and then decreased very rapidly. This is caused by the discharge resistance of the generator field being momentarily connected in parallel with the field during part of the travel of the field switch; thus the discharge resistance is connected directly across the exciter terminals for a short interval of time.

*Effect of Shorting the Resistance in Series with the Exciter Field.*—The generator was running at normal speed with the field switch open. The exciter voltage was then brought up to 100 volts and the resistance in series with the exciter field short circuited. The result is depicted in Fig. 21 and shows that the exciter voltage will increase from 100 volts to 150 volts in a time interval of 70 cycles, or 1.166 seconds. The same test was made on the 1,200-r.p.m. motor-driven spare exciter and the results are also shown in Fig. 21. In this case the voltage on the spare exciter increased from 100 volts to 150 volts in 35 cycles, or 0.583 second.

TABLE VI—OPERATION OF RELAY BY ONE ELEMENT ONLY

|  | Low-Tension Breaker Tripped |  |
|---|---|---|
|  | Overfrequency Element, Fig. 17 | Overvoltage Element, Fig. 18 |
| Load dropped, kw | 17,500 | 17,350 |
| Power factor, per cent | 100 | 99.9* |
| Increase in low-tension voltage, per cent | 145 | 166 |
| Overspeed operated, per cent | 115 | ..... |
| Overvoltage operated, per cent | ..... | 160 |
| Time for relay to operate, cycles | 67 | 85.5 |

*Lag.

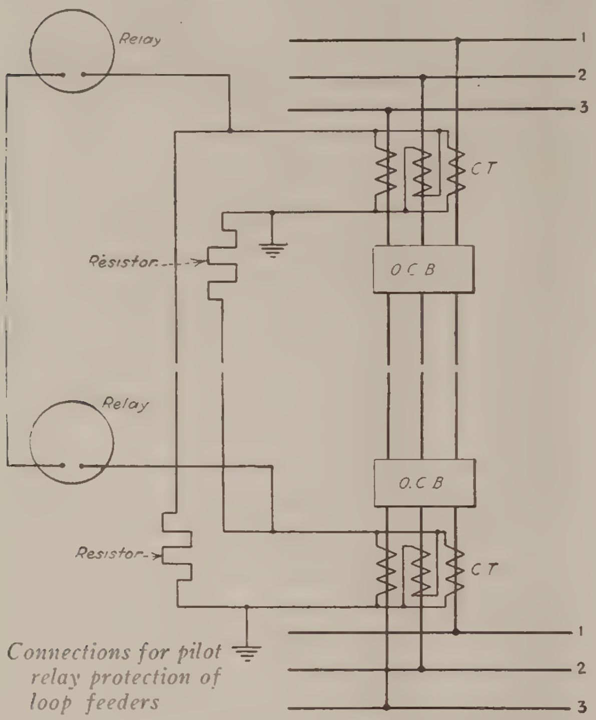
*Decay of Exciter Voltage When Exciter Field is Opened.*—In this test the generator was running at normal speed with the main field switch opened. The exciter voltage was adjusted to 250 volts, then the exciter field was opened. The time required for the exciter voltage to drop from 250 volts to 50 volts was approximately two seconds, the measurement being made with a voltmeter and stop watch.

*Effect of Main Field Series Resistance.*—With the exciter voltage held at 253 volts, all of the series resistance of the main field was cut in. The actual voltage across the generator field was thereby reduced to 75 volts, the current in the field was 220 amp. and the low-tension generator voltage was 5,700 volts.

## Pilot-Wire Relay Scheme

By Earl Baughn
*Engineering Department, Washington Water Power Company, Spokane, Wash.*

VERY often it is desirable to protect short sections of primary loop feeders by some sort of pilot wire relay scheme. A scheme suggested by W. H. Cole is described on page 661 of the Oct. 1, 1927, issue of Electrical World. A modification of this scheme has been developed for the loop feeders supplying an alternating-current network in Spokane. The connections used are shown in the accompanying diagram.



*Connections for pilot relay protection of loop feeders*

Under normal conditions there is a current flowing in the pilot wire loop equal to twice the current in any one current transformer secondary. There is no current in the relay operating circuit, since the two ends of this circuit are connected to points of equal potential. In case of a cable fault between the two groups of current transformers the current from one group is reversed so that it opposes that of the other. There are then two paths for the current, one through the relay operating circuit and the other from the ground on one current transformer group to the ground on the other. The total current divides inversely as the impedance of the two pilot wires in series to the impedance of the relay circuit including the relays.

This scheme has the advantage of eliminating the one to one ratio current transformer used by Mr. Cole, and also, by the reversal of the secondaries of one current transformer in each group, protection is secured against three-phase and single-phase short circuits, except between lines 1 and 3, in addition to line to ground faults. Three-conductor cables of the usual types as well as cable of the Hockstadter type may be used when protected with such a relay scheme. Relays should be of as small volt-ampere load as possible. In cases where the pilot wire conductors are very short it may be necessary to include small resistors of one-half to one ohm resistance to increase the impedance of the pilot wire conductors so that a larger proportion of the current will flow through the relays rather than through the ground connections upon trouble within the section of cable protected.

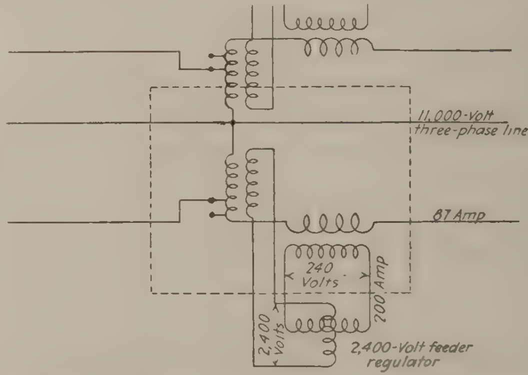
## 2,400-Volt Regulators Used for 11-Kv. Line

By E. F. Pearson
*Electrical Engineer Northwestern Electric Company, Portland, Ore.*

ADVANTAGES of using standard stock 2,400-volt feeder regulator equipment and a saving in cost over an 11,000-volt regulator led the Northwestern Electric Company to develop an ingenious scheme for regulating the voltage on an 11-kv. feeder. Two 200-amp. induction feeder regulators in conjunction with two special transformers, connected as shown in the accompanying diagram, give 10 per cent voltage regulation on an 11-kv., three-phase line.

Special four-winding transformers were built for the purpose by the Westinghouse Electric & Manufacturing Company. Two independent transformers contained in one case were placed on the same core. One is a series transformer with its primary excited from the 2,400-volt regulator and its secondary in series with the 11-kv. line. The other is a transformer with a tapped 11,000-volt primary winding to give a fixed boost by auto-transformer action and a 2,400-volt secondary winding to excite the regulators.

In the first installation made the regulator-exciting transformer was connected to give a fixed boost of 5 per cent. With this connection the regulator will buck the voltage 5 per cent to offset the 5 per cent fixed boost at light loads, so that the 11-kv. feeder voltage will be that normally impressed at the distant substation. At times of heavy load the boost of the regulator is added to the fixed boost, giving a total boost of 10 per cent. Any other combination of boost and buck may be had by selecting other taps on the auto-transformer winding.



*Four-winding transformer and 2,400-volt regulator used on 11,000-volt line*

A study of the problem when the scheme was first considered indicates that two single-phase regulating units, as described, would be preferable to a special three-phase transformer and a three-phase, 2,400-volt regulator. In considering this manner of regulation it was at first thought that there might be trouble with harmonic voltages, but this did not prove to be the case.

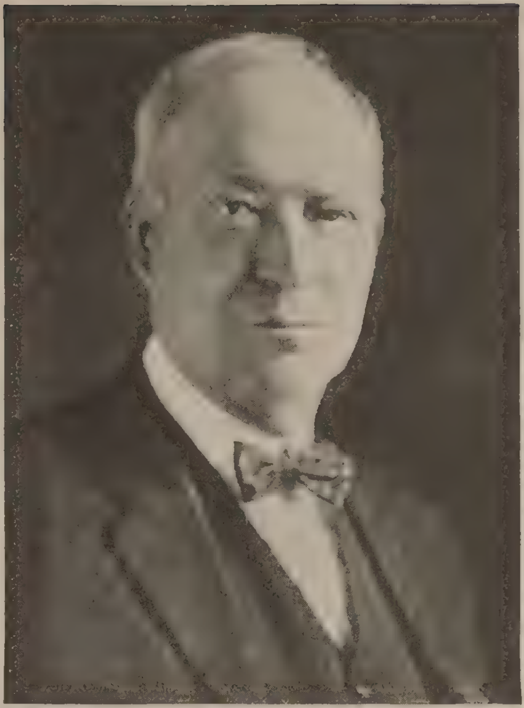
# Financial Set-up Simplified

### Subsidiaries of Buffalo, Niagara & Eastern system lose their identity in merger with the parent company

*Based on an Interview with*

F. D. COREY

*President Buffalo, Niagara & Eastern Power Corporation*



*F. D. Corey*

CONSOLIDATION or merger programs have been adopted by a number of the leading public utilities in recent months for materially simplifying their financial structures. Not infrequently existing franchises or the presence of uncallable securities have prevented a complete consummation of such programs. In the case of one representative company, the Buffalo, Niagara & Eastern Power Corporation, and its subsidiary corporations, engaged in the electrical business in the State of New York, the simplification process is complete and far reaching. The plan contemplates the consolidation into a single operating company of the Buffalo, Niagara & Eastern Power Corporation and its subsidiary corporations engaged in the electrical business in the State of New York, President F. D. Corey told a representative of the ELECTRICAL WORLD.

This unification into a single company presents less difficulties than many of the other power systems. The parent company as at present constituted is the holding company and owns practically all of the common stock of the subsidiaries. Furthermore, the preferred issues of the subsidiaries have been called and no restrictions or limitations appear to stand in the way of a complete consolidation of all of the above-mentioned companies. It is urged, and may be reasonably expected, that this unification or consolidation into a single operating company will reduce overhead very materially and result in a more economical and efficient operation of the properties. It is hoped that the unification process will be consummated at or near the end of the present calendar year.

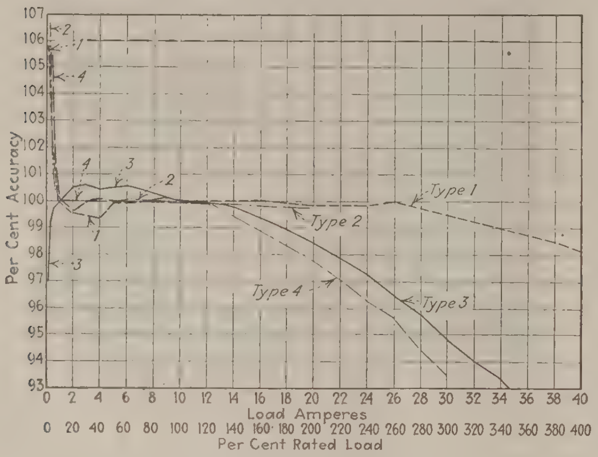
The first step taken in the proposed unification and reorganization plan was the authorization of an issue of 500,000 shares of first preferred stock without par value of the Buffalo, Niagara & Eastern Power Corporation. This step was consummated on April 2, 1928. Three hundred and fifty thousand shares of this issue will be used for the purpose of acquiring by exchange, or providing funds for the redemption of, the existing preferred stocks of the subsidiary companies. Such issues include 680,724 shares of preferred stock of the Niagara Falls Power Company, 497,785 shares of Niagara, Lockport & Ontario Power Company preferred stock and 4,568 shares of preferred A and 1,207 shares of preferred B stock of the Tonawanda Power Company. When the plan is completed the single company will be obligated for the entire funded indebtednesses of the group consolidated.

The reduction in overhead cost and the advantages accruing from centralized management need no special emphasis. It is obvious that a very substantial annual reduction in operating costs will be made. The actual saving in dividend charges will also be substantial. In the case of the Niagara Falls Power Company the present preferred issue is a 7 per cent one; the present Niagara, Lockport & Ontario Power company preferred issue is 6.4 per cent, and of the Tonawanda Power Company issues one is 7 per cent and the other is 6 per cent. Since the new issue is at the rate of $5 per share per annum, it is apparent that the actual money saving will be quite substantial.

In so far as the shares, or proceeds of shares, of first preferred stock are used for the acquisition or redemption of these subsidiary preferred stocks, their issue will somewhat increase the liquidation value of the securities which are senior to existing classes of stock of the corporation. At the same time it will materially increase the earnings available for dividends on such existing classes of stock and thus improve their position. The offer of an exchange of shares of the first preferred stock for outstanding shares of the subsidiary preferred stocks that has been made to the holders thereof enables them to receive an amount equal to the retirement or redemption price in shares of the new first preferred stock at the price of $95 per share. The portion of the 350,000 shares of first preferred stock not taken by exchange will be sold to provide funds to enable the subsidiary companies to retire or redeem their said preferred stocks at the retirement or redemption price thereof. Such retirement or redemption should be completed by June 30, 1928. From the foregoing it will appear that already substantial progress has been made in the carrying out of the program of unification and consolidation.

# Watt-Hour Meter Performance Improved with Low-Speed Elements

As a result of impartial tests with four types of watt-hour meters the load characteristic curves for sixteen instruments are represented in the accompanying figure. This information was presented by W. B. Brown, New Orleans Public Service, Inc., at the eighth annual convention of the Southwestern Geographic Division of the National Electric Light Association. Type 1 represents a low-speed, high-torque meter. Type 2 is a high-torque meter but a high-speed characteristic impairs its accuracy. Type 3 is a high-speed device rotating 100 per cent faster than type 1. Type 4 has a speed midway between that of 2 and 3. The most interesting feature of type 1 is that from approximately 4½ per cent rated load to 400 per cent rated load the meter registers within a limit of 2 per cent of perfect accuracy. This indicates a better development of the low-speed, high-torque principle which approaches the ideal condition of the 100 per cent performance curve



*Comparative performance of single-phase, two-wire, watt-hour meters*

# Remodeled Home Lighting Equal to Several Average Homes

By M. Luckiesh

*Director Lighting Research Laboratory, National Lamp Works, Nela Park, Cleveland*

The old houses needing remodeling have received little attention during relighting and rewiring campaigns. Perhaps it has not been generally appreciated that several million such houses exist.

Recognizing the possibilities in increasing the resale value and in increasing the comfort and convenience in these old houses by a moderate expenditure, *Household Magazine* sponsored the remodeling of a typical old house in Dixon, Ill., and we specified the wiring and lighting equipment.

This house was wired and equipped for a few hundred dollars. It was originally an eight-room house and typical of several millions of old houses in this country. No shade worthy of the term was found in it. The old and new equipment are listed in the following table:

| | Before Remodeling | After Remodeling |
|---|---|---|
| Convenience outlets | 0 | 24 |
| Wall brackets | 0 | 7 |
| Portable lamps | .. | 14 |
| Ceiling fixtures | 2 | 14 |
| Drop cords | 7 | 0 |
| Tungsten lamps | 11 | 69 |
| Connected load (watts) | 350 | 3,670 |
| Wiring outlets | 8 | 69 |

The remodeling of one such "old house" is the equivalent of adding several average homes (6½ rooms) to the central-station lines, as indicated below:

| | Remodeled Home | Average Home |
|---|---|---|
| Convenience outlets | 24 | 4 |
| Portable lamps | 14 | 3 |
| Utility brackets | 7 | 4 |
| Ceiling fixtures | 14 | 9 |
| Tungsten lamps | 69 | 27 |
| Connected load (watts) | 3,670 | 1,000 |

This is just the beginning of an activity which will prove profitable to all concerned. It will mean, to the householder, a home in exchange for a house and a few hundred dollars. It will mean increased lamp, fixture, wiring and energy sales to those concerned.

# Varnished Metal Baked at 2.4 Cents per 100 Lb.

"Our total cost for electric baking, 2.4 cents per 100 lb. of metal, is so low that we would not consider using gas or oil ovens with their increased fire hazard," states W. C. Kenney, president of the Kenney Manufacturing Company, Auburn, R. I., in connection with operating results obtained from an electric oven installation designed by C. I. Hayes, Providence, R. I. The above cost includes overhead. Two 30-kw. ovens are in service in this plant, which uses them in baking lacquer on tin plate employed in making curtain rods. The operating schedule calls for a one-hour bake at 250 deg. F. The ovens are operated single phase, but can be run on three-phase circuits if desired. The Kenney company further states that it finds no variation in the color of the work turned out, which means that every bake is the same and the temperature uniform throughout the oven.

*Uniform results and low costs led to purchase of duplicate oven*

# The Parable of the Range in the Parlor

A true story that has led to the standardization of heavier home services in many cities

By Earl Whitehorne

ONCE upon a time a certain salesman called upon the general manager of a certain power company. He knew him well. and when he came in the G. M. shut the door and began to tear his hair and curse the gas company. It was a sad, sad story he had to tell.

It seems that this general manager six months ago, in a sparkling moment, had one day in a much-advertised contest given away to a fortunate customer one electric range. It was a beautiful big range, replete with hot and cold folding doors, gold fingernails and all the latest improvements. It was delivered to the modest home of one John Doe and deposited in the parlor—for there was no room in the kitchen.

Now John Doe was delighted and so was Jenny and so were little Jack and the baby to have possession of this lovely thing. And John immediately sent for an electrical contractor to see about getting this fine and noble cook stove to work. The contractor found, of course, that the wiring in the little home of the Does would not carry a range and figured out an estimate on running a new service, a range circuit, installing the necessary switches, and so forth. The cost would be $65, he told John.

And then John said, "Why, what is all this $65 for?"

The contractor explained that John's service was inadequate. He had ¾-in. conduit, two No. 10 wires and a 30-amp. meter service switch. The first thing the contractor would have to do would be to tear out this old service and in its place install 1¼-in. conduit, three No. 6 wires and a 60-amp. meter service switch, and then run wires from the service up to the kitchen. The big cost of the installation would be the meter service.

"Well," John said, "I can't understand why big enough service wasn't put in at the time the house was built."

The contractor said, "Well, you're right. If it had been done then it would only have cost you around $15 instead of $65 to connect this range up now."

The range continued to encumber the parlor. This is a true story and the facts must be faced.

Now there came one evening to the home of the Does two friends to call. And the man friend said to John, "What's that there in the corner?"

"It's an electric range," said John, and he told them the wonderful story of how they won this hifalutin' and expensive luxury in a contest.

"Well, what's it for?" asked the friend.

"Why, to cook with," answered John.

"Well, what's it doing in here?" exclaimed the friend. "Why don't you put it in the kitchen and use it?" And then Jenny Doe explained, as wives will. They couldn't afford to rewire their house in order to connect it. Maybe they couldn't afford to use it. But they had it.

Well, to cut a long tale short, they all went out into the kitchen to look at the place where it might be put—as people do—and there was the old bedraggled gas range. And then the friend gave birth to an idea.

"Why don't you see if you can't exchange it for a new gas range?" said he. That was an exciting moment. So it was when the man came from the gas company. He also had an idea. Of course, they were not in the electric range business, but why did the Does want to fool with an electric stove that would ruin them if they ever tried to cook on it. Let's go right down and see some nice new gas ranges. Now here's this bee-utiful new gas cabinet range with extra double X enamel and nickel knuckles. It costs $150, but we will deliver it to your house and connect it up absolutely without charge and cart away your old black gas range and remove your despicable $350 electric range right out of the parlor. Who wants a range in the parlor anyhow? The idea! Thus the salesman.

And that is just what happened. And then next week in the big front window of the gas company was an interesting exhibit. A large gray electric range—in a gas window, mind you—and there was a great placard that read—"John Doe won this electric range in a contest. It cost him nothing. But he found that it would cost so much to have it wired up and then to use it that he came down here and bought a No. 17 Young Bride's Delight and asked us to take this off his hands"—or words to that effect.

And the general manager of the power company threatened and swore. And his friend the salesman said, "Wait a minute, I know the gas man. Let me go and see if I can't straighten it out. And he went and he did.

### Service Inadequacy

And then this salesman got to thinking and he went back to his friend the general manager of the power company and told him that the fatal electric range was no more in the gas office window. And he asked him a question. "Why is it," he said, "that this kind of thing can happen, that a man can win a beautiful electric range and take it home delighted with it and then not be able to use it and finally throw it out and pay his fuel money to the gas company? What's wrong with us in the electrical industry?" And then he told him.

"Did it ever occur to you," he asked the G.M., "that through the 40 years we electrical men have been connecting houses to the power systems of America—until we've got some seventeen million and a half—that in practically every house we have deliberately blocked our future market? Consider these four things:

1. When the gas company takes on a customer it installs a service and a meter. In the beginning there may be just a small range in the kitchen. But later if the customer decides to have a gas water heater or a gas radiator he simply installs it and connects it. The meter and the service are adequate.
2. When the water company runs a service to a house and sets a meter there may be only one bathroom and a kitchen sink. But

later if the family wants two more baths and a downstairs toilet there is no trouble about it. The service and the meter are ready. There is no need to go to the city for a permit and to pay for a bigger main and a more costly service. You use the water that you want.

3. And just so, when you have a telephone put in, your idea is that you desire to talk to other people in your town or in a nearby town or city. But suppose you wish to call Chicago, or New York, or San Francisco, or even London, are you compelled to ask the company for a different instrument, a bigger service and a special preparation for this broader, unexpected use of your telephone? You are not. You take the receiver down and just say, "Give me Chicago 41144," and you get it.

4. But when you apply for our electric service, your home is wired and you make application to the power company. The contractor installs a 30-amp. service entrance switch. The utility sets a 15-amp. meter, perhaps. Everything is lovely—until some day you and your wife decide to cook electrically. And then you find that though you can have plenty of gas for a water heater, or plenty of water for another bathroom or can talk to Florida through the same telephone you had put in to chatter round the town, when it comes to electricity all is very different. For the great electrical industry is not accustomed to have people ask suddenly to use more service than they expected. In fact, the great electrical industry hasn't been organized with any such idea in mind.

"And so in all America any large additional use of electric service is barred because the service arrangements and the meter, having no imagination of their own, have not expected it and are not ready. And if John Doe or Mrs. Mary Brady want to use an electric range they must call for a contractor and rewire their house, and put in heavier copper up to the range. For the electrical industry gives warning that it permits no man or woman to change his or her mind and cook by electricity unless he or she pays perhaps $40, or in some towns $90 or more, to change the wiring. It has never occurred to electrical men that the service entrance might be made ready in advance."

### Better Standard

That's what the salesman said. And the general manager thought a while and he said, "I guess you're right. I'd never thought of it before."

And then the salesman said, "Why don't we put an end to this condition in this town by standardizing at least on a 60-amp. service entrance so when somebody wants to use a range, at least the service will be ready, and there will only be a very small expense to run a circuit to the kitchen?"

And the general manager agreed and they called a meeting of all the local contractors and the inspectors and everybody interested and before long there was established in that city a new ruling that has standardized the 60-amp. service capacity—ready to serve.

And filled with zeal from this experience, this salesman has been preaching this gospel in other cities and getting other groups together, and out of this work has come a movement. The idea has been planted in many minds and it looks as though in many cities they are going to tear down this old barrier to the increased use of electricity by standardizing on a minimum service capacity of three No. 6 wires and a 60-amp. service switch on all services in their jurisdiction. At the present time in Grand Rapids and Lansing, Mich., they now have rulings of this nature in effect. A letter which I received recently from a Grand Rapids electrical man said: "I want to add that our 60-amp. rule is working out fine and every one is satisfied."

But it has not been easy. In some sections there is the most determined opposition on the part of the power companies. It has never been done. It is not necessary. People are not using ranges. It will make house wiring more expensive. These and a dozen other reasons are thrown up. But none of them can stand against the cold logic that bids the electrical industry remove these barriers that now prevent the greater use of electricity for cooking and for water heating.

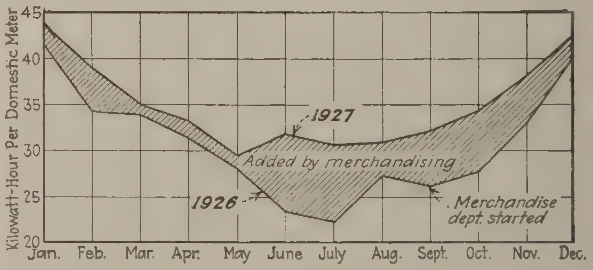
It is about time that we exposed ourselves to the possibility that some day the Johns and Marys in these houses will desire and have the right to cook and heat their water electrically. Forethought and preparation are highly regarded in most instances. Must the electrical industry deny itself the opportunity to profit by this good old axiom in so many homes? Is our vaunted readiness to serve to be so easily confounded?

No. It is high time for us in the electrical industry to join this adequate service movement and begin automatically to provide our customers with an adequate service when a home is built or a building is wired. Then there won't be any more ranges reposing in the parlors.

## Revenue per Meter Increased by Merchandising

THAT the kilowatt-hour consumption and revenue per domestic customer is increased directly as the result of efforts on merchandising is shown in the experience of the Southwestern Gas & Electric Company, of which Edwin W. Vennard is general commercial manager. This company is a firm believer in concentrated merchandising activities because it has followed closely its effect upon the residential use of energy in the towns served and can see the concrete benefits in increased domestic revenue.

The accompanying chart shows the increase in the domestic kilowatt-hour consumption for 1927 over 1926 in Shreveport, La., which is the largest community served by the company. In 1926 the average consumption per meter per month varied from 42 kw.-hr. in January down to approximately 22 kw.-hr. in the summer time. In September, 1926, a merchandise department was installed in Shreveport and aggressive appliance selling was commenced. Results have been most gratifying, as shown by the increase of 7½ kw.-hr. per domestic meter in 1927 over 1926. The two curves indicate this very clearly, particularly the increases during the summer months following a very active campaign on electric fans. Based on an average rate of 7½ cents per kilowatt-hour the revenue increase from 12,000 meters in July, 1927, was approximately $6,800.



*Effect of merchandising upon kilowatt-hour consumption per domestic meter*

The energy consumption in July, 1927, increased 7½ kw.-hr. per meter over July, 1926. Based on 7½ cents per kilowatt-hour, the total revenue increase for 12,000 meters was $6,800.

*Variable speed motors increase paper cutter output 33⅓ per cent*

# Paper-Mill Motorization

## *Improves Production and Quality*

Keen competition has made it necessary to devise new ways of automatically controlling product and cost of making it

By R. S. Lowry
*Formerly Electrical Engineer Champion Coated Paper Company,*
*Now Chief Engineer Ingalls Stone Company, Bedford, Ind.*

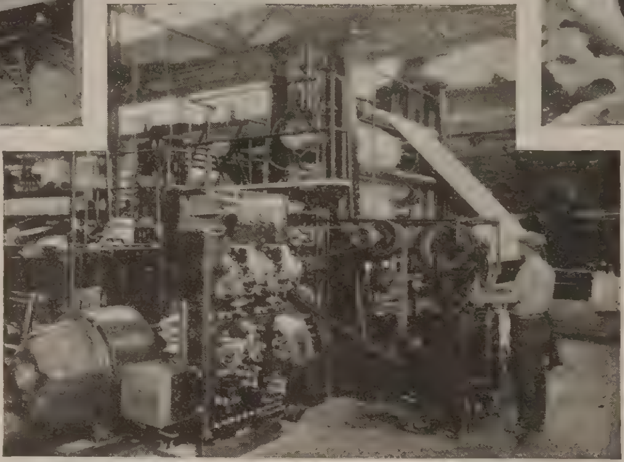
MANY changes have been made in paper-mill machines and in the method of driving and controlling them which tend to take much of the human element out of paper making. It is this human factor which interferes to a large degree with the production of a uniform quality and which also tends to make for varying costs in the production of the same grade of paper over long periods of time. Although some human supervision will always be needed, "feel" and sight enter so much into the making of paper, even at the present time, that uniformity of quality is hard to guarantee without considerable "waste" and time loss after repeated trials to meet certain specifications. The use of various meters is helping to eliminate what might be termed guesswork. They determine the quality of the stock and the ingredients which go into the product, giving the same results regardless of who is observing readings.

Proper motorization of individual machines not only tends to save power but places machines so perfectly under the control of the operator that he is able to obtain results not possible with other methods of driving.

Stock pumps driven by motors may actually affect in an indirect way the quality of the stock handled, for it is possible to vary the speed of the motor to suit the amount of stock to be delivered to the machine and thus reduce the amount returned to chests or agitators. The circulating of an unnecessary amount of stock besides wasting power has a deleterious effect on the stock. In many cases the pump may actually be shut down at times with resultant savings and benefit to stock. By placing an ammeter on the pump motor it is possible to tell the condition of the pump and the piping system and thus foresee trouble which might later interfere seriously with production.

Motorization of the beater engines has taken a great amount of the human element out of paper making. A motor on each beater makes for greater flexibility, saves power and might almost be considered an absolute necessity if it is desired to know exactly what goes on in the beater. A meter will tell very closely how "hard the roll is on the plate." The exact pressure cannot be told by sound. The accompanying chart serves to illustrate how far wrong a beaterman may be in attempting to set the roll by sound.

A beater roll which rests on the bedplate too firmly will not give as good results, so far as treatment of the stock is concerned, as one which rubs the plate firmly but allows the bearings to take part of the weight of the roll. Motorization tends to check overfurnishing of the beater or too great a change in stock consistency. Overfurnishing of the beater prevents proper circula-



*Top, left — Direct-current motors on platers double output*

*Top, right — Sectional drive of book paper machines*

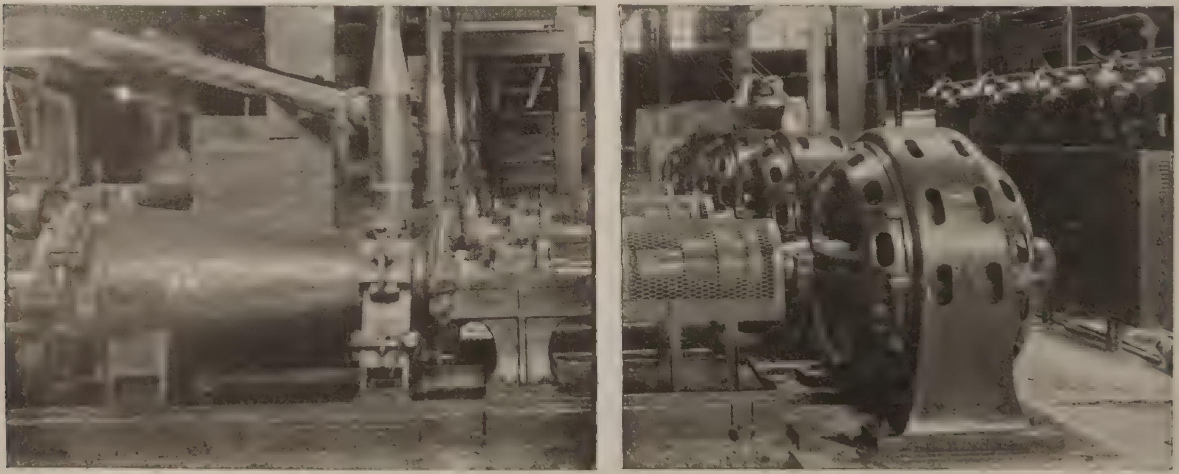
*At left—Super-calender driven by single direct-current motor allows high speeds*

tion of stock with consequent heating and non-uniformity of treatment.

Probably no machine in the paper mill has a greater influence on the power bill than the beater. It can be considered as an enormous brake in the hands of men not greatly interested in saving power. Even motors 100 per cent larger than necessary for proper beating can easily be stalled by a careless beaterman unless the control is equipped with proper protective apparatus. Here is where the motor with its meters proves valuable.

The Jordan engine has lent itself admirably to motorization and here the quality of stock is also affected by the method of drive. This is an ideal application for the synchronous motor, which holds the Jordan absolutely to one speed for all loads and insures uniform treatment of the fibers for any setting of the plug. A wattmeter indicates the pressure of plug against shell and much more accurately than depending on sound. A badly worn plug or shell will cause the power to mount high and the relays may even operate to remove the motor from the line. When this condition of plug and shell exists the stock will probably not be "short" enough and the meter indications are proof positive of what the trouble is.

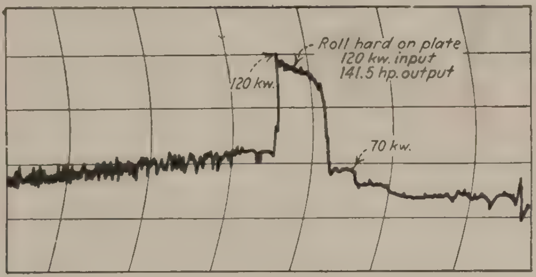
Sectional drive of paper machines is now out of the experimental stage and here the electric motor performs admirably to improve the quantity and quality of the output. The advantages of the sectional drive are numerous and in some respects revolutionary. Due to smooth starting and running and to the fact that at all times the amount of pull on the "wire" of the Fourdrinier is accurately known from meter indications the life of the wire will often be doubled or trebled. Should the stock in the wire be too "slow" or contain too much water, necessitating too high a vacuum or too many "flat boxes," the meter on the motor will indicate an abnormal



*Battery of four Jordans driven by synchronous motors* load. Conversely, the above condition would be indicated by an abnormal load on the motor. The "draw" between the various sections can be accurately adjusted and also can be calculated from meter readings. At the dry end of the machine the paper has its maximum strength in tension. It is frequently a question of dispute between machine tenders whether the draw is right between the last drier and first calender sections. It seems that no two men judge alike, but a glance at the meters on a sectional drive will settle the dispute.

The writer recollects a case where the paper was snapping off at the first calender. By quickly taking meter readings and calculating the horsepower being transmitted by the sheet and getting it down to pounds pull it was found the paper was actually under a tension of 130 lb. per foot of width, which was nearly double the required breaking strength for the grade.

Separate motors on each section of a paper machine also segregate bearing and other troubles causing abnormal loads. As an illustration one machine normally required 70 amp. on the first drier section. One day the load increased to 75 amp. and on the following day, which happened to be Saturday, the ampere load had increased to 80. Converted into horsepower this increase in amperage was equivalent to only about 2 hp. On Sunday morning, with the machine down, each bearing on the first drier section was carefully examined. On the back side of the machine on one of the drier rolls, where it was impossible to get at the bearing with the machine running, a bearing was found entirely lacking oil. The bearing and journal had not been cut as the meters, having shown up trouble with such a small increase in power, had made it possible to locate the trouble before any damage was done. With other types of drive the trouble would hardly have been located until the bearing smoked, which might possibly have meant a shutdown and attendant loss of production.



*Guesswork expensive in beater operation*

After power readings had been taken of the beater and the roll setting pronounced right to give the desired results the roll was raised and the beaterman asked to again set the roll at the same point. With the correct setting the motor was taking only about 70 kw., while after resetting the roll the motor pulled 120 kw., or an overload of 71 per cent.

Super-calenders driven from line shafts are far out of date and unsatisfactory. Often the breaking of the sheet on one calender will cause the paper to snap off on one or more of the other calenders operated from the same line shaft. Speeds as high as 1,000 ft. per minute are now attained by proper motorization. Needless to say, the calender must be under perfect control at this speed or should the paper break there would be a great amount of waste and the cotton or fiber rolls of the stack might be damaged.

With a calender drive lately developed it is possible to stop the stacks within 10 ft. of paper or before a "tag end" can enter the stack, and this from a speed of 1,000 ft. per minute. This higher speed means an increase in output of 60 per cent to 75 per cent over line-shaft drive or even some of the old types of motor drive. The adjustable speed motor allowing a range in speed from 30 ft. per minute to 1,000 or more feet per minute permits the operator to run the calender at the speed best suiting the grade of paper. Furthermore, waste, due to breaks, can be practically eliminated.

### PLATER ELECTRIFICATION SPEEDS PRODUCTION

Probably the most startling effect of motorization on production occurs in electrifying a plater. This machine consists of two chilled rolls which are caused to run alternately forward and backward by the driving mechanism. In the case of a motor-driven machine the motor is simply reversed after being "plugged." Before passing through the plater rolls the sheets of paper or cardboard are placed between alternate sheets of zinc in stacks ranging from about 1 in. to several inches in height. This stack is then passed back and forth between the rolls under enormous pressure, the zinc sheets imparting a special finish to the cardboard.

With the original line-shaft drive the operator was able to keep only one crew of three girls busy stacking and unstacking the sheets. The motor drive and its control speeded up the machine to such an extent that another crew of girls was placed at the operator's right. The output was doubled, or, in other words, one machine did the work of two.

Paper cutters run by adjustable-speed motors with push-button control will immediately show an increase of output of from 25 per cent to 33⅓ per cent, depending on the operator. Where a number of cutters side by side have been properly motorized the factor of rivalry between workmen enters in so strongly that the increase in output is often amazing. Each operator is interested in seeing his or her pile of paper grow faster than his neighbors' and new interest is taken in the work. Certainly there is no better way in the world of getting an increase in output. The process is automatic.

This is the age of speed and, given the correct equipment, the workman carries the tendency right to his work and enjoys it to the mutual benefit of himself and his employer. With correct equipment the workman produces more with the same or less energy expended and it has not cost him anything. He is better off and so is the industry.

## A Freak Cause of Service Outage

THE list of freak causes of trouble on electric systems continues to grow. The switch on a 4,800-volt power line of a large Middle West company opened automatically at 4:32 one morning recently and service on the line was interrupted for three minutes. Two phases were found burned open and the third conductor badly damaged at the trainer leads to a transformer bank serving an industrial customer. Temporary repairs restored service to this customer at 6:55 a.m. The trouble later was found to be due to a felt ball about 12 in. in diameter which had been used by workmen on a job in the vicinity for a game of basketball, probably during their noon hour, the loops to the transformer being used as a basket. The ball was left lying in the loops, presumably for several days, and, becoming rain-soaked, caused an arc-over between two leads, burning them open. The wire was No. 00, rubber covered.

# Trend of Electrical and General Industry Compared

A COMPARISON of the viewpoint of executives of the electrical industry and executives of industry in general is shown in the accompanying tabulation. In a study to develop trends in general industry the Sherman Corporation, Boston, asked executives of all manufacturing concerns to check a list of factors as to whether they were, in the case of the reporting company, favorable or unfavorable. Another list showing the trend of practice in industry also was checked.

It is clear that the electrical industry considers competition, overproduction, profit margins, surplus plant capacity, selling and distribution expenses and hand-to-mouth buying as the outstanding unfavorable items. General industry, on the other hand, looks on none of these items as unfavorably as does the electrical industry. In the case of competition, only 9 per cent of general industry considers it unfavorable, compared to 91 per cent that looks upon it as favorable. On the other hand, 67 per cent of the electrical industry considers competition unfavorable and none considers it favorable, the remainder giving no definite answer.

In addition to the tabulated data some interesting statements from manufacturers in the electrical industry were received by the Sherman Corporation. These electrical industry executives reported their judgments as to what they believed are the problems of business in 1928. Some of the opinions are as follows: A manufacturer of lighting equipment says he considers as the major problems in his industry for 1928 intensive selling, cutting down overhead and less volume and greater profit.

A manufacturer of electrical products declares that distribution, research, employer-employee relationships are the principal problems in his industry.

A manufacturer of electrical welding rings, rims, bands, angles and flanges says that he finds his principal problems are further reduction in manufacturing costs and domestic and foreign competition.

FAVORABLE AND UNFAVORABLE FACTORS IN INDUSTRY

| Factor (General Conditions) | General Industry Per Cent Favorable | General Industry Per Cent Unfavorable | Electrical Industry Per Cent Favorable | Electrical Industry Per Cent Unfavorable |
|---|---|---|---|---|
| 1. Money rates | 98 | 2 | 67 | 00 |
| 2. Employee relationships | 93 | 7 | 67 | 00 |
| 3. Labor efficiency | 84 | 12 | 67 | 33 |
| 4. Credits | 84 | 16 | 100 | 00 |
| 5. Wage scales | 81 | 19 | 67 | 33 |
| 6. Collections | 74 | 26 | 100 | 00 |
| 7. Development of new products | 74 | 26 | 67 | 00 |
| 8. Commodity prices | 69 | 31 | 33 | 33 |
| 9. Inventory turnover | 67 | 33 | 33 | 33 |
| 10. Mergers | 65 | 35 | 33 | 00 |
| 11. Style | 62 | 38 | 00 | 00 |
| 12. Agricultural conditions | 55 | 45 | 00 | 00 |
| 13. Political developments | 54 | 46 | 00 | 00 |
| 14. Capital turnover | 54 | 46 | 67 | 33 |
| 15. Weather | 51 | 49 | 33 | 00 |
| Factor (Special Conditions) | | | | |
| 1. Competition | 91 | 9 | 00 | 67 |
| 2. Competition from within industry | 87 | 13 | 33 | 33 |
| 3. Overproduction | 87 | 13 | 00 | 67 |
| 4. Profit margins | 77 | 23 | 00 | 100 |
| 5. Limited markets | 77 | 23 | 00 | 00 |
| 6. Federal taxation | 77 | 23 | 00 | 00 |
| 7. Competition from outside industry | 76 | 24 | 00 | 00 |
| 8. State taxation | 72 | 28 | 00 | 33 |
| 9. Surplus plant capacity | 69 | 31 | 00 | 67 |
| 10. Foreign competition | 67 | 33 | 00 | 00 |
| 11. Local taxation | 65 | 35 | 33 | 33 |
| 12. Installment selling | 63 | 37 | 33 | 00 |
| 13. Government regulation of business | 62 | 38 | 00 | 00 |
| 14. Selling and distribution expenses | 59 | 41 | 00 | 67 |
| 15. Hand-to-mouth buying | 59 | 41 | 00 | 100 |

TREND OF PRACTICE IN INDUSTRY

| Have You | General Industry Per Cent Yes | General Industry Per Cent No | Electrical Industry Per Cent Yes | Electrical Industry Per Cent No |
|---|---|---|---|---|
| Reduced unit manufacturing costs | 73 | 27 | 84 | 16 |
| Reduced overhead | 56 | 44 | 40 | 48 |
| Reduced sales expense | 29 | 71 | 42 | 58 |
| Reduced selling price | 54 | 46 | 58 | 33 |
| Reduced number of items | 27 | 73 | 33 | 56 |
| Increased number of items | 44 | 56 | 33 | 66 |
| Purchased new machinery | 70 | 30 | 75 | 17 |
| Increased inventory turnover | 60 | 40 | 58 | 33 |
| Increased capital turnover | 46 | 54 | 33 | 58 |
| Cut down manufacturing time | 52 | 48 | 75 | 25 |
| Carried on product research | 61 | 39 | 75 | 08 |
| Carried on process research | 61 | 39 | 67 | 25 |
| Carried on market research | 56 | 44 | 67 | 25 |
| Developed new merchandising plans | 52 | 48 | 92 | 08 |
| Increased sales volume | 52 | 48 | 25 | 67 |
| Improved quality | 82 | 18 | 83 | 17 |
| Cut quality | 1 | 99 | 00 | 92 |
| Changed wage methods | 13 | 87 | 00 | 92 |
| Revised wage scales—upward | 16 | 84 | 17 | 83 |
| Revised wage scales—downward | 17 | 83 | 08 | 92 |
| Has advertising appropriation been increased | 34 | 66 | 50 | 50 |
| Has advertising appropriation been decreased | 20 | 80 | 25 | 75 |
| Have there been major changes in personnel | 14 | 86 | 25 | 42 |
| General management | 16 | 84 | 17 | 25 |
| Sales executives | 23 | 77 | 42 | 17 |
| Production executives | 22 | 78 | 17 | 25 |
| Have you had merger under serious consideration | 20 | 80 | 00 | 75 |

NOTE—Where the "Yes" and "No" percentages, for any one factor, do not add up to 100, it is because some of the matters were not reported on.

A manufacturer of electric motors and generators says that his problems are sales, manufacturing costs and prices.

A manufacturer of electrical specialties reports that the matter of maintaining or increasing sales without driving sales costs out of line will be the big problem in 1928.

A manufacturer of electric appliances feels that the matter of maintaining volume at a better rate of profit will be his major problem.

A few of the statements made by manufacturers in the electrical industry, outlining the basic causes of the increase or decrease in profit margins, may be of interest and are as follows:

*Reasons for Increased Profits:* Electrical products—"Improved manufacturing methods."

Electrical specialties—"Price reductions and increased sales work."

Household appliances—"By manufacturing items formerly purchased, lower labor costs even at a higher average wage scale, and slightly increased sales volume."

*Reasons for Decreased Profits:* Electrical equipment—"Sales volume decreased about 10 per cent; sales price decreased about 10 per cent; we have not thought it wise to decrease our burdens to correspond with decreased volume and price; only reductives are such as naturally accrue from decreased production."

# Creating Favorable First Impression

REALIZING that first impressions are often lasting and that many an electric range, electric refrigerator or other appliance is in disrepute with the customer because of some misunderstanding or lack of information concerning its use, H. H. Courtright, manager of the merchandising division of the San Joaquin Light & Power Corporation, has adopted a means of eliminating the possibility of unfavorable first impressions of electric refrigerator purchasers.

Before delivering a refrigerator it is thoroughly inspected and tested and delivered with the coils frosted, or at least very cold. No trays are delivered with the refrigerator. The installation man mentions this to the housewife and tells her that a salesman will come with the trays as soon as the machine is set up. Following the installer comes the salesman with the trays. The ice tray is filled with ice cubes and the dessert tray with a frozen pudding ready to be served. An apology is made for not having sent the trays with the machine, but the salesman suggests that the housewife may be glad to have the ice cubes ready when her husband comes home. Also he mentions the fact that there is enough frozen dessert for two families and suggests that perhaps she would like to show her new machine to the neighbors and have them taste the frozen dessert.

This delights the housewife and she calls in the neighbors and treats them to some of the dessert and the refrigerator is "sold" from the time it enters the house. This plan was adopted because it was found that the trays often have an invisible film of oil on them from the stamping process and if they are not thoroughly cleaned the first batch of ice cubes will taste of oil and the refrigerator will prove a disappointment to the whole family. The first experience with frozen dessert may likewise prove unsatisfactory. The method adopted by Mr. Courtright eliminates these possibilities and gives him an opportunity to improve the company's relations with its customers and often develops prospects for other sales.

## Appliance-Use Table Answers Cost Queries

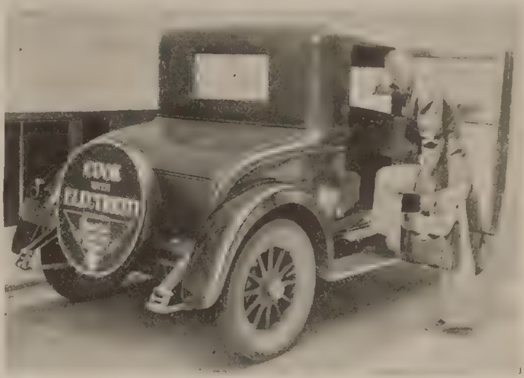
By Willard Allphin

*Fall River (Mass.) Electric Light Company*

TO ENABLE residential service customers quickly to estimate the cost of using various leading appliances on the Fall River Electric Light Company's new household rate a table has been prepared showing how much each appliance adds to the previous monthly bill over a wide range of values. The residential service rate referred to is as follows: First 25 kw.-hr. per month, at 8 cents each; next 75 kw.-hr., 5 cents each; over 100 kw.-hr., 3 cents each; minimum charge, \$6 per year. Thirty thousand folders, 8⅜ in. x 10¾ in. in size, have been printed carrying this table with an illustrative application.

## Tire Cover Is Silent Salesman for Electric Cooking

ONCE a thing has become an established fact in the minds of customers there is rarely any question as to its value or practicability. The Valley Electrical Supply Company, merchandising subsidiary of the San Joaquin Light & Power Corporation, believes that by equipping 250 automobiles of the two companies with tire covers advertising electric cooking a state of consciousness will be created in the public mind that will bring about a better understanding of the salient facts regarding electric cooking.



*Electric cooking message on 250 company automobiles*

These 250 cars traversing the entire system with their tire covers are silent salesmen and act as constant reminders of the fact that there is a special rate for electric cooking; that it is clean, cool and economical. The tire covers are also a means of identifying salesmen and it has been found that the men are taking particular pains to park where the sign will be most conspicuous.

The copy on the cover is brief and the design and color scheme are planned to gain the most in readability.

*Message from Fall River Electric Company to Its Customers*

In using this table, use the new total each time you add an appliance. For example, suppose your average bill at present is \$1.35 and you wish to know how much it would be if you added a refrigerator, a range and a washing machine. In the column headed \$1.25 to \$1.50, we find that the refrigerator will cost approximately \$2.70 a month. Adding this to \$1.35 gives us a new total of \$4.05. In the column headed \$4 to \$4.50, we find that a range for three people will cost approximately \$3.55. Adding this to the \$4.05 gives us a total of \$7.60. Since the new bill is over \$5.75, the washing machine will cost approximately \$0.03 a month to operate, or a grand total of \$7.63 for all electric service.

We suggest that you save this folder for future reference, and if you have any further questions please feel free to call on us to telephone 1730—Power Department.

| If your present monthly bill is from. | \$0.50 to 0.75 | 0.75 to 1.00 | 1.00 to 1.25 | 1.25 to 1.50 | 1.50 to 1.75 | 1.75 to 2.00 | 2.00 to 2.25 | 2.25 to 2.50 | 2.50 to 2.75 | 2.75 to 3.00 | 3.00 to 3.50 | 3.50 to 4.00 | 4.00 to 4.50 | 4.50 to 5.00 | 5.00 to 5.75 | Ove 5.75 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| The cost per month of operating an Electric range, one to three people will be about | 5.30 | 5.15 | 5.00 | 4.85 | 4.70 | 4.55 | 4.45 | 4.30 | 4.20 | 4.10 | 3.95 | 3.75 | 3.55 | 3.35 | 3.10 | 3.00 |
| Electric range, four to six people will be about | 6.05 | 5.90 | 5.75 | 5.60 | 5.45 | 5.30 | 5.15 | 5.05 | 4.95 | 4.85 | 4.70 | 4.50 | 4.30 | 4.10 | 3.85 | 3.75 |
| Refrigerator | 3.00 | 2.90 | 2.80 | 2.70 | 2.60 | 2.53 | 2.50 | 2.50 | 2.50 | 2.50 | 2.45 | 2.25 | 2.05 | 1.85 | 1.60 | 1.50 |
| Water heater, one to three people | 5.00 | 4.85 | 4.70 | 4.55 | 4.40 | 4.25 | 4.10 | 4.00 | 3.90 | 3.80 | 3.65 | 3.45 | 3.25 | 3.05 | 2.80 | 2.70 |
| Water heater, four to six people | 6.80 | 6.65 | 6.50 | 6.35 | 6.20 | 6.05 | 5.90 | 5.80 | 5.70 | 5.60 | 5.45 | 5.25 | 5.05 | 4.85 | 4.60 | 4.50 |
| Flat iron, one to three people | 0.40 | 0.40 | 0.40 | 0.40 | 0.37 | 0.28 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.22 | 0.15 |
| Flat iron, four to six people | 0.72 | 0.72 | 0.72 | 0.66 | 0.57 | 0.48 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.45 | 0.37 | 0.27 |
| Vacuum sweeper, five-room house | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.13 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.08 | 0.06 |
| Vacuum sweeper, eight-room house | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.18 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.13 | 0.09 |
| Toaster, ten minutes per day | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.13 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.08 | 0.06 |
| Toaster, twenty minutes per day | 0.32 | 0.32 | 0.32 | 0.32 | 0.32 | 0.26 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.16 | 0.12 |
| Washing machine, one to three people | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.10 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 | 0.05 |
| Washing machine, four to six people | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.18 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.13 | 0.09 |
| Grill, ten minutes per day | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.13 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.08 | 0.06 |
| Grill, 20 minutes per day | 0.32 | 0.32 | 0.32 | 0.32 | 0.32 | 0.23 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.16 | 0.12 |
| Percolator, fifteen minutes per day | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.13 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.08 | 0.06 |
| Percolator, thirty minutes per day | 0.32 | 0.32 | 0.32 | 0.32 | 0.32 | 0.26 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.16 | 0.12 |
| Waffle iron, two hours per month | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.10 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 | 0.05 |
| Waffle iron, four hours per month | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.18 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.13 | 0.09 |
| Heating pad | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.03 |
| Fan | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 | 0.13 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.08 | 0.06 |
| Sewing machine | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.03 |
| Portable heater, one hour per day | 1.48 | 1.39 | 1.30 | 1.21 | 1.12 | 1.03 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.70 | 0.60 |
| Portable heater, two hours per day | 2.48 | 2.39 | 2.30 | 2.21 | 2.12 | 2.03 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 1.96 | 1.76 | 1.55 | 1.30 | 1.20 |

# Bills as Messengers*

By H. T. East
*Assistant to Vice-President*
*Public Service Company of Northern Illinois*

The electric service bill may be considered as merely a statement informing the consumer of the amount due the company for the preceding month or it may be looked upon as a periodic contact with each and every patron of the company. If the bill is regarded as a monthly customer contact, as it certainly should be, the natural tendency is to study the messenger and carefully consider the means of improving it. Bills which are neat, accurate, distinctive and clear help produce good will and offset, to some extent, the unwelcome feeling which the receipt of any communication calling for a cash expenditure naturally produces in the mind of the none-too-eager recipient thereof.

### Information Bill

It is considered good practice to show all or nearly all of the following data:

Name and address of company.
Where bills may be paid.
Name and address of customer.
Customer's account number or other account identification.
The date the bill was issued.
The date on which the discount expires.
Actual dates of present and previous meter readings.
Present and previous meter index.
Total kilowatt-hours used.
Kilowatt-hours charged at each rate.
Gross bill.
Discount.
Net bill.
Unpaid previous bills.

The addresses of local offices, stores and other authorized collection agencies may also be shown. Bills covering more than one month's service should be plainly marked.

### Rate Schedules on Bills

Since it is impossible to check the computation used in determining the total bill without the rates, they are usually printed on the back of the bill. The discount or additional charge must also be quoted. If the rates vary in different sections it is difficult and unpolitic to show them unless separate bills are used for each section of the territory. If the schedule is such that a few sentences of explanation will enable the customer to understand the application of the rate, it seems desirable to show it on the bill. If a brief explanation will not serve the purpose, such information must be omitted.

### Unpaid Bills and Merchandise Items

Space must be provided for showing previous unpaid bills. Companies which make a practice of billing merchandise payments on the service bill must also provide space for such entries.

### Messages on Bills

It is not uncommon to include a small merchandise advertisement on the monthly bill, but opinion on this matter has not been crystallized.

Bills are also used as a medium for carrying messages such as warnings against permitting unidentified company representatives to enter premises, instructions as to how to read meters, announcements of store openings, changes in rates, new policies, or service messages designed to promote public relations.

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**Service suggestion, Customer Relations Section, N.E.L.A.*

## Four Cardinal Points in Rural Service

1. Rates especially developed to meet rural conditions.

2. A rural service department where the responsibility for the development is placed.

3. Minimum line construction costs consistent with economical upkeep.

4. Development of a selling program which will place reliable information in the farmer's hands.

Dr. E. A. White,
*Director National Committee on the Relation of Electricity to Agriculture.*

# Letters from Our Readers

## *Motor Starting Current Vs. Lighting Flicker*

*To the Editor of the* Electrical World:

I do not believe that Mr. Johnson is in real disagreement in regard to my article, upon which he comments in the April 28 issue of the Electrical World. In his illustration the motor at $M$ has but a two-way feed from each of two directions along the mains $AA'$, although at the points $A$ and $A'$ there is a four-way feed resulting from the network of three sets of mains and a transformer bank at these points. Mr. Johnson combines all the cable and transformer impedances from all the included banks to the motor $M$; that is, he sets up the condition equivalent to a one-way feed.

Applying the approximate formula $IR \cos \phi + IX \sin \phi = 2$, substituting $R = 0.00303$ and $X = 0.00696$ ohms, the value of $I$ becomes 276 amp. for 15 per cent power factor, as against 270 amp. as determined by him.

For two-way feed Mr. Johnson's values of combined impedance would be doubled and the value of $I$ halved, but since a two-way feed is now being considered the allowable motor current becomes $2 \times I/2 = I$ as before. Mr. Johnson has merely made too literal an interpretation of my memorandum.

H. L. Wallau,
Electrical Engineer.
Cleveland Electric Illuminating Company.

## *Senility, Not Sensibility*

*To the Editor of the* Electrical World:

In setting up the copy of my letter appearing on page 1302 of your June 16 issue the printer has thrown my thought 90 degrees out of phase by using the word "sensibility" instead of "senility." Of course it is not necessary to point out that "sensibility" means mental receptivity, discernment, etc., while "senility" is a "horse of another color."

H. W. Young,
President.
Delta Star Electric Company,
Chicago, Ill.

# Digest of Electrical Literature

## Hydro-Electric Development and Steam Equipment

*Progress in the Burning of Coal.*—A. G. Christie.—As the result of an examination and analysis of contemporary practices in the combustion of coal the author has arrived at a number of conclusions regarding future developments in this field. Several influences are credited with bringing about the recent progress in the combustion of coal, namely, increased furnace size and better combustion conditions, increased furnace temperatures, a better appreciation of the effect of radiant heat transfer, a better appreciation of equipment and furnace requirements for various coals, improvements in stoker design, improvements in powdered coal systems and better instruments and improved furnace control. It is anticipated that furnace sizes will not be decreased and may be increased. Higher fuel-burning capacities of furnaces will be secured by better firing methods, further mixing of gases in the furnace and, in the case of stokers, improved methods of distributing air to the fuel bed. The use of preheated air will be extended, according to the author. New furnaces will aim to secure the highest furnace temperatures possible to assure rapid and efficient transfer of heat. These and many other essential fundamental characteristics have been considered by Professor Christie. — *Engineers and Engineering,* May, 1928.

*High-Pressure Steam Boilers.*—G. A. Orrok.—The lines of further investigation which apparently offer the greatest possibilities in the future design and construction of high-pressure steam boilers have been completed by the author. Among the factors discussed are: The effect of tube inclination; the circulation problem, releasing surface and steam space; safety in operation; increase in capacity; boiler materials, temperature margins, and stresses in superheater tubes, riveted drums and headers. It is developed that a high-pressure boiler must consist largely of banks of tubes; headers in great variety are available up to at least 1,400 lb. pressure; drums must be of small diameter and should not contain over 10 per cent of the water content of the boiler; below 1,000 lb. there is no need of employing alloy steels, but above that pressure such steels are available and should be used if the temperature margins so require; for superheats higher than 800 deg. alloy steels are indicated; twenty or more different designs of boilers are successfully operating at pressures of 500 lb. and over, six at 1,000 lb. and one at 2,000 and over, and enough work has been done to indicate that their efficiencies are comparable to those obtained with boilers of lower pressure.—*Mechanical Engineering,* June, 1928.

*Fuel Handling and Ash Disposal.*—J. R. McCausland.—A discussion of methods and equipment which may be used for the handling of fuel and ash in electric generating stations has been offered, utilizing the practices of one large utility system as a basis. The observations consist largely of experience data obtained at three large tide-water stations utilizing bituminous coal. The author has considered shipping conditions, unloading equipment, a description of the individual plants involved and the facilities available at each, coal storage, prevention of spontaneous combustion and similar factors.—*Mechanical Engineering,* June, 1928.

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## Generation, Control, Switching and Protection

*Automatic Generating Station in Japan.* — U. Vetsch. — The paper describes a hydraulic generating station located in a mountainous, inaccesible place and designed, for this reason, to be fully automatic. Starting and stopping are accomplished by closing the oil switch at the other end of the transmission line, which ties the automatic station to the distant base plant at Shizumo. One 2,000-kva. vertical shaft, 11,000-volt, 900-r.p.m. generator is installed, driven by a horizontal plane spiral turbine. A relatively small number of auxiliary relays were added to the otherwise standard equipment of the station. Starting and stopping operations are carried on in the same sequence as is customary for manual operation, but the individual steps are mechanically and electrically so interlocked as to prevent the next step unless the previous one has been correctly finished. To avoid the installation and care of a storage battery, the main generator carries on its shaft not only the exciter but also a small auxiliary direct-current generator for the controls. An automatic synchronizer closes the main breaker in the station when potential and phase are correct. Overload, overspeed and temperature relays are provided for the protection of the generator.—*Brown, Boveri Mitteilungen,* May, 1928.

*The Cost of Electrical Switchgear.*—H. Trencham.—It is the contention of the author that the cost, and consequently capital investment, involved in the switching devices used by electric utilities is far too high and he has accordingly offered suggestions toward the reduction of this essential but unproductive item in station design. While a number of specific suggestions involving standardization and minimization of unnecessary items of equipment are offered, a consideration of the technical difficulties involved is recognized.—*Electrical Engineer (Australia),* April 16, 1928.

## Transmission, Substations and Distribution

*Impregnation of Wooden Poles.*—R. Nowotny.—According to the process described by the author a mixture of sodium-fluorate and nitrated phenol is injected into the endangered zone of a wooden pole by means of a special tool which is a combination of hammer and injection syringe. The point of the tool is driven about 1½ in. deep into the wood and a few cubic centimeters of the antiseptic liquid is discharged into the pole. This is repeated at numerous points all around the shaft. Tests made several months after this treatment indicated that the injected chemicals spread out by capillary diffusion a considerable distance up and down from the point of application. A number of European telegraph, telephone and power companies have adopted this impregnation method with good results.—*Elektrotechnik und Maschinenbau,* April 29, 1928.

*Rigorous and Approximate Theories of Electrical Transmission Along Wires.*—John R. Carson.—The elementary theory based upon concepts of transmission phenomena completely determined by the self and mutual impedances of the conductors and the self and mutual capacities, together with the dielectric leakage, are seen by the author as not altogether adequate because of admitted approximation. The first defect is recognized as being a transmission phenomena correctly represented only at some distance from the physical terminals of the system or at some distance from points of discontinuity. It is also stated that when conductors of large cross-sections or the ground form part of the transmission system the elementary theory becomes inadequate. The problems here dealt with have been stated as, first, to investigate the conditions under which the specifications of the system by means of its self and mutual impedances is valid and, secondly, to provide a general method for calculating these circuit parameters from the geometry and electrical constants of the system. — *Reprint B-289 Bell Telephone Laboratories, Inc.*

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## Units, Measurements and Instruments

*Various Methods of Connecting Indicating Wattmeters.*—John Auchincloss.—A discussion of suitable methods for connecting indicating wattmeters for three-phase, three-wire circuits; three-phase, four-wire circuits; single-phase and polyphase instruments; various combinations of current and potential transformers, and certain power-factor and voltage-balance considerations are offered by the author in a technical evaluation of possible practices. It is stated that since no billing is done with indicating wattmeters, operating companies sometimes sacrifice accuracy for the sake of avoiding added investment in large instrument transformers. This is recognized as a justifiable practice in some cases, but is not recommended without a thorough understanding of the accuracies inherent in such combinations and in their application. — *General Electric Review,* May 1928.

*Totalizing the Output of Two or More A.-C. Circuits.*—The installation and operating requirements that must be satisfied for the totalizing of the output of two or more alternating-current circuits on one watt-hour meter by paralleling the secondaries of current transformers are offered in this report. This method of measurement has been devised to meet certain peculiar conditions existing in various parts of the country. It is stated that it has been considered advisable to make a study of the method and to point out some of the limitations and requirements that must be satisfied in its application. The effect of equally and unequally loaded circuits, current-transformer secondary connections and secondary burden are all discussed in detail. The general problem of the determination of correction factors for a combined installation of this type has been thoroughly covered and the procedures are included for the determination of these factors by actual test and by calculation. Test data substantiate the conclusions determined in this investigation.—*Serial Report National Electric Light Association,* May, 1928.

## *Illumination*

*Four Variables of the Visual Threshold.*—Percy W. Cobb and Frank K. Moss.—At least four variables are recounted by the authors as entering into the description of any visual object. Two of these are recognized as photometric, namely, the brightness of the object and that of its ground. The third is the size of the object expressed in visual angle, and the fourth is the time during which the image of the object acts upon the retina of the eye. The object of the present investigation has been to determine the inter-relations of these factors by a uniform method over wider ranges than has previously been undertaken. The specific objects to be determined were: The brightness, closely approximated by the brightness of the background upon which a dark object is exposed when at its threshold value; the contrast ratio, which is the ratio of the difference between these two, due to the background brightness; the visual angle under which the object is seen, and the exposure time.—*Journal of the Franklin Institute,* June, 1928.

*Daylight, Artificial Light and Artificial Daylight.*—J. S. Dow.—An analysis of the merits and drawbacks of the three types of illumination ordinarily available has been offered in this discussion, in which the results of a comprehensive research investigation have been included. Comparisons and differences between natural and artificial light, the contrast effect of the bright sky, the differences in the visible and ultra-violet spectrum, requirements of different classes of buildings, the transition from natural to artificial light, the relative intensity of illumination needed by natural and artificial light, influence on acuteness of vision, architectural considerations and several psychological effects have been considered in this discussion. — *Journal of Good Lighting (England),* June, 1928.

## *Heat Applications and Material Handling*

*Storage Batteries in Relation to Modern Supply of Electric Lighting and Power.*—E. C. McKinnon.—It is the author's prediction that storage batteries will be in wide demand for innumerable purposes for many years. New applications are foreseen as continually arising and it is stated that no equally reliable stand-by source of electrical energy is at present known. The author reports a definite trend in Great Britain toward the running of the supply station's power auxiliaries from a direct current supply and the installation of storage batteries of adequate capacity to carry the station's power load for a period varying from twenty minutes to one hour. This insures an unfailing supply of power for maintaining the circulating water supply, operating overhead cranes, a proportion of the stoker motors, switch control and the essential pilot lighting. A number of features have been considered in this discussion, including battery room design, battery design, tests, special applications, special methods of charging, the supply of materials for the construction of batteries and a consideration of the future prospects for use by electric light and power companies.—*Journal of the Institute of Electrical Engineers (England),* May, 1928.

## *Telegraphy, Telephony, Radio and Signals*

*The Design and Distribution of Wireless Broadcasting Stations for a National Service.* — P. P. Eckersley. — Great Britain was the first nation to give a single authority the responsibility for the conduct of a national service of broadcasting. This paper deals with some of the aspects of the underlying problems in the distribution and design of broadcasting stations to give a national service. The endeavor to present a comprehensive view of the situation precludes the possibility of a quantitative discussion. Each of the sections of the paper might well be used as a basis for a more detailed discussion, but a general exposition of the subject is offered here. The author suggests that peculiar interest attaches to the science of broadcasting, as the subject comprises not only technical but also psychological problems. No other technical public service depends for its successful operation upon material and operation supplied by relatively unskilled persons under no authority or disciplined direction.—*Journal of the Institution of Electrical Engineers (England),* May, 1928.

## *Miscellaneous*

*Combined Light and Suction-Fan Trap for Insects.*—W. B. Herms and R. W. Burgess.—An insect trap consisting of a 300-watt lamp, a reflector, a small electric fan, a collecting sack and a wind vane, for directional location of a protective windshield, has been utilized with conspicuous success in an insect-infested lake section of California. As a measure of the efficiency of this device it is reported that in two hours of use 11 lb. of gnats were trapped and destroyed. During a season more than 156 lb. of the insects were similarly eliminated. The device is simple, being capable of home-made construction, and may be placed in any location where electricity is available. The energy requirement is low, consisting of the 300-watt lamp and a small electric lamp motor.—*Electrical West,* April 1, 1928.

*Photomicrographic Study of Rough or Nodulized Electrodeposited Nickel.*—C. Upthegrove and Edwin M. Baker. —Nodulized or rough nickel deposits are undesirable in that they cause rejections of plated work, increase the difficulty of buffing and lower the protective value of the plate. A photomicrographic study was made of some excessively nodulized deposits. This study indicated that the nodules are apparently not related to imperfections in the base upon which the plating is done nor to the method of cleaning, as the nodulized growth may start after metal has been deposited to some thickness. In general, it is concluded that the nodules are a result of suspended particles in the bath which may come in contact with the surface of the metal after deposition has started. The indicated remedy, therefore, is the maintenance of more nearly clear solutions.—*Report American Electrochemical Society,* April, 1928.

*Are Electrons Waves?*—C. J. Davisson.—Circumstances have been found, according to the author, in which electrons do not appear as particles at all, but as waves. The results of a number of experiments in which a narrow stream of electrons has been directed against the base of a nickel crystal and the conditions under which a sharply defined stream of electrons leaves the crystal have justified this conclusion. Observations were also made with reflected-electron phenomena in connection with a target of ordinary polycrystalline nickel. Wave lengths and velocities of electrons are developed as a result of several phases of the determinations made. On the other hand, it is not contended that electrons are waves, although they have the characteristics and qualities indicated in this research.—*Journal of the Franklin Institute,* May, 1928.

# News of the Industry

## San Francisco Valuation Figures Miles Apart

*Pacific Gas & Electric and Great Western Companies Value Distribution Systems Plus Severance Damages at $97,000,000, City at $28,200,000*

THE marked difference of opinion long known to exist as to the valuation of the San Francisco electrical distribution systems of the Pacific Gas & Electric Company and the Great Western Power Company between those two companies on the one hand and the City and County of San Francisco on the other hand is clearly brought out in the briefs filed June 15 with the California Railroad Commission. The Pacific Gas & Electric Company sets $67,000,000 as the value of the property which the city is seeking to acquire for the distribution of electrical energy developed by the Hetch Hetchy project. The city's figure is $18,894,005, including severance damages put at $457,360. The Pacific Gas & Electric Company sets its severance damages at $27,000,000. The Great Western Power Company has set $30,000,000 as the valuation of its properties in question, while the city believes that $9,306,537 is an equitable valuation of the same properties.

The figures given relate to the value of the properties on Feb. 11, 1924, the date the city filed its petition to the Railroad Commission "to fix and determine the just compensation to be paid by the City and County of San Francisco." Hearings and surveys have extended over the last four years. The actual hearings have covered a period of approximately three years and numerous witnesses of national standing have testified. Among the most prominent of these are Dr. Arthur T. Hadley, former president of Yale University; Alex Dow, president Detroit Edison Company, through whose testimony to the effect that he would have been willing to organize a syndicate in 1924 and purchase the property involved for $40,000,000 the Pacific Gas & Electric Company established the valuation of its property, and Sidney Z. Mitchell, president Electric Bond & Share Company, New York, whose estimate of the market value of the property on Feb. 11, 1924, has been used as its valuation figure by the Great Western Power Company.

The two companies contend that in arriving at the valuation figures a number of major factors should be taken into consideration, such as reproduction cost new, market value as it would be reflected in the remaining properties after the San Francisco holdings had been withdrawn, added difficulty in obtaining money because of the loss of the best-paying part of the entire system, going-concern value, and revenue loss through loss of urban consumption of energy in winter when there is slack demand for energy in rural districts.

On the other hand, the city holds that the claims presented by the companies are grossly extravagant and exaggerated and that the basic theory of damage to the remainder of the system and business is unsound and cannot be supported by principles of law applicable to eminent domain proceedings.

Regardless of the decision in the present case, another series of hearings must be held to determine the value added to the properties by expenditures since 1924. The expenditures of the Pacific Gas & Electric Company are said to have been between $12,000,000 and $15,000,000 and those of the Great Western company between $7,000,000 and $9,000,000.

## Denver Greets the Institute

### Summer Convention in Colorado's Capital Adds Another to the Technical and Social Successes of the A.I.E.E.—Five Americans Made Honorary Members

DELEGATES from forty states attended the summer convention of the American Institute of Electrical Engineers in Denver on June 24 to 29. More than five hundred engineers listened to excellent technical programs, enjoyed the entertainment and were delighted by Rocky Mountain scenery. On Monday the section and branch delegates discussed their affairs. At the business meeting on Tuesday important announcements were made and formal announcement of the new officers elected was made. The mail ballot resulted, as usual, in indorsement of the official slate as follows:

*President*—Rudolph F. Schuchardt, electrical engineer Commonwealth Edison Company, Chicago.

*Vice-Presidents* — Northeastern District, E. B. Merriam, General Electric Company; New York City District, H. A. Kidder, Interborough Rapid Transit Company, New York; Great Lakes District, W. T. Ryan, University of Minnesota; Southwest District, B. D. Hull, Southwestern Bell Telephone Company, Dallas; Northwest District, G. E. Quinan, Puget Sound Power & Light Company, Seattle.

*Managers*—A. E. Bettis, Kansas City Power & Light Company; J. Allen Johnson, Niagara Falls Power Company; A. M. MacCutcheon, Reliance Electric & Engineering Company, Cleveland.

*Treasurer*—George A. Hamilton, electrical engineer (retired), Elizabeth, N. J.

The board of directors announced the election of five honorary members of the Institute. These are Thomas A. Edison, John J. Carty, Michael I. Pupin, Ambrose Swasey and Elihu Thomson. Their election is in conformity with a new policy, they being the first honorary members who reside in this country.

In his presidential address Bancroft Gherardi talked on the topic "Civilization and the Engineer." He traced the growth of science from the time of Galileo and Newton and showed that power and machinery had enabled mankind to produce more than the primary necessities of life. Through this excess production capital was created, and capital made possible leisure for cultural development. President Gherardi pointed out that culture could be sustained only by widely distributed material prosperity and that the engineer and his works contributed many things to the spiritual progress of the world.

The technical sessions afforded opportunity to hear and discuss notable technical papers. One session was devoted to recent investigations of surges on transmission lines. Several utility companies presented data taken from surge recorders and stated the conclusions arrived at. In general high-voltage surges were found to occur with values ten to twelve times normal because of lightning and four to five times normal because of switching. No definite conclusions could be made from the data as to the effective work of ground wires, nor were the data sufficiently accurate and numerous to determine the wave fronts, types of waves and other quantitative results. More experimentation was announced as an industry program.

Another feature session dealt with the use of high-speed circuit breakers in railroad electrification. Several papers described design characteristics of breakers of the latch and magnetic holding types and discussed the details of these breakers as applied in railway service. In general the object is to interrupt a fault as quickly as possible in order to minimize inductive effects and damage to apparatus. An active discussion occurred as to the relative merits of oil and air breakers and as to the relay arrangements used to get selective breaker operation.

The technical committee chairmen presented reports of work done during the year and gave a résumé of the status of the art in their respective fields of activity. Notable progress was evidenced in many lines of research and development. The use of structural-steel welded materials is increasing rapidly. Many improvements have been made in transformers and in other machinery. In lighting there has been a refinement in design and an extension of application because of the trend toward decorative illumination. In electrochemistry and electrometallurgy many new applications were recorded.

The use of graphite in dry cells, commercial growth of electrolytic zinc plants, chromium-plated materials and new devices in heat-treating of materials were some of the topics brought up. Standardization has been used in several types of equipment and much will be presented next week.

At other technical meetings a wide variety of topics were presented and discussed, including welding, elevators, carrier current, arcs and transmission-line design. All the technical sessions were well attended. A complete report will be presented.

The whole convention enjoyed an all-day trip through Denver's parks and among the snowclad mountains. A dinner-dance was given on Wednesday evening and a theater party was scheduled for the outdoor theater on Thursday. With good weather, a delightful environment and admirable local committee arrangements, the summer meeting at Denver scores a notable success.

## Tennessee and Arkansas Bureaus Investigated

*Federal Trade Commission Still Concerned with Utterances of State Information Committee Directors—Kansas Also Heard From*

MORE letters from J. B. Sheridan, director of the Missouri Committee on Public Utility Information, were placed in evidence when he again went on the stand at Washington on Thursday, June 21, in the investigation into the public utilities which the Federal Trade Commission is making. These dealt, among other things, with the Associated Press and its attitude toward the committee's publicity matter, which Mr. Sheridan at one time thought unfavorable, but which subsequently, he thought, changed; with the expressed approval of Governor Sam Baker when he was Superintendent of Public Schools in Missouri of a plan to distribute public utility pamphlets in the schools, followed by a refusal to give the proposal formal indorsement, and with the political agitation against the utilities promoted by what Mr. Sheridan called the "Walsh-Norris-Pinchot-La Follette crowd."

The witness in letters to Thorne Browne of the Middle West Division of the National Electric Light Association said that he was convinced that the public utility industry should "clean house" and rid itself of companies which did not play the game squarely, recommending publicity as the means of carrying out the idea.

Guy P. Newbern, director of the Tennessee Public Utility Information Bureau, testifying the next day, asserted that his bureau had distributed considerable printed matter opposing the Muscle Shoals project. Letters introduced at the hearing indicated that a close watch was maintained on newspaper editorials and articles on this subject. In a report to his executive committee, Mr. Newbern described how at a meeting of public utility men in Washington in April, 1926, "plans were made for a big educational campaign on the Muscle Shoals bids of the associated power companies." Mr. Newbern testified that pamphlet supplied to the bureau by the National Electric Light Association were distributed in large numbers to Tennessee schools, newspapers, libraries and public officials. Ten thousand sets of three pamphlets each were placed in schools last year, one of the exhibits showed. Mr. Newbern said that his bureau collected and disbursed $18,000 in 1927. There had been no survey of textbooks in Tennessee.

Details of the utilities' fight in behalf of the state utility commission in Tennessee were revealed in a speech by Ross Murphy, former director of the bureau, placed in the record during examination of Mr. Newbern. Reviewing a controversy over that commission, Murphy told utility men "only the concerted efforts of every public utility in the state" saved the commission in the Senate after the House had passed a repeal bill, the bill being set aside by a vote of 18 to 11.

On Tuesday, June 26, Earle W. Hodges, now connected with Henry L. Doherty, New York, but formerly director of the Arkansas Public Service Information Bureau, was a witness. A transcript of a speech alleged to have been made by him in 1923 at an N.E.L.A. meeting in New York was shown to him. In this transcript Mr. Hodges was quoted as saying: "If we do have any propaganda (and I don't like that word at all, for it is one of the Kaiser's favorites), we so conceal or 'sugarcoat' that propaganda with boosting that it is generously entered into and got back of by all of the chambers of commerce, civic clubs, men's and women's organizations over the state." Mr. Hodges could not remember using these words.

Rex I. Brown of Little Rock, secretary-treasurer of both the Information Bureau and the Arkansas Utilities Association, refused to admit that the *Dixie Magazine,* devoted to stimulating interest in the state's resources, had been subsidized. In the course of two and a half years, he said, $8,719 had been paid the magazine for subscriptions and advertisements and as loans. In no instance had he requested the publication of any article in the magazine.

Further questions brought from Mr. Brown the statement that no textbook survey had been undertaken in Arkansas, as far as he knew, and no effort had been made to check up on the amount of utility news printed in the Arkansas newspapers.

Observers in attendance at the hearings on Wednesday were impressed with the clear, straightforward testimony of H. Lee Jones, the director of the Kansas bureau. He had a ready and positive answer to each question, and it was apparent that he was proud of the work his bureau had done and had no doubt as to the soundness of the doctrines he has preached and the wisdom of the methods used to further them. Mr. Jones insisted that no advertising was placed with any newspaper with any thought or desire to influence its editorial policy. The support of any editor who could be influenced by advertising, he declared, would not be worth having. His committee acted on that assumption and placed its advertising on a strictly commercial basis.

Mr. Jones told of the co-operation of Kansas utilities with the state authorities, state educational institutions and agricultural organizations in efforts to speed the extension of electric service to the farms. He stated that 13,000 copies of a pamphlet setting forth fundamental facts on the utility industries had been distributed to schools and that an advertisement had been carried in one issue of the *Kansas Teacher* in which it was represented that the booklet would be of value in connection with courses in physics and civics. There was no concealment of the source of the material. Those interested were asked to apply to the Information Bureau of Kansas Public Service Companies.

Indiana men were under subpœna for Thursday's session.

## Wisconsin Accountants Stage Meeting of Wide Scope

Three addresses of general interest to all utility men as well as to the public were made at the annual two-day convention of the Accounting Section of the Wisconsin Utilities Association in Milwaukee, June 21-22. The interest they aroused was undoubtedly responsible for attracting the largest attendance ever recorded by this section. A total of 96 accountants were registered, as against 56 last year, and at one of the sessions more than 150 utility men were in the audience.

Lewis E. Gettle, chairman of the Railroad Commission of Wisconsin, denounced in scathing terms the Hearst newspaper propaganda and the attempts that have been made to misrepresent his own attitude in opposing the Walsh resolution. Mr. Gettle represented the Wisconsin association as chairman at the Washington hearings and was accused of being "dragged there by the power interests." His address was a reasoned defense of state versus federal regulation.

Paul M. Binzel, Milwaukee, manager of the buying department of Morris Fox & Company, investment bankers, stressed earning power and minimized equities as a proper basis for the issuance of utility as well as industrial securities. He also argued against the use of reproduction cost as a basis for rates or security issues.

Karl F. McMurry, certified public accountant, Madison, presented records from reports filed with state government departments showing comparisons on rates and population served between privately owned and municipally owned electric systems in Wisconsin. These records, he said, prove that the most economical electric service is furnished by the large privately owned companies.

Two accounting papers that provoked discussion were presented by A. A. Meisenheimer, general storekeeper of the Milwaukee Electric Railway & Light Company, and S. A. Bialecki, credit manager of the Milwaukee Gas Light Company. Mr. Meisenheimer explained in detail the adaptation of tabulating machines to the 57 classes of stores accounts of the company. Mr. Bialecki described methods used to keep losses on bills for service and merchandising down to one-tenth of 1 per cent.

Louis T. Smith, assistant secretary of the Milwaukee Gas Light Company, was elected chairman of the section. A. J. Bohl, assistant secretary-treasurer Milwaukee Electric Railway & Light Company, was elected vice-chairman.

## Purchases and Mergers

The New England Power Association has acquired the controlling interest in the Quincy (Mass.) Electric Light & Power Company, which serves 19,000 customers in the metropolitan district adjoining Boston. The company had gross earnings of $857,000 in 1927.

On Tuesday the Consolidated Gas, Electric Light & Power Company obtained from the Maryland Public Service Commission the right to acquire the entire property and assets of the Northern Maryland Power Company at a cost of $590,875 in cash and, in addition, either a part or all of a deferred obligation amounting to $230,400. This ends the fight recorded from time to time in these columns between the Baltimore and the Philadelphia light and power interests to absorb the Havre de Grace utility. The Baltimore company, when it gets control, will have the right to operate in every part of Harford County except one election district.

Holders of more than a majority of the stock of the Harrisburg Light & Power Company voted this week to sell their interests to the Pennsylvania Power & Light Company in accordance with the proposal already noted.

Sale of the Georgetown (Ky.) Water, Gas & Electric Company, owned by Mrs. R. W. Nelson, to the International Utilities Corporation, holding company of the Lexington Utilities Company, is announced.

Sale of the municipal electric system of Summerfield, Kan., to the Iowa-Nebraska Power Company is announced. Summerfield has been buying its energy wholesale from the municipal plant at Pawnee City, Neb. A transmission line is under way.

Custer City, Okla., has voted to sell its municipal light and power plant to the Southwestern Light & Power Company.

Norfolk, Ark., has sold its lighting plant to the Arkansas Power & Light Company. The new owner has acquired a controlling interest also in plants at four other towns in the northern part of the state—Cotter, Mountain Home, Gassville and Flippin.

The Georgia Power & Light Company has purchased the electric light plant at Pearson and will build a transmission line from Cogdell to that place.

The Gulf States Utilities Company, Lake Charles, La., has offered $125,000 for the lighting, waterworks and ice plants of Vinton, La. The voters are to decide.

The Gulf Utilities Company, New Port Richey, Fla., has acquired the Cedar Keys (Fla.) Light & Power Company, Cedar Keys, Fla. The Florida Public Service Company, Orlando, Fla., is arranging to buy the Mount Dora municipal power plant.

# McGraw-Hill and Shaw Company Merge

### Consolidation Affects Large Number of Engineering and Industrial Papers—Shaw and McGraw-Shaw Companies Become Divisions of McGraw-Hill

A CONSOLIDATION affecting two large publishing interests has just been brought about by the merger of the McGraw-Hill Publishing Company, Inc., of New York and the A. W. Shaw Company of Chicago.

The Shaw organization publishes the *Magazine of Business, System* and the *Industrial Distributor and Salesman*, while the McGraw-Hill organization is the publisher, either directly or through subsidiary and affiliated companies, of more than twenty leading business papers, including the ELECTRICAL WORLD, and of engineering and business books. The two companies have had a close relationship since last fall, when they jointly formed the McGraw-Shaw Company, which publishes *Factory and Industrial Management* and *Industrial Engineering*.

A. W. Shaw will continue as chairman of the board and James H. McGraw will become president of the A. W. Shaw Company. Mr. Shaw will also become a director of the McGraw-Hill Publishing Company, Inc., and will continue as president of the McGraw-Shaw Company. Wheeler Sammons will become a director and member of the executive committee of the McGraw-Hill Publishing Company and senior vice-president and general manager of the A. W. Shaw division of the business, which will be known as the "A. W. Shaw Company, a division of the McGraw-Hill Publishing Company, Inc." The McGraw-Shaw Company will also be operated as a division of the McGraw-Hill Publishing Company.

Two reasons for the merger are stressed by the officers of the merging companies. The magazines of the two organizations are complementary in character. The Shaw papers cover business broadly, giving the business man an understanding of what is going on in all branches of trade, industry and finance. Their service is extensive in character. The McGraw-Hill service, on the other hand, is intensive. Its magazines give a highly specialized service to given major industries and to related industrial groups. Thus the consolidated companies serve the business man in both his general and special business interests. The second reason is the very evident economy and increased effectiveness of consolidated operation, enabling a superior service to be rendered to the whole sweep of American business. Mr. McGraw said:

"Mr. Shaw's organization and ours have been working closely together for more than a year and have seen the benefits of consolidated effort between groups having widely different publishing experiences. The Shaw company has had a signal success in publishing magazines of large circulation and of broad appeal to the industrial and business worlds. The McGraw-Hill company has intensively served by specialized publications the leading engineering industries and the trade channels for distributing their products.

"It was apparent that the McGraw-Hill group of industrial and trade papers would have a new way of carrying the message of common business problems if it was allied with papers like the *Magazine of Business* and *System*. At the same time these publications would be immeasurably strengthened by being tied in with and assisted by the great editorial staff of over one hundred and thirty industrial and business specialists who edit the McGraw-Hill papers. There were also conspicuous opportunities for more effective subscription and advertising work and for economies in every phase of publishing. The logic of these opportunities could not be escaped. The merger has been the result.

"Though every paper of the merging companies will be strengthened by the consolidation, and thus render greater service to its readers and advertisers, the most conspicuous result will be the new and strong position of the *Magazine of Business*. Through Mr. Shaw's vision and courage it is a magazine of strength, standing and influence. It now becomes the capstone of the virile group of papers and the other publishing activities of the McGraw-Hill company, thus extending the scope of the latter organization to the whole range of American business. At the same time, drawing on the intimate contact with trade and industry of the large corps of McGraw-Hill specialist editors, it will speak with unexampled authority on the problems of business. It will be able to render an outstanding service to the business men of America by its authoritative information, its expert interpretation and its fearless advocacy of sound business policies. It will fight for the interests of business, but it will place in an equally important position the responsibility of business to the public. It will, in a word, stand for true business statesmanship."

Mr. Shaw expressed his gratification over the merger in a similar vein.

# Northwest Men for Proclaiming Facts

## Portland Convention Indorses Principles of National Committee on Public Policy—All Sections of Geographic Association Hold Excellent Sessions

DETERMINATION to continue to disseminate facts about the electrical industry as widely as possible was repeatedly expressed at the twenty-first annual convention of the Northwest Electric Light and Power Association, held at Portland, Ore., June 19-22. Urged at the opening session by the president of the association, A. C. McMicken, and two of the principal speakers—Franklin T. Griffith, president Portland Electric Power Company, and Preston S. Arkwright, president-elect of the N.E.L.A.—this determination was voiced in a resolution passed at the executive session "vigorously indorsing" the principles laid down by the public policy committee of the national association at Atlantic City answering propaganda charges.

Making a plea for a continuation of state regulation as opposed to federal regulation of electric utility companies, J. M. Thompson, member of the Public Utilities Commission of Idaho, attacked the theory that in crossing state lines electrical energy becomes a commodity in interstate commerce and therefore escapes the jurisdiction of any state commission. He showed that such energy, before it can serve any useful purpose in the state importing it, becomes commingled with all the other electrical energy generated in that state and takes on a purely local character, which brings it under the jurisdiction of the commission of the importing state. Prior to leaving the exporting state it falls under the jurisdiction of that state's regulatory body in that the property used in such export should be deducted from the property used by the exporting company for purely local distribution in determining that company's rate base in the exporting state. Therefore there is no energy that is not at all times within the jurisdiction of some state commission.

At the session devoted to the Commercial Section C. E. Greenwood, commercial director N.E.L.A., discussed the results of the recent industry sales conferences, through which, as already explained in the ELECTRICAL WORLD, a decision has been reached to study the possibility of a national advertising campaign. Eloise Davison, home economics adviser, N.E.L.A., told of the work of her department.

Reviewing accomplishments in the field of farm electrification and looking forward to greater things, J. T. Jardine, chairman of the Oregon committee on the relation of electricity to agriculture, pointed to agriculture's trend toward industrialization as involving "joint responsibility and joint interest" on the part of all concerned.

In the engineering sessions J. B. Fisken, Washington Water Power Company, Spokane, outlined the history of accident prevention work in industry, called attention to the lack of progress in this work in the electrical industry, outlined a safety program, analyzed accident costs, and closed with a plea that the industry give more attention to the subject.

Discussing phases of electrical development in Great Britain, L. A. McArthur, Pacific Power & Light Company, Portland, stated it as his opinion that the trend in that country was away from government operation and toward private operation.

For the Accounting Section, Chairman F. W. Brownell, Puget Sound Power & Light Company, Seattle, outlined a plan for broadening the scope of the section to include studies of a research nature both within and without the industry, not of a strictly accounting nature, but coming within the scope of the duties of the accounting executive. A study of taxation conditions in the territory during the past year had proved very valuable and would be amplified during the coming year.

Two trends respecting the absorption of securities of electric power companies have raised the point that greater care might be given to the form in which financial statements are published, according to Carl S. Dakan, University of Washington—first, the placing of utility bonds on the legal list for savings banks; second, customer ownership. Mr. Dakan had many suggestions looking toward standardization of terminology and method of presentation of financial reports with a view to eventually forcing the buyer to assume his fair share of the investment risk.

The effort of the Public Relations Section for the year had been devoted to interesting the rank and file of company organizations in informing itself about industry and company problems, and the convention program of the section was largely devoted to displaying the results of that work. Two public-speaking contests and three essay contests had been conducted within the member companies by committees of the section, and the winners of these contests presented their winning papers or talks before the convention.

Officers elected were: President, R. M. Boykin, Puget Sound Power & Light Company, Seattle; vice-president, L. M. Hibbard, Idaho Power Company, Boise; state vice-presidents: for Idaho, R. B. King, Idaho Power Company, Boise; for Oregon, George L. Myers, Pacific Power & Light Company, Portland; for Montana, W. B. McDonald, Mountain States Power Company, Kalispell; for Utah, P. M. Parry, Utah Power & Light Company, Salt Lake City; for Washington, N. W. Brockett, Puget Sound Power & Light Company, Seattle; treasurer, W. E. Best, Puget Sound Power & Light Company, Seattle; secretary, Berkeley Snow, *Electrical West*, Portland.

Registration was about 350, and a crowd of well over 500, the largest ever recorded at a session of this division's convention, heard the public relations program on the last day of the convention. Excellent entertainment was provided.

# Canadian Convention a Big Social Success

## *Committee Reports and Formal Proceedings Play Subordinate Part in Four-Day Steamboat Trip Affording Profit Through Personal Intercourse*

MANY of the 275 delegates on the four-day boat convention of the Canadian Electrical Association last week pronounced it the most successful which they had ever attended. The president of the association, J. B. Woodyatt, in his opening remarks, expressed the motive which guided the preparation and execution of the program. He declared that the chief value of a convention is the opportunity which it affords for men with related interests from widely separated territories to get acquainted with one another and compare problems and experiences. He emphasized the social value, saying that committee meetings throughout the year can accomplish better business results than discussions on the floor of a convention. Only three half days were allotted to committee reports, and they were presented with great dispatch, a few remarks on the outstanding accomplishments of the past year being concluded by reference to the printed reports for details.

The SS. *St. Lawrence*, on which the convention was held, made the trip from Montreal via the St. Lawrence and Saguenay Rivers to Port Alfred and return, allowing a full day's stop-over at Port Alfred for a 125-mile motor trip to the Aluminum Company's plant at Arvida, the Price Brothers paper mill at Riverbend and the Duke-Price hydroelectric plant at Ile Maligne. A stop-over at Murray Bay was made for sports and the banquet.

Aside from the pronounced social character of the convention, it was notable in that executives of the utility regulating commissions were invited to attend for the express purpose of seeing that "utility men are not so diabolical as they are pictured," as Mr. Woodyatt phrased it. Four members of the Quebec Public Service Commission, a member of the Electrical Commission of Montreal and a member of the Ottawa Board of Railway Commissioners attended. The Canadian Engineering Standards Association and Electrical Standards Laboratory were also represented.

R. J. Wensley demonstrated "Televox," the "electrical man," and R. Treat presented a paper on methods of providing the most reliable transmission service.

P. S. Gregory, assistant to the vice-president of the Shawinigan Water & Power Company, was elected president for the coming year. H. M. Lyster continues as secretary of the association.

## Neff and Holloway Address Agricultural Engineers

Assurances that the utility companies will do whatever is necessary to extend 24-hour electric service to the farms of the country just as they have extended it to all villages and hamlets were given the American Society of Agricultural Engineers by G. C. Neff, general manager of the Wisconsin Power & Light Company, who addressed that body at Washington on June 21. He declared that five hundred thousand farmers now are receiving 24-hour service.

E. A. Holloway, sales engineer Iowa Railway & Light Corporation, presented for reference a summary of a number of representative line-extension policies and rural rate schedules from which future policies may be more intelligently planned. The paper contained the complete rate schedule and rules for the extension of rural lines used by eight companies in as many states, arranged so that all can apply each schedule to a specific rural extension with accuracy. Three specific rural lines, one with three, one with four and one with five consumers per mile of line, were used for the application of each rate schedule.

R. W. Trullinger, assistant in experiment station administration, Department of Agriculture, read a paper on "Research in Rural Electrification, 1927," in which he came to the conclusion "that it is not always entirely sound to assume the perfection and economy of any particular kind of power and its corresponding equipment and to modify agricultural practices to permit the use of such power and equipment. The tendency, on the other hand, appears to be to determine the requirements of individual practices for power, and, with this as a basis, to lay down the specifications for power equipment which will best meet these requirements."

## Want Large Delegation for Tokyo Congress

A nation-wide movement to marshal a large delegation of engineers from the United States to attend the first World Congress of Engineers, which will be held in Tokyo next year, is now under way. Maurice Holland, executive director of the American committee, reports that engineers and engineering societies in the United States will be organized into units to promote interest in the congress. As before announced, Dr. Elmer A. Sperry is chairman of the American committee and Herbert Hoover is honorary chairman.

A special committee on promotion and attendance has appointed Ernest Hartford of New York as its secretary. Mr. Hartford was authorized to organize local co-operative committees throughout the United States which would include the local sections of the founder engineering societies as well as independent local engineering clubs and societies. Through these groups it is expected that prominent engineers from many cities in the United States will be led to attend and participate in the congress. William E. Wickenden was authorized to communicate with the presidents of engineering colleges requesting their indorsement of and active aid in a plan to raise by subscription among the alumni a testimonial fund to send delegates to the congress. The delegates are to be designated by the proper officials of the colleges and to be members of their faculties.

The members of the committee on promotion and attendance are George W. Fuller, chairman; Edward Dean Adams, J. J. Carty, Howard E. Coffin, Gano Dunn, Bancroft Gherardi, John Hays Hammond, Charles H. Herty, Samuel Insull, Arthur D. Little, William Benson Mayo, Charles D. Marx, William C. Potter, E. Wilbur Rice, Jr., Charles M. Schwab, George Otis Smith, John F. Stevens, S. W. Stratton, Ambrose Swasey, Samuel M. Vauclain, H. H. Westinghouse and William E. Wickenden.

## A.S.T.M. Annual Meeting at Atlantic City

Atlantic City was the scene this week of the thirty-first annual meeting of the American Society for Testing Materials. The president's opening remarks were made by Prof. H. F. Moore of the University of Illinois on Tuesday afternoon. Committee reports were, as usual, very copious. A summary of a few items of especial interest to electrical technicians and specialists is as follows:

The committee on magnetic properties (Thomas Spooner, chairman) submitted a proposed standardization of magnetic terms, units and symbols and recommended the advancement to standard of revised methods of test for magnetic properties of iron and steel at low inductions.

The committee on magnetic analysis (R. L. Sanford chairman) discussed the nature and present status of magnetic analysis and the relation of the committee to its development and pointed out the need for a larger number of investigators and a greater degree of co-operation in this field of non-destructive testing.

The incremental permeability method for the magnetic analysis of high-speed steel was discussed by W. B. Kouwenhoven and Julian D. Tebo, who presented results of tests on high-speed steel bars using a method based on incremental permeability in which a given magnetizing force is applied to the bar in question and the change in flux produced by an increment of magnetizing force is measured.

Endurance of high-speed cut-off tools in relation to magnetic and other measurements was the topic of Haakon Styri, who presented results of magnetic, electric, Rockwell hardness and duroscope readings on a number of standard cut-off tools hardened from different temperatures and used in cutting off rings of high-carbon chromium steel of about 200 Brinell hardness.

The committee on electrical insulating materials (H. S. Vassar, chairman) submitted, as tentative, methods of testing varnished-cloth tape, additional tests for laminated materials covering compressive strength and water absorption, and a complete revision of the tentative methods of testing molded insulating materials for resistance to impact, broadening the scope

## Toledo Edison Pursues Its School Work Undismayed

THIS year's graduating class of the Notre Dame Academy, a school for girls at Toledo, Ohio, recently visited the Acme generating plant of the Toledo Edison Company and after a tour of inspection commandeered one of the electric locomotives for a ride about the coal-storage yards and switch tracks. As a result several girls expressed a determination to pursue the study of electricity through their college courses. Since the first of January the Toledo Edison Company has provided for this and other schools in its territory a series of talks and practical demonstrations dealing with the manufacture and distribution of electrical energy. Many letters of appreciation have been received by C. L. Proctor, vice-president and general manager, from the teachers and school boards of schools visited. Mr. Proctor will extend this educational service over a wider field, and plans have been perfected whereby upward of thirty thousand high-school and college students will hear these talks by Jan. 1.

to include ceramic and laminated materials. This committee recommended modification in methods of testing molded insulating materials, calling for a new form of tension-test specimen.

## Camp Co-operation VIII Arranges Program

As already published, the seventh electrical league conference—Camp Co-operation VIII—held under the auspices of the League Council and sponsored by the Society for Electrical Development, will take place at Association Island, Henderson Harbor, N. Y., Aug. 2 to 7, inclusive. The many acceptances already received point to a well-attended meeting. In the business program, prepared under the direction of the League Council, headed by J. E. North, two main subjects have been kept in mind —(1) to report on plans, experiences, developments and results of league activities carried on during the past twelve months; (2) to give the league representatives a picture of changes in national thinking and working both inside and outside the industry. The wiring, lighting, appliance and industrial phases of league work will all be treated.

The conference will open Thursday afternoon, Aug. 2, with flag-raising exercises and an address by C. L. Collens. In the evening F. W. Freeman, president Society for Electrical Development, will speak; J. E. North will report for the League Council, and W. E. Sprackling for the Electrical Industry Sales Conference.

On Friday morning, when promotion of wiring business will be the theme, "The Place of the 'Red Seal' in the Program to Adequately Wire the Homes of America" will be discussed by S. A. Dennis, and "The Status of 'Red Seal' Today" by B. Badrian. Conspicuous examples of "red seal" accomplishment will be given by C. C. Monroe of Detroit, E. W. Hane of Chattanooga, E. J. Beil of Youngstown and a representative of the California Electrical Bureau. On Friday evening Mr. North will tell about "The Plan for Further Broadening the Electrical Market," and other topics will be adequately presented. The promotion of lighting business will be the topic for Saturday. In the evening "The Buying Habits of the Electricity-Using Public" will be examined by Dr. Paul T. Cherington and "The Future of Associations as a Useful Instrument" will be discussed by Hugh P. Baker, manager trade association department, United States Chamber of Commerce.

Sunday will be given over to rest and recreation with an address after supper by a speaker of national prominence. Monday the promotion of appliance business will be on the carpet. "Intertrade Merchandising Problems" will be looked into by C. E. Greenwood, commercial director N.E.L.A. There will be an open forum for the discussion of league problems in the evening. Promotion of industrial business will take up Tuesday morning, Aug. 7.

## Briefer News

Interstate Line from Shreveport to Marshall Begun.—Construction of a 66,000-volt transmission line from Shreveport, La., to Marshall, Tex., about 25 miles, by way of Trees City, La., and Jefferson, Tex., is starting. The line will be erected for the Southwestern Gas & Electric Company, which supplies power for most of the towns and cities in that area.

McGraw-Hill Publishing Company Announces "Food Industries."—The McGraw-Hill Publishing Company announces that, starting in October, it will publish a monthly to be known as *Food Industries.* The new publication will be for men interested in the manufacturing and processing of foods. Its editorial direction will be under Dr. H. C. Parmelee, editor of *Chemical and Metallurgical Engineering.*

Boston League Has Service Connection Committee.—A service connection committee of executive officers has been formed by the Metropolitan Electrical League of Boston for a discussion of the advantages of uniformity of thought about central-station service requirements. A sub-committee will analyze service requirements of the Boston, Cambridge and Malden central-station companies. When this analysis shall have been completed the companies will, it is thought, be in a position to co-ordinate their requirements by agreement between themselves and in line with suggestions from other groups. The action taken is almost sure to attract interested consideration throughout New England central-station circles.

## *Coming Meetings*

**[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for Jan. 7, page 80.]**

Michigan Section, N.E.L.A.—Mackinac Island, July 5-7. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Public Utilities Advertising Association—Detroit, July 8-12. T. P. Pfeiffer, Byllesby Engineering & Management Corp., Chicago.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

National Electric Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

National Electrical Manufacturers' Association — Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

Wisconsin Legislature Committee Inspects Ontario Hydro.—A special committee appointed by the Wisconsin Legislature has been touring the Province of Ontario making a detailed inspection of hydro-electric service in representative rural communities and in towns and cities, with a view of making recommendations for further utilization of Wisconsin's water-power resources. The party is under the direction of John Purcell, who is in charge of rural extension work in Wisconsin.

Illumination Problems Studied by Special Class at Nela Park.—The course on problems of modern illumination given from June 11 to 16 by the Nela School of Lighting of the National Lamp Works in Cleveland was well attended. Thirty-seven members were registered, several from across the seas, and the remainder consisting of central-station men, college instructors and men closely associated with the business of lighting. Takeshi Hirohashi of Tokyo, Japan, received honorable mention in the final examinations.

Seattle to House City Lighting Department in New Substation.—The Seattle City Council has appropriated $991,500 to cover the cost of a substation and lighting department office building and equipment. Tentative plans provide for a structure with two stories and two basements at Third Avenue and Madison Street. This building will cost $200,000, the site the same amount, and the remainder will be spent in equipment.

Crossing the Red River from Texas to Oklahoma.—The recently energized 66,000-volt transmission line which links the West Texas Utilities Company's system at Vernon, Tex., with that of the Southwestern Light & Power Company at Frederick, Okla., crosses the Red River by means of a span which is 2,223 ft. in length between rest frames and 3,316 ft. between dead ends. It is carried on steel towers high over the stream that here forms the interstate boundary.

Bill Introduced to Permit New Orleans to Buy Public Service Properties.—Measures have been reported favorably to the Louisiana Senate which prescribe methods of finance that will enable the city of New Orleans to exercise its legal authority to purchase properties of the New Orleans Public Service, Inc. The bills authorize the city, after approval by a vote of the people of New Orleans, to issue 50-year bonds, to be secured by the properties purchased and the income derived from them. The city government also is empowered to sell or lease the properties to third parties. These bills, it was explained, are for the purpose of permitting the city to distribute natural gas in New Orleans in the event other arrangements are not made. The New Orleans Public Service, Inc., owns also the light and power system of city.

Detroit's New "White Way."—Detroit is getting ready to boast one of the most brilliantly lighted thoroughfares in the world after July 10, when current will be sent into the "whiteway" system on Washington Boulevard. Plans for the event include the attendance of city officials, members of the International Advertising Association, which will be in convention there, and men prominent in the city's business life.

Power Plant Stack to Guide Aviators.—A move to co-operate with the government in directing aviators at night is reported from Colorado. The smokestack of the Pueblo plant of the Southern Colorado Power Company is 250 ft. high and 14 ft. in diameter at the base. The stack is to be lighted by eight 500-watt floodlamps placed in pairs at the base of the stack. When lighted they will cause the stack to appear as a huge illuminated cylinder.

Pacific Gas & Electric Will Supply Energy to 43 Airway Beacons.—Contract to supply electrical energy for the lighting of 43 airway beacons in California has been awarded to the Pacific Gas & Electric Company by the United States government. The contract includes 85 miles of the San Francisco-Los Angeles route, 185 miles of the San Francisco-Seattle route and 135 miles of the San Francisco-Salt Lake route, or a total of more than 400 miles. The beacons will be approximately 10 miles apart.

Brooklyn Edison Company's Prohibition of Submetering Challenged.—Steps which were taken by the Brooklyn Edison Company to prevent the spread of the practice of electric submetering from Manhattan Borough, where it is widespread, to Brooklyn, where it had obtained a relatively small foothold, by means of an amendment to the company's rules filed with the New York Public Service Commission, have been challenged by the Survel Realty Corporation, owner of a large new apartment building, and a hearing on the company's rule, which has been in operation since Feb. 5 and which probibits service through a master meter for submetering, will be held.

Dix River Plant Breaks Record.—All generating records of the Kentucky Hydro-Electric Company, operating the Dix River plant, were broken on June 13, when over a twenty-four-hour period the plant produced 512,000 kw.-hr., operating steadily at 94.9 per cent of generating capacity. A still higher record could probably have been made if there had been an outlet for additional energy. On June 12 the output was 486,000 kw.-hr. The previous record had been made on Jan. 1, 1927, and was 453,000 kw.-hr. Heavy rains made the new figures possible, there being 244.7 ft. of water behind the dam and 2.7 ft. of water breaking over the spillway. The company says the output recorded is in excess of the anticipated capacity of the plant.

Columbus' New "White Way."—"White way" boulevard lights are being installed in the driving park on Livingston Avenue, Columbus, Ohio. Approximately 17,000 ft. of cable and 64 light standards will be used to light Kelton, Lilley, Berkeley and Geers Avenues in the park, according to the superintendent of the municipal light plant. The new lamps are of the lantern type, 13 ft. above the street, with 400-cp. bulbs. The are spaced 200 ft. apart on alternate sides of the streets.

"Televox" a Popular Man at Electrical Conventions.—At a number of recent electrical conventions a popular attendant has been "Televox," the electrical man built by R. J. Wensley of the Westinghouse Electric & Manufacturing Company to demonstrate his televocal system for the automatic operation of machinery by sound. This system was described in the Electrical World, for Oct. 15, 1927 (page 803). The picture shows W. L. Frost, general commercial manager Southern California Edison Company and retiring president Pacific Coast Electrical Association, giving orders to "Televox" at the recent Pasadena convention of that association.

Dedication of Norwood Plant in North Carolina. — Seven hundred people, representing 191 communities, attended a barbecue given by the Carolina Power & Light Company near Mount Gilead to mark the opening of the Norwood hydro-electric power plant. This new station, situated on the Pee Dee River in Montgomery County, about four miles from Mount Gilead, has a concrete spillway dam 1,553 ft. long combined with an earth dam 1,258 ft. long with a maximum height of 100 ft. The reservoir is 18 miles long with a maximum width of three-fourths of a mile and covers 6,500 acres. The power house is built into the downstream face of the dam on the east side of the river. The generating equipment consists of one 24,000-hp. and two 29,000-hp. vertical generators, directly connected to waterwheels, making the total capacity of the plant approximately 82,000-hp. Provision has been made for the installation of a fourth unit. The generators are outside the power house and are protected by steel covers. The operating head on the wheel is 72 ft.

Springfield, Mass., and Turners Falls Company Sign Contract.—The Springfield (Mass.) Water Commission and the Turners Falls Power & Electric Company have signed the contract by which the company is to purchase from the city electrical energy generated in a plant to be built in connection with the Cobble Mountain reservoir and dam. The next move is to obtain the approval of the Massachusetts Public Utilities Commission, which is asked to set an early date for a hearing. The company is to take a 30-year lease of the plant, with payments of $270,000 annually, and turn the plant back to the city in a satisfactory condition at the expiration of that term.

Experiment in Parallel Operation Between Keokuk and Boston.—The area of previous experiments in long-distance parallel operation was extended recently during a four-hour test of the Joliet-Kewanee line of the Illinois Power & Light Corporation. When the test began power from Keokuk to Kewanee was cut at Galesburg and Chicago station power was cut into the Kewanee loop. Immediately thereafter Keokuk was cut into the Chicago wire, St. Louis was added to the circuit, and then parallel operation all the way to Boston was effected through Chicago. It was reported to be the first time that direct connection had been established between Chicago and St. Louis.

"World's Largest" Cooling Tower for Birmingham, England.—A reinforced-concrete cooling tower which is now being erected in connection with the Hams Hall generating station at Birmingham, England, will, its designers say, take precedence as the biggest in the world. It is to rise to a height of 220 ft. and will have a diameter of 168 ft. at the base. It is the first of two towers each capable of cooling the circulating water required for a 30,000-kw. turbine. The foundations of the station are nearing completion, and an electrically operated overhead crane with a lifting capacity of more than 150 tons is ready to install the first large alternator. The cost of the first unit of this plant is estimated at approximately $7,500,000.

New Jersey Power & Light Awards Contract for 50,000-Kw. Turbine.—The New Jersey Power & Light Company, subsidiary of the General Gas & Electric Corporation, has awarded to the General Electric Company a contract for a 50,000-kw. turbine to be installed in the new steam generating station of the power company at Holland, N. J., on the Delaware River and operated at 1,200 lb. pressure. Construction work on this plant, which is to represent an investment of approximately $5,000,000, is now actively under way, and it is planned that this new generating unit of the Pennsylvania-New Jersey power system shall be ready for operation early in 1929. The station will be tied in with the Metropolitan Edison system, another General Gas & Electric subsidiary.

**Texas City's Coming Power Plant.**—The new steam power plant of the Texas-Louisiana Power Company at Texas City, Tex., will be completed soon at a cost of $300,000. The first unit will be placed in operation early in July. Transmission lines are being constructed from the plant to La Marque and a number of other towns in the Gulf Coast region. The plant also will furnish power and light for Texas City itself.

**Eastern Shore Generating Plant in Full Operation.**—The million-dollar 12,000-kw. generating plant at Vienna, Md., now owned by the Insull interests and operated by the Eastern Shore Public Service Company of Salisbury, Md., is now virtually in full operation, that company reports, and serves 17,000 customers over 294 miles of transmission lines and 315 miles of distribution lines. It is the largest generating plant on the tri-state peninsula made up of Delaware and parts of Maryland and Virginia and sometimes distinguished as "Delmarva."

**Rural Rate Reductions on San Joaquin System.**—Reductions in rates for agricultural power on the system of the San Joaquin Light & Power Corporation in Merced, Mariposa, Madera, Fresno, Tulare, Kings and Kern Counties, which will result in an estimated saving of $250,000 a year, have been ordered by the California State Railroad Commission. The new rate schedule will become effective April 1, 1929. It resulted from informal negotiations conducted between representatives of the corporation and the California Farm Bureau Federation.

**Kansas Commission Refuses to Order Rate Reduction for Wichita.**—Present rate schedules of the Kansas Gas & Electric Company for Wichita will continue in force, the Kansas Public Service Commission has decided. The city of Wichita sought to compel the company to lower its charges, on the ground that Wichita, the largest city on the system, enjoys no advantage over smaller towns in the matter of rates and that a city of approximately 100,000 population shrould pay less for its electricity than places having a population of only a few hundred.

**Mid-Hudson Region of New York Gets Another Rate Decrease.**—The Central Hudson Gas & Electric Corporation of Poughkeepsie, N. Y., has announced another reduction in its rates for all classes of electrical customers, to become effective on bills rendered on and after July 15. The reduction represents a total net annual saving to customers in the territory served of $75,000. This is the second rate reduction since the consolidation on Jan. 1, 1927, of the separate companies which formerly operated in the central Hudson region and the fifth rate reduction since 1924.

# Commission Rulings

**New Jersey Commission Refuses Jurisdiction Over Contract for Special Industrial Service.**—A contract between E. I. Dupont de Nemours & Company and the Atlantic City Electric Company by which the latter agreed to construct an additional line of poles to serve the former, which in turn was bound to take service for a number of years at a compensation sufficient to amortize the capital expenditure, was not passed upon by the New Jersey Board of Public Utility Commissioners, which found that it came within the class of contracts for special service between public utilities and certain consumers that do not require the approval of the board. The fact that happenings at some future time might bring the matter within the board's jurisdiction could not be anticipated, since they might never arise.

**Company Not to Blame for Unsatisfactory Service to Direct-Current Elevator.** — Complaint against inadequate electric service furnished by the Grays Harbor Railway & Light Company in Aberdeen, Wash., was made by a customer who alleged that to this was due difficulty in operating the elevators in his five-story building. It was determined that 370 volts potential was required to hold the brakes on the elevator in a released position, and that if the voltage was less, the brakes would not release and the elevator could not be operated without great inconvenience to the tenants. Voltage at the power house was between 595 and 600, but when traffic was heavy the voltage was frequently reduced below 370. The Department of Public Works dismissed the complaint, pointing out that the elevator was installed in the year 1910 at a time when alternating-current elevators had not been perfected and that the company did not then furnish and had not since furnished direct-current service from a commercial line. Service furnished to the elevator was declared to be as good as it ever was. It appeared that one of two things was necessary to give satisfactory elevator service—either to install alternating-current equipment or to build a line direct to the power house. The department was unable to find any reason why the public utility company should bear any portion of the cost of either.

**Metering Energy to Rural Customer Owning Her Transmission Line.**—In denying an application by the Iron River Water, Light & Telephone Company to increase its rural electric rates to a single customer owning her own transmission line, an unusually long one, the Wisconsin Railroad Commission ordered an adjustment of the method of metering previously followed on the line, of which it said it had no authority to authorize the company to assume ownership, and the frequent and unexplainable necessity for meter repairs on which constituted, it asserted, a burden from which the special-contract consumer was entitled to relief. The commission held the most satisfactory solution of the metering problem to be the installation of two meters on the secondary side of the transformers, one for lighting circuits and the other for motors, in view of the fact that such meters are less expensive than primary metering equipment and also because of the protection from lightning or other voltage disturbances. The objection that such local meters would not record transformer losses was held illogical where the primary metering of the type employed did not register more than a small fraction of such losses. The core loss could be accurately estimated, the commission said. Moreover, the core loss and copper losses were more than offset by the value to the company of that portion of the extension used in the service of other customers.

# Recent Court Decisions

**Borough Which Allowed Wire in Park to Sag Within Reach of Children Negligent.**—In Novak vs. Borough of Ford City, a suit for damages because of injury to an eight-year-old boy who seized a sagging wire conveying electricity for lighting purposes to a monument in a park, the trial court found for the plaintiff, and the Supreme Court of Pennsylvania has confirmed the finding. The vertical distance of the wire at the time of the accident from a small mound on which children were accustomed to play was estimated by different witnesses at from 4 ft. to 6½ ft. It was maintained by the defendant that the boy jumped and caught hold of the wire and had climbed on the monument base with that purpose. These actions, if performed, were natural on the part of a child and to be anticipated, the court said, and, though there was no proof of actual notice to the borough that the wire was sagging, there was ample proof of constructive notice, the same condition having been complained of as far back as the preceding summer. (141 At. 496.)*

**Vested Rights, Privileges and Franchises Cannot Be Impaired by Ordinance.**—Declaring void an ordinance of the Borough of Montvale regulating the erection and maintenance of poles, wires and accessories for the transmission of energy, the Supreme Court of New Jersey has declared in a suit brought against the borough by the Rockland Electric Company that "where a borough ordinance has given to an electric light company permission to erect upon the streets and public places in the borough poles and appliances for the carrying and transmission of electrical current, the streets and public places have been designated for such purpose in such ordinance, and the company has expended money in the prosecution of its business in reliance upon said ordinance, the rights, privileges and franchises granted thereby are vested and cannot be repealed or impaired by the passage by the borough council of an ordinance requiring the obtaining of a new consent from the mayor and borough council." (141 At. 673.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# News About Men of the Industry

### *P. S. Gregory New President of Canadian Association*

P. S. Gregory, assistant to the vice-president and general manager of the Shawinigan Water & Power Company, has been elected president of the Canadian Electrical Association for the coming year. He has been in the utility business since 1912, starting first in the traction field and entering the electric light and power field in 1918. At that time he became electrical engineer of the Shawinigan subsidiary distribution companies, later (1922) growing into his present executive position, where negotiation of large power contracts constitutes a major function. Mr. Gregory was graduated from Bishops University and McGill University with B.A. and B.Sc. degrees respectively. He has been on the executive committee of the Montreal branch of the Engineering Institute of Canada, chairman of the meter and power sales bureaus of the Canadian Electrical Association and a member of the Electric Club of Montreal.

*P. S. Gregory*

George Clinton Ward, executive vice-president of the Southern California Edison Company, was awarded the honorary degree of doctor of science at Oberlin College on June 19 in recognition of his work in applying the results of scientific research to the field of electrical and mechanical engineering.

George Kidd, for many years president of the British Columbia Electric Railway Company, Ltd., Vancouver, has been made president of the British Columbia Power Corporation, which now controls the former company and all its subsidiaries. W. G. Murrin, for a long period vice-president of the British Columbia company, has become vice-president of the British Columbia Power Corporation and A. T. B. Goward will continue to occupy a similar position with headquarters in Victoria. Sir Frank Barnard and Blake Wilson are members of the board of directors. Mr. Kidd, who recently returned to Vancouver from eastern Canada, where he attended a conference of the new owners of the company, stated that he had been assured that the past policy and management of the electric railway company would be continued and that there was not the slightest intention on the part of the new owners of interfering in any way with the rates or affairs of the company as they have been conducted for many years.

Robert A. Millikan, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, was awarded the honorary degree of doctor of science by Princeton University at the recent commencement exercises. Dr. Millikan won this recognition as a result of his scientific studies on the electron. The citation read: "In the history of modern physics his work will always have a conspicuous place."

George M. Gadsby, president of the West Penn Power Company, was made the recipient of the honorary degree of doctor of engineering by the University of Pittsburgh at the recent commencement exercises. The interest of Mr. Gadsby in the promotion and development of educational programs within and without his company and in developing educational opportunities for those within his company's employ was cited by Dean Holbrook of the university as one of the reasons for the awarding of the degree. Mr. Gadsby is a graduate of Marietta College and of the Massachusetts Institute of Technology. He received his master of arts degree at Marietta College and this month was elected a member of its board of trustees.

Stuart M. Cooper, president of the South Carolina Power Company, has resigned after an association with the Charleston utilities of nine years to affiliate himself with the United Gas Improvement Company, Philadelphia. The U.G.I. organization owned the public service company in Charleston until 1926, when the Charleston Consolidated Railway & Lighting Company was bought by the Southeastern Power & Light Company. Prior to removing to the South Mr. Cooper had been connected with the United Gas Improvement Company since 1907. A graduate of Syracuse University in electrical engineering, he served as assistant engineer of the Syracuse Lighting Company, subsequently entering the employ of the New York & Queens Electric Light & Power Company. After a period of three years he was transferred to the Counties Gas & Electric Company, Norristown, Pa., subsequently removing his interests to the main office of the United Gas Improvement Company. In 1919 he became general manager of the Charleston company, later vice-president and two years ago president.

### *Luke Bradley Resigns*

Luke C. Bradley, president of the Rhode Island Public Service Company, which some time ago took over the United Electric Railways and the Narragansett Electric Lighting Company, announced on June 23 that he will submit his resignation to the directors of the company at their July meeting. The resignation is to become effective Aug. 1. He will assume an executive position with the Electric Bond & Share Company, New York.

Early in February, 1927, Mr. Bradley was elected president of the service company, to succeed Louis C. Gerry. Mr. Bradley resigned a similar position with the Virginia Electric & Power Company to accept the Providence offer. Associated with Stone & Webster, Inc., of Boston, in executive positions for 22 years, Mr. Bradley had varied experience as directing head of utility companies in different parts of the country. As president of the Virginia company he had direct supervision over electric light and power properties, street railways, bus systems and gas properties extending over 40 cities in Virginia and North Carolina. He was also executive vice-president and division manager of utility properties under the management of Stone & Webster in the Southwest and is recognized as one of the most successful executives in the public utility field.

*L. C. Bradley*

It is reported that Frank D. Comerford, president of the New England Power Association, will succeed Mr. Bradley as president of the Rhode Island Public Service Company.

E. P. Peck, whose resignation as vice-president of the Utica (N. Y.) Gas & Electric Company, was announced in the April 21 issue of the Electrical World, has been appointed to the position of engineer of special studies for the New York Power & Light Corporation with offices in Albany. During his association with the

Utica utility, which dated back to 1919, he was responsible for the engineering of the extensive transmission and distribution lines at Utica, New Hartford and Deerfield and the building of those at Ilion, Little Falls and Dolgeville.

## *E. Donald Tolles Directs Wholesalers' Association*

*E. D. Tolles*

E. Donald Tolles, who was elected managing director of the National Electrical Wholesalers' Association at the recent convention held in Hot Springs, Va., as announced in the June 9 issue of the Electrical World, brings to his new executive position a broad background of experience in association work. After a business career covering a period of ten years, he became associated in managing a number of societies and trade associations with Franz Neilson, whom he succeeded as secretary of the New York Electrical Credit Association in 1920. Mr. Tolles first became identified with the Electrical Supply Jobbers' Association, forerunner of the National Electrical Wholesalers' Association, in 1917, as secretary of its Atlantic Division and four years later he was appointed its national representative, in this position acquainting himself with a large number of both manufacturers and jobbers throughout the United States. He more recently served as executive secretary of the association before assuming the duties of managing director.

Mr. Tolles is a native of Attice, N. Y. During the war he was active in Washington in the interests of the industry, devoting particular attention to the cause of the jobbers.

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Walter G. Jens has been appointed manager of the Pittsburgh branch of the Byllesby Engineering & Management Corporation, having formerly served as general superintendent of that corporation. Mr. Jens went to Pittsburgh in 1926 from Minneapolis, where he had been in charge of construction work for the Northern States Power Company for about ten years prior to that time. When the Pittsburgh branch of the Byllesby corporation was organized on Jan. 1, 1927, Mr. Jens was general superintendent of construction and in December of that year was made acting manager. His appointment as manager was made the occasion of a dinner in his honor on June 18, at which M. R. Sumner, general superintendent of construction, reviewed Mr. Jens' work and paid tribute to his executive leadership.

Maurice A. Oudin, vice-president of the International General Electric Company, Inc., who has just returned from a trip to Europe, was decorated with the order of Commander of the Crown of Italy.

James G. Harbord, president of the Radio Corporation of America, was awarded the honorary degree of doctor of laws by Yale University at the recent commencement exercises held in the Woolsey Hall Auditorium at New Haven.

## *T. A. Kenney Elected to New Executive Position*

T. A. Kenney, who recently became a director of the Commonwealth Power Corporation, has been elected a vice-president and director of the Allied Power & Light Corporation, which was formed recently to consolidate the interests of Hodenpyl, Hardy & Company, Inc., and Stevens & Wood, Inc. Mr. Kenney at an early age entered the employ of the Hudson River Power Transmission Company, which subsequently became a part of the Adirondack Water Power Corporation. This early association, which afforded first-hand experience with the electrical industry, included not only high-voltage power transmission but local electric distribution, industrial power application and electric railway operation as well. In 1912 Mr. Kenney joined the Hodenpyl, Hardy organization in the capacity of manager of the production and transmission department of the Consumers Power Company with headquarters at Jackson, Mich. That company was then consolidating a great many widely scattered hydro-electric companies in the state and interconnecting them, all of which required further pioneering work. Four years later he came to New York as assistant to B. C. Cobb in charge of operations of the Hodenpyl, Hardy properties which comprise one of the largest public utility groups in the United States.

In addition to his executive duties, Mr. Kenney has been prominently identified with the National Electric Light Association and the American Electric Railway Association activities. He is at present a member of the public policy committee of the National Electric Light Association, and in addition to being a member of the executive committee of the American Electric Railway Association is chairman of the finance committee of that organization. In addition to his duties with the Commonwealth Power Corporation and the Allied Power & Light Corporation Mr. Kenney is vice-president and a director of a number of other utility companies.

*T. A. Kenney*

# Obituary

William Lund, a pioneer inventor in the electrical field, died at Hull, Mass., June 19, at the age of 87. Mr. Lund was a native of Bradford, England, and retired from business in Philadelphia ten years ago.

Walter Claude Johnson, who was associated with the electrical industry in Great Britain in its early days, died June 2 near London in his eightieth year. Following an engineering apprenticeship, Mr. Johnson received an appointment with the Telegraph Construction & Maintenance Company, in which position he obtained experience in the laying of submarine cables and the manufacture of machinery for that purpose. In 1876, in conjunction with S. E. Phillips, he founded the business of Johnson & Phillips, Ltd., Charlton, England. Following the introduction of electric lighting, the partners engaged in the production of generators and arc lamps, and subsequently undertook the manufacture of insulated wires and cables.

Charles A. Harber, long identified with the electrical industry in Kansas City, Mo., died at his home in Fairmount, Mo., after a long illness. Mr. Harber was general superintendent of the Kansas City Power & Light Company for 27 years, having retired in 1910. He was 68 years of age.

Thomas S. Marlowe, who directed the installation of the electric light plant at Holden, Mass., died June 12 at his home in that town. Mr. Marlowe was superintendent of the Holden plant for 35 years and was a native of Underhill, Vt., where he was born 62 years ago.

# Financial and Statistical News

## Missouri Utility Makes New Offering

During the past week the Missouri Power & Light Company issued first mortgage 4½ per cent gold bonds, series B, to the amount of $1,500,000, the price being 92¼ and accrued interest, to yield 5 per cent. These securities, dated May 1, 1928, and maturing May 1, 1958, will constitute a direct obligation of the company and will be secured by a first mortgage on the entire fixed property of the company now owned or to be hereafter acquired, subject, however, to underlying mortgage liens, if any, on future acquisitions by the company. The proceeds from the sale of this issue of bonds will be used to reimburse the company for property additions, expenditures for which have been or are to be made.

## Commonwealth Power Pays Larger Common Dividend

The directors of the Commonwealth Power Corporation have declared a quarterly dividend of 75 cents per share on the common stock, payable Aug. 1 to holders of record July 12. From Aug. 1, 1927, to May 1, 1928, inclusive, quarterly dividends of 62½ cents per share were paid on this issue, and in addition the company on May 1 last paid an extra dividend of 50 cents per share. R. P. Stevens was elected vice-president and director and also a member of the executive committee and T. A. Kenney and H. S. Scarritt were elected members of the board, succeeding Earl S. Colman, W. M. Flook and Waldo S. Reed.

## New French Holding Company Formed

Formation of a new holding company, organized by American and French interests for the purpose of taking an active part in the development of the electrical industry in Europe through the acquisition of stocks, was announced during the past week. The company, which will be known as Compagnie Franco-Americaine pour l'Electricité et l'Industrie, will have a capitalization of 50,000,000 francs. The group interested in the formation of the company consists of Blair & Company, Inc., l'Union des Mines, Banque Compagnie Générale d'Electricité, l'Union Houillère Electrique.

CENTRAL PUBLIC SERVICE TO READJUST STRUCTURE.—At a general meeting to be held July 9 directors of the Central Public Service Corporation will propose to the stockholders a number of amendments which will result in a comprehensive plan for the readjustment of the financial structure. It is proposed to give the class A stock priority over the common stock to the extent of $1.75 a share per annum in earnings and $30 a share in liquidation. In addition the class A stock will participate equally with the common in earnings and surplus in liquidation after the common stock has received an amount equivalent to the class A priority. At the present time the class A stock is limited to a maximum of $2.50 a share per annum in dividends and to a maximum of $25 a share in liquidation, in priority to the common stock. This readjustment of the company's financial structure will enable the organization to exercise greater flexibility and economy in taking care of future requirements for growth and expansion.

JERSEY COURT ENJOINS FINANCE COMPANY.—An injunction has been granted by Vice-Chancellor Berry to the Public Service Corporation of New Jersey restraining the Public Service Finance Corporation of Newark from using the words "Public Service" as part of its title. At the hearing affidavits were filed to show that the Public Service Finance Corporation, which was incorporated to do a personal loan business, was not connected financially or otherwise with the Public Service Corporation or with any of its subsidiaries.

## German Utility Company Floats New Loan

The East Prussian Power Company made an offering of first mortgage sinking fund gold bonds, amounting to $3,500,000, at 91 and interest, yielding 6.75 per cent. These securities, dated June 1, 1928, mature June 1, 1953. They will be secured by a direct first mortgage, ranking equally with an existing mortgage securing approximately $553,572 5 per cent internal bonds, on substantially all the fixed properties of the company.

## Public Service Corporation in Economical Operating Position

IN SHARP contrast to the situation in the case of some of the larger utility systems with properties scattered to the four corners of the country, the Public Service Corporation of New Jersey has its assets of over $615,000,000 segregated within a compact area between New York and Philadelphia. The system has reached its present prominent position among the nation's twelve leading utility groups by natural growth, over the past two decades, rather than by the purchase of any important new properties.

Public Service Corporation's common stock has yielded large returns, but more moderate than in the case of some of the other holding company issues. The average price of the stock during 1923 was $46. After a three-for-one split a current price of the stock, on the original basis, would be around $160. Common dividends have been paid uninterruptedly since 1907. On the original $100 par stock a dividend of $4 was paid in 1920 and 1921. This was steadily increased to an $8 rate in 1923, when shares were split two-for-one. On the new stock $5 was being paid until 1926, when the three-for-one split referred to was effected. Thus the current rate of $2 is equivalent to $12 on the original shares. Furthermore, from 1924 to 1926 the corporation gave five allotments of common stock for subscription, and in November last and January of this year shareholders were offered rights for 6 per cent preferred stock and 4½ per cent debentures with a combined maximum per share worth of 96 cents.

After dividends, surplus earnings have been consistently turned back into the improvement of properties and equipment. Refunding of bonds at lower interest rates during recent months has made possible a saving of more than 20 cents per common share annually. Furthermore, appropriations of 19 per cent of gross revenues for maintenance, depreciation and retirement expenses are larger than in the case of most similarly situated companies. The operating ratio for the system as of Dec. 31, not including maintenance charges, was 42.6 per cent. Fixed capital of the system amounted to $4.47 per dollar of gross.

The Public Service Corporation has followed the customer-ownership policy with marked success. At the end of last year there were 89,769 accounts on the stock ledgers, against 67,303 the year before. In addition there were 18,912 open accounts with subscribers.

Capitalization is represented by $29,079,000 guaranteed stocks of leased companies, $108,613,000 6 per cent preferred stock, including that of the operating gas and electric subsidiary; $28,908,000 7 per cent and $21,531,000 8 per cent preferred stock, as well as 4,153,613 shares of no-par common stock. The funded debt at a recent date totaled $289,460,000.

## Record Hydro Output

The production of electrical energy by the use of water power in April established three records, the United States Geological Survey points out. More electricity was produced in a month than ever before, 29,400,000,000 kw.-hr.; the average daily rate of production of electricity by water was also the largest, 98,000,000 kw.-hr., and the proportion of the total output produced by water power was the largest of record, 43 per cent. More than 2,700,000 tons of coal would have been required to generate the electricity produced by water power in April. These totals apply to all energy generated in public utility plants, including those for electric railway and other plants as well as those for light and power. The former, however, constitute only a small fraction of the total. Corresponding data for central-station output were published in the résumé of operations of the industry in the Electrical World of June 23, 1928.

**Empire Power Resumes Dividend.**—The directors have declared a dividend of 50 cents per share on the participating stock, payable July 1 to holders of record June 21. Quarterly dividends at this rate were paid from October, 1926, to October, 1927, inclusive, but none has been paid since that date.

**Recent Listings.**—The New York Stock Exchange has authorized the listing of $1,003,000 additional 30-year first lien stamped 5 per cent sinking fund gold bonds of the Federal Light & Traction Company, due March 1, 1942, making the total applied for $3,823,500 in 5 per cent bonds, $3,482,000 stamped 6 per cent bonds and $3,203,500 stamped 5 per cent bonds. There have also been authorized for listing on the New York Exchange 5,251 additional shares of common stock, class A, of the General Gas & Electric Corporation, without par value, on official notice of issuance and payment in full, making the total amount applied for 356,160 shares. Convertible gold debentures of the Public Service Corporation of New Jersey have been authorized for listing on the New York Exchange to the amount of $24,719,500. These securities, bearing interest at the rate of 4½ per cent mature Feb. 1, 1948. The New York Stock Exchange has also authorized the listing of 141,000 additional shares of class A stock of the Utilities Power & Light Corporation (without par value) on official notice of issuance and payment in full, making the total amount applied for 725,000 shares of class A stock.

## Ontario Commission Issues Report

The Ontario Hydro-Electric Power Commission reports a net surplus of $1,291,986 for all hydro municipalities for the fiscal year ended Dec. 31, 1927. Total revenue collected by the electrical utilities during that period was $24,583,022. The cost of power was $13,652,712; cost of operation, maintenance and administration, $4,681,466; debenture charges and interest, $3,694,855. Depreciation is set at $1,262,000. The total investment of the commission in power undertakings and hydro-electric railways is $204,372,066, and the investment of the municipalities in distributing systems and other assets is $81,792,678, making in power and hydro-electric undertakings a total investment of $286,164,745. The total revenue derived from this capital investment aggregated $34,056,707 in 1927.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies*

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

| Companies | Bid Price Tuesday June 26 | Low 1928 | High 1928 |
|---|---|---|---|
| ABITIBI PWR. & PAPER, com. new—no par | 60 | 57 | 85 |
| Ala Pwr., $7 cum. pf.—no par | m 114 | 114 | 115½ |
| Allis Chalmers Mfg., 6% com | 116½ | 115¼ | 129¾ |
| Aluminum Co. of Amer., com. | 142 | 120 | 197¾ |
| Aluminum Co. of Amer., 6% pf. | m 108¾ | 105½ | 110½ |
| Amer. & Foreign Pwr 7% pf—no par | m 106½ | 105¼ | 110 |
| Amer. & Foreign Pwr., com.—no par | 34½ | 22⅝ | 38⅞ |
| Amer. Bosch Magneto, com—no par | 32½ | 15⅜ | 41 |
| Amer. Brown Boveri Elec.† | 17¾ | 10⅝ | 26½ |
| Amer. Brown Boveri Elec., pf $7 | 60 | 40¼ | 65⅝ |
| Amer. Gas & Elec., 6% pf.—no par | 104¾ | 104½ | 111 |
| Amer. Gas & Elec., com.†—no par | 162¼ | 117½ | 184 |
| Amer. Lt. & Trac., 6% pf. | 118 | 116 | 120 |
| Amer. Lt. & Trac., new com. | 222 | 170 | 249 |
| Amer. Pwr. & Lt., 5% pf. | 104½ | 103½ | 107½ |
| Amer. Pwr. & Lt., com.†—no par | 77⅝ | 62¼ | 95 |
| Amer. Pub. Serv., 7% pf | a 101 | 97¼ | 104 |
| Amer. Pub. Serv., com.† | m 60 | 70 | 75 |
| Amer. Public Utilities, 7% ptc. pf. | a 93¾ | 93⅜ | 97½ |
| Amer. Public Utilities, 7% pr. pf. | a 94 | 94 | 103 |
| Amer. Public Utilities, com. | m 50 | ... | ... |
| Amer. States Sec., A | a 10 | 4 | 13⅞ |
| Amer. States Sec., B | a 12 | 4¾ | 17⅞ |
| Amer. Superpower, 6% 1st pf | l 97½ | ... | ... |
| Amer. Superpower, Class A†—no par | m 34⅜ | 34¼ | 56 |
| Amer. Superpower, Class B†—no par | m 36½ | 36⅛ | 56⅞ |
| Amer. Wtr Wks & Elec., 6% pf. | m 100 | 101½ | 106 |
| Amer. W. W. & E., com new—no par | 56¼ | 52 | 70¾ |
| Anaconda Copper cap. $3. | 67⅞ | 53⅜ | 74⅞ |
| Appalachian Electric Pwr., 7% pf. | 109 | 108½ | 110 |
| Arkansas Pwr. & Lt., 7% pf | 106 | 108 | 109¼ |
| Assoc. Gas & Elec., $3 50—50 | 52 | ... | ... |
| Assoc. Gas & Elec., pf—$6—no par | 96 | 96 | 98½ |
| Assoc. G. & E., Class A, 10—no par | 49½ | 47 | 52⅞ |
| BABCOCK & WILCOX, 7% com. | 123½ | 117½ | 128 |
| Binghamton L., H. & P., $6 pf | 100 | 102 | 109¼ |
| Birmingham Elec., pf.—$6—no par | 107 | 104 | 107 |
| Blackstone Valley G. & E., 6% pf. | m 105 | 106 | 112 |
| Blackstone Valley Gas & Elec., 10% com.—.50 | m 165 | 135 | 170 |
| Blaw-Knox com.† | i 101½ | 91 | 108 |
| Brazilian Trac., Lt. & Pwr., com., new | f 56½ | ... | ... |
| Broad River Pwr., 7% pf. | 102 | 105 | 108½ |
| Brooklyn Edison, 8% com | m 240 | 106¼ | 268½ |
| Buffalo, Niagara & East. Pwr., $1.60 pf -25 | l 26⅜ | ... | ... |
| Buffalo, Niagara & East. Pwr. com. $1.20—no par | l 38½ | ... | ... |
| CALIFORNIA ELEC. GENERATING, 6% pf. | 99 | 98 | 101 |
| Carolina Pwr. & Lt., pf.—$7—no par ex. div. | l 108 | 109 | 111 |
| Central & S. W. Util., $7 pf.—no par | a 101 | 99⅛ | 105½ |
| Central & S. W. Util., pr. ln. $7 pf.—no par | a 106 | 103½ | 112 |
| Central Ark. Ry. & Lt., 7% pf. | 105 | 105 | 107½ |
| Central Ill. Pub. Serv., $6 pf. | a 99 | 97¼ | 100½ |
| Central Ind. Pwr., 7% pf. | a 99½ | 94 | 101 |
| Central Maine Power, 6% pf. | 97 | 96 | 98½ |
| Central Maine Power, 7% | 110 | 109 | 112 |
| Central Pwr. & Lt., 7% pf | 105 | 104½ | 114 |
| Central States Elec., 7% pf. | 115 | 104½ | 121⅝ |
| Cincinnati Gas & Elec., 5% com. | g 100 | 97¼ | 100¼ |
| Cities Service, $6 pf.—no par | l 100⅜ | 94½ | 103½ |
| Cities Service, pf. B—no par | l 9½ | 8¾ | 9⅞ |
| Cities Service, pf. BB—no par | l 95 | 88½ | 97 |
| Cities Service, com.—20 | l 66½ | 54 | 71½ |
| Cities Service, Bks. Shrs.—10 | l 33½ | 26⅞ | 35½ |
| Cities Service Pwr. & Lt., 7% pf. | m 107 | 106 | 109½ |
| Cities Service Pwr. & Lt., 6% pf. | 100½ | 95½ | 102 |
| Cleveland Elec. Illg., 6% pf. | 110 | 113 | 115½ |
| Cleveland Elec. Illg., 10% com. | 425 | 350 | 425 |
| Columbia Gas & Elec., 6% pf. | 107½ | 106 | 110⅛ |
| Columbia G. & E. com. $5—no par | 107 | 89½ | 118⅞ |
| Columbus Elec. & Power, $2 com. no par | m 70 | 66 | 79⅞ |
| Columbus Elec. & Pwr., 7% | 110 | ... | ... |
| Columbus Ry., Pwr. & Lt., 7% | 104 | 107 | 111 |
| Columbus Ry., Pwr. & Lt., 7% pf. B. | 105 | 105 | 111 |
| Columbus Ry., P. & Lt., com. no par | 125 | 120 | 125 |
| Commonwealth Edison, 8% com. | a 182 | 165 | 189 |
| Commonwealth Pwr., 6% pf. | 100⅛ | 100⅜ | 104⅛ |
| Commonw'th Pwr., $2, com.—no par | 75 | 62¼ | 87½ |
| Conn. Lt. & Pwr., 8% pf. | 121 | 120 | 123 |
| Conn. Lt. & Pwr., 7% pf. | 117 | 118 | 121 |
| Cons. Gas of N. Y., pf. | 101 | 100¾ | 105½ |
| Cons. Gas of N. Y., com. $5—no par | 143 | 119⅝ | 170 |
| Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 6% pf. | e 109¾ | 109½ | 114½ |
| Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 5% Pf. | e 101 | 100 | 105 |
| Cons. Gas, Elec. Lt. & Pwr. of Baltimore, com. $3.00—no par | e 77 | 67½ | 93 |
| Consolidated Power & Lt., 7% pf | m 105 | 106 | 109 |
| Consumers Power, 6% pf. | 103 | 105½ | 106½ |
| Consumers Power, 6.6% pf. | 103 | 106 | 107 |
| Continental Gas & Elec., 7% pr. pf. | 105 | 106½ | 108½ |
| Conti. G. & E. com. $4.40—no par | m 225 | 240 | 265 |
| Crocker Wheeler, com.† | 62 | ... | ... |
| Crocker Wheeler, 7% pf. | 96 | 77 | 98 |
| DALLAS PWR. & LT., 7% pf | 110 | 110 | 111½ |
| Dayton Pwr. & Lt., 6% pf | 106 | 107 | 110½ |
| Derby Gas & Elec., 7% pf. | 100 | 96 | 100½ |
| Detroit Edison, 8% com | m 199 | 166½ | 209¾ |
| Dubilier Condenser, com.—no par | 3½ | 2⅛ | 5½ |
| Duke Pwr., cap. | 135 | 130 | 145 |
| Duquesne Lt., 5% pf. | m 101⅛ | 101 | 116½ |
| EASTERN NEW YORK UTIL., $7 pf. | m 110 | 111 | 112½ |
| Eastern States Pwr. B | 20½ | 11½ | 26½ |
| Eastern States Pwr., pf | m 100 | 98 | 100½ |
| East. Tex. Elec., 7% pf | 105 | 106 | 109 |
| Edison Elec. of Boston, $12 com. | d 275½ | 252 | 305 |
| El Paso Elec. 7% pf | m 111 | 110 | 112½ |
| Elec. Bond & Share, 6% pf. | l 108¾ | 108⅜ | 111⅛ |
| Elec. Bd. & Sh. Sec., com. $1—no par | l 103 | 76 | 127½ |
| Electric Household Util.† | a 24 | 13½ | 27 |
| Elec. Investors, 6% pf.—no par | 99 | 101 | 104 |
| Elec. Investors, com.†—no par | 63½ | 40½ | 79½ |
| Elec. Pwr. & Lt., ctfs. pf. | 107½ | 106½ | 110½ |
| Elec. Pwr. & Lt., ctfs., com.—no par. | 35⅝ | 28¾ | 45½ |
| Elec. Ry. Securities, com.—no par | 6½ | ... | ... |
| Elec. St. Battery com. $5.25—no par | 74⅜ | 69 | 84¾ |
| Elmira Wtr., Lt. & R.R., 7% pf. | 105 | 104 | 115 |
| Empire Pwr., ptc.† | 35 | 27⅛ | 39½ |
| Engr. Pub. Serv. $7, pf.—no par | m 110¾ | 107 | 111½ |
| Engr. Pub. Serv., com.—no par | 37 | 33 | 46½ |
| Eureka Vacuum Cleaner, com. $4—no par | 63½ | 62½ | 79 |
| FAIRBANKS MORSE, 7% pf. | 109¾ | 104 | 114¾ |
| F.-M., com.—$3—no par | 39 | 32½ | 54 |
| Federal Lt. & Trac., com. $1.40 | 53 | 42 | 56½ |
| Federal Lt. & Trac., $6 pf.—no par | m 102¼ | 98 | 109 |
| Florida Pwr. & Lt., 7% pf. | m 103 | 105 | 108 |
| Ft. Worth Pwr. & Lt., 7% pf. | l 113½ | 113 | 114½ |
| GALVESTON-HOUSTON ELEC. 6% pf | 80 | 75 | 85 |
| Galveston-Houston Elec., com | 33 | 31½ | 42½ |
| General Cable, Cl. A | 63¾ | 56 | 84½ |
| Gen. Elec. $3 com.—no par | 146½ | 124 | 174½ |
| Gen. Elec., special—6% | 11⅜ | 11¼ | 11⅜ |
| Gen. Gas & Elec. (Del.), com. A $1.50 no par | 45⅞ | 35½ | 50⅞ |
| Gen. G. & E. (Del.) pf. A. $8—no par | 135 | 125 | 144 |
| Gen. G. & E. (Del.) pf. A $7—no par | 118 | 110 | 120 |
| Gen. G. & E. (Del.) pf. B $7 | 114 | 104 | 117 |
| Gen. Pub. Serv., $7 pf. | 98 | ... | ... |
| Gen. Pub. Serv., com., no par | 22½ | 16⅜ | 29 |
| General Public Utilities, $7 pf | m 98 | 98 | 103 |
| Ga. Lt., Pwr. & Rys., com. | m 58 | 55 | 65 |
| Gt. Western Pwr., 70% pf. | h 104 | ... | ... |
| IDAHO PWR., 7% pf. | 109 | 109 | 111½ |
| Ill. No. Utilities, 6% pf. | m 99 | 96 | 100 |
| Ill. Pwr. & Lt., 7% pf. | 106½ | 103 | 107 |
| Indianapolis Pwr. & Lt., 6½% pf | m 104 | 102 | 107½ |
| Indianapolis Pwr. & Lt., $7 pf. | 101 | 100 | 105 |
| Ingersoll Rand com | m 91 | 90 | 98 |
| Int. Combus. Engr., com. $2—no par | 58½ | 45½ | 72⅞ |
| Int. Combustion Engr., 7% pf. | 106 | 103 | 109 |
| Int. Util., Class A—$3.50—no par | 45½ | 44⅞ | 52 |
| Int. Utilities, Class B—no par | 15¾ | 6¾ | 9½ |
| Interstate Pwr., pf.—$7—no par | 100 | 99 | 105 |
| Interstate Pub. Serv., 7% pf. | 100 | 103 | 108 |
| Iowa Ry. & Lt., 7% pf. | 101 | 102 | 103 |
| JERSEY CENTRAL PWR. & LT. CO., 7% pf. | 105½ | 105 | 107 |
| Johns-Manville, com.d—no par | 102½ | 96½ | 134 |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 27. *m*Bid price Saturday, June 23. *n*Latest quotations available. †Dividend rate variable.

## *Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)*

**(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)**

| Companies | Bid Price Tuesday June 26 | Low 1928 | High 1928 |
|---|---|---|---|
| KANSAS CITY POWER & LIGHT pf $7 | m109½ | 109 | 114 |
| Kansas Gas & Elec. 7% pf. | l108 | 107 | 110 |
| Kelvinator Corp. | 14 | 11¾ | 22¼ |
| Kentucky Hydro-Elec., 7% pf. | m103 | 100 | 105 |
| Kentucky Sec., 6% pf. | 95 | 94 | 98 |
| Kentucky Sec., 5% com. | 150 | 140 | 150 |
| Kentucky Utilities, 6% pf. | 105 | 100 | 105 |
| LACLEDE GAS LT., 10% com. | 252 | 200 | 260 |
| Lehigh Pwr. Sec., com.—no par | n 65 | 19¾ | 65 |
| Long Island Ltg., 7% pf. | m109 | 110½ | 112½ |
| Long Island Ltg., 6% pf. | m104 | 107 | 109 |
| Long Island Ltg., com.†—no par | m250 | 170 | 250 |
| Los Angeles Gas & Elec., 6% pf. | h110 | 105½ | 112½ |
| Louisville Gas & Elec., cl. A. $1.75 | 34¾ | 28 | 41 |
| MAN. ELEC. SUPPLY, cap. $5—no par | 58 | 50 | 66¾ |
| Maytag Co., com. 50—no par | 19 | 18½ | 22 |
| Memphis P. & L., pf.—$7—no par | 110 | 109 | 111 |
| Metropolitan Ed., pf.—$6—no par | 108 | 103 | 109½ |
| Metropolitan Ed., pf.—$7—no par | 108 | 109 | 111½ |
| Metropolitan Ed., com. $5—no par | m170 | 125 | 185 |
| Middle West Utilities, 6% pf | a 97½ | 93½ | 100½ |
| Middle West Util., 6% pr. lien no par | a103 | 99 | 108 |
| Middle West Util., com. $7—no par | a144 | 123½ | 169 |
| Midland Utilities, pr. ln. 7% pf. | a 99½ | 99½ | 107 |
| Midland Utilities, 7% pf. A. | a103 | 103 | 105½ |
| Milwaukee Elec. Ry. & Lt., 7% pf. | 105 | 100 | 106 |
| Milwaukee Elec. Ry. & Lt., 6% pf. | 100 | 98 | 110 |
| Minn. Pwr. & Lt., 7% pf. | l106½ | 107 | 109 |
| Miss. River Pwr., 6% pf. | 110 | 94 | 112½ |
| Mohawk Hudson Pwr., 1st pf.—$7—no par | m106 | 100 | 110 |
| Mohawk Hudson Pwr., 2d pf.—$7—no par | m104 | 100 | 109 |
| Mohawk Hudson Pwr., com.—no par | 39¾ | 29½ | 53 |
| Montana Pwr., 5% com. | m145 | 102½ | 175 |
| Montreal Pwr., com. $2 no par | f102 | .... | .... |
| Mountain States Pwr., 7% pf. | m103 | 97 | 105 |
| Mountain States Pwr., com.† | 18½ | .... | .... |
| NASSAU & SUFFOLK LTG., 7% pf. | 107 | 98 | 110½ |
| National Carbon, 8% pf. | a137 | 136½ | 139¾ |
| National Elec. Pwr., A† | a 33½ | 27½ | 42 |
| National Pwr. & Lt., pf.—7% | 109 | 107¾ | 111 |
| National Pwr. & Lt., com.†—no par | 33⅞ | 21½ | 36½ |
| National Pub. Serv., 7% pf. | 100 | 99 | 104 |
| National Pub. Serv., 7% ptc., pf. | n114 | .... | .... |
| National Pub. Serv., A com. $1.60—no par | 27¾ | 22 | 29½ |
| National Pub. Serv., B com.—no par | m 30½ | 24½ | 32½ |
| Nebraska Pwr., 7% pf. | l108½ | 110 | 111½ |
| Nevada-Calif. Elec., com. | n 50 | 33½ | 50 |
| New Brunswick Pwr., 4% pf. | 60 | 60 | 70 |
| New Eng. Pub. Serv., pr. ln. pf. $7 | 110 | 98½ | 110½ |
| New Eng. Pub. Serv., pf. $7 | 98 | 95 | 108 |
| New Orleans Pub. Serv.—7% pf. | 105 | 106 | 110 |
| N. Y. & Queens Elec. Lt. & Pwr., 5% pf. | 102 | 91 | 104 |
| N. Y. Central Elec., 7% pf | 105 | 101 | 107 |
| New York Power & Light 7% pf. | 112 | .... | .... |
| Niagara Falls Pwr., 7% pf.—25 | m 27½ | 27½ | 29½ |
| No. Amer., 6% pf.—50 | m 54½ | 53½ | 55¾ |
| No. Amer., com.—10 | 68¾ | 58¾ | 78½ |
| No. Amer. Edison, $6 pf.—no par | 100¾ | 100½ | 105½ |
| Northeastern Pwr., com. | 26½ | 19½ | 31 |
| No. N. Y. Utilities, 7% pf. | 107 | 103 | 109 |
| No. Ohio Pwr., com.—no par | 26¾ | 18 | 32 |
| Northern Ohio Pwr. & Lt., 6% pf. | 100 | 90 | 100 |
| No. Ont. Lt. & Pr. 6% pf | m 98 | 94 | 100 |
| No. States Pwr. (Del.), 7% pf. | 109 | 101 | 110½ |
| No. States Pwr. (Del.), 8% com. | 135½ | 123 | 152 |
| No. Texas Elec., 6% pf. | 55 | 45 | 70 |
| No. Texas Elec., com. | 19 | .... | .... |
| OHIO BRASS, com. B $4—no par. | k 93½ | 90¾ | 100½ |
| Ohio Brass, 6% pf. | k107½ | 106 | 108½ |
| Ohio Pwr., 6% pf. | 108 | 104 | 109½ |
| Ohio Pub. Serv., $6 pf. | 104 | 95 | 105 |
| Ohio Pub. Serv., 7% pf. | 112 | 107 | 112 |
| Ohio River Edison, 7% pf. | 107 | 106 | 109¾ |
| Oklahoma Gas & Elec., 7% pf. | 109 | 106 | 115½ |
| PACIFIC GAS & ELEC., 6% pf. | m 26¾ | 23½ | 30 |
| Pacific Gas & Elec., 8% new com. | m 47½ | 43½ | 53½ |
| Pacific Pwr. & Lt., 7% pf. | l109 | 106 | 110 |
| Packard Electric | k 66½ | 47 | 68½ |
| Penn Cent. Lt. & Pwr., $5 pf.—no par | c 78¾ | 79½ | 82 |
| Penn-Ohio Edison, 6% pf. no par | m 95 | 78 | 99 |
| Penn-Ohio Edison, 7% pf. | 108 | 97½ | 109 |
| Penn-Ohio Pwr. & Lt., 7% pf. | 105 | 99 | 112 |
| Penn Pwr. & Lt.—$7—no par ex.div. | l108½ | 109½ | 110½ |
| Penn Wtr. & Pwr., $2.50 com., new | e 79 | 68 | 90 |
| Phila. Co., 5% pf.—50 | 48 | 45½ | 48½ |
| Phila. Co., 6% pf.—50 | m 52¾ | 52 | 57 |
| Phila. Co., com.—50 | m160 | 145 | 174½ |
| Phila. Elec., 8% com.—25 | c 67 | 55½ | 74¾ |
| Portland Elec. Pwr., 7% pf. | 103 | 100 | 106 |
| Portland Elec. Pwr., 6% pf. | 93 | 78 | 96 |
| Portland Elec. Pwr., 6% 2d pf. | 83 | 55 | 88 |
| Portland Elec. Pwr., com. | 43 | .... | .... |
| Potomac Elec. Power, 6% pf. | j111¾ | .... | .... |
| Pwr. Sec., pf.—no par | 60 | 50 | 68 |
| Pwr. Sec., com.—no par | m 13½ | 11½ | 14½ |
| Public Serv. of Colorado, 7% pf. | 107 | .... | .... |
| Pub. Serv. of N. J., 6% pf. | 109¾ | 103¾ | 115 |
| Pub. Serv. of N. J., 7% pf. | 126½ | 118 | 129½ |
| Pub. Serv. of N. J., $2 com.—no par | 54½ | 41½ | 66¾ |
| Pub. Serv. of No. Ill., 6% pf. | a119 | 110 | 119 |
| P. S. of No. Ill., com. $8—no par | a185 | 159½ | 190½ |
| Pub. Serv. of No. Ill., $8 com. | a185 | 139¾ | 190 |
| Pub. Serv. of Okla., 7% pr. ln. | 109 | 100 | 107 |
| Pub. Serv. Elec. & Gas, 6% pf. | 107½ | 107½ | 110½ |
| Puget Sound Pwr. & Lt., 7% pf. | m110 | 105 | 110 |
| Puget Sound Pwr. & Lt., $6 pf.—no par | m100 | 96½ | 105½ |
| Puget Sound Pwr. & Lt., com. | 89 | 34¾ | 94¾ |
| RADIO CORP. OF AMER., $3.50 pf.—50 | 55½ | 54½ | 60 |
| Radio Corp. of Amer., com.—no par. | 175½ | 85½ | 224 |
| Rochester Gas & Elec. 6% pf. D | 105½ | 105½ | 106½ |
| Rochester Gas & Elec., 7% pf. B. | 104 | 105 | 108 |
| Rochester Gas & Elec., 6% pf. C. | 104 | 105½ | 106½ |
| SAN JOAQUIN Lt. & Pwr., 7% pr. pf | 117 | 110 | 117½ |
| St. Joseph Ry., L., H. & P., 5% pf. | m 75 | 70 | 75 |
| Servel, Inc. | m 14½ | 4½ | 16½ |
| Shawinigan Water & Power, com., $2 no par | f 92 | ... | .. |
| Sierra Pacific Elec., 2% com. | 38½ | 29 | 40½ |
| Sioux City Gas & Elec., 7% pf. | 105½ | 100 | 108½ |
| Southeastern Pwr. & Lt., pf.—$7 no par | l107 | .... | .... |
| Southeastern Pwr. & Lt., ptc. pf. | l 87 | .... | .... |
| Southeastern Pwr. & Lt., com.—no par | 49¾ | 40¾ | 61 |
| So. Calif. Edison, 8% pf. | 49 | 38½ | 53 |
| So. Calif. Edison, 7% pf. | 29 | 27½ | 29½ |
| So. Calif. Edison, 6% pf. | 27 | 25½ | 28 |
| So. Calif. Edison, 8% com. | 45½ | 43½ | 53½ |
| Southern Cities Utilities, 7% pf. | 83 | 75 | 92 |
| Southwestern Lt. & Pwr., A $3 | 65 | 60 | 80 |
| Southwestern Lt. & Pwr., B. | 50 | ... | .. |
| Southwestern Lt. & Pwr., $6 pf. | 90 | 88 | 96¾ |
| Southwestern Pwr. & Lt., 7% pf. | m111½ | 103 | 115 |
| Standard Gas & Elec., 8% pf. | 68¾ | 65 | 71½ |
| Standard Gas & Elec., 7% pr. pf. | 113 | 108 | 115 |
| Standard G. & E., com. $3.50 | 64½ | 57¾ | 74¾ |
| Standard Power & Light, com. | 49 | 29¾ | 58½ |
| Standard Pwr. & Lt., 7% pf. | 104¾ | 103¾ | 107¾ |
| Staten Island Edison, pf.—$6—no par | 97 | 99 | 103½ |
| Superheater, $6 com.—no par | 150 | ... | ... |
| Syracuse Lighting, 7% pf. | 110 | 103 | 112½ |
| Syracuse Lighting, 8% pf. | m120 | 114 | 121 |
| TAMPA ELEC., com. $2 | 65 | ... | ... |
| Tenn. Elec. Pwr., 6% pf. | 100 | 92 | 103 |
| Tenn. Elec. Pwr., 7% pf. | 107 | 107 | 110 |
| Tex. Pwr. & Lt., 7% pf. | l114 | 113½ | 115 |
| Tide Water Pwr., 8% pf. | 106 | 108 | 112 |
| Timken Roller Bear., com.—$4 no par | 118½ | 112¾ | 134 |
| Toledo Edison, 7% pf. | 109 | 108 | 111 |
| Toledo Edison, 6% pf. | 105 | 95 | 105 |
| Toledo Edison, 6% com. | m145 | 120 | 150 |
| Tri-City Ry. & Lt., 6% pf. | 90 | 88 | 102 |
| UNITED GAS & ELEC., 7% pf. | 95 | 98 | 103 |
| United Gas & Elec. (N. J.), 5% pf. | 75 | 70 | 77 |
| United Gas Impr., 8% com.—50 | c134½ | 114½ | 149¾ |
| United Lt. & Pwr., pf.—$4—no par. | m 55 | 49 | 56½ |
| United Lt. & Pwr., pf.—$6.50—no par | 101 | 95 | 101½ |
| United L. & P., com. A .48—no par. | 23½ | 13¾ | 26¾ |
| United L. & P., com. B .48—no par. | 28 | 20½ | 31 |
| Utah Pwr. & Lt., 7% pf. | l107½ | 109½ | 112 |
| Utica Gas & Elec., 7% pf. | 106 | 105 | 106½ |
| Utica Gas & Elec., 8% com. | m200 | 215 | 225 |
| Utilities Pwr. & Lt., 7% pf. | 98 | 98 | 104 |
| Utilities Pwr. & Lt., com. A $2 | 37 | 28½ | 45¾ |
| Utilities Pwr. & Lt., com. B $1—no par | 28 | 18½ | 32¾ |
| VERMONT HYDRO-ELEC.; 7% pf. | 99 | 95 | 102 |
| Virginia Elec. & Pwr., 7% pf. | m108 | 108 | 111 |
| Virginia Public Service 7% pf. | 102 | 97 | 103½ |
| WAGNER ELEC., 7% pf. | b104 | 96½ | 107 |
| Wagner Elec., com.—no par | b 79½ | 37 | 120 |
| Washington Ry. & Elec., 7% com | j 450 | .... | .... |
| Washington Ry. & Elec., 5% pf. | j 99¾ | .... | .... |
| Washington Wtr. Pwr., 8% com. | 225 | 175 | 235 |
| West Penn Elec., 7% pf. | 109½ | 108 | 115 |
| West Penn Elec., Cl. A $7 | 103½ | 103 | 112 |
| West Penn Pwr., 7% pf. | 116½ | 114¾ | 117½ |
| West Penn Pwr., 6% pf. | 104½ | 104 | 113 |
| West Virginia Lt., Ht. & Pwr., 7% pf. | 95 | 94 | 100 |
| Western Pwr., 7% pf. | 104 | 98 | 105 |
| Western States Gas & Elec., 7% pf. | 104 | 100 | 106 |
| Western States Gas & Elec., com. | n 38 | .... | .... |
| Westinghouse Elec. & Mfg., 8% com.—50 | 92¾ | 88½ | 112 |
| Weston Elec. Instrument, Cl. A $2—no par | m 32½ | 30¾ | 40½ |
| Weston Elec. Instrument, com.—no par | m 22½ | 12½ | 28½ |
| Wheeling Elec., 6% pf. | 106 | 95 | 109 |
| Worthington Pump, 7% pf. A. | m 49 | 46½ | 58½ |
| Worthington Pump, 6% B. | m 43 | 41 | 51 |
| Worthington Pump, com. | 30 | 28 | 37¾ |
| YALE & TOWNE com. $5—25. | m 70 | 68½ | 84½ |

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland.
*l*Bid price Wednesday, June 27. *m*Bid price Saturday, June 23. *n*Latest quotations available. †Dividend rate variable.

BARCELONA TRACTION PAYS EXTRA DIVIDEND.—Directors of the Barcelona Traction, Light & Power Company, Ltd., have declared an extra dividend of 1 per cent and the quarterly dividend of 1¾ per cent on the non-cumulative participating preferred stock, all payable June 30 to holders of record June 21. An extra distribution of like amount was made on this issue on June 30, 1927.

CONNECTICUT UTILITY INCREASES CAPITAL.—The Rockville-Willimantic Lighting Company, Willimantic, Conn., will increase its capital stock, as recommended by directors and approved by stockholders of the company, by issuing 11,996 shares of common stock of no par value and 1,000 shares of preferred stock par value $100. The latter issue will be offered to stockholders at par on July 1 at the rate of one share of new stock for each eight shares of old stock. There is $800,000 of preferred stock outstanding.

MASSACHUSETTS UTILITY CHANGES PAR OF STOCK.—The Webster & Southbridge Gas & Electric Company, Webster, Mass., has been authorized to change the par value of the company's stock from $100 to $25 and to offer an additional stock issue of $400,000.

NORTHEASTERN POWER DECLARES INCREASED COMMON DIVIDEND. — The directors of the Northeastern Power Corporation have declared a quarterly dividend of 25 cents per share on the common stock and the usual quarterly dividend of $1.50 per share on the class A stock, both payable July 1 to holders of record June 15. From July 1, 1927, to April 1, 1928, inclusive, the corporation paid quarterly dividends of 15 cents per share on the common stock.

INDIANA UTILITY INCREASES CAPITAL.—The Liberty Light & Power Company of Richmond, Ind., has filed papers with the Secretary of State increasing its stock from $75,000 common and the same amount preferred to $125,000 common and the same amount preferred.

OHIO RIVER EDISON DOUBLES STOCK. —The Ohio River Edison Company has increased its 7 per cent cumulative preferred stock from 60,000 to 120,000 shares of $100 par value and its no-par common stock from 300,000 to 600,000 shares.

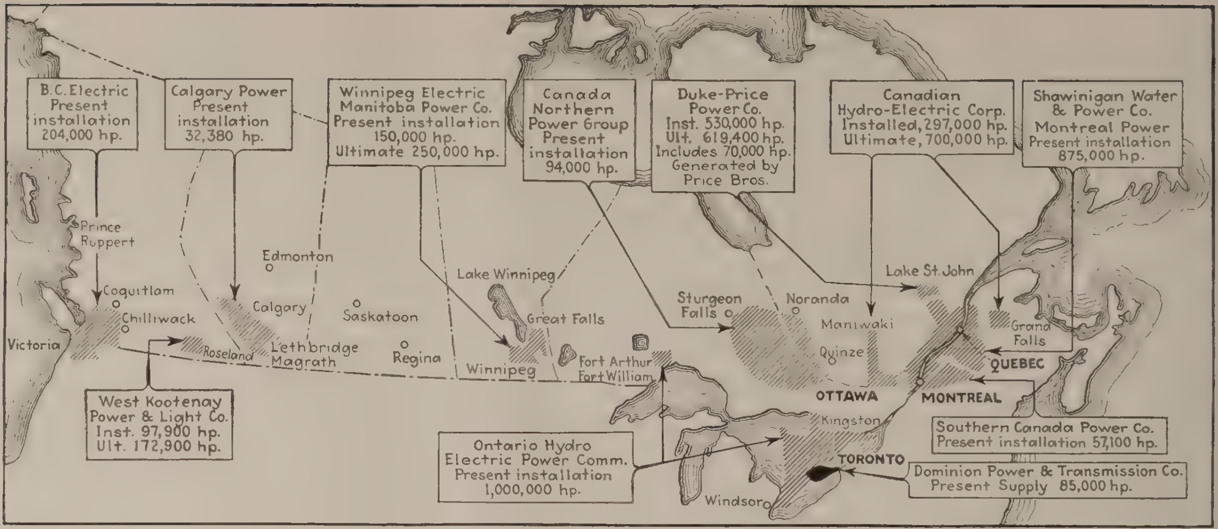
B.C. Electric
Present installation 204,000 hp.
Calgary Power
Present installation 32,380 hp.
Winnipeg Electric
Manitoba Power Co.
Present installation 150,000 hp.
Ultimate 250,000 hp.
Canada Northern Power Group
Present installation 94,000 hp.
Duke-Price Power Co.
Inst. 530,000 hp.
Ult. 619,400 hp.
Includes 70,000 hp. Generated by Price Bros.
Canadian Hydro-Electric Corp.
Installed, 297,000 hp.
Ultimate, 700,000 hp.
Shawinigan Water & Power Co.
Montreal Power
Present installation 875,000 hp.
Prince Ruppert
Edmonton
Coquitlam
Chilliwack
Calgary
Saskatoon
Lake Winnipeg
Great Falls
Sturgeon Falls
Noranda
Lake St. John
Maniwaki
Grand Falls
Victoria
Roseland
Lethbridge
Magrath
Regina
Winnipeg
Fort Arthur
Fort William
Quinze
QUEBEC
OTTAWA
MONTREAL
Kingston
TORONTO
Windsor
West Kootenay Power & Light Co.
Inst. 97,900 hp.
Ult. 172,900 hp.
Ontario Hydro Electric Power Comm.
Present installation 1,000,000 hp.
Southern Canada Power Co.
Present installation 57,100 hp.
Dominion Power & Transmission Co.
Present Supply 85,000 hp.

*Chart by courtesy of the Financial Post.*

*Canada's present power installation is largely concentrated in the East*

# Reanalysis of Power Possibilities in Canada

DURING 1927 a reanalysis of the power possibilities in various districts throughout Canada has resulted in an increase in the total estimated available figures for the Dominion in spite of the fact that a recent judgment of the Privy Council takes from Canada and adjudges to Newfoundland a considerable area in Labrador, previously regarded as part of northeastern Quebec, in which large water powers are located. The most recent figures for the Dominion indicate the total resources to be 20,197,000 hp. under conditions of ordinary minimum flow, or 33,113,000 hp. ordinarily available for six months of the year.

The figures for available water power listed in the accompanying table are based upon rapids, falls and power sites of which the actual existent drop or the head possible of concentration is definitely established or at least well authenticated. Many rapids and falls of greater or lesser power capacity are scattered on rivers and streams from coast to coast which are not as yet recorded, and which will only become available for tabulation as more detailed survey work is undertaken and completed. This is particularly true in the relatively unexplored northern districts. Nor is any consideration given to the power concentrations which are feasible on rivers and streams of gradual gradient, where economic heads may be created by the construction of power dams, excepting only at points where definite studies have been carried out and the results made matters of record. In brief, the figures hereunder are based on definite rapids, falls and power sites, and may be said to represent the minimum water-power possibilities of the Dominion:

| Province | Available 24-Hour Power at 80 Per Cent Efficiency At Ordinary Min. Flow, Hp. | At Ordinary Six Months Flow, Hp. | Turbine Installation, Hp. |
|---|---|---|---|
| British Columbia | 1,931,000 | 5,103,500 | 473,142 |
| Alberta | 390,000 | 1,049,500 | 34,107 |
| Saskatchewan | 542,000 | 1,082,000 | 35 |
| Manitoba | 3,309,000 | 5,344,500 | 255,125 |
| Ontario | 5,330,000 | 6,940,000 | 1,816,908 |
| Quebec | 8,459,000 | 13,064,000 | 2,064,723 |
| New Brunswick | 87,000 | 120,800 | 47,231 |
| Nova Scotia | 20,800 | 128,300 | 70,017 |
| Prince Edward Island | 3,000 | 5,300 | 2,434 |
| Yukon and Northwest Territories | 125,200 | 275,300 | 13,199 |
| Canada | 20,197,000 | 33,113,200 | 4,777,921 |

It is believed that these are conservative estimates, since an analysis of the water-power plants scattered from coast to coast concerning which complete data are available as to turbine installation and satisfactory information as to stream flow gives an average machine installation 30 per cent greater than the ordinary six-month flow power. Applying this, the figures quoted above, therefore, indicate that the present recorded water-power resources of the Dominion will permit of a turbine installation of approximately 43,000,000 hp.

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PHILADELPHIA COMPANY PAYS EXTRA DIVIDEND.—Directors of the Philadelphia Company have declared an extra dividend of $1.50 per share on the common stock, payable July 31 to holders of record July 2. The regular quarterly dividend of $1 per share on this issue, previously declared, is payable on the same date.

MASSACHUSETTS UTILITY AUTHORIZED TO ISSUE STOCK.—The Massachusetts Department of Public Utilities has authorized the Edison Electric Illuminating Company of Boston to issue 32,230 shares of additional capital stock (par $25) at $45 per share.

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## Customer-Ownership Sales Rise

After several low months customer-ownership sales of stock rose in April to $19,794,000, involving 422,200 shares in 15,090 transactions, according to monthly reports received from electric light and power companies by the ELECTRICAL WORLD. The average of $1,300 per transaction is exceptionally high; the figure rarely rises above $800 or $900. In the present instance it is due to the combined influence of one campaign, which ran close to $2,000 per transaction, and of heavy sales by several other companies, each averaging well over $1,000 per transaction; the tendency toward sales in rather large blocks was quite general. The total for the month was close to the average for the year 1927, and since the heavy financing of last October was exceeded only in January, and then by 8 per cent.

Revised figures for March indicate the sale in 18,710 transactions of 194,900 shares valued at $11,569,000. The average per transaction, about $620, is in line with that of other months.

In March the sale of $25 shares exceeded $2,500,000 and in April it almost reached $8,000,000. Other shares were sold at prices close to $100. These large sales of low-priced shares account for the average of $60 per share in March and $47 in April.

# Business News and Market Conditions

## Record Manufacturing Operations During May

### Electrical Manufacturing Plants Operating at the Rate of 17 per Cent Above Last Year—May Operations 5.6 per Cent Above April

THE electrical manufacturing industry entered the last month of the first half of the year with a rate of productive operations about 17 per cent over May of last year. Never before has such a high rate of activity been recorded by the industry as was witnessed during the current month of May. The former record activity was recorded in October of last year, but the May rate was about 2.4 per cent over that of last October.

The electrical manufacturing plants closed the year of 1927 in a rather unpromising manner, with a rate of operations about 4.7 per cent under December, 1926. A distinct downward trend was recorded as the year unfolded, March operations being about 8 per cent under those recorded in December. With April, however, came an unexpected radically upward turn, which was continued through May, the increase in the rate of activity for the two months' period being 17 per cent. Such an increase in the operations of these plants was not to be expected at this season of the year, in past years the usual upward turn not being started until September. All indications point to very unusual summer operations by the nation's electrical manufacturing plants.

The smaller electrical manufacturing plants reported a much greater increase of operations than was reported by the larger companies, but practically every plant reported substantial increases over May of last year.

The index of activities in the electrical manufacturing industry based on the consumption of electrical energy stands at 134.6 for May, as compared with 128.4 for April and 131.3 for the former record month of October, 1927. Comparative indexes of productive activity referred to the average of the period 1923-1925 as 100 and adjusted for number of working days are as follows:

| | |
|---|---|
| May 1928 | 134.6 |
| April, 1928 | 128.4 |
| March, 1928 | 115.3 |
| May, 1927 | 115.0 |
| Average first five months 1928 | 124.9 |
| Average first five months 1927 | 116.4 |

General industry has not recorded the same upward swing and record operations witnessed by the electrical manufacturing plants. Consumption of electrical energy by more than 3,000 large manufacturing plants in the United States in May was 0.2 per cent under the rate established in April and 1.3 per cent below that for the corresponding month last year. This is the first time since last September that industrial activity dropped below that of the same month in the year previous. May was the peak month of general industrial activity in 1927, while in the current year so far the high point was reached in February.

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## Lighting Fixture Award in National Competition

At the national competitive exhibit of residential luminaires held in connection with the convention and exhibit of the Artistic Lighting Equipment Association at Chicago this month a number of awards were offered for the development of something new in the line of lighting fixtures. The awards were intended to serve as a stimulus to the development of a new thought in fixtures, which it is expected will have sufficient power to encourage and make possible a refixturing activity.

The competition was held under the joint sponsorship of the committee on resident lighting equipment of the Association of Edison Illuminating Companies, the home lighting committee of the National Electric Light Association and the Electric Association of Chicago.

Prizes for units listing above $30 were made as follows:

First Prize, $300—Beardslee Chandelier Manufacturing Company.

Second Prize, $200 each—Duplexalite Division of the Miller Company and R. Williamson & Company.

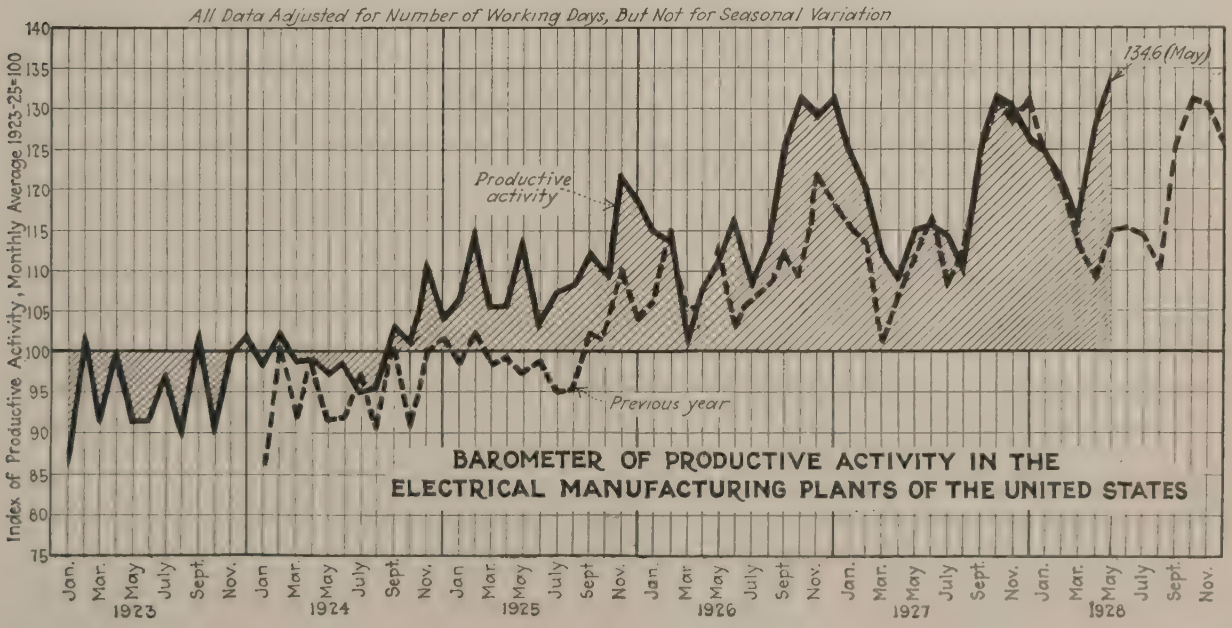
Honorable mention to the Edwin F. Guth Company.

Prizes for units listing below $30 were:

First Prize, $300—Miller Company.

Second Prize, $200—Lightolier Company.

The awards were made on the basis


All Data Adjusted for Number of Working Days, But Not for Seasonal Variation

BAROMETER OF PRODUCTIVE ACTIVITY IN THE ELECTRICAL MANUFACTURING PLANTS OF THE UNITED STATES of the best combination of the three essential factors that should be embodied in all equipment for home lighting:

1. Quality of illumination gaged by a sufficient quantity of light given without glare and objectionable shadows.
2. Excellence of workmanship in mechanical and electrical construction.
3. Artistry of design when viewed both lighted and unlighted in natural surroundings.

The two first of these factors were readily measured by scientific standards and all fixtures were tested in these respects in the Electrical Testing Laboratories, New York.

The third factor, that of beauty and appropriateness of design, was based on the aid offered by the lighting units to the American homemaker in having the equipment conform to the high standards of modern home decorating. The following constituted the board of judges: Harry H. Bentley, American Institute of Architects; W. McKee, Art Institute, Chicago; C. G. Everson, Artistic Lighting Equipment Association; L. H. Lamont, Association of Electragists International; L. V. James, Electric Association, Chicago; P. S. Millar, Electrical Testing Laboratories; W. H. Rademacher, Illuminating Engineering Society; E. D. Tillson, National Electric Light Association, and Mrs. Winifred Hathaway, National Society for the Prevention of Blindness.

# Market Conditions

CENTRAL-STATION companies are buying line equipment and supplies in New England in increasing volume. Industrial orders are steady with small motors in good demand. An improved tone is noted in the Eastern market. A Maryland utility plans a generating plant to cost $500,000 and a New York engineering firm is planning a 30,000-hp. power plant in connection with an electric smelter to cost $5,000,000. A steam railroad purchased $75,000 worth of motor-generator sets for headlight service. Steel and iron mills, cement mills and chemical plants are prominent factors in current industrial commitments.

An increase in orders, both as to number and size, is reported in the Southeast. A new paper mill in Alabama will require more than $1,000,000 worth of electrical material. An improved tone continues in the St. Louis district. In the Middle West the volume of business transacted is increasing. On the Pacific Coast industrial plant buying has been active. Miscellaneous wiring and line material was purchased by a Utah smelter, $6,000 worth of turbine spare parts by a sugar refinery, and 72 motors by the National Paper Products Company.

## *Metal Markets Quiet and Steady*

Buying of each of the non-ferrous metals has been of modest proportions during the past week. Prices are for the most part unchanged, copper continuing at 14¾ cents Connecticut and lead at 6.30 cents in New York and 6.15 cents in St. Louis. Zinc is a little firmer than a week ago, forward position commanding as high as 6¼ cents.

NEW YORK METAL MARKET PRICES

| | June 20, 1928 Cents per Pound | June. 27, 1928 Cents per Pound |
|---|---|---|
| Copper, electrolytic..... | 14.525 | 13.75 |
| Lead, Am. S. & R. price | 6.30 | 6.30 |
| Antimony.............. | 9½ | 9½ |
| Nickel, ingot........... | 35 | 35 |
| Zinc spots.............. | 6.50 | 6.55 |
| Tin, Straits............. | 47 | 47 |
| Aluminum, 99 per cent... | 24.30 | 24.30 |

Base copper wire price June 27, 1928, 16⅝ cents.

## *Increase in Orders Reported in Southeast*

Business is improving in the electrical field with increases noted in orders, both as to number and size. The largest order placed was for oil circuit breakers amounting to $100,000 for a power company in the western portion of the territory, while transformer and switching equipment amounting to $60,000 was ordered by a power company in Florida. Another central-station company ordered creosoted pine poles amounting to $10,000 and pole line hardware totaling $2,500. Some other central-station orders were for house type watt-hour meters amounting to $6,800, distribution and small power transformers amounting to $4,100 and poles totaling $2,200.

The electrical material requirements of a new paper mill being constructed in Alabama will approximate $1,000,000 and will include a 6,000 kw. turbine and three 1,000 hp. boilers. Electrification contracts have been closed on three cotton mills in the Carolinas and the electrical materials for these jobs will total $20,000, $10,000 and $8,000, respectively. A cotton mill in Georgia ordered wiring supplies costing about $6,000, for use in connection with a new mill lighting lay-out. A Georgia municipality ordered electrical pumping equipment amounting to $2,000, while another town in the same state purchased a carload of creosoted pine poles. Construction projects are as follows:

The Selma Compress Company, Selma, Ala., will build a plant, to cost $140,000. The Piedmont Corporation, Atlanta, Ga., plans a rock-crushing plant near Lithonia, Ga., to cost $300,000. The Georgia Power & Light Company, Waycross, Ga., plans extensions in plants to cost $300,000. The Tobacco By-Products & Chemical Corporation, Louisville, Ky., plans a power plant, at its proposed local chemical works, to cost $175,000. The Mississippi Power & Light Company, Jackson, Miss., plans a substation at Lexington, Miss. The Lampton-Reid Company, Magnolia, Miss., will build an electric-operated cotton ginning plant, to cost $50,000. Shelby, N. C., will make extensions in its light and power system to cost $16,000. Standard Looms, Inc., Spartanburg, S. C., will soon ask bids for a textile loom manufacturing plant at East Spartanburg, to cost $300,000. East Ridge, Tenn., plans an ornamental lighting system.

## *Improved Market Tone in Eastern District*

Orders and inquiries in the Eastern district have shown noticeable improvement. A central-station company in New Jersey has placed a contract for a 50,000-kw. turbo-generator unit. A Maryland utility plans an addition to its generating plant to cost $500,000; a New York central station plans a large plant to represent an investment of several million dollars, and a New York engineering company has contracted to install a 30,000 hp. station in Chile.

Steel and iron mills, cement mills and chemical plants are prominent factors in current industrial commitments; the first noted is particularly strong with inquiries for industrial motors and accessory equipment, and future sizable orders are anticipated. A cement mill in Illinois has contracted for a number of motors for grinding mills, waste heat boiler fans and other service, totaling about $35,000. The same manufacturer has also secured an order from a chemical plant in Michigan for motor-generator units to an amount of about $50,000. A paper mill in West Virginia has given a commitment to another maker for a 400 kw. extraction turbine unit for process work, as well as for other apparatus, the total account approximating $100,000. Several automobile manufacturers in Michigan have entered the market for requirements for new plants and good business is looked for from this quarter. Wire and cable business holds satisfactory and the outlook is encouraging.

Philadelphia shows improvement in industrial business. Central station commitments are slow and inquiries have declined. A feature of immediate future business is local railway electrification. The city of Philadelphia has approved plans of the Philadelphia & Reading Railway for a terminal yard at Logan, in connection with proposed electrification of its Germantown and Chestnut Hill branches. Construction operations in the Eastern district include the following:

The J. G. White Engineering Corporation, New York, will build a power plant and electric smelter in Chile for the Electro-Siderurgical de Valdivia, now being organized, to cost $5,000,000. The General Cable Company, New York, will build a plant at Mobile, Ala., to cost $250,000. The Geller Shoe Manufacturing Company, Brooklyn, plans a factory to cost $100,000. The Sealright Corporation, Fulton, N. Y., plans an addition to cost $200,000. The

Koeppen Metal Products, Inc., Union City, N. J., will build a plant at Carlstadt, N. J., to cost $100,000.

The Susquehanna Collieries Company, Mount Carmel, Pa., will electrify its Cameron colliery, to cost $65,000. Drexel Institute, Philadelphia, will build an engineering building to cost $200,000. The Department of Property and Supplies, Harrisburg, Pa., will receive bids July 9, for cast iron lighting standards. Robert N. Dippy, Philadelphia, architect, is preparing plans for a cold storage plant to cost $100,000. The Eastern Shore Public Service Company, Salisbury, Md., plans a power plant at Vienna, Md., to cost $500,000. The International Paint Corporation, St. Helena, Md., plans a plant to cost $100,000.

## *Central-Station Companies Buying in New England*

Expansions of power and service lines in New England are responsible for a gradual increase in the buying of line equipment and supplies. A number of orders for poles, cross arms and wire were reported, including an order for two carloads; several orders for switches and control apparatus were received, and insulators are selling well.

Industrial orders are steady with small motors in good demand. Activity is reported among manufacturers of fractional-horse power motors and the volume delivered in this district to date is in excess of that for the same period last year. Industrial heating is active. One manufacturer reports two orders for Western delivery consisting of 20 kw. and 30 kw. capacities for special heat treating. The general tone of the market is encouraging. Construction projects are as follows:

The Lynn Gas Light & Electric Company, Lynn, Mass., plans to expend $100,000 in linking up stations and connecting with power groups. The New England Power Company, Worcester, Mass., is to connect Pratts Junction with Lowell with a new line. A short line connection to a new transformer station will be soon made by the Randolph and Holbrook Power & Electric Light Company, Randolph, Mass. The Webster & Southbridge Gas & Electric Company, Webster, Mass., plans to expand its plant; a new power plant is planned by the Montan Company, Westboro, Mass. The Holyoke Company, Holyoke, Mass., plans additional machinery at its wire and cable works. The Bureau of Yards & Docks, Washington, D. C., will receive bids until July 5, for automatic refrigerating equipment for the naval station at Portsmouth, N. H. (Specification 5656). The Prairie Window Ventilator Corporation, Providence, R. I., plans an expansion to cost $85,000.

## *Most Sections of Middle West Report Active Business*

Comparatively good business continues in most sections of the Middle West, and the volume is gradually increasing. It is expected that the month of June will show an increase in total business over the month of May. Industrial activity is somewhat spotty, although generally speaking it is considered good, with seasonal depressions here and there. Reports from the automobile industry indicate an excellent condition and the steel and railroad industries apparently are prosperous. There has been a good demand for poles, insulators, and other construction materials. An interesting order covered a 5,000-kva. distribution transformer. Jobbers' sales are normal with a slightly increasing volume of business. Construction projects are as follows:

The Art Engraving Company, Chicago, plans a plant to cost $250,000. Darling & Company, East St. Louis, Ill., plans an addition to its fertilizer plant to cost $100,000. The F. L. Bromley Properties, Inc., Detroit, will build a unit at its automotive plant, to cost $200,000. The Mount Clemens Pottery Company, Mount Clemens, Mich., plans additions, to cost $80,000; Waldron, Inc., Minneapolis, Minn., plans a laundry to cost $200,000. The Glaser Provision Company, Omaha, Neb., plans a packing plant, to cost $100,000. The Pyrometric Laboratory, Columbus, Ohio, plans a factory and laboratory to cost $90,000. The Kohler Company, Kohler, Wis., plans an addition to its pottery plant, to cost $100,000. The Invincible Metal Furniture Company, Manitowoc, Wis., plans an addition to its aircraft plant, to cost $100,000. The Weber Lifelike Fly Company, Stevens Point, Wis., will build an addition to its fishing tackle factory, to cost $80,000. The Houghton County Electric Company, Houghton, Mich., plans an improved lighting system at Red Jacket, Mich.

## *Improved Tone Continues in St. Louis District*

The general condition of business in the St. Louis district continues to show an improved tone. Orders for small motors, transformers and equipment are being placed in good volume and are slightly better than for the same period last year. One order for a lot of motors to drive centrifugal pumps amounted to $1,500. Appliances are selling in good quantity. Fan business is very slow on account of cool weather. Some good-sized contracts for street lighting are being estimated. Utility companies are not buying actively at present. Construction projects are as follows:

C. M. Conoway, Dallas, Tex., and associates, plan an ice plant at Hoisington, Kan., to cost $250,000. The Southwestern Gas & Electric Company, Shreveport, La., plans a 66,000-volt transmission line from Shreveport to Marshall, La. Kennett, Mo., will receive bids until July 17, for Diesel oil engines, and other complete power plant equipment. The Scullin Steel Company, St. Louis, will make extensions, to cost $200,000. The Market Development Corporation, International Life Building, St. Louis, plans a cold storage plant to cost $175,000. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., will build a transmission line from Washington to Etowoh, Okla., about 40 miles, to cost $65,000.

The West Texas Utilities Company, Abilene, Tex., plans a substation at Baird, Tex. The Martha Washington Candies Company, Chicago, plans an addition to its plant at Fort Worth, Tex., to cost $80,000. The Globe-El Paso Cotton Oil Company, Old Fort Bliss, Tex., plans new plants to cost $175,000. The Central Power & Light Company, San Antonio, Tex., will make extensions in its power plant at Falfurrias, Tex., to cost $20,000. Blackwell, Cushing, Lone Wolf, and Temple, Okla., plan ornamental lighting systems.

## *Industrial Buying Active on Pacific Coast*

Industrial plant ordering has been good on the Pacific Coast and includes such orders as miscellaneous wiring and line material for a Utah smelter, $6,000 worth of turbine spare parts for a sugar refinery and a 100-hp. synchronous motor valued at $2,500 for a chemical plant. The state industrial heating load is estimated at and is said to be increasing annually by 10,000 kw. The increasing industrialization of the Pacific Coast is evidenced by the number of plants seeking Pacific Coast locations, such as the Fokker airplane interests, a steel plant and the Seiberling tire people. Hotel construction announced includes a $1,000,000 Biltmore Hotel for Phoenix and a chain of California highway hotels. Other interesting construction includes a $750,000 grain terminal for Portland, new quartermaster's warehouses and office buildings for Fort Mason, San Francisco, and a $1,000,000 apartment house for Seattle, Wash.

Lighting business is now one of the busiest branches of the California electrical industry. New installations are being planned by Madera, Woodland, Chico, San Anselmo, Sonora and Los Banos, and San Jose has awarded a contract amounting to $5,000. Power company purchasing includes miscellaneous maintenance material in small lots. The Pacific Gas & Electric Company's range campaign, lasting eight weeks, has resulted in the sale of 1,147 electric ranges.

The largest motor movement reported in the Puget Sound district included four 150-hp., fifty-four 50-hp. and fourteen from 15 hp. down, for the Chipper plant of the National Paper Products Company. The sale of a 1,000-gallon pump and a 100-hp. steam turbine for a pumping plant also is reported. Seattle is negotiating for the installation of a third generating unit at the Skagit hydro-electric project involving an outlay estimated at $350,000. Construction projects are as follows:

The Verde Central Mines, Inc., Jerome, Ariz., will build a mill and concentrating plant, to cost $150,000. The Evans Auto Loading Company, Detroit, plans a plant at Eureka, Calif., for the manufacture of battery boxes, to cost $100,000. The contracting officer, Quartermaster Corps, Fort Winfield Scott, Calif., will receive bids July 9 for Diesel engines for marine service (Circular 1). The Jacumba Land & Cattle Company, Jacumba, Calif., plans a power plant at Jacumba Hot Springs, to cost $50,000. The John O. Gilbert Chocolate Company, Jackson, Mich., plans a candy plant at Los Angeles, to cost $800,000.

The Great Western Power Company, San Francisco, will make extensions in the power substation at Oakland, Calif., to cost $35,000. The Union Pacific Railway Company, Portland, Ore., plans a grain elevator on Swan Island, to cost $650,000. Bakersfield, Los Angeles, Chico, Los Banos, Hanford, Pasadena, Glendale and San Leandro, Calif., plan ornamental lighting systems.

The Pacific Gas & Electric Company, San Francisco, plans an improved lighting system at San Anselmo, Calif.

# Activities of the Trade

## Westinghouse Battery Sold to New Company

Formal announcement has been made of the sale of the Westinghouse Union Battery Company of Swissvale, Pa., by A. L. Humphrey, president of the Westinghouse Air Brake Company. A new company, known as the Wubco Battery Corporation, has been organized, taking over the equipment, inventory, sales outlets and good will. The new company will be headed by J. L. Rupp as president. Mr. Rupp was a former executive of the old company and has been actively concerned in storage battery development and standards for the past fifteen years. The new company states that the manufacture of the same quality Westinghouse batteries will be carried on in the present plant at Swissvale.

## General Cable to Build Plant in Mobile, Ala.

The purchase of a piece of land on tidewater in the city of Mobile, Ala., has been announced by the General Cable Corporation, which will erect a factory for the manufacture of electrical wires and cables. The officials of the company have for some time past been studying the situation in the Southern states, believing that inasmuch as their factories situated in the northern part of the United States are in a position to serve to good advantage all sections of the country with the exception of the southeastern portion, the addition of a Southern mill would be a logical development of the company's natural facilities.

The General Cable Corporation, which was formed last November, purchased the plants of the Baltimore Rolling Mills, formerly owned by the American Smelting & Refining Company, the Dudlo Manufacturing Company, the Rome Wire Company, the Safety Cable Company and the Standard Underground Cable Company. The corporation, with headquarters at 420 Lexington Avenue, New York, now has fourteen plants making a complete line of all kinds of electrical wires and cables.

**The Cutler-Hammer Manufacturing Company**, Milwaukee, manufacturer of electric controlling devices, announces a new unbreakable attachment plug with an improved type of cord grip, designed particularly to lessen short-circuit hazards. The cord grip cap can be obtained in either bakelite brown or zinc gray finish.

**The Eagle Electric Manufacturing Company**, 59 Hall Street, Brooklyn, N. Y., has placed on the market the new Eagle armor-clad appliance plug. The company also announces that it has adopted a strict wholesalers' policy and its dealer business is being turned over to Eagle distributors to handle; also that Charles F. Copeland has joined the active selling force of the company. Mr. Copeland will act as direct office representative in all territories east of the Mississippi and will help to build up electrical wholesale business.

## "Mazda" Lamp Prices Reduced

For the eleventh time since 1920 the General Electric Company has announced a reduction in the prices of "Mazda" incandescent lamps effective July 1. The reductions average 14 per cent and apply to types which represent about 82 per cent of the total consumption of large "Mazda" lamps. The company states that this reduction brings the prices to less than half, or about 45 per cent, of the 1914 average. This great reduction in price becomes even more impressive when one considers that during the same period the lighting efficiency of "Mazda" lamps has been tremendously increased, the cost of materials has gone up, and the average wage paid to lamp makers has more than doubled.

It is because the public has concentrated the bulk of demand on the five lamps in the standard line of inside frosted "Mazda" lamps that the General Electric Company has been able to achieve increasing efficiency in mass production and greater economies in lamp distribution. The policy of the General Electric Company, as has been declared by President Gerard Swope, is that the savings thus achieved be shared with the public. The policy is again confirmed in the July 1 price reduction, which affords consumers savings of 3 cents and 5 cents on the most widely used types of "Mazda" lamps.

| Lamp Size | Old Price, Cents | New Price, Cents |
|---|---|---|
| 25 watt | 23 | 20 |
| 40 watt | 23 | 20 |
| 50 watt | 25 | 22 |
| 60 watt | 25 | 22 |
| 100 watt | 40 | 35 |

## Brown Boveri Approves Sale of Part of Holdings

The proposal to sell part of the holdings of the American Brown Boveri Corporation, as reported in the June 23 issue of the Electrical World, was approved this week by holders of founders' stock at a special meeting called for the purpose. The company will sell its entire stock holdings in the Moloney Electric Company of St. Louis to Stifel, Nicolaus & Company of St. Louis and its shipbuilding business at Camden, N. J., to Laurence R. Wilder, a director of the American Brown Boveri Company, who, with his associates, has organized the Transoceanic Corporation. Both holdings will be sold for cash. The sales will enable the corporation to retire its bonded debt of slightly more than $5,000,000, to repay its bank loans and to reduce the outstanding preferred stock by $1,000,000.

## Hubbard Adopts Display Truck for Touring Country

Exhibited for the first time at Young's Million Dollar Pier during the week of the 51st National Electric Light Association convention at Atlantic City, the Hubbard "Linebuilder," as shown in the illustration, will be used to demonstrate the company's line of pole-line hardware and Peirce construction specialties. The display truck consists of a 2½-ton White truck chassis with a special body. The equipment is displayed as used in the field and there are a number of loose samples for inspection. It is intended to make a tour of the country with the truck so as to place before companies or individuals interested a complete line of Hubbard products. The tour will be conducted by Hubbard sales engineers, who will have charge of the display truck while it is in their territories.

*Hubbard "Linebuilder" with samples of pole-line hardware and construction specialties displayed as used in the field*

# New Equipment Available

## Switching and Protective Unit for Rural Service

A switching and protective unit that consists of an air break switch, a choke coil and a fuse which can be used on systems where the short-circuit currents may run as high as 5,000 amp. has been developed by the Hi-Voltage Equipment Company, Cleveland. The unit is intended for rural service or small industrial substations. The switch is built with monel ball bearings that do not require any lubrication. The bearing spindle which carries the operating insulator is a machined steel forging. Only three insulators, as shown in the illustration, are used to carry the switch, choke coil and fuse. Six standard types of mounting are provided. The switches are available for voltages from 10,000 to 40,000.

*Rural service switch combined with protective unit*

## Air Filters

An air filter which can be inserted in air pipe lines and which it is claimed will remove dust, water, oil, rust, scale and other foreign matter from air passing through the pipes has been placed on the market by the Staynew Filter Corporation, Rochester, N. Y. The filter consists of an aluminum housing inclosed in a pressed steel housing, which the manufacturers claim will withstand a working pressure of 125 lb. The filter mounted inside consists of a felt filter medium formed in pockets over radial wire screen fins grouped around a central outlet.. This permits mounting a relatively large area of felt in a compact space. The large capacity inserts are designed to pass 250 cu.ft. of free air per minute and contain 20 sq.ft. of felt within a volume slightly smaller than a cubic foot. Cleaning is accomplished by reversing the air flow.

Another type of filter used in filtering large volumes of air is of similar construction mounted in heavy pressed-steel frames. The filter can be cleaned by a special air suction cleaner. The manufacturers claim that it can be operated under ordinary conditions for several months before cleaning is necessary.

## Electrolysis Drainage Valve

The "Kuprox" electrolysis drainage valve for safeguarding against reverse currents, which cause electrolysis and chemical decomposition of underground metallic structures, has been developed by the Kodel Electric & Manufacturing Company, Cincinnati, Ohio. These drainage valves have no contacts or moving parts, are said to require no attention and will function indefinitely. Arranged for either pole or manhole installation and built in capacities up to 1,000 amp., the Kuprox (copper oxide) valve is said to be adaptable to any and all conditions where vagabond electric currents from grounded electrical distributing systems are causing decomposition of underground cables.

## Potential Transformer Fuse and Wire Wound Resistor

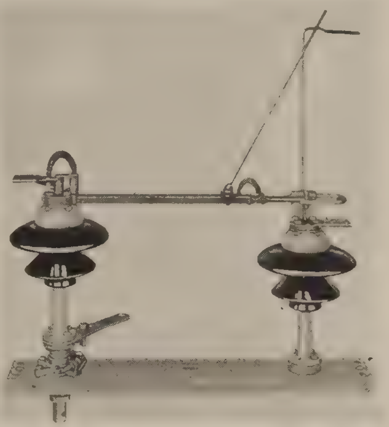
The type H combination potential transformer fuse and wire wound resistor for 2,500 to 25,000-volt service has been placed on the market by the Westinghouse Electric & Manufacturing Company. It is intended for indoor application and can be mounted on any flat surface or upon 1¼-in. pipe. The resistors are placed in series with the fuses and are said to limit effectively the current in case of short circuit. This permits the use of potential transformer fuses on any circuit regardless of its short-circuit amperes, provided the voltage rating of the system is not more than that of the fuses and resistors.

The resistors are made up of coiled nichrome wire wound in the grooves of a heavy wet-process porcelain tube. They are combined with fuse, fuse mountings and insulators. The resistor may be mounted either in line with or perpendicular to the insulators.

PRIMARY-RESISTANCE DRUM SWITCHES.—A new line of primary resistance drum switches for use with squirrel-cage induction motors on small cranes, hoists, machine tools, etc., has been announced by the General Electric Company. It is a primary reversing switch designed for wall mounting and can be furnished with a standard conduit box. It is made in two forms, CR-3200-1250-B, for hoists where the motor is overhauled in the lowering direction, and CR-3200-1250-A, for hoists where the motor is not overhauled in the lowering direction. The switches are built without operating mechanism so that the user may select the type of operating equipment he desires. The switches are designed for operation on maximum primary voltages of 550 and the maximum horsepower rating for two- or three-phase service is 15.

## Two-Insulator "Hi-Pressure" Contact Switch

A complete line of type "A" switches, as shown in the illustration, has been developed by the Railway & Industrial Engineering Company, Greensburg, Pa., up to 154 kv. The blade revolves on a rotor bearing, and in closing the toggle end strikes the stop and straightens out, sliding the contact surfaces into closed position. The final sliding movement takes place under high pressure, which the manufacturer claims removes all dirt, ice and corrosion. They are built for either air-break or disconnecting purposes.



*"Hi-Pressure" contact switch of the two-insulator type*

## Gasoline-Engine-Driven Welding Outfit

A 300-amp. gasoline - engine - driven welder, known as Model S-1964, has been placed on the market by the Lincoln Electric Company, Cleveland. The welding generator is rated at 300 amp. in accordance with N.E.M.A. standards and has a current range of from 75 to 400 amp. for metallic electrode welding. It is direct connected to a six-cylinder Buda Model HS-6 engine, operating at 1,500 r.p.m. Both units are mounted on a welded steel base. The generator has a laminated magnetic circuit with separately excited field, stabilizer, variable voltage and steel construction features of the company's line of "Stable-Arc" welders. The over-all dimensions are 93 in. long, 35 in. wide with an over-all height of 45 in. The equipment has been designed to meet the constantly increasing use of larger electrodes in welding, and the six-cylinder performance gives a smooth, even flow of power, so necessary for successful welding.

# Electrical Patents

*Announced by U. S. Patent Office*

(Issued June 5, 1928)

1,672,302. Siren-Control System; H. S. Campbell, Hammond, Ind. App. filed Dec. 22, 1922.

1,672,312. Electrical Fixture Unit; S. N. Griffith, Doylestown, Pa. App. filed Aug. 21, 1923.

1,672,314. Friction Brake; J. H. Hall, Cleveland Heighs, Ohio. App. filed Oct. 5, 1925. Of the spring-applied and electromagnetically-released type.

1,672,324. Wire-Threading Leader and Coupler; C. H. Kepler, Oakland, Calif. App. filed Oct. 23, 1925. To facilitate the passing of wires through conduits.

1,672,357. Joint for Electric Cables; J. F. Watson, Abbey Wood, England. App. filed Oct. 29, 1927.

1,672,365. Electric Switch; G. A. Burnham, Saugus, Mass. App. filed July 25, 1921. Oil immersed.

1,672,402. Plating Apparatus and Product Thereof; E. R. Armstrong, Hollyoak, Del. App. filed Oct. 14, 1924.

1,672,410. Method for Testing Railway-Traffic-Controlling Apparatus; L. O. Grondahl, Pittsburgh, and P. H. Geiger, Wilkinsburg, Pa. App. filed Jan 18, 1926.

1,672,476. Protecting Apparatus for Linemen; M. T. Tipsord and H. W. Bodendieck, Taylorville, Ill. App. filed Jan. 30, 1926.

1,672,494. Switch-Operating Mechanism; A. F. C. Lotz, Chicago, Ill. App. filed June 1, 1925. Mechanism for closing an oil switch and for tripping the same open.

1,672,509. Reel for Electric Irons; B. F. P. Vedder, Milwaukee, Wis. App. filed Nov. 11, 1926.

1,672,521. Electric Plug Connecter; A. R. Goldrick, Cleveland, Ohio. App. filed Dec. 1, 1921.

1,672,556. Two-Light Plug; T. A. Both, Stratford, Conn. App. filed June 13, 1924.

1,672,592. Sterilizing Apparatus; D. G. Will, Fort Wayne, Ind. App. filed Nov. 17, 1924.

1,672,620. Combination Fuse and Plug; W. B. Moss, Jr., and M. L. Ardisana, Evanston, Ill. App. filed June 14, 1926.

1,672,664. Twin-Light Plug; O. H. Van Amburg, Bridgeport, Conn. App. filed Nov. 21, 1922.

1,672,667. Electric Furnace; H. L. Watson, Lynn, Mass. App. filed Nov. 13, 1926. High temperature.

1,672,669. Constant Current Transformer; T. G. Whyte, Lynn, Mass. App. filed Aug. 13, 1925. Of the movable coil type.

1,672,670. Electric Motor-Control System and Apparatus; M. Wilfart, Paris, France. App. filed July 17, 1924. For use in operating machines having widely varying load characteristics such as rolling mills and the like.

1,672,674. Regulating System; R. M. Carothers, Schenectady, N. Y. App. filed June 24, 1926. Voltage regulating.

1,672,680. Dynamo-Electric Machine; E. H. Freiburghouse, Schenectady, N. Y. App. filed April 21, 1925. Ventilating system.

1,672,683. Outlet or Junction Box; H. G. Knoderer, Englewood, N. J. App. filed June 4, 1921.

1,672,685. Commutator; G. Lewinnek, Berlin, Germany. App. filed Jan. 4, 1926. Double commutator.

1,672,690. Control System and Apparatus for Electrical Devices; C. C. Runner, Schenectady, N. Y. App. filed Aug. 6, 1924.

1,672,693. Expansion Joint; R. C. Scott, Cambridge, Mass. App. filed June 1, 1925. For buses employed in high voltage power or switching stations for the transmission of electrical energy.

1,672,702. Welding Apparatus; J. M. Weed, Schenectady, N. Y. App. filed Dec. 11, 1923.

1,672,703. Induction Voltage Regulator; H. R. West, Pittsfield, Mass. App. filed Sept. 23, 1927.

1,672,706. Method of Making Contact Tips; W. W. Brown, Erie, Pa. App. filed Jan. 13, 1926. Of drum controllers or other switch mechanism.

1,672,714. Nonaqueous Electrolytic Condenser; E. W. Engle, Lake Forest, Ill. App. filed Aug. 29, 1927.

1,672,724. Electric Oven; F. H. McCormick, Glen Ellyn, Ill. App. filed Oct. 18, 1926.

1,672,725. Electric Heater; F. H. McCormick, Glen Ellyn, Ill. App. filed Oct. 1, 1927.

1,672,727. Electric Switch; A. H. Nero, West Hartford, Conn. App. filed Feb. 15, 1926.

1,672,729. Magnetic Cut-Out Plug; C. Pape, Berlin, Germany. App. filed Nov. 5, 1925.

1,672,777. Regulating Apparatus; D. C. Prince, Schenectady, N. Y. App. filed March 13, 1926. For the transmission of current between alternating and direct current circuits.

1,672,791. Electrical Switch; W. S. Thimblethorpe, London, England. App. filed Aug. 21, 1926. Two-way delayed action switch useful in signaling work and apparatus.

1,672,800. Electric Cut-Out for Stills and the Like; L. F. Boss, Woods Hole, Mass. App. filed May 12, 1926.

1,672,802. Device for Resetting Power-Driven Mechanism to a Predetermined Position; M. Chirol, Bourg-La-Reine, France. App. filed Nov. 19, 1926.

1,672,809. Electric Iron and Stand; W. P. Haynie, Philadelphia, Pa. App. filed Oct. 5, 1925.

1,672,821. Submarine Cable Core and Insulation Therefor; C. Martell, Cicero, Ill. App. filed Oct. 7, 1924.

1,672,847. Electrical Power System; J. J. Kane, Milwaukee, Wis. App. filed April 19, 1921. Device for regulating generators driven by prime-movers, to supply variable loads, especially where there is a tendency for the generator-driving means to operate at a speed dependent upon the load.

1,672,859. Intermittent-Current Device; J. W. Phelps, Chicago, Ill. App. filed March 11, 1925. Make and break or flashing device.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Johannesburg, South Africa (No. 31,758), for batteries for radio and flashlights, household electric equipment and cable insulated wire.

Purchase and agencv are desired in Calcutta, India (No. 31,764), for electric fans, incandescent lamps, sockets, switches, etc., and small motors.

An agency is desired in Port Elizabeth, South Africa (No. 31,761), for flashlights and cable insulated wire.

An agency is desired in The Hague, Netherlands (No. 31,760), for household electric equipment.

An agency is desired in Barbados, West Indies (No. 31,754), for small hydro-electric generator sets.

Purchase is desired in São Paulo, Brazil (No. 31,757), of electric motors and small steel furnaces.

Purchase is desired in Sydney, Australia (No. 31,755), of fractional horsepower motors.

An agency is desired in London, England (No. 31,811), for portable electric bakers' and confectioners' ovens.

Purchase and agency are desired in Oslo, Norway (No. 31,762), for sewing machine motors, electric vacuum cleaners, washing machines and wringers.

Purchase is desired in Huddersfield, England (No. 31,759), and in Halifax, England (No. 31,763), of traffic-control devices.

Purchase is desired in Hamburg, Germany (No. 31,756), of electric welding machines.

An agency is desired in Algiers, Algeria (No. 31,753), for X-rays and ultra-violet rays apparatus.

Copies of a tender for the supply of transformers and switchgear for a new pre-cooling plant which is now being erected in Durban by the South African Railways and Harbors have been received (EE 1076). The closing date is July 12, 1928.

The Porto Rico Railway, Light & Power Company, San Juan, will begin work on the Rio Blanco power project, to cost $800,000. J. R. McKey, San Juan, P. R., Assistant Trade Commissioner.

An agency is desired by Remy Armbruster Jun., Basel 1, Switzerland, for motors and industrial heating equipment.

# New Trade Literature

APPARATUS FOR BURNING PULVERIZED FUEL.—Catalog U-3 describing the "Lopulco" unit system for burning pulverized fuel by the direct-fired method has been issued by the Combustion Engineering Corporation, 200 Madison Avenue, New York City. The construction and operation of the mills used in the system are described and illustrated. Line diagrams of the applications of the "Lopulco" unit system to various types and sizes of boilers are included. It also contains illustrations covering the various types of horizontal, vertical and tangential burners used with the system.

RELAY AND TEST BLOCKS.—The General Electric Company, Schenectady, N. Y., has issued bulletins GEA-943 and GEA-949 covering respectively polyphase induction power-directional relays and temperature overload relay panels for use with hand compensators. The company also is distributing bulletin GEA-900, which describes and illustrates its type PK-1 test blocks and plugs for switchboard-mounted meters, instruments and relays.

AIR COMPRESSOR.—Bulletin No. 140 issued by the Pennsylvania Pump & Compressor Company, Easton, Pa., describes its multiple-belt-driven semi-portable air compressor unit arranged for automatic start and stop control.

ALLOY STEEL. — The International Nickel Company, Inc., 67 Wall Street, New York City, is distributing bulletin No. 12, which contains information on the use of alloy steel for boiler construction.

MOTOR DRIVES FOR WOOLEN CARDS AND MOTORS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-967 covering its types FTR and FQR squirrel-cage and types MT and MQ wound-rotor motor drives for woolen cards. The company is also distributing bulletin GEA-166A describing its alternating-current, open or inclosed crane and hoist motors.

OIL PURIFIER.—The De Laval Separator Company, 165 Broadway, New York City, has issued a bulletin which covers the new No. 700 portable De Laval insulating oil purifier. It contains information on the construction of the oil purifier and shows how it is used.

REFRIGERATORS.—"Modern Refrigeration in the Modern Color Setting" is the title of a booklet issued by the Servel Sales, Inc., 51 East 42d Street, New York City. It discusses in detail the modern color idea, particularly as applied to the kitchen.

GENERATING AND OIL-TESTING SETS. — The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-781A describing and illustrating the steam-engine-driven generating sets for marine service. The company also has issued bulletin GEA-832 covering its portable oil-testing sets.

CONDUIT ACCESSORIES.—The Cleveland Wrought Products Company, West 58th Street and Denison Avenue, Cleveland, is distributing a circular covering its electrical conduit accessories, including lock nuts, pipe clamps and conduit bushings.

CHAIN DRIVE, POWER TRANSMISSION EQUIPMENT, ETC.—The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a catalog and engineering data book, No. 500, which covers the complete chain, sprocket, power transmission, elevating and conveying and engineering divisions of the company's business and contains information of practical use to the engineer. Complete price lists also are included.

OUTDOOR STATION EQUIPMENT, SWITCHES AND ELECTRIC FURNACES. —Bulletins GEA-782, GEA-403A, GEA-939, GEA-979 and GEA-972 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its weatherproof switch houses with manually operated oil circuit breakers for outdoor station equipment, the CR-900 reversing and non-reversing drum-type switches, disconnecting switches for indoor service, the CR2960-SY104A and SY103A control circuit switches and the GE pot-type electric furnaces for cyanide hardening.

STARTER. — The Allen - Bradley Company, Milwaukee, has issued bulletin No. 648 covering its resisto-transformer starter, a new starter for squirrel-cage motors. The bulletin contains illustrations, wiring diagrams and a complete description of the starter.